11 00 039 Check compression of all cylinders

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

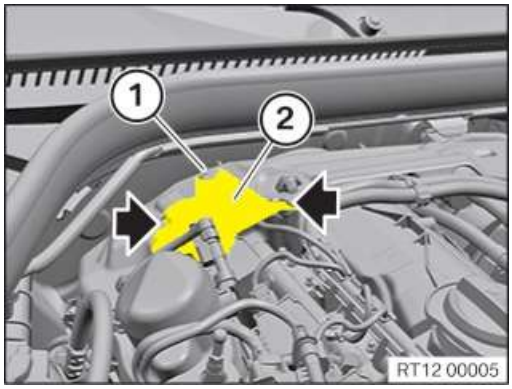
- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Release the service opening of the sound insulation at the top of the engine

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- Detach the service opening (2) in the marked areas (arrows) and twist it to the side at the pivot point (1).

3 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

Electrostatic discharge.

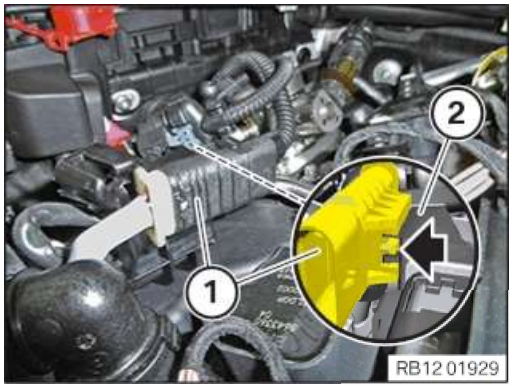
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

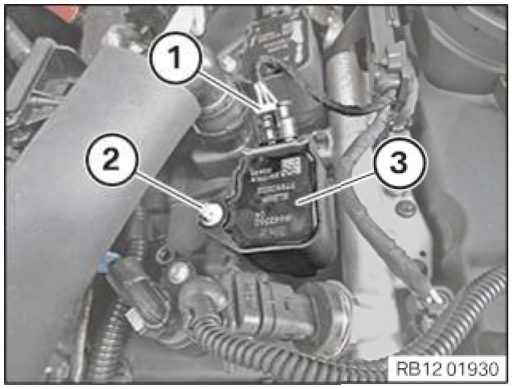
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- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

4 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

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TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

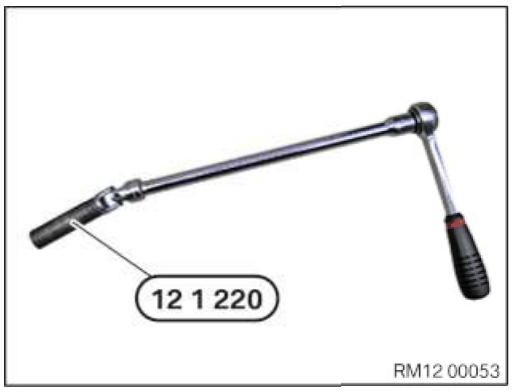
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

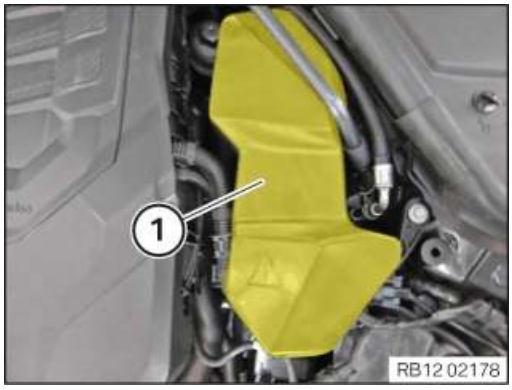
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.



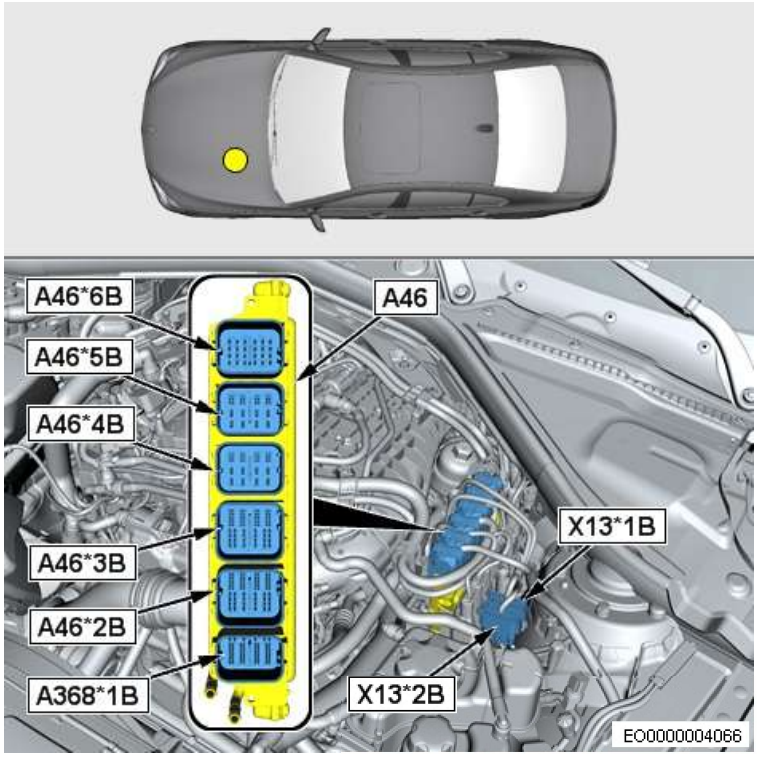
- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

5 – Remove the cover of the DME control unit



- Pull the cover (1) toward the top and remove.

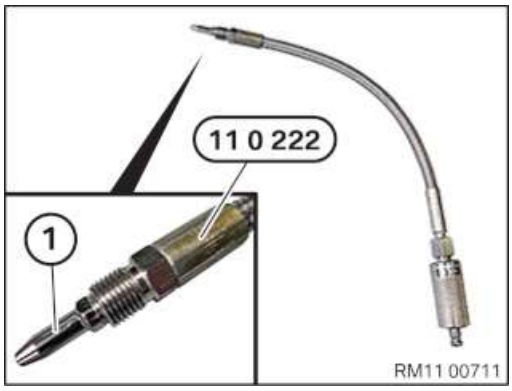
6 – Disconnect the connector A46*6B from the control unit



- Disconnect the plug connection A46*6B.

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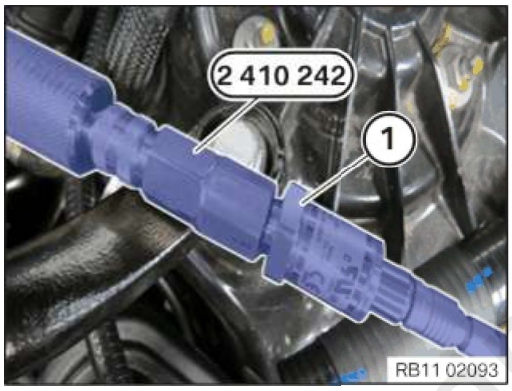
7 – Check compression of all cylinders



- Unscrew sensor (1) from special tool 0 490 615 (11 0 222).
- Check the secure fit of the valve below.



- Prepare special tool 0 490 615 (11 0 222) in conjunction with the special tool 0 496 306 (11 8 732) and 0 496 107 (11 8 730).
- Screw special tool 0 490 615 (11 0 222) with **10 Nm** on the special tool 0 496 107 (11 8 730).



- Connect special tool to special tool 0 490 613 (11 0 220) with the bayonet fitting.
- (1) Screw hand-tight into the special tool .
- (1) with the connect.



- Screw the special tool 0 490 615 (11 0 222) into the spark plug thread using the special tool 0 496 305 (11 8 731) by hand.

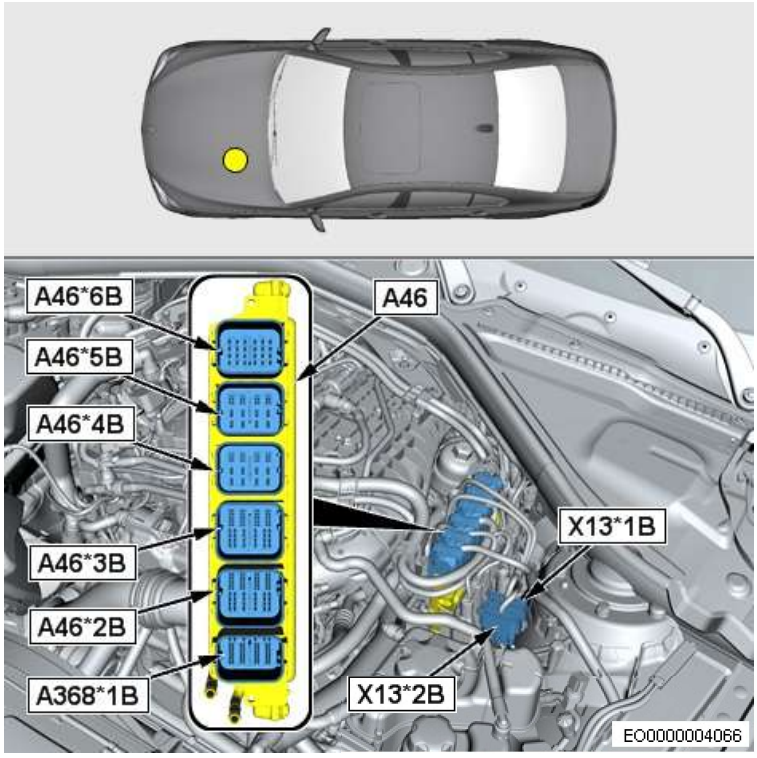


- Observe diagnosis instructions.

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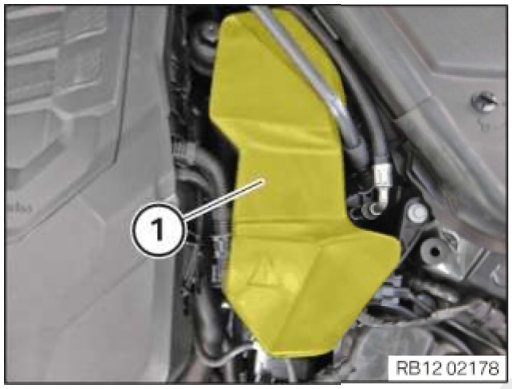
POSTPROCESSES

8 – Plug the connector A46*6B in at the control unit



- Connect and lock the connector A46*6B to the control unit.
- Make sure the connector engages audibly.

9 – Installing the cover of the DME control unit

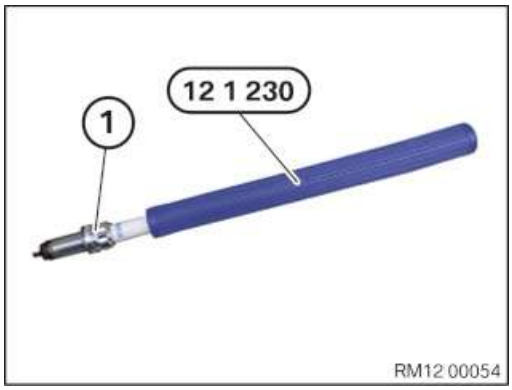


- Insert and install cover (1) into guides.

10 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

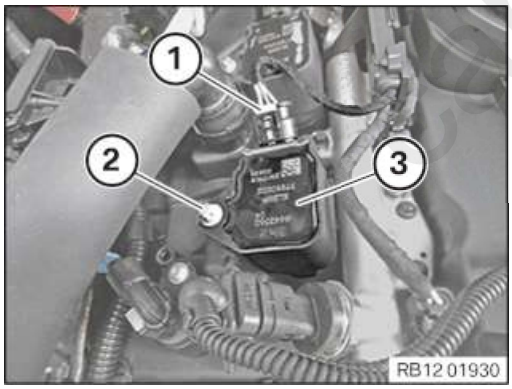
M12x1.25		Tightening torque	23 Nm

11 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Install ignition coil.**



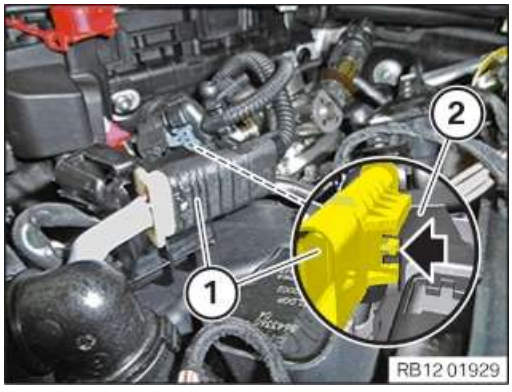
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

  The connector (1) must engage audibly.

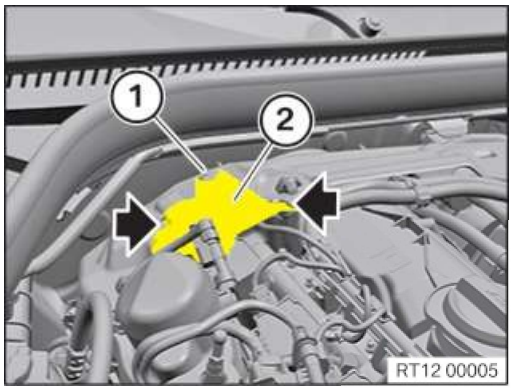
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- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

12 – Mounting the service opening in sound insulation on top of engine



- Turn the sound insulation (2) at the pivot point (1) to the installation position and guide it in where marked (arrows).

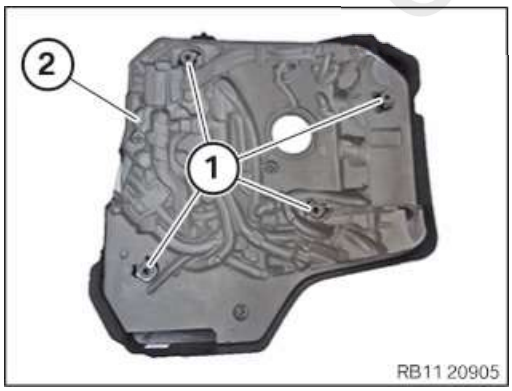
13 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

Additional Information

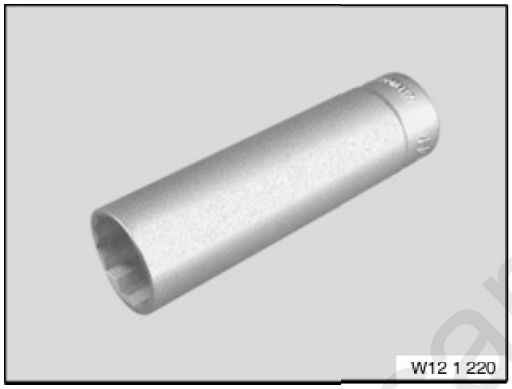
Overview of Tightening Torques

Spark plugs			Used in step 10
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 11
Screw		Tightening torque	8 Nm

Overview of Special Tools

0 495 560 (12 1 220) Socket



Common	Used in step 410
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 490 615 (11 0 222) Sensor



Common	Used in step 7
Usage	(Test probe) For recording compression testers 11 0 221 and 11 0 160 / engine: M21, M41, M47, M51, M57, M57T2
Included in the tool or work	0 490 613
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 306 (11 8 732) Ring

Common	Used in step 7
Usage	(Sealing ring) For secure connection of test probe 11 0 222 and adapter 11 8 730/731.
Included in the tool or work	0 496 107
Storage location	
Replaced by	
In connection with	
SI-Number	01 16 07 (392)

0 496 107 (11 8 730) Adapter



Common	Used in step 7
Usage	For compression testing.
Included in the tool or work	
Storage location	C21
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

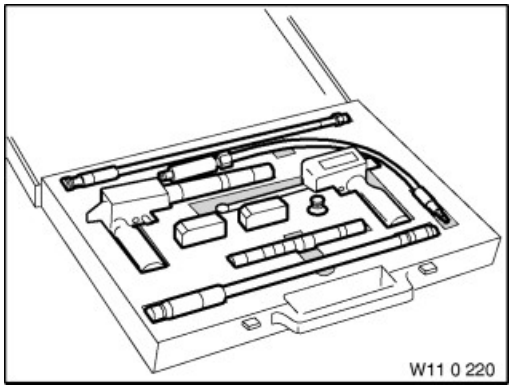
Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 305 (11 8 731)		**Adapter** Liquidation of existing inventory and then available only as a complete tool set 11 8 730 (83 30 0 496 107) – as of 19.04.12.	
2	0 496 306 (11 8 732)		**Ring** (Sealing ring) For secure connection of test probe 11 0 222 and adapter 11 8 730/731.	

0 490 613 (11 0 220) Compression tester

Common	Used in step 7
Usage	(compression pressure testing set) For all petrol and diesel engines.

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Included in the tool or work

Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 09 92 (558)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 493 634 (11 0 231)		**Case** With foam insert for recording compression tester	
16	0 495 279 (11 0 239)		**Adapter** M67, M67TU engine	
4	0 490 617 (11 0 224)		**Compression tester** (compression tester) For petrol engines.	
4	0 490 622 (11 0 229)		**Card** (Cards) 100 pieces For recording compression tester 11 0 224	
2	0 493 387 (11 0 236)		**Sensor** (Test probe) For recording compression tester 11 0 221 or DIS pressure sensor / engine: M47, M57, M57TU, M57T2	
2	0 494 517 (11 0 237)		**Adapter** Measuring "absolute compression" at all cylinders. Engine: W17	
4	0 490 614 (11 0 221)		**Compression tester** (compression tester) For diesel engines.	
4	0 490 615 (11 0 222)		**Sensor** (Test probe) For recording compression testers 11 0 221 and 11 0 160 / engine: M21, M41, M47, M51, M57, M57T2	
4	0 490 616 (11 0 223)		**Card** (Cards) 100 pieces For recording compression tester 11 0 221	
4	0 490 618 (11 0 225)		**Hose** (Extension hose) For rubber tapered section with fitting 11 0 228	

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4	0 490 619 (11 0 226)		**Sensor** (Test probe) For recording compression testers 11 0 224 and 11 0 160 / engine: M10, M20, M30, M40, M42, M43, M44, M50, M52, M60, M62, M70, M73, N62, S50US, S52US, S62	
4	0 490 620 (11 0 227)	0 493 129	**Sensor** (Test probe) For recording compression testers 11 0 224 and 11 0 160 / engine: S14, S38, S50 - Replaced by 11 0 235 (0 493 129)	
4	0 490 621 (11 0 228)		**Tapered section** (Rubber tapered section) For recording compression testers 11 0 224 and 11 0 160.	
4	0 490 625 (11 0 233)		**Valve** (non-return valve)	
4	0 490 626 (11 0 234)		**Filter** (filter) 3 x 3 mm	
9	0 493 129 (11 0 235)		**Sensor** (test probe, screw-in) For measuring "absolute compression" at all cylinders, engine: S14, S38, S50B30, S50B32, S50US, S52US, S54, S85	

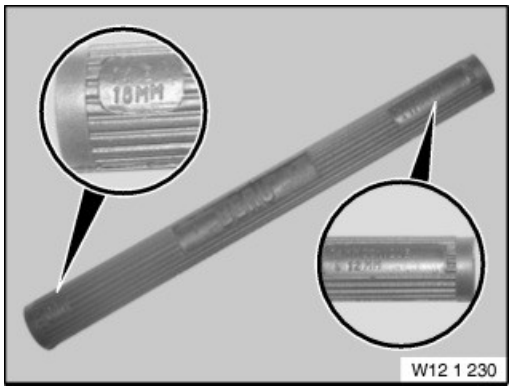
0 496 305 (11 8 731) Adapter



Common Used in step 7

Usage	Liquidation of existing inventory and then available only as a complete tool set 11 8 730 (83 30 0 496 107) – as of 19.04.12.
Included in the tool or work	0 496 107
Storage location	
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 496 065 (12 1 230) Fitting aid



Common Used in step 10

Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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Replacement tools:

0 493 129 (11 0 235) Sensor



Common	Used in step 7
Usage	(Test probe, screw-in) For measuring "absolute compression" at all cylinders, engine: S14, S38, S50B30, S50B32, S50US, S52US, S54, S85
Included in the tool or work	0 490 613
Storage location	
Replaced by	
In connection with	
SI-Number	

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	3

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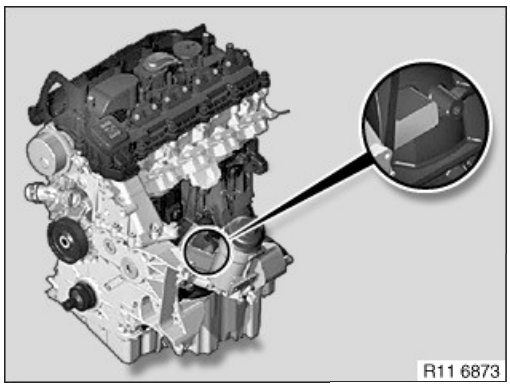
Engine identification

Engine number at the marked surface.

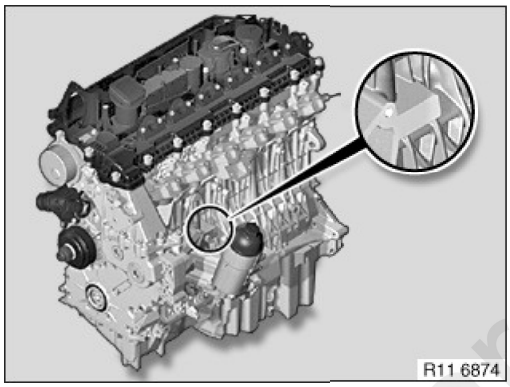
Replacement drives are already assigned a number containing the identification and engine number at the factory.

The old drive number must be imprinted for replacement crankcases.

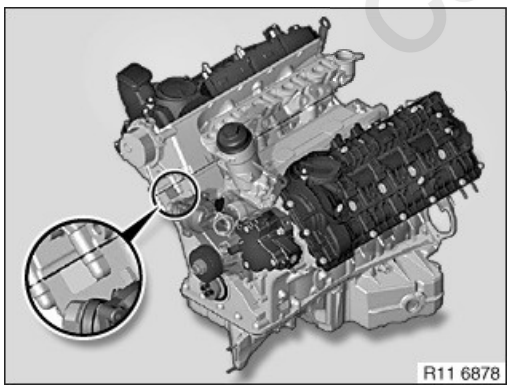
Magnesium crank cases feature a label, the engine number does not need to be embossed.



M47 / M47TU / M47T2

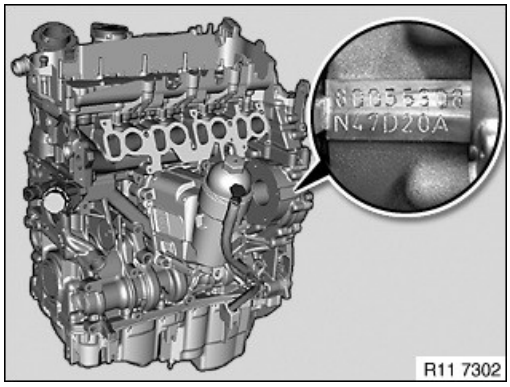


M57 / M57TU / M57T2

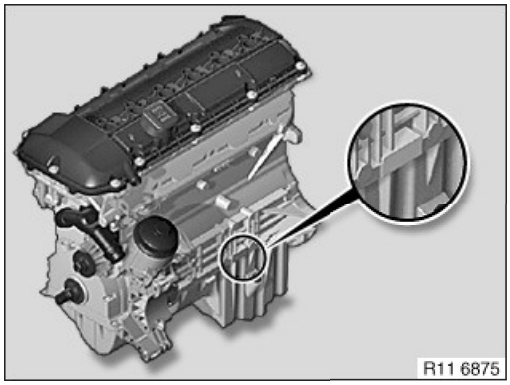


M67 / M67TU

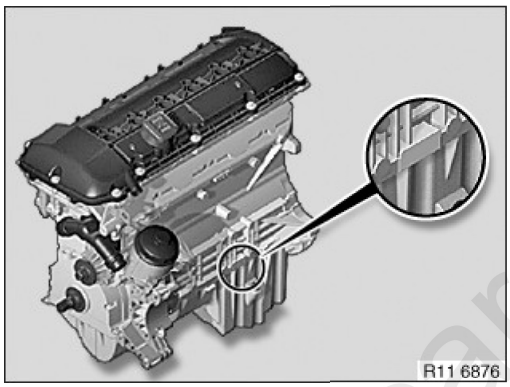
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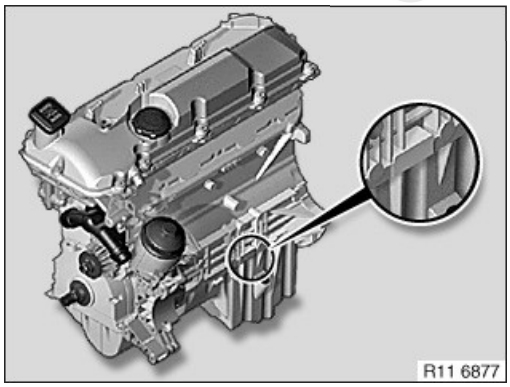
N47 / N47S / N47C / N47T / N57 / N57S / N57T



M52 / M52TU

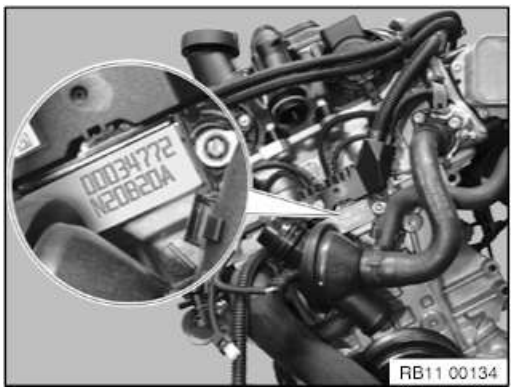


M54

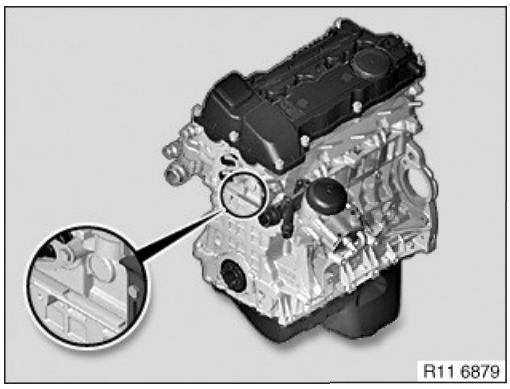


M56

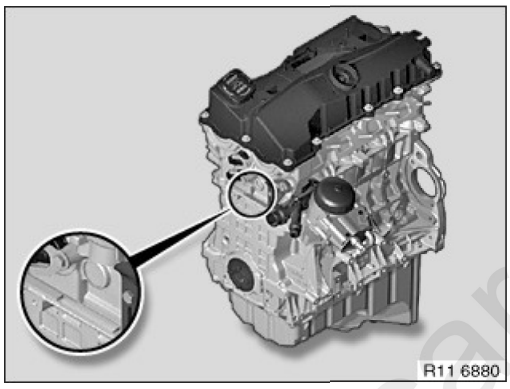
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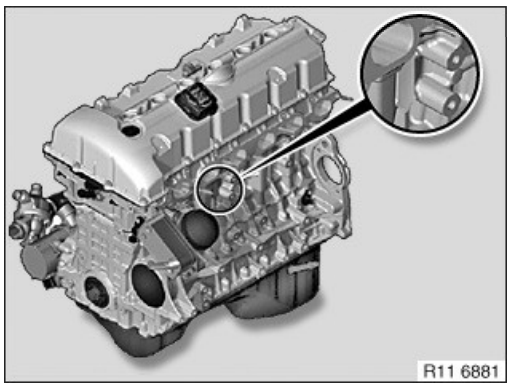
N20 / N26



N40 / N45 / N45T / N43

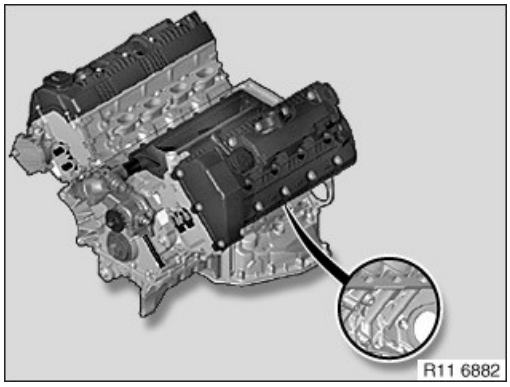


N42 / N46 / N46T

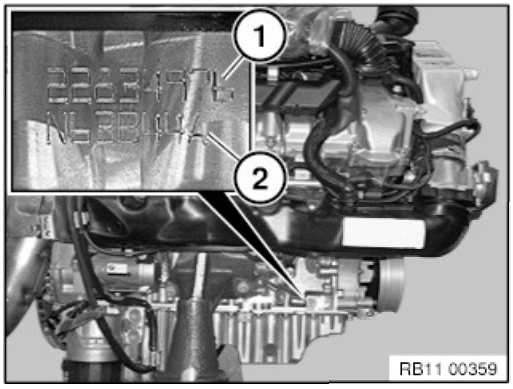


N51 / N52 / N52K / N52T / N53 / N54 / N55

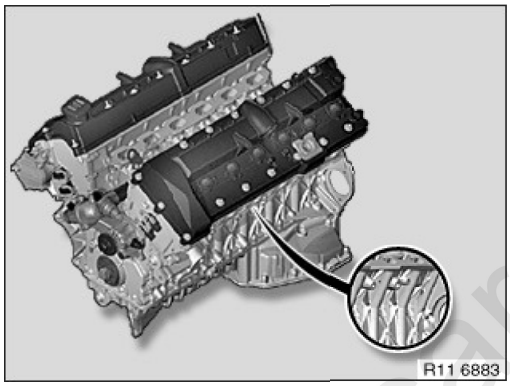
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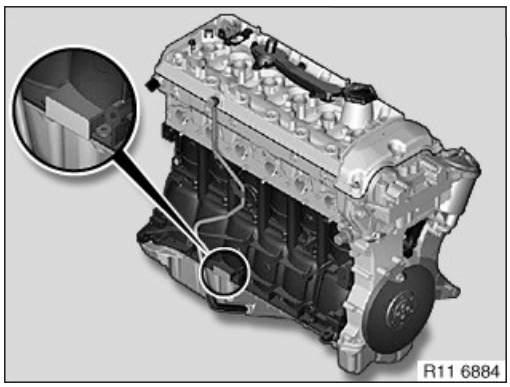
N62 / N62TU



Position (1) engine number.
Position (2) engine code letters.
N63, N63O1. N63O2
S63
N74, N74O1,
S63T0 to engine number 2001 0052 on right side cyl. 1-4.
S63T0 from engine number 2001 0053 on left side cyl.l 5-8.
E72 Vehicles must be imprinted on the left side cyl. 5-8.

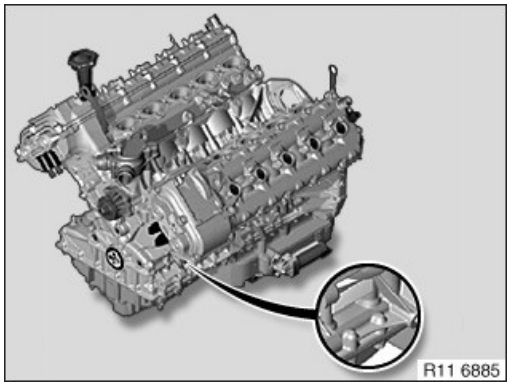


N73



S54

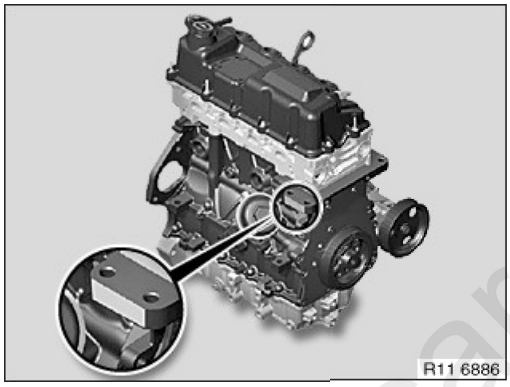
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S85 / S65



S55

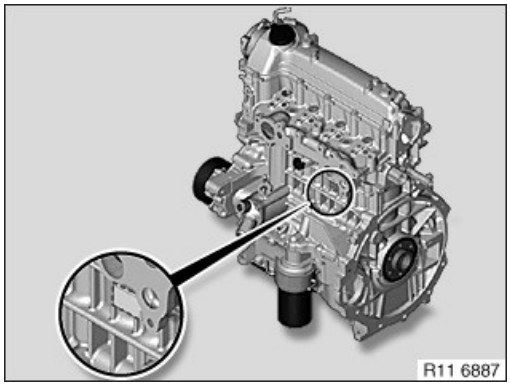


W10 / W11



W16

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W17



W20

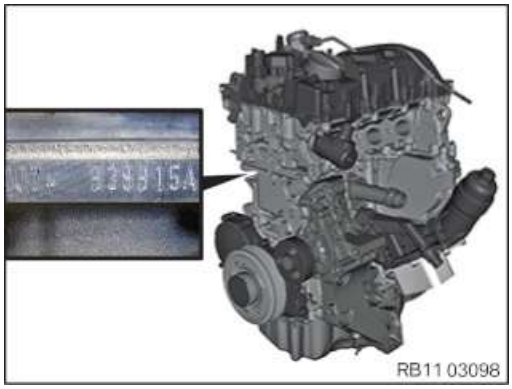


N12 / N13 / N14 / N16 / N18

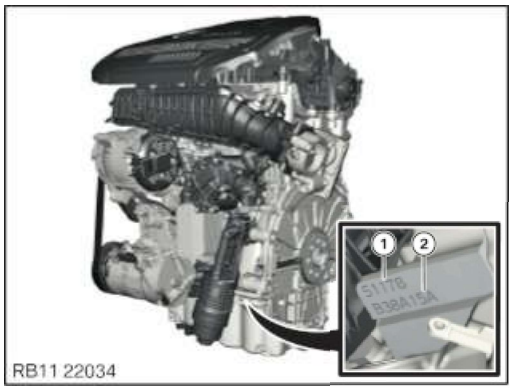


B37 / B38**A** / B47 / B48**A**
in the area of the oil sump

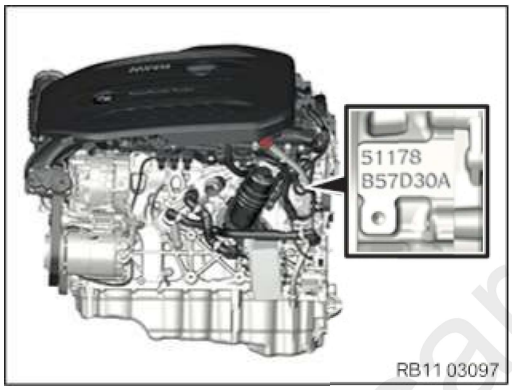
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B38**B** / B48**B**



B38



B57



B58

Assemble engine.

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11 00 300 Engine oil consumption measurement

Attention!

This procedure for measuring oil consumption may not be used for the S 85 due to the oil pan design.

Many complaints about oil consumption are caused by the oil level being measured using the wrong method.

The oil consumption should be measured after a distance of 7,500 km at the earliest, as the process of running in the engine will not have been essentially completed and the engine oil consumption stabilised until this distance has been covered.

Engine oil consumption that may occur in an engine can only be determined by the customer on the basis of the refilled engine oil quantity. As soon as the engine oil level falls below the MAX mark on the dipstick, many customers top up the engine oil without paying attention to a number of basic rules, such as the vehicle must be standing on level ground, a certain period of time must be left to allow the oil to flow back to the sump. In such cases, the available container sizes (e. g. 1-litre can) make it easy to top up above the MAX mark. Too much added engine oil is damaging to the engine and is consumed more quickly due to the splash effect.

It is therefore recommended to allow the engine oil level to the MIN mark and only then to add the required engine oil quantity. The distance between the marks is equivalent to approx. 1.0 to 1.5 litres.

The procedure for checking the oil level is given in the Owner's Handbook for the vehicle concerned.

The service delegates will only deal with claims made under warranty if exact measurements by weighing are available (see below).

Measuring oil consumption by weighing:

To assess a warranty or goodwill claim, only the following oil consumption measurement method by weighing can be accepted (this must have been carried out by a BMW contractual partner):

Note:

The engine must not leak any oil.

Engine oil may only be drained off when the engine is at its normal operating temperature. The engine oil temperature must be at least 90 °C and read off on the diagnosis system.

Preparation:

1. Eliminate any leaks and traces of oil before measuring the engine oil consumption.
2. Allow the engine to run at idling speed for 5 minutes, during which the engine oil temperature must not drop below 90 °C.
3. Unscrew the main flow oil filter cover (the engine oil will flow back into the oil sump from the oil filter housing).
4. Unscrew the oil drain plug.
5. Allow the engine oil to drain off for 15 minutes.
   If necessary, remove the fan/fan cowl.
6. Turn the engine once through 360 degrees by the vibration damper.
7. Allow the engine oil to drain off for 15 minutes.
8. Retighten the primary flow oil filter.
9. Pour in the specified engine oil quantity for the engine type in question (with filter change).
10. Drive the vehicle for a distance of at least 1,000 km/500 miles. Increasing the mileage will produce significantly better measuring results.
    Measurement procedure:
11. Check the engine for leaks; if the engine is not tight, the examination will not be meaningful.
12. Prepare the measuring container to be able to capture the oil quantity.
13. Allow the engine to run at idling speed for 5 minutes, during which the engine oil temperature must not drop below 90 °C.
14. Unscrew the main flow oil filter cover (the engine oil will flow back into the oil sump from the oil filter housing).

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15. Unscrew the oil drain plug.
16. Allow the engine oil to drain off for 15 minutes.
    If necessary, remove the fan/fan cowl.
17. Turn the engine once through 360 degrees by the vibration damper.
18. Allow the engine oil to drain off for 15 minutes.
19. Weight the **amount of drained engine oil**. (Engine oil has a density of about 0.86 g/cm³ at room temperature.)

$$\text{Engine oil consumption} = \frac{\text{Amount of oil added (cm³) - amount of oil drained off (g): 0.86 g/cm³}}{\text{mileage reading when draining - mileage reading when adding engine oil}}$$

Example:

Volume of oil added at mileage reading 44,800: 4.000 cm³

Weight of oil added at mileage reading 45,900: 2.700 g

$$\text{Engine oil consumption} = \frac{\text{4.000 cm3 - 2.700 g : 0.86 g/cm³}}{\text{45,900 km - 44,800 km}} = 0.78 \text{ cm³/km}$$

0.78 cm³/km = 0.78 l/1,000 km

Test certificate for engine oil consumption:

Vehicle data: _____

BMW (type): _____

Chassis number: _____

Added oil quantity (in ccm): _____ ccm at kilometre reading:_____

less drained off oil quantity (in g) : 0.86 (g/ccm) _____ ccm at kilometre reading:_____

=> oil consumption: _____ ccm => mileage: _____ km

Oil consumption [l/1000 km] =

_____ *[ccm] oil consumption* _____ [km] mileage

Oil consumption after balancing out: _____ l/1000 km

Oil grade: _____

Oil grade: _____

Viscosity: _____

Cause of damage: _____

_____ _____

Dealer address Signature

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11 00 ... Engine oil consumption measurement

Procedure for engine oil consumption measurement, see following documents:

- Engine oil consumption measurement (all without S85)
- Engine oil consumption measurement (only S85 with one oil drain plug)
- Engine oil consumption measurement (only S85 with two oil drain plugs)
- Record on oil consumption measurement

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11 . . . . . Equipment recoding special tool number of the transverse member for fixing the engine in the installation location

Equipment recoding from 00 0 200 to 00 6 0 000

Designation	Special tool new	Special tool previous
Cross-member, previous	---	00 0 200
Cross-member, new	00 6 000	---
Mounting bridge	00 6 001	00 0 201
Spindle with hook	00 6 002	00 0 202
Extension	00 6 003	00 0 203
Adapter support	00 6 004	00 0 204
Extension	00 6 005	00 0 205
Chain with hook	00 6 006	00 0 209
Set of supports	00 6 010	00 0 206
Set of supports	00 6 020	00 0 207
Set of supports	00 6 030	00 0 208
Connector	00 6 031	---
Profile strip (2 x)	00 6 032	---
Supports (4 x)	00 6 033	---
Set of supports	00 6 040	---
Profile strip	00 6 041	00 0 451
Supports (2 x)	00 6 042	00 0 452
Supports, short (2 x)	00 6 043	---
Set of supports	00 6 050	---
Profile strip (2 x)	00 6 051	---
Supports, short (2 x)	00 6 052	---
Supports, long (2 x)	00 6 053	---
Support, long	00 6 060	---
Supports (2 x)	00 6 070	---

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11 00 ... Handling components after flood damage

Flood damage can occur if the permissible fording depth of a vehicle is exceeded. Ingress of water can cause damage to the engine (water shock) or components.

Because dirt particles generally enter into the component with the water (e.g. starter motor, wiring harness), the components need to be thoroughly inspected.

Residual moisture in the components leads to corrosion (increased contact resistance in the component), which can lead to a component failure at a later time.

If water ingress into the electrical components cannot be ruled out, it is recommended to replace the component to ensure correct functioning through the vehicle lifetime.

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11 00 ... Overview of consumables (Electronic Parts Catalogue)

1.0 Sealing compound for **injection**.

	Repair instructions (engine)	Designation, Electronic Parts Catalogue	Part number, Electronic Parts Catalogue	Application examples
1.1	S55, S65, S85	Loctite 171000 primer	83 19 7 515 683	For hardening Loctite 193140 sealing compound
1.2	S55, S65, S85	Loctite 193140 liquid sealing compound	83 19 0 439 030	Sealing between crankcase upper and lower halves
1.7	W20	Dow Corning liquid sealing compound	07 58 0 397 777	Sealing between crankcase upper and lower halves Sealing of oil sump

2.0 Sealing compound for **application**.

	Designation in repair instructions	Designation, Electronic Parts Catalogue	Part number, Electronic Parts Catalogue	Application examples
2.1	M41, M47, M47TU, M47T2, M50, M51, M52, M52TU, M54, M57, M57TU, M57T2, M60, M62 N12, N14, N16, N18 N20, N26 N40, N42, N45, N45N, N46, N46N, N43, N47, N47top, N47C N47D1 N51, N52, N52N, N53, N54, N55, N57, N57T, N62, N62TU, N63, N63O1 N73, N73H, N74 S14, S38, S50, S52, S54, S62, S65, S85	Drei Bond 1209 liquid sealing compound	07 58 9 062 376	For sealing junction points on crankcase
2.2	N12, N13, N14, N16, N18, N20, N26, N40, N42,N43, N45, N46, N51, N52, N53, N54, N55 W10, W11, W16,	Loctite 5970 liquid sealing compound	83 19 0 404 517	Sealing between crankcase upper and lower sections.
2.2	N47top, N47D1, N47C1 N57D1 N57S1, B32 ,B36 ,B37 ,B38 ,B42 ,B46 ,B47 ,B48 ,B57 ,B58	Loctite 5970 liquid sealing compound	83 19 0 404 517	Timing case cover sealing, oil sump, coolant pump, component carrier.
2.3	N12, N14, N16, N18 W16	Loctite 648 liquid sealing compound	07 58 9 067 732	Sealing between the seal plug and crankcase

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2.4	N12, N13, N14, N16, N18 W16	Loctite 121078 liquid sealing compound	83 19 2 223 765	Sealing between cover sleeve and crankcase

3.0 **Cleaning agent**.

	Designation in repair instructions	Designation, Electronic Parts Catalogue	Part number, Electronic Parts Catalogue	Application examples
3.1	N12, N13, N14, N18, N20, N26, N45, N46, N45T, N46T, N43, N51, N52, N52Kp, N52TU, N53, N55, N63, N63S, N63 Hybrid, N63O1, N63O2 N73, N74 B37, B38 B47, B48, B58	Cold cleaner (chlorine free)	83 19 0 026 956	Cleaning assemblies, washing engine
3.2	M47, M47T1 M47T2, M57 M57T1, M57T2 N47 K/U/O/T 0/1 N47C	Universal cleaner	83 19 2 360 981	Clean intake pipe.
3.3	All	Brake cleaner	83 19 2 365 214	Clean.

4.0 Lubricant for **application**.

	Designation in repair instructions	Designation, Electronic Parts Catalogue	Part number, Electronic Parts Catalogue	Application examples
4.1	N12, N13, N18, N20, N26, N42, N46, N46TU, N51, N52, N52KP, N52TU, N55, N62, N62TU, N63O0, N63O1, N63O2, N73 S55, S63T0 B38, B48, B58	Lubricating grease Longtime PD1	83 19 2 160 340	For greasing the splined shaft on actuator drive/gearing of intermediate shaft.
4.2	M47, M47TU, M47T2, M57, M57TU, M57T2,	High-temperature assembly paste	83 23 0 309 003	For greasing the thread on the exhaust turbocharger.
4.3	N12, N13, N14, N16, N18 N20, N26, N40, N42, N45, N45TU N46, N46TU, N43. N51, N52, N52Kp, N52TU, N53, N54, N55. N62, N62TU, N63O0, N63O1, N63O2 N73, N73H, N74. S63T1, S65, S85. B38, B48, B58	High temperature paste	83 19 2 158 851 83 19 2 158 852	For greasing the threads on the oxygen sensors.

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4.4	N47, N47O1 N47C1, N47T N47D1 N57 N57D1 N63O0, N63O1, N63O2 S63, S63T0	Copper paste	81 22 9 400 794	For greasing the double hex head bolt on the exhaust turbocharger. For greasing the central bolt on the VANOS gear.
4.5	M47, M47TU, M47T2 M57, M57TU, M57T2 N47, N47O1 N47C1, N47T N47D1 N57 N57D1	High-temperature grease (UrethynE2).	83 23 0 441 070	For greasing the injectors or injector shafts. Solenoid valve and piezo injector.
4.6	N47T0, N47T1 N57T0, N57T1, N57S1 B47T0,	Assembly paste	83 29 9 407 778	For lubricating the O-rings of the pressure pipes. Multistage turbocharging assembly.
4.7	W20	Assembly paste, grease	No longer greased.	For greasing the torsion splined shaft.
4.8	N63O1, N63O2	Assembly paste, grease	83 23 9 407 778	For greasing the central bolt on the crankshaft.
4.9	W20	Assembly paste, grease	83 23 9 407 778	Grease O-ring on alternator.

5.0 lubricant for **filling**

	Designation in repair instructions	**Designation, Electronic Parts Catalogue**	**Part number, Electronic Parts Catalogue**	**Application examples**
5.1	M47, M57	Exhaust turbocharger additive	83 19 2 362 168	For filling the exhaust turbocharger after the renewal.
5.2	B32, B36, B37, B38, B42, B46, B47, B48, B58	Exhaust turbocharger additive, petrol MSP	83 19 2 457 276	For filling the exhaust turbocharger after the renewal.

6.0 Lubricants to loosen locked **screw connections.**

	Designation in repair instructions	**Designation, Electronic Parts Catalogue**	**Part number, Electronic Parts Catalogue**	**Application examples**
6.1	M47, M47TU, M47TU2, M57, M57TU, M57TU2. N47, N47C, N47D1, N57, N57D1, N57S1 W16, W17, B37, B47, B57	Brunox lubricating grease	83 23 0 418 567	For releasing the glow elements.
6.2	E89 F10, F11.	Brunox lubricating grease	83 23 0 418 567	For releasing and tightening the screw connection of the rubber mounts.

7.0 **Leak detection spray and contact spray**

	Designation in repair instructions	**Designation, Electronic Parts Catalogue**	**Part number, Electronic Parts Catalogue**	**Application examples**

7.1	Petrol: N13, N20, N26, N54, N55 B38, B48, B58 Diesel fuel: M47, M47TU, M47TU2, M57, M57TU, M57TU2. N47, N47C, N47D1, N57, N57D1, B37, B47	Leak detection spray	83 19 9 407 861	Check charge air path for tightness. Example: leakage on charge air hose or charge air cooler.
7.2	S55	Contact spray	81 22 9 400 208	For cleaning and protecting of electrical plug connections.

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11 00 050 Removing and installing engine

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Motor vehicle may slip off the vehicle hoist where components are supported.

Danger! Life-threatening injuries!

- Secure the vehicle hoist against lowering and lifting.

WARNING

Motor vehicle may slip off the vehicle hoist if the weight is distributed unevenly.

Danger! Life-threatening injuries!

- Ensure there is a specific weight compensation on the motor vehicle.

WARNING

Vehicle may slip off the vehicle hoist if the vehicle hoist is handled incorrectly.

Danger! Life-threatening injuries!

- Observe safety information on raising the vehicle using a vehicle hoist.
- For additional information see: 00 ... Raising the vehicle using a vehicle hoist.

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.

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- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

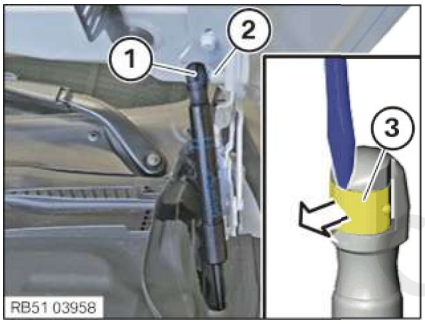
Engine compartment lid is open.

CAUTION

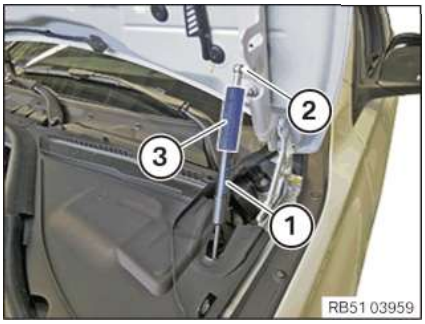
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



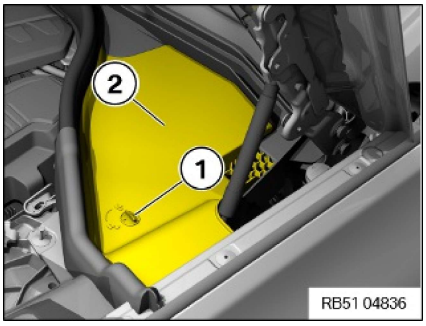
TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

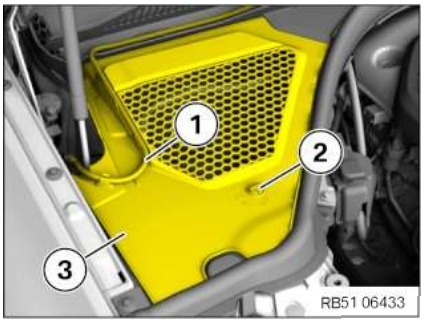
3 – Remove the cover of the engine compartment at the rear left

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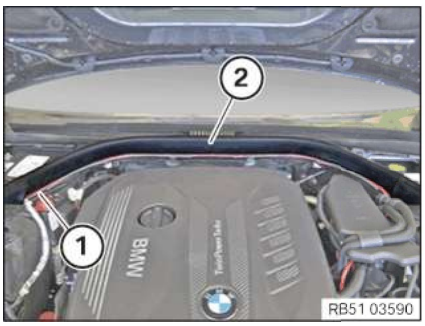
- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

4 – Remove the cover of the rear right engine compartment



- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

5 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

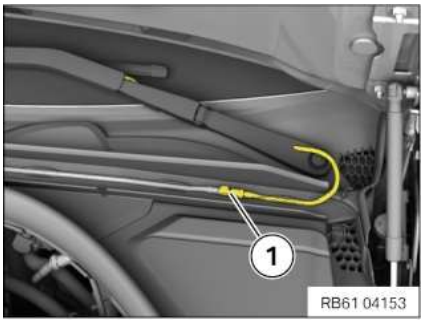
▸ **Remove the wiper arm**

RISK OF DAMAGE

Damage to wiper console

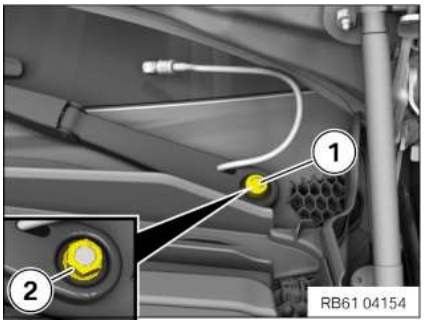
While removing the wiper arms without using special tool, the wiper console can break.

- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.

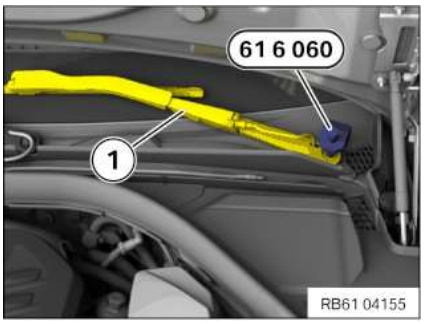


- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.

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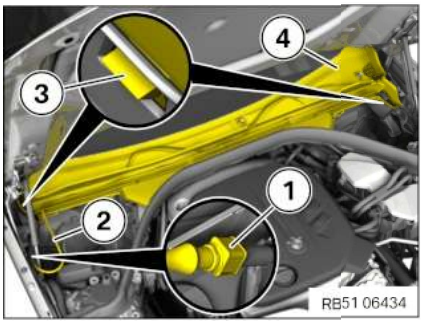


- Remove the protective cap (1).
- Loosen nut (2).

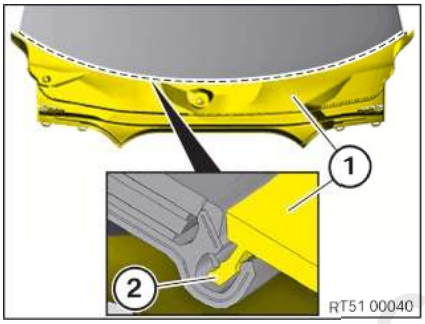


- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover



- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

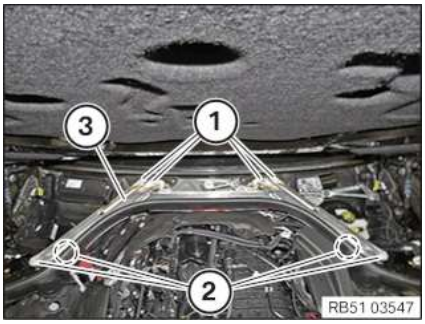


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

8 – Removing the centre bulkhead upper part

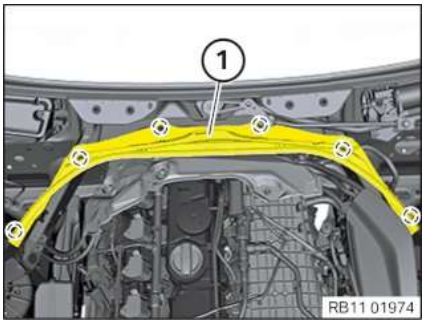
TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.

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- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

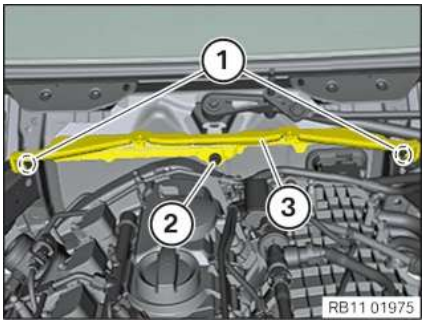
10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section

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- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

Electrostatic discharge.

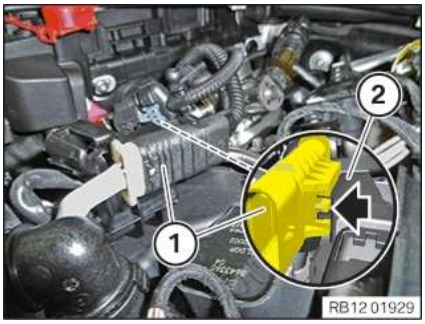
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

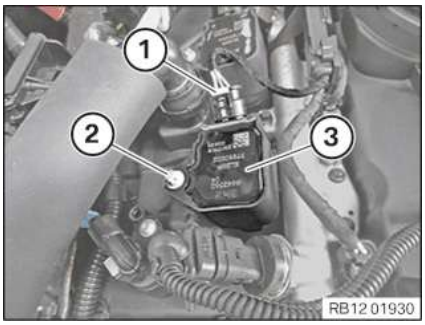


- Unlock plug connection (1) and disconnect.

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- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

13 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

RISK OF DAMAGE

Contaminant or foreign body.

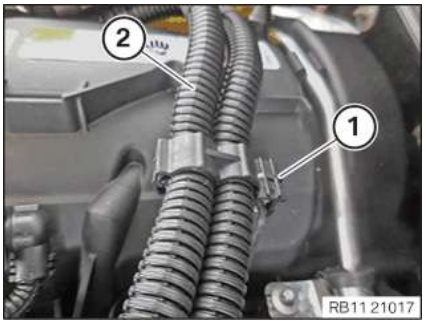
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

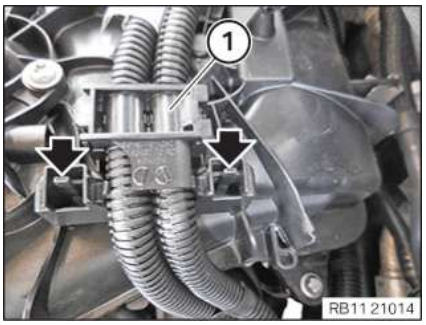
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

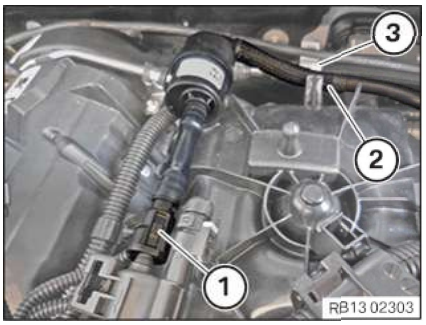
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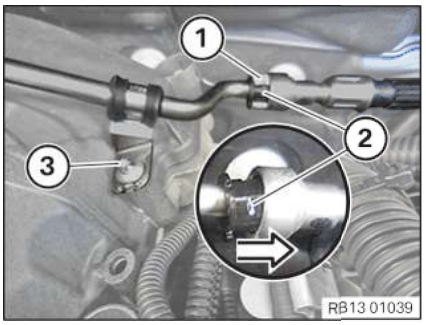
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



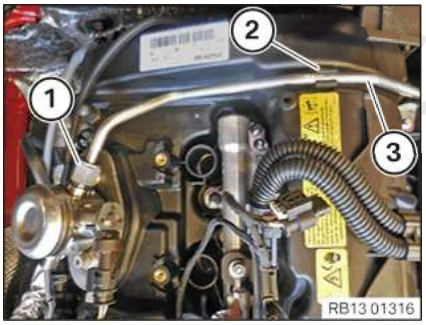
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).



- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

14 – Removing the clean air pipe with the resonator

WARNING

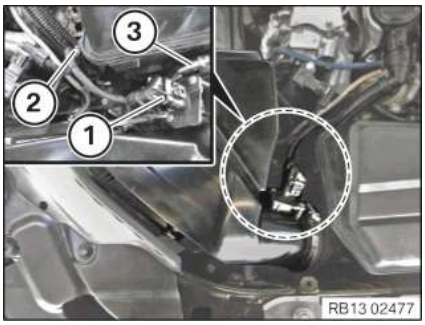
Hot surfaces.

Risk of burning!

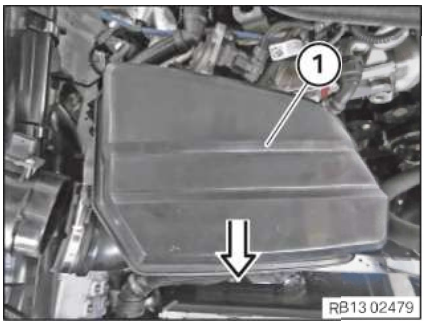
- Perform all work only on components that have cooled down.



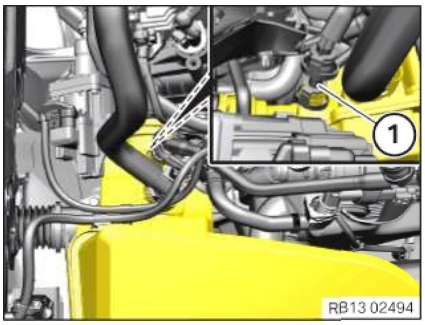
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



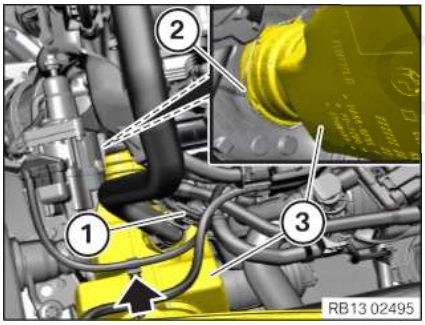
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

15 – Remove charge air line

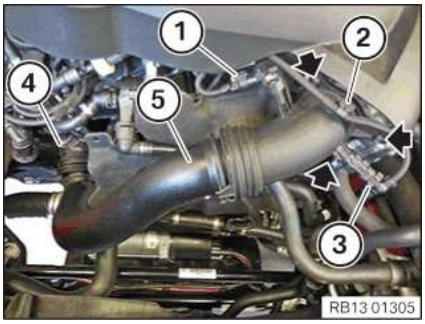
WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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- Unlock and loosen the connector (1) on the charging pressure sensor.
- Unlock and loosen clamp (2).
- Unlock and disconnect the connector (3) from the charge-air temperature sensor.
- Remove screws (arrows).
- Unlock and loosen the clamp (4) on the exhaust turbocharger.
- Guide out and remove charge air line (5).

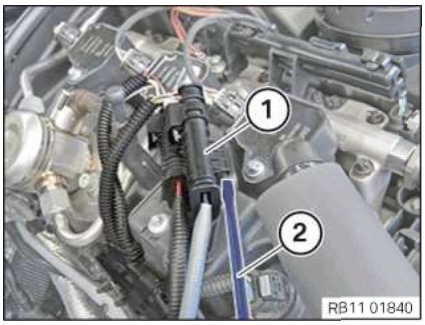
16 – Remove the control sensor

WARNING

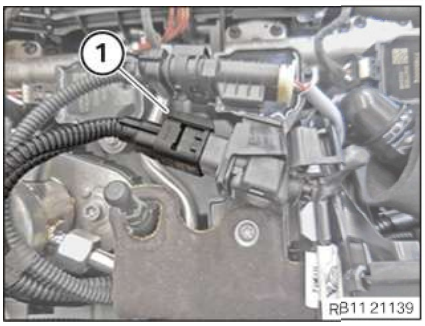
Hot surfaces.

Risk of burning!

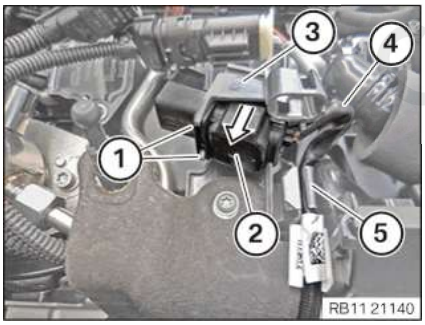
- Perform all work only on components that have cooled down.



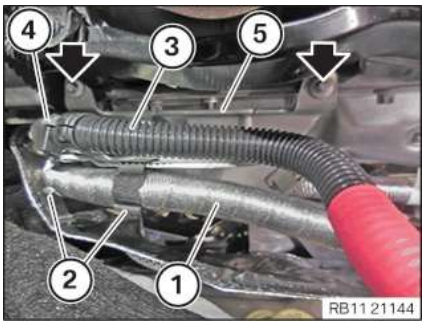
- Unlock connector (1) with screwdriver (2) and remove from the carrier plate.
- Unlock and loosen connector (1).



- Unlock and loosen connector (1).

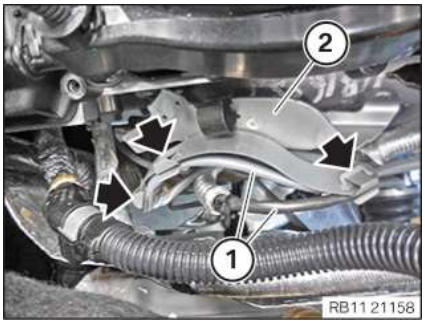


- Unlock the locks (1).
- Guide the connector (2) out of the bracket (3)in the **direction of the arrow** and set it aside.
- Release the cable (4) from the clamp (5).

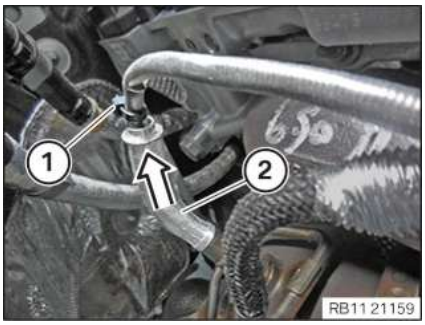


- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.

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- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

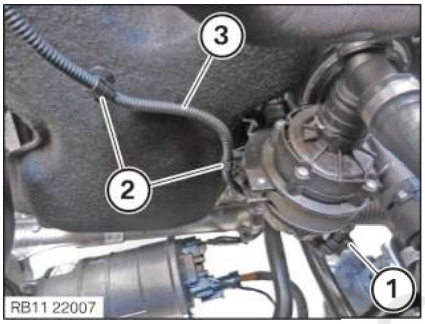


- Unfasten cable strap (1).
- Feed out the heat shield (2) **in direction of arrow** and set it aside.

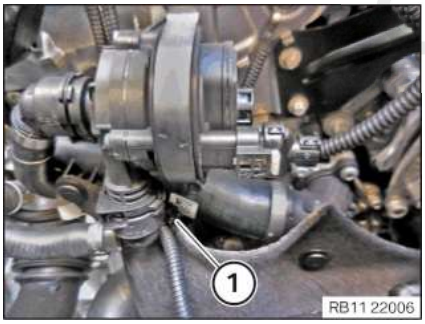


- Release and remove the control sensor (1) with the special tool 0 491 074 (11 7 020).

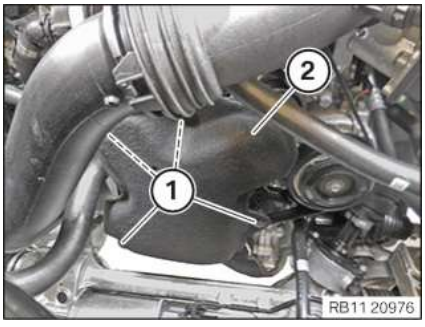
17 – Removing the acoustic cover for the engine at the front



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

18 – Releasing the electrical auxiliary coolant pump for the charge air cooler or the air conditioning condenser

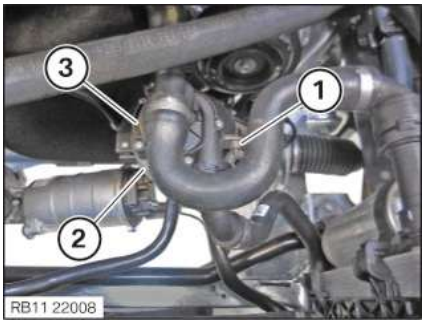
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RISK OF DAMAGE

Non-visible damage to the coolant pump.

Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.



- Loosen nut (1).
- Thread out holder (2) and set aside.
- Guide out the electrical auxiliary coolant pump (3) and set it aside.

19 – Removing the drive belt for alternator

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

Component with preload.

Danger of injury!

- Reduce preload as far as possible before disassembly. Relieve component.

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.



- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Secure the belt tensioner with the special tool 0 496 268 (11 0 390).
- Guide out the drive belt for the alternator (2) and remove it.

20 – Removing the DME control unit

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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

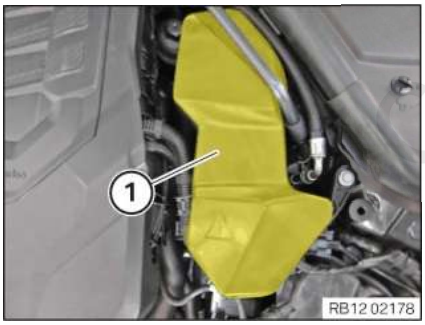
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

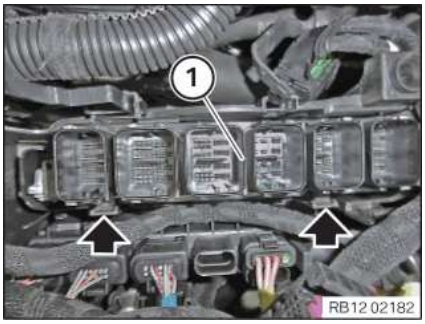


- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).

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- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

21 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

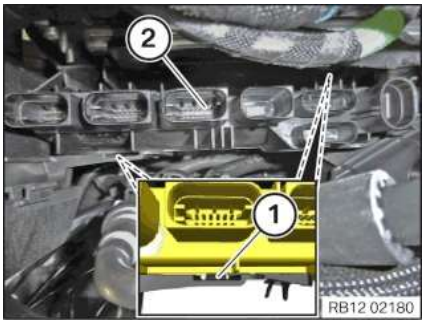
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



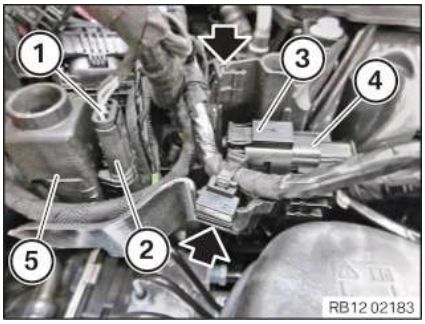
- Unlock and disconnect plug connections (1).



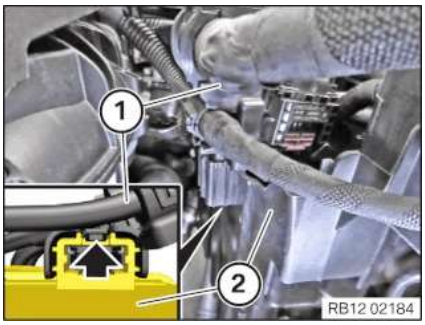
- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

22 – Removing the control unit holder

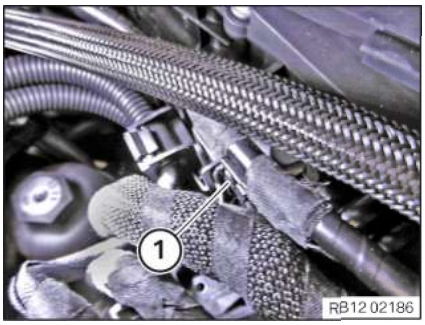
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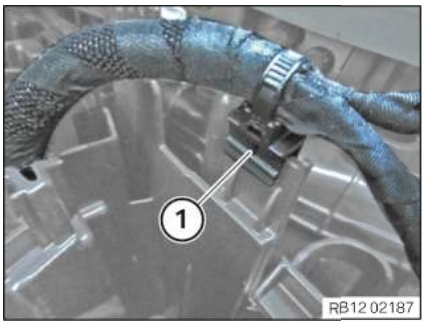
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).



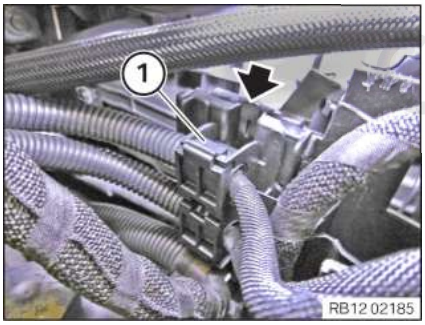
- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).



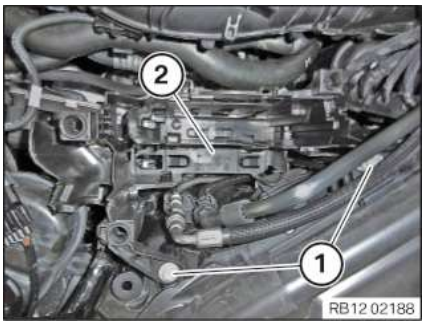
- Loosen clamp (1).



- Loosen clamp (1).



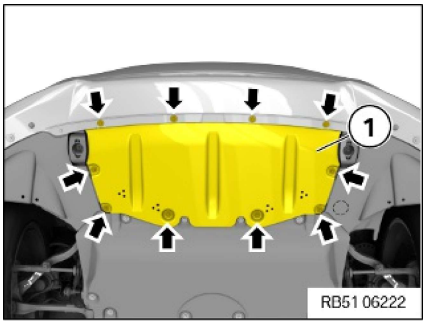
- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

23 – Removing the front underbody protection

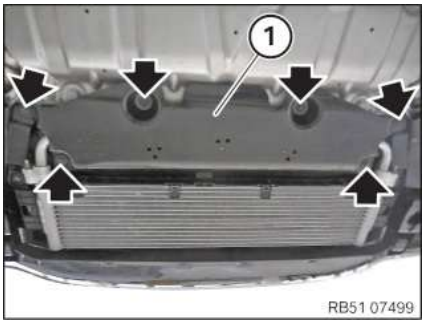
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- **Version 1:**

  Remove screws (arrows).

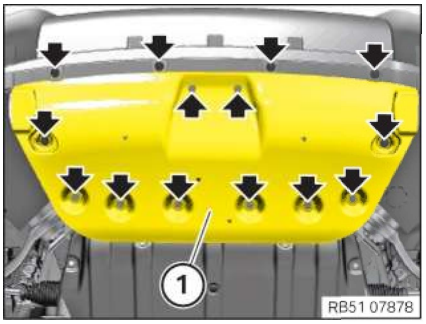
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

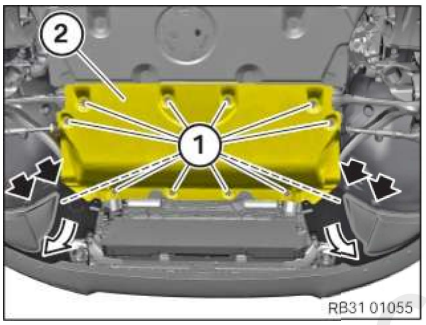


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

24 – Remove the underbody protection of the steering gear



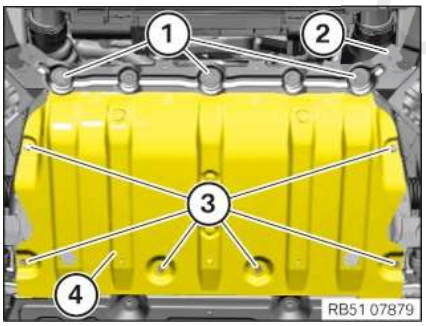
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

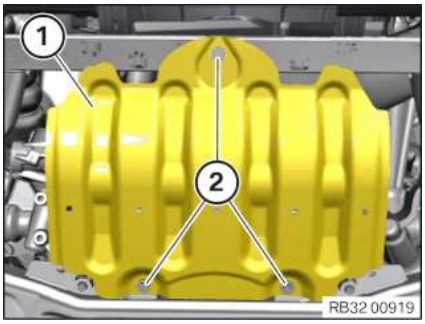
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

25 – If installed: Removing the steering start protection

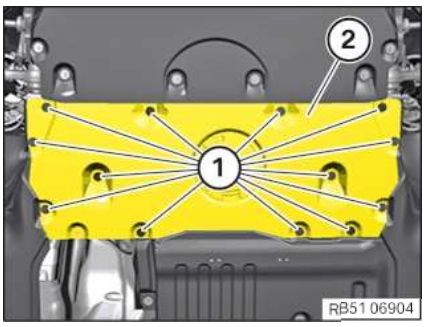
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

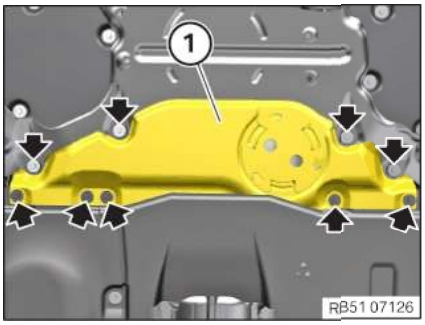
26 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

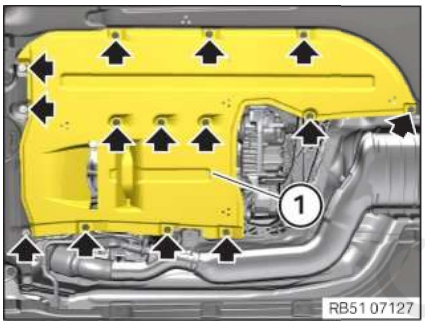


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

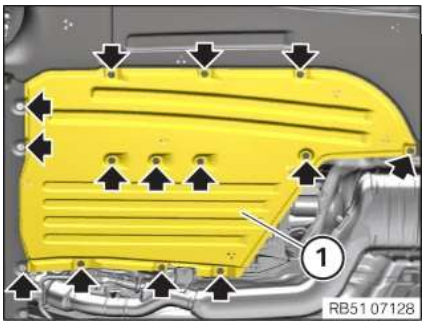
27 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



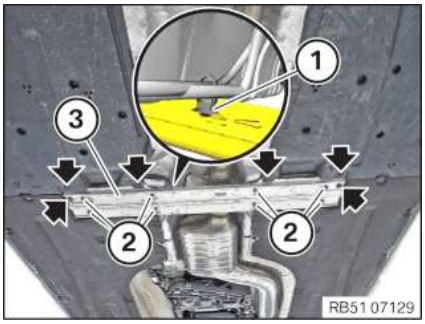
- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

28 – Remove the connecting support from the tunnel

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- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

29 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

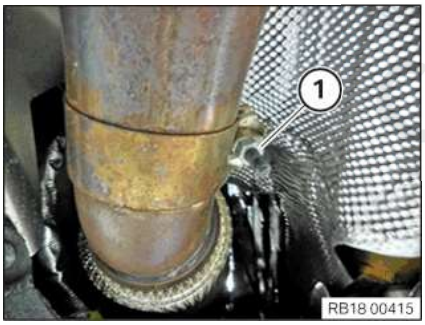
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

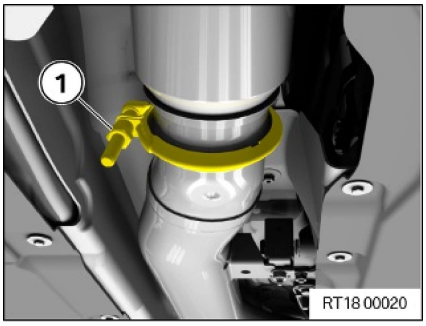
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).



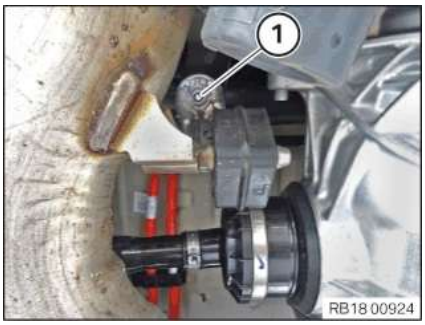
- **Equipment specification 2 (V-clips)**

  Unfasten clamp (1).

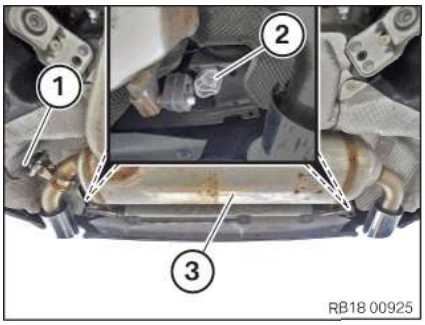
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- Loosen nut (1).



- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

30 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

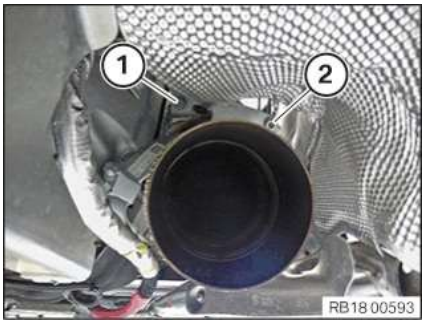
CAUTION

Component with heavy weight.

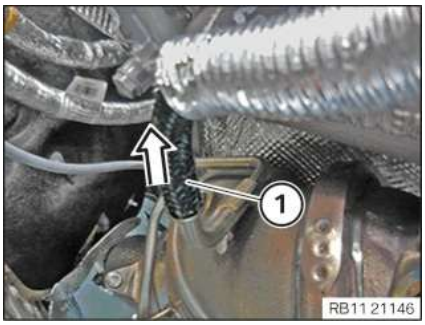
Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

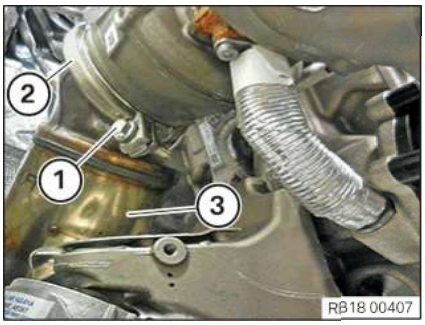
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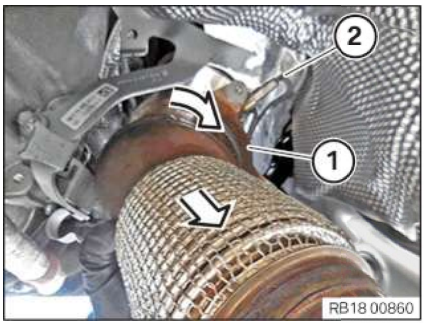
- Loosen screw (1).
- Loosen nut (2).



- Pull off pressure hose (1) in direction of arrow and set it aside.



- Loosen screw (1).
- Feed out V-clip (2) on catalytic converter (3) and remove.



- Guide out catalytic converter (1) in direction of arrow and remove.
- Ensure that monitoring oxygen sensor (2) is **not** damaged.

31 – Removing starter motor

Prerequisite

Battery earth leads are disconnected.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on 12 V vehicle electrical system.

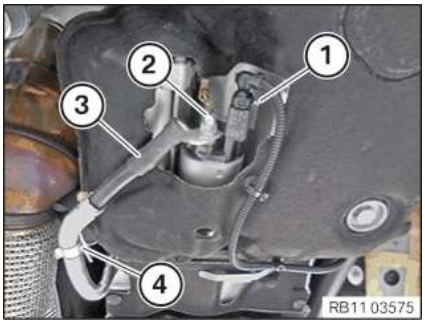
Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

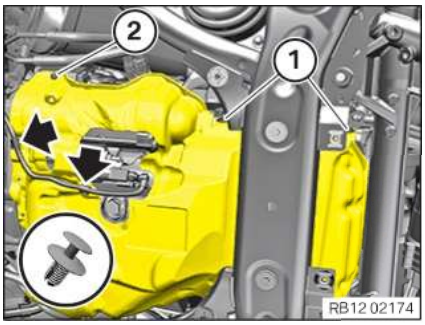
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TECHNICAL INFORMATION

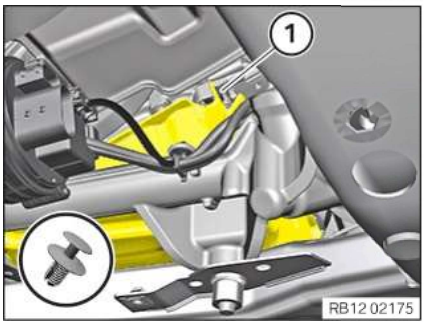
Make sure that the acoustic cover is **not** damaged while removing the starter motor.
A damaged lower acoustic cover can only be renewed when the front axle is lowered.



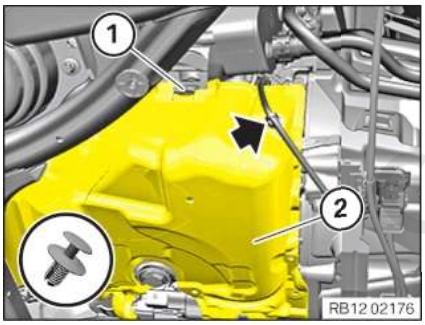
- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Release positive battery cable (3) from holder (4).



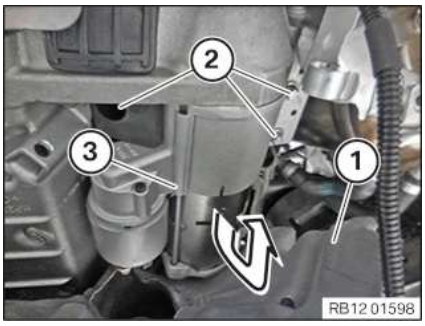
- Loosen the expanding rivet (1).
- Undo fir tree clip (2).
- Release the clamps (arrows).



- Loosen expanding rivet (1).
- Lower the acoustic cover of the oil sump.



- Loosen expanding rivet (1).
- Loosen the clamp (arrow).
- Lower acoustic cover (2).



- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Loosen screws (2).
- Carefully guide out the starter motor (3) in direction of arrow and remove.

32 – Draining the coolant from the high-temperature cooling system

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

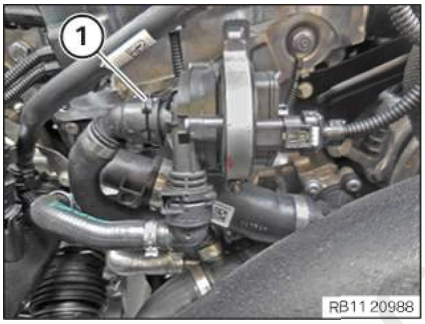
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

33 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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TECHNICAL INFORMATION

Life-long fill of coolant!

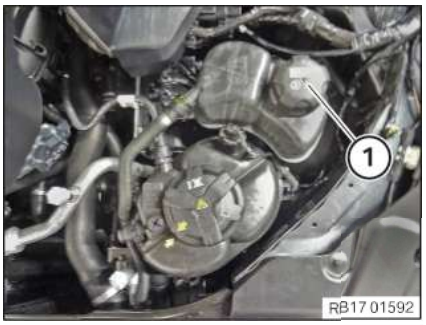
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

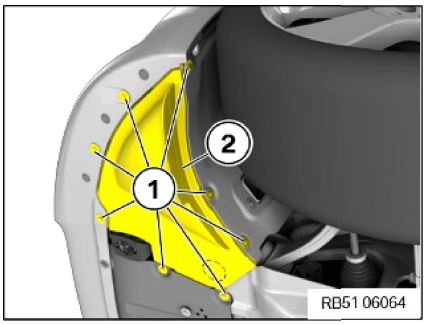
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

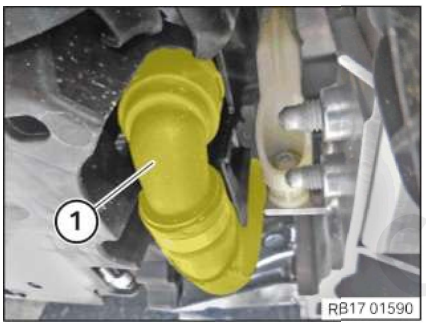
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).

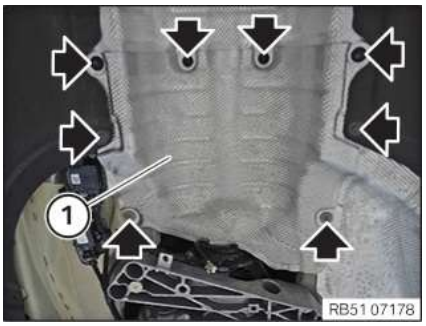


- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.



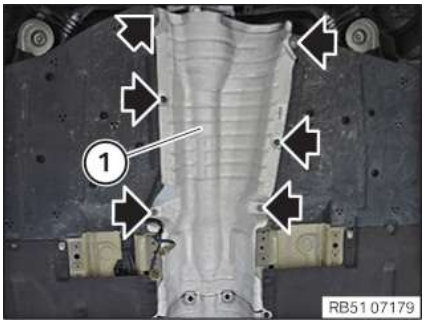
- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

34 – Remove heat shields



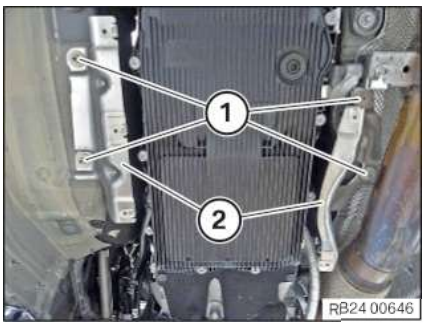
- Loosen bolts and nuts (arrows).
- Remove heat shield (1).

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- Loosen bolts and nuts (arrows).
- Remove heat shield (1).

35 – Remove the retaining plates



- Loosen nuts (1).
- Feed out retaining plates (2) and remove.

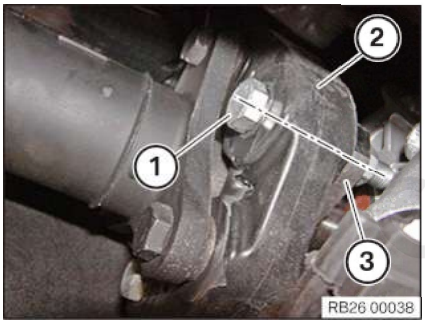
36 – Partially release propeller shaft

RISK OF DAMAGE

Damage to propeller shaft during removal.

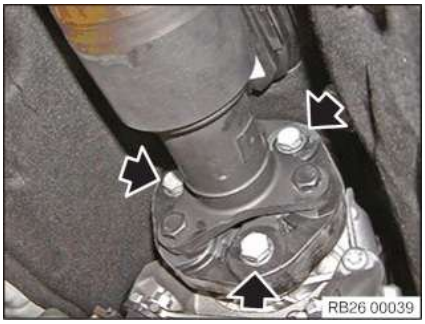
Non-observance of the removal guidelines for the propeller shaft on the rear axle differential may cause severe damage.

- Do not disassemble the three-hole flange, flexible disc and propeller shaft. The three-hole flange to the rear axle differential is balanced with the flexible disc and propeller shaft.
- Loosen the recessed nut against the direction of travel in clockwise direction. The propeller shaft must be loosened on the recessed nut only and exclusively in the direction of rotation otherwise the anti-twist lock of the bi-hexagonal flange nut is damaged.
- In the event of a damaged anti-twist lock on the bi-hexagonal flange nut: Replace the rear axle differential.

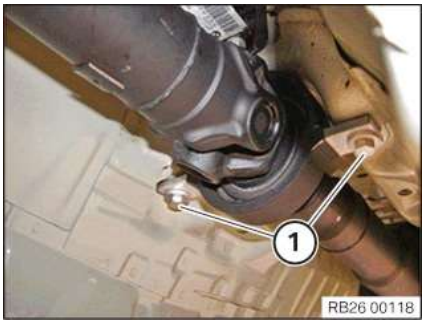


- Mark the installation position of the screw connection (1) of the flexible disc (2) and the three-hole flange (3).

  The mark makes it possible for the propeller shaft to be installed again in the same position. This should prevent a humming noise from the drive train during driving.

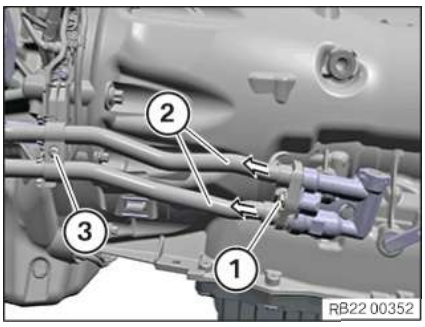


- Remove screws (arrows).



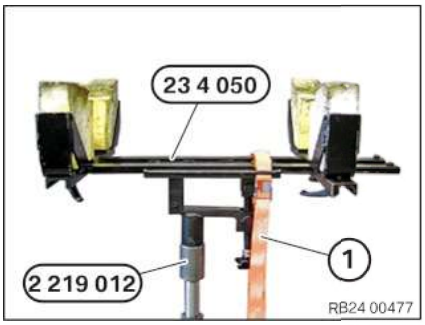
- Unscrew the bolts (1) on the centre mount and hold down the propeller shaft.
  Major deflection angles of the propeller shaft may damage the propeller shaft and/or the joints.
- Tie up propeller shaft to underbody.

37 – Disconnect hydraulic lines on the transmission

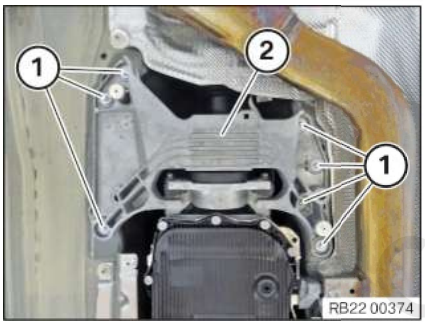


- Loosen screw (1).
- Loosen screw (3).
- Disconnect hydraulic lines (2) to transmission oil cooler.

38 – Detach transmission cross member

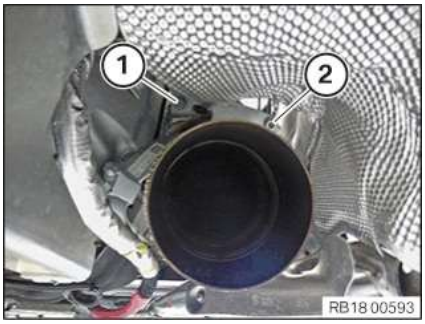


- Support the transmission using special tools 0 495 498 (23 4 050) and 2 219 012.
- Secure the transmission with the tensioning strap (1).



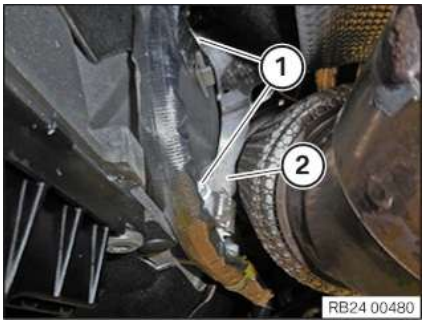
- Loosen screws (1).
- Release transmission cross member (2).

39 – Remove exhaust system holder



- Loosen screw (1).
- Loosen nut (2).

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- Loosen screws (1).
- Remove the exhaust bracket (2).

40 – Remove automatic transmission (GA8HP51Z)

CAUTION

Materials harmful to health.

Contact with fluids harmful to health!

- Note and follow safety information on containers.
- Conduct all work in appropriate personal protective equipment only.

RISK OF DAMAGE

Damage to the engine block.

Damaged and corroded bolts will lead to major damage in the engine block and the transmission.

- It is imperative that protruding threads of the transmission bolts are checked for corrosion and damage prior to removal.
- It is imperative that all rust is removed from corroded threads and that they are cleaned prior to removal.
- Renew rusted and damaged bolts.

RISK OF DAMAGE

Damage of components in the engine compartment.

When removing the transmission, tilting of the engine may damage components in the engine compartment.

- Before removing the transmission: Support engine.
- Secure the engine against tilt movements.
- Follow the specifications of the repair instructions.

RISK OF DAMAGE

Damage to the transmission.

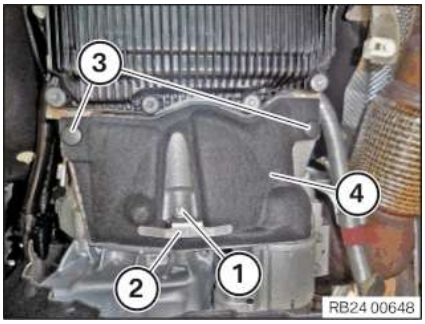
Damage to the transmission through unapproved transmission oil.

- Use only the approved transmission oil.
- After completion of repair work, check transmission oil level.

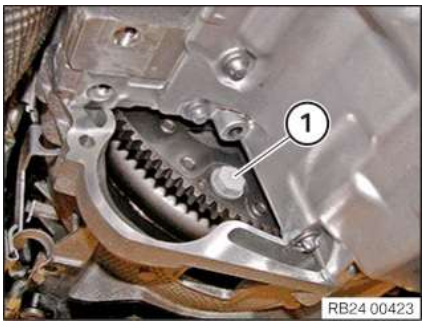


- Unscrew the bolt (1) and disconnect the ground strap (2).

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- Loosen the screw (1) and remove the holder (2).
- Pull the expanding rivet (3) off.
- Remove the acoustic cover (4).



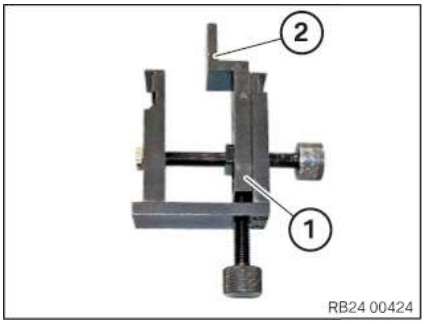
TECHNICAL INFORMATION

Only G05 and G07

In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

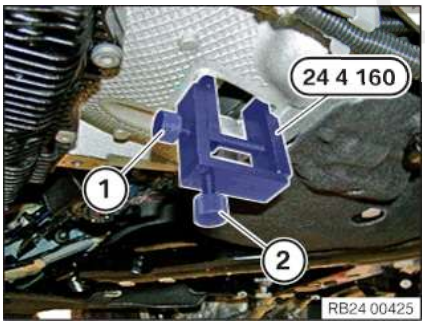
- Turn the engine on the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of rotation until the bolt (1) becomes visible in the recess.
- Undo all 6 screws (1) on the torque converter.



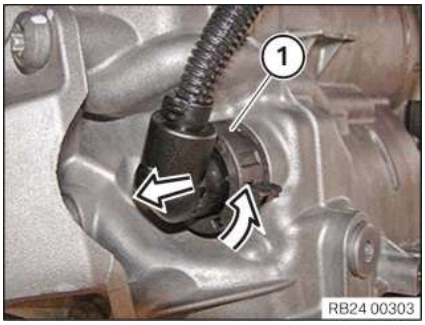
- Prepare special tool 0 494 478 (24 4 161) (1) with the shaped element 0 496 061 (24 4 166) (2) as shown.



- Remove the sealing cap (1).



- Insert special tool 0 494 451 (24 4 160) into the recess of the transmission housing and apply slight tension using the screw (1).
- Screw the bolt (2) in to the stop.
- Tighten down screw (1).



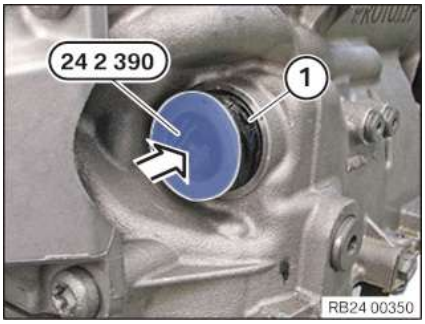
TECHNICAL INFORMATION

Notes on mechatronics are a fundamental requirement for these repair instructions and must be complied with at all times.

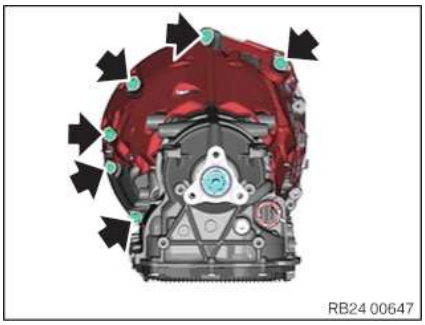
For additional information see: 24 34 ... Notes on mechatronics (GA8HP50Z/GA8HP51Z/GA8HP75Z/GA8HP76Z/GA8HP95Z)

- Unlock connector (1) by turning and pull off.
- Do not touch pins.
- Loosen all cable clips.

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- Insert the special tool 0 494 213 (24 2 390) in the sealing sleeve (1) in direction of arrow.

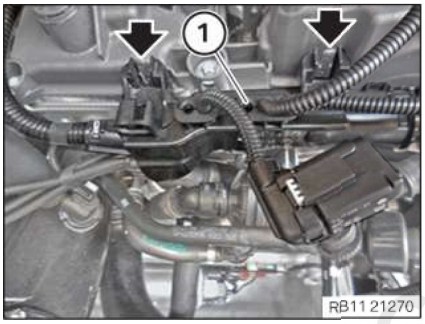


- Support engine.
- Release remaining screws.
- Remove transmission.

41 – Installing special tool 2 459 012 on the cylinder head



- Prepare special tool 2 459 012.



- Unlock the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



- Guide in and position special tool 2 459 012.
- Tighten the screws (1).

Special tool to cylinder head

M8		Tightening torque	21,5 Nm

MAIN WORK

42 – Removing engine

WARNING

Vehicle may slip off the vehicle hoist if the vehicle hoist is handled incorrectly.

Danger! Life-threatening injuries!

- Observe safety information on raising the vehicle using a vehicle hoist.
- For additional information see: 00 ... Raising the vehicle using a vehicle hoist.

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WARNING

Motor vehicle may slip off the vehicle hoist if the weight is distributed unevenly.

Danger! Life-threatening injuries!

- Ensure there is a specific weight compensation on the motor vehicle.

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

WARNING

Contact with hazardous fluids.

Hazardous to health!

- Note and follow safety information on containers.
- Conduct all work in appropriate personal protective equipment only.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

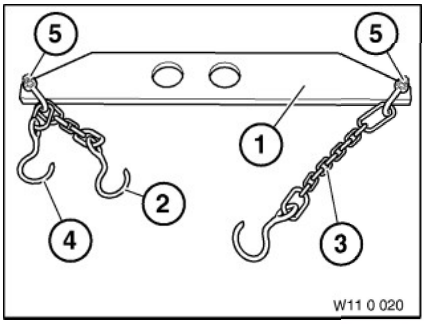
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

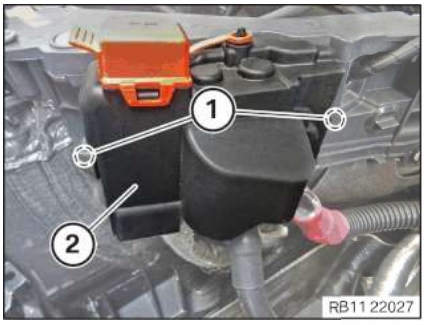
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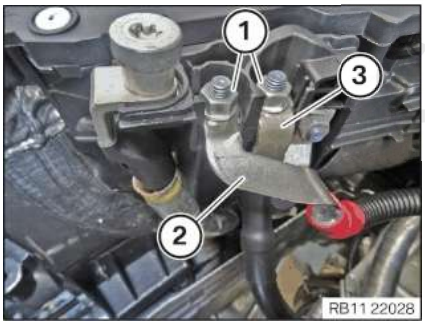
- Prepare the workshop crane 2 220 718.



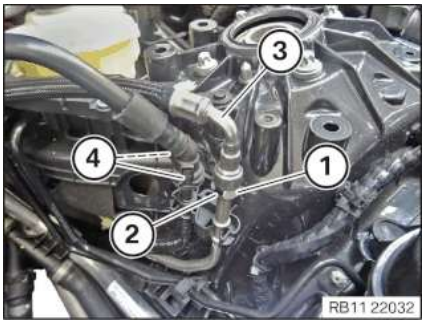
- Prepare special tool .



- Remove the cover (2) from the latch mechanisms (1).
- Remove the cover (2) in an upwards direction.

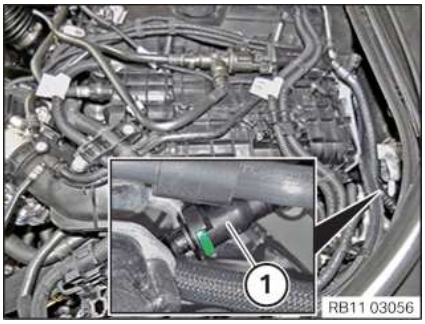


- Loosen nuts (1).
- Remove the positive battery cable (2) and set it aside.
- Remove the positive battery cable (3) and set it aside.



- Loosen clamp (1).
- Unlock and release lock (2).
- Guide the fuel feed line (3) out and set it aside.
- Catch and dispose of escaping fuel.
- Unlock and disconnect the tank ventilation line (4).

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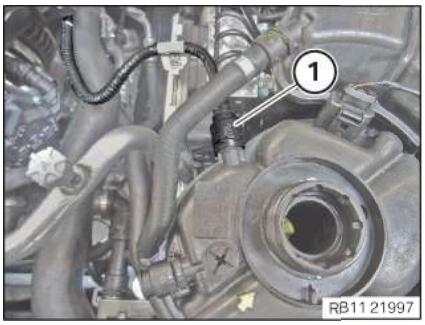
- Unlock and disconnect the vacuum line (1).



- Unlock and release coolant line (1) and (2).
- Catch and dispose of escaping coolant.



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Unlock and loosen coolant line (1).

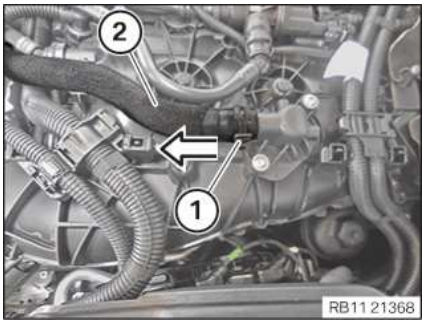


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

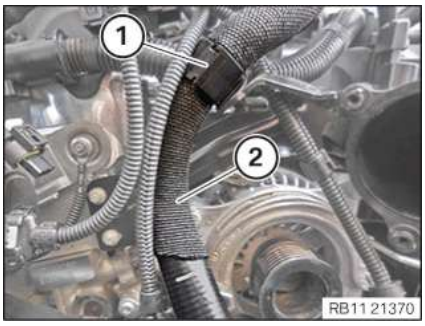


- Unlock and release coolant line (1) at the electric coolant pump (2).
- Catch and dispose of escaping coolant.

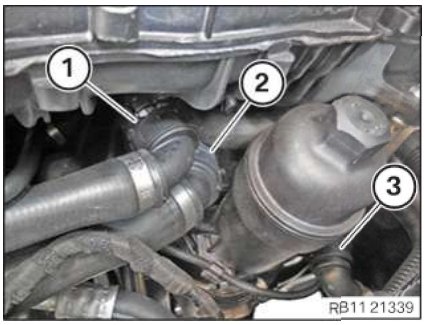
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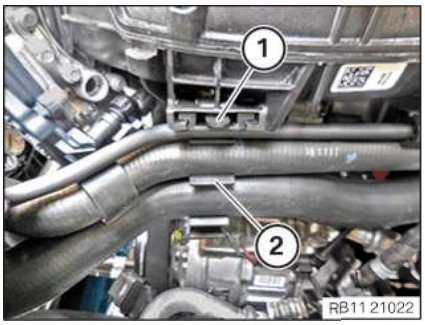
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Feed out coolant hose (2) in **direction of arrow** and place aside.
- Catch and dispose of escaping coolant.



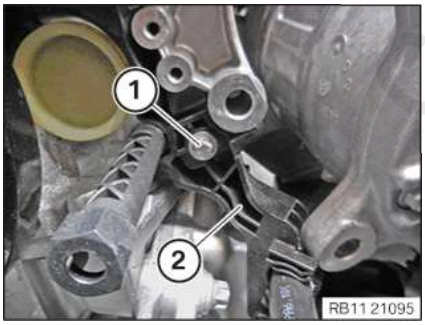
- Unlock and loosen clamp (1).
- Feed out the coolant hose (2) and set it aside.



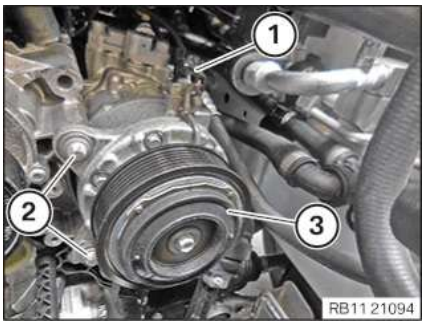
- Unlock coolant lines (1) to (3) and release.
- Catch and dispose of escaping coolant.



- Unlock lock (1).
- Thread out holder (2) and set aside.



- Loosen screw (1).
- Thread out holder (2) and set aside.



TECHNICAL INFORMATION

Only loosen the air conditioning compressor, do not remove it.
Do not draw off the refrigerant.
Do not loosen the refrigerant lines.

- Unlock and loosen connector (1).
- Loosen screws (2).
- Slide the air conditioning compressor (3) out and set it aside.
- Secure air conditioning compressor (3) against falling down with special tool 2 413 317.

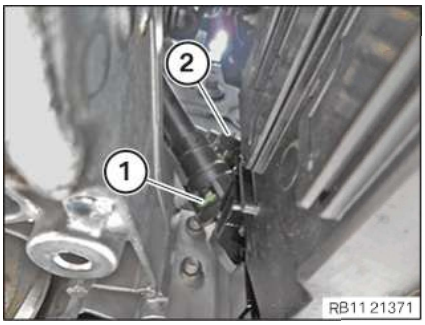
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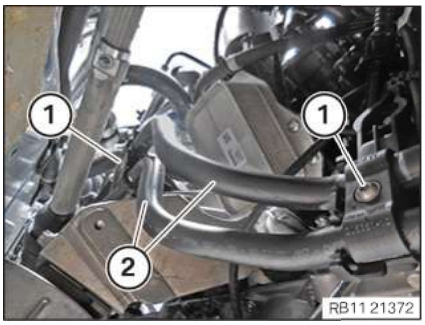
- Loosen screw (1).



- Loosen screw (1).
- Guide out and remove manifold support (2).



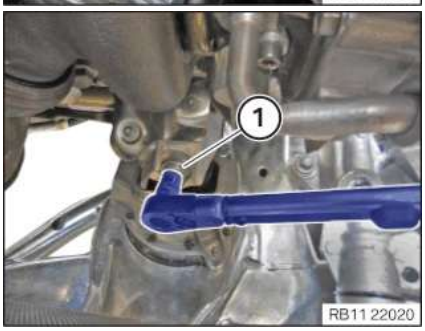
- Unlock and release transmission oil line (1).
- Unlock and release transmission oil line (2).
- Catch and dispose of escaping transmission oil.



- Loosen screws (1).
- Feed out the transmission oil lines (2) and remove.
- Catch and dispose of escaping transmission oil.

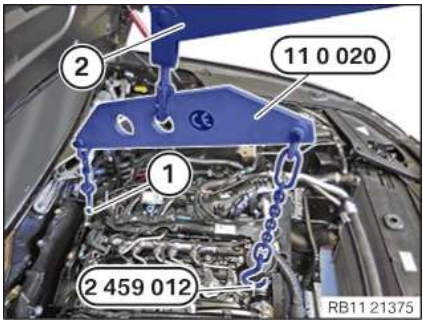


- Release screw (1) on the left engine mount from the top with a commercially available tool.



- Release screw (1) on the right engine mount from the top with a commercially available tool.

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- Mount the special tool to the workshop crane (2) 2 220 718.
- Attach special tool to the engine mounting bracket (1).
- Attach special tool to special tool 2 459 012.
- Feed out engine using the workshop crane (2) 2 220 718 and lift out.

43 – Install engine

WARNING

Vehicle may slip off the vehicle hoist if the vehicle hoist is handled incorrectly.

Danger! Life-threatening injuries!

- Observe safety information on raising the vehicle using a vehicle hoist.
- For additional information see: 00 ... Raising the vehicle using a vehicle hoist.

WARNING

Motor vehicle may slip off the vehicle hoist if the weight is distributed unevenly.

Danger! Life-threatening injuries!

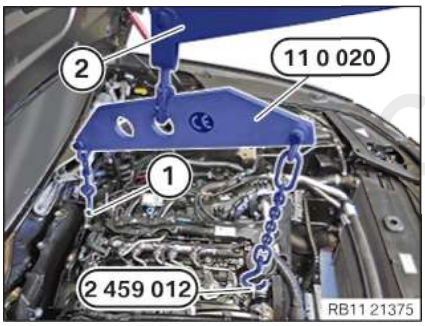
- Ensure there is a specific weight compensation on the motor vehicle.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



- Guide in and install the engine with workshop crane (2) 2 220 718.
- Lower the engine with workshop crane (2) 2 220 718.
- Guide out special tool on workshop crane (2) 2 220 718.
- Guide out special tool on engine mounting bracket (1).
- Guide out special tool on special tool 2 459 012.



- Tighten bolt (1) of the right engine mount from the **top** using a standard tool.

Engine mount to engine mounting bracket

M12		Tightening torque	100 Nm

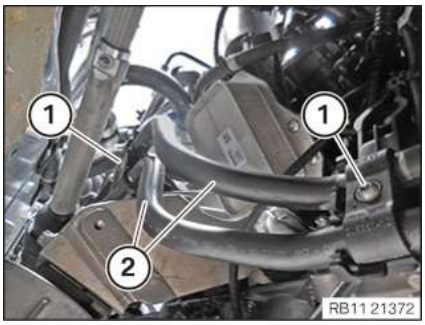
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- Tighten bolt (1) of the left engine mount from the **bottom** using a standard tool.

Engine mount to engine mounting bracket

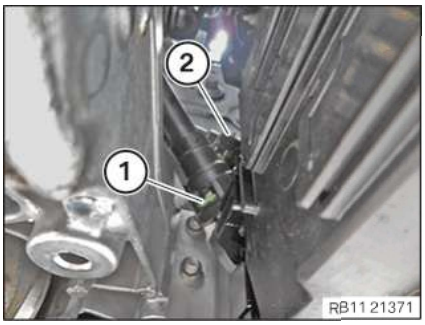
M12		Tightening torque	100 Nm



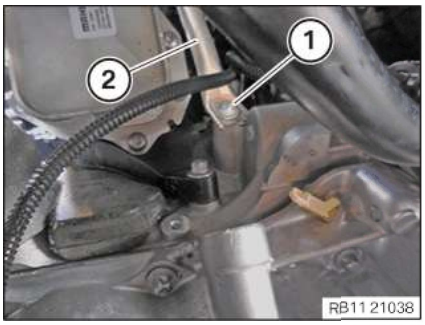
- Feed in and install transmission oil lines (2).
- Tighten the screws (1).

Holder for transmission oil line

Screw	*Renewscrew*	Tightening torque	5 Nm



- Connect and lock.unlock transmission oil lines (1) and (2).
- Ensure that transmission oil lines (2) and (1) engage audibly.



- Guide in and position manifold support (2).
- Hand-tighten the bolts (1).



- Tighten down screw (1).

Intake plenum to support

M6X25		Tightening torque	8 Nm

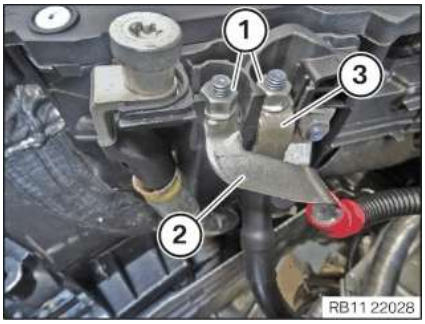


- Tighten screws (1) on manifold supports (2).

Manifold support to crankcase

M6x16		Tightening torque	8 Nm

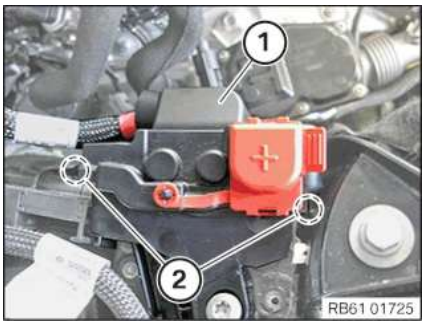
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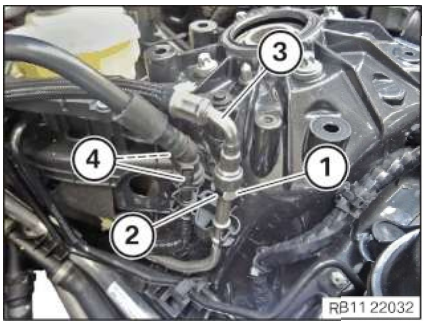
- Insert and position the positive battery cable (3).
- Insert and position the positive battery cable (2).
- Tighten nuts (1).

Positive battery cable

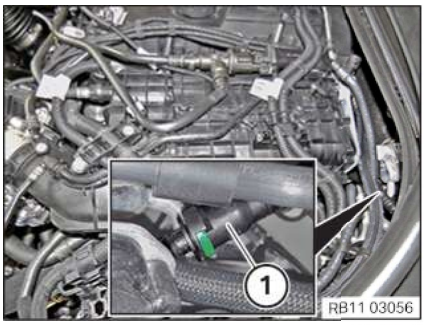
Flange nutM8		Tightening torque	15 Nm



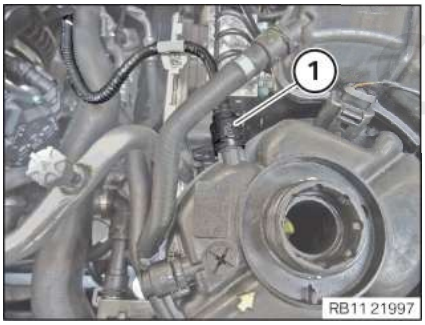
- Feed in the cover (2) in a downwards direction.
- Engage the cover (2) in the latch mechanisms (1).



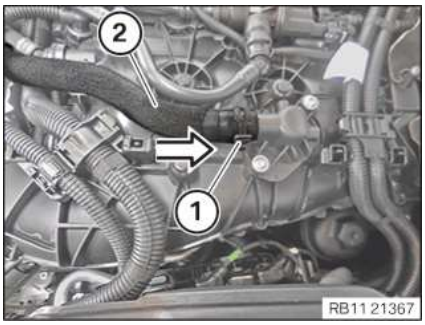
- Connect tank ventilation line (4) and lock.
- Make sure that the tank ventilation line (4) engages audibly.
- Connect and lock fuel delivery line (3).
- Ensure that the lock (2)engages audibly.
- Feed in and install the clamp (1).



- Connect the vacuum line (1) and lock.
- Make sure you can hear the vacuum line (1) engage.

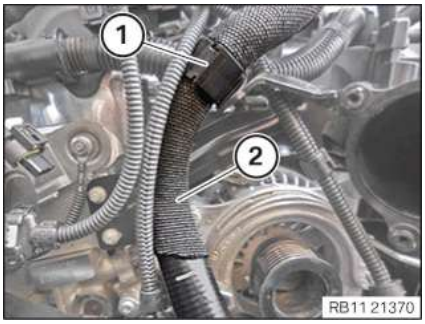


- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.

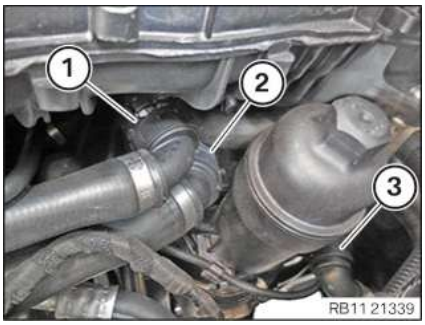


- Guide in and install coolant hose (2) in the **direction of the arrow**.
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).

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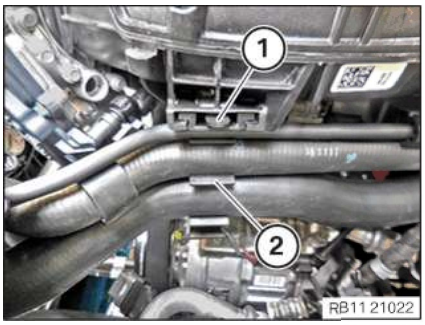
- Guide in and position coolant hose (2).
- Lock clamp (1).
- Make sure that the clamp (1) engages audibly.



- Connect and lock coolant lines (1) to (3).
- Ensure that coolant lines (1) to (3) engage audibly.



- Connect and lock coolant lines (1) and (2).
- Make sure that coolant lines (1) and (2) engage audibly.



- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Connect and lock coolant line (1).
- Ensure that coolant line (1) engages audibly.

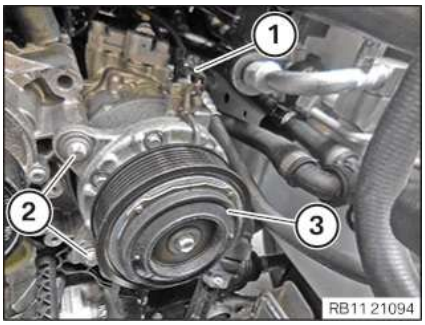


- Connect and lock the coolant line (1) to the electric coolant pump (2).
- Make sure that the cooling line (1) engages audibly.

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- Connect and lock coolant line (1).
- Ensure that coolant line (1) engages audibly.

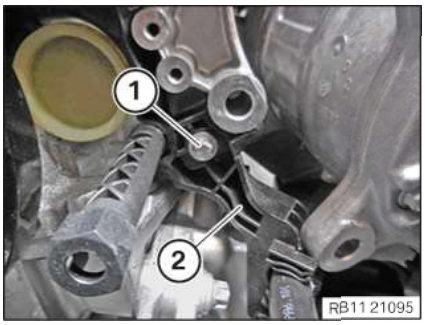


- Insert and install the air conditioning compressor (3).
- Tighten the screws (2).

Air conditioning compressor in component carrier

M10		Tightening torque	38 Nm

- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten down screw (1).

Transmission oil line holders to component carrier

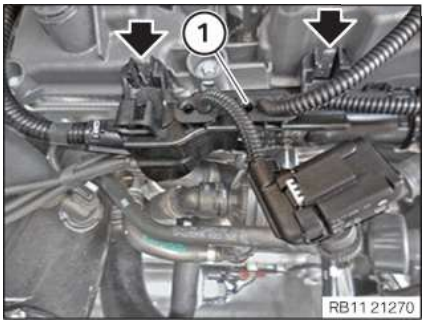
M6X16		Tightening torque	12 Nm

POSTPROCESSES

44 – Removing special tool 2 459 012 on the cylinder head



- Loosen screws (1).
- Guide the special tool 2 459 012 out and remove.



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

45 – Installing fuel delivery line

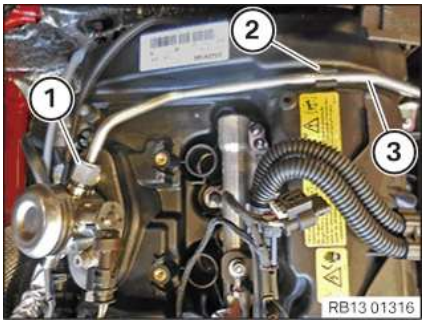
RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

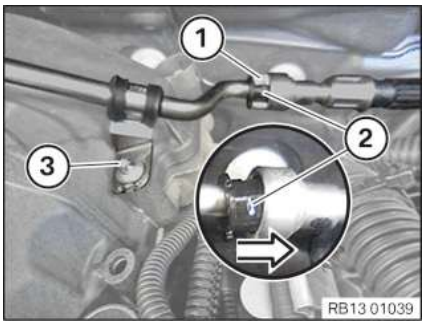
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- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

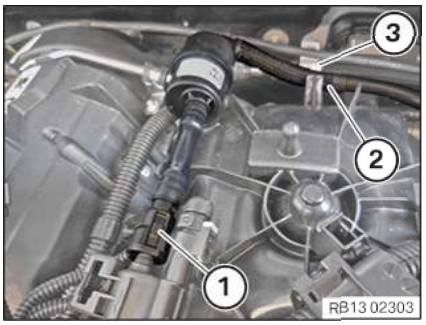
M14		Tightening torque	31 Nm



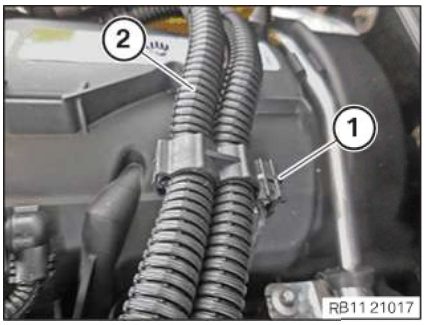
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

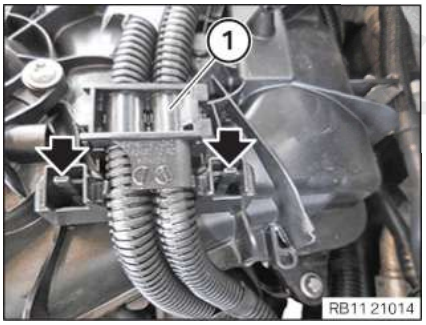
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).



- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

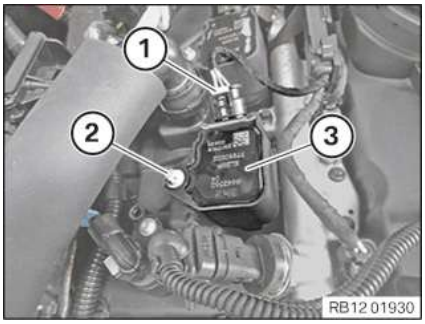
46 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Install ignition coil.**

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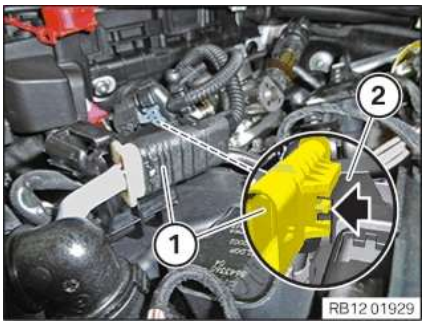


- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.
  The connector (1) must engage audibly.

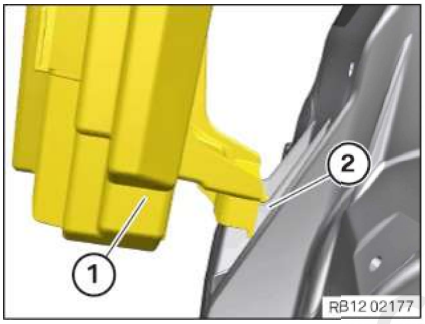


- Connect and lock connector (1) with holder (2) (arrow).
  The connector (1) must engage audibly.

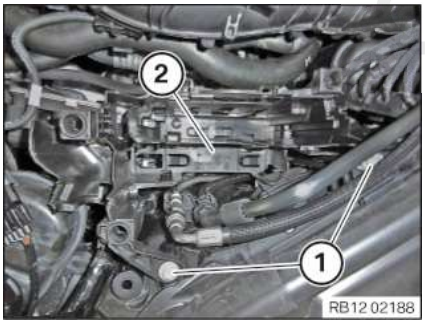


- Connect connectors (1) and lock.
  The connector (1) must engage audibly.

47 – Installing the control unit holder



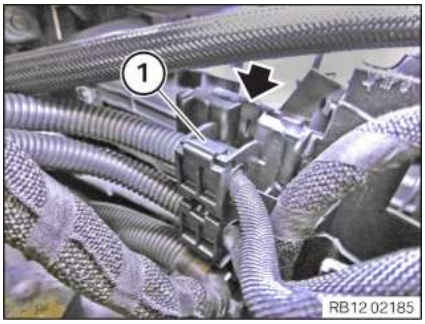
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

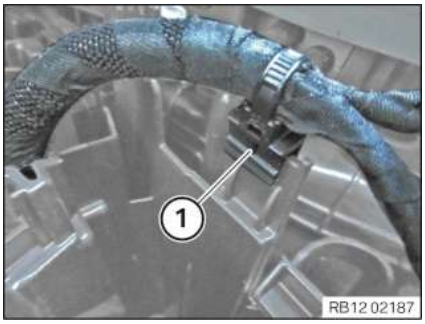
Control unit holder on spring strut dome

Hexagon screw		Tightening torque	8 Nm

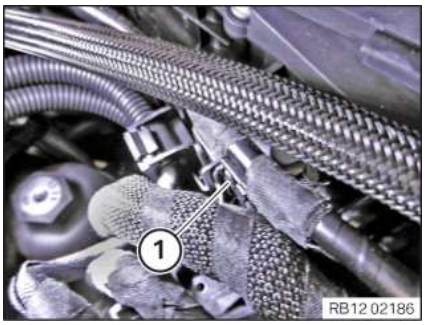


- Feed in and install the cable clip (1).
  Lock (arrow) must audibly engage.

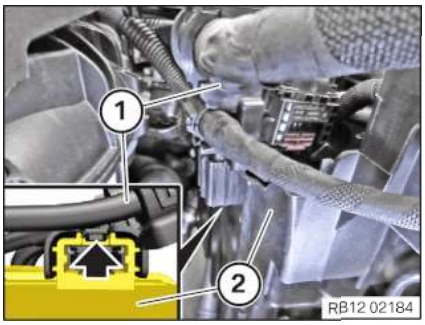
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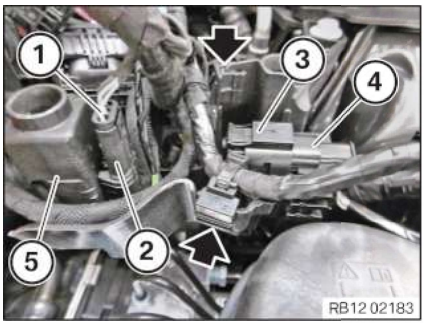
- Secure clamps (1).



- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

48 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

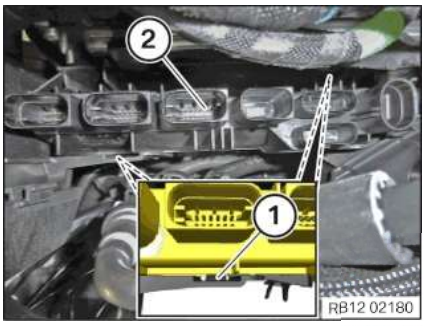
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Insert and install the integrated supply module (PDM) (2).

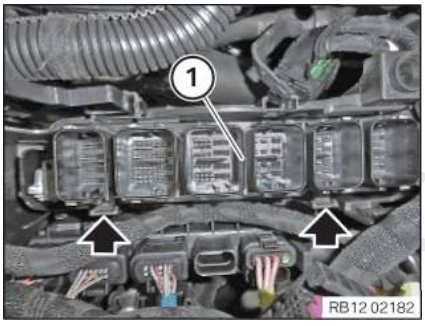
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



- Connect connectors (1) and lock.

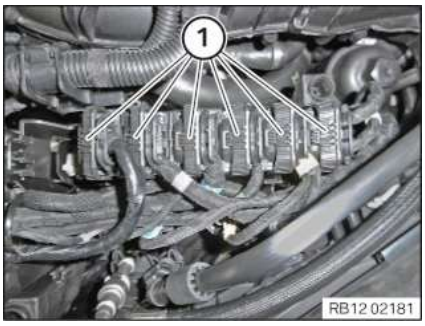
  The connectors (1) must engage audibly.

49 – Installing the DME control unit



- Feed in and install DME control unit (1).

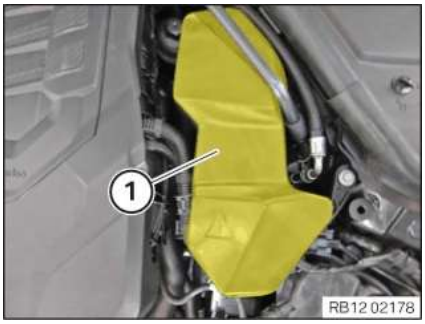
  The locks (arrows) must engage audibly.



- Connect connectors (1) and lock.

  All connectors (1) must engage audibly.

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- Insert and install cover (1) into guides.

50 – Installing the drive belt for alternator

Overview of drive belt for alternator



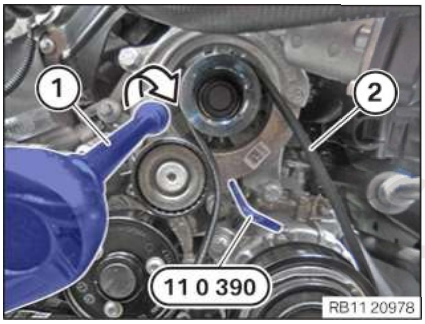
1. Drive belt for alternator

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.

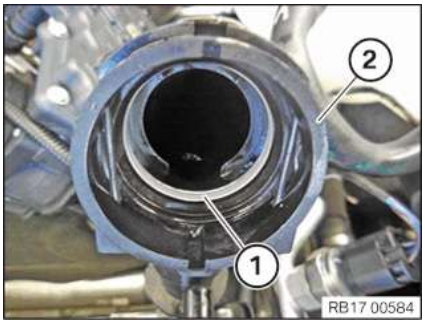


- Position the drive belt for alternator (2) on the ancillary components.
- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Feed the special tool 0 496 268 (11 0 390) out of the belt tensioner and remove it.

51 – Connecting the coolant lines for the high-temperature coolant circuit

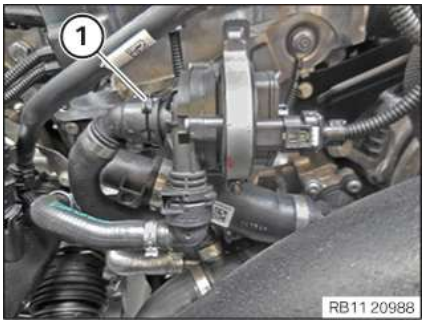
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.

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- Connect and lock coolant line (1).
  Coolant line (1) must audibly engage.

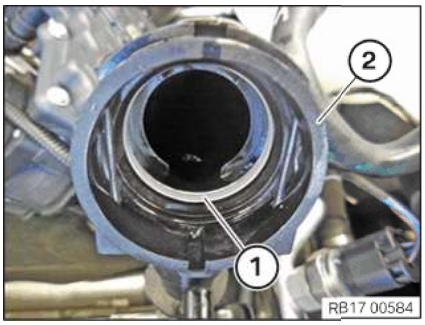


- Connect and lock coolant line (1).
  Coolant line (1) must audibly engage.

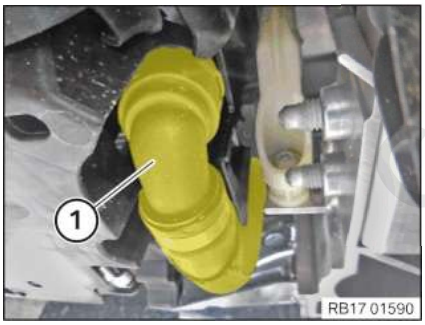
52 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

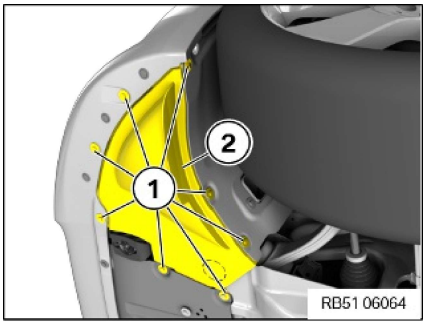
Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).
  The coolant line (1) must audibly engage.



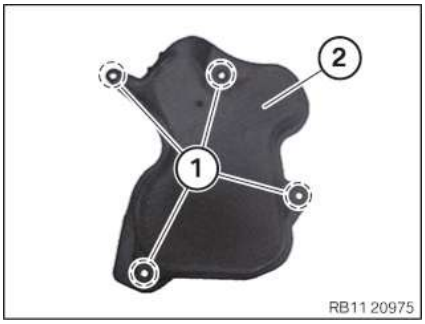
- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

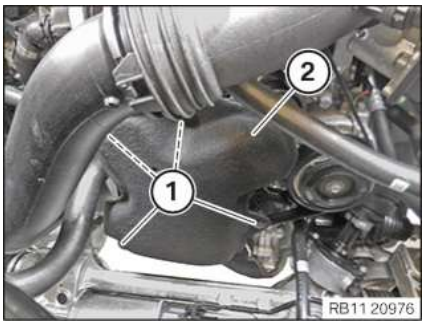
53 – Install the acoustic cover for the engine at the front

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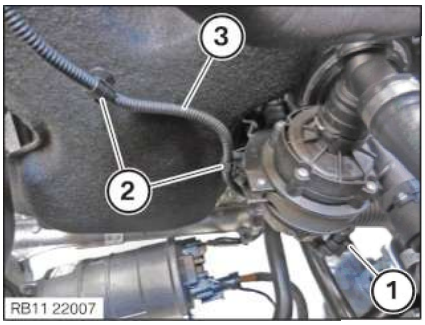


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

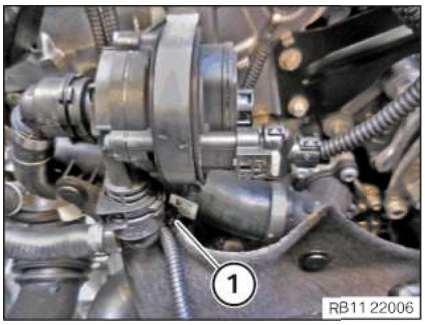


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



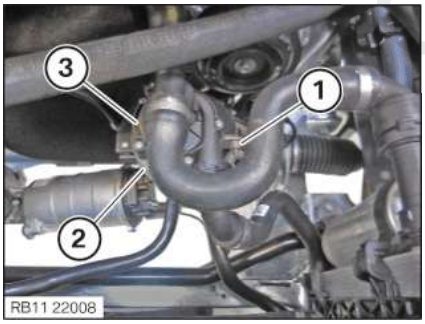
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

54 – Mounting the electrical auxiliary coolant pump for the charge air cooler/air conditioning condenser



- Feed in and position the electrical auxiliary coolant pump (3).
- Insert and install the holder (2).
- Tighten nut (1).

Electric coolant pump to holder

M6		Tightening torque	8 Nm

55 – Install automatic transmission (GA8HP51Z)

RISK OF DAMAGE

Damage to the transmission.

Damage to the transmission through unapproved transmission oil.

- Use only the approved transmission oil.
- After completion of repair work, check transmission oil level.

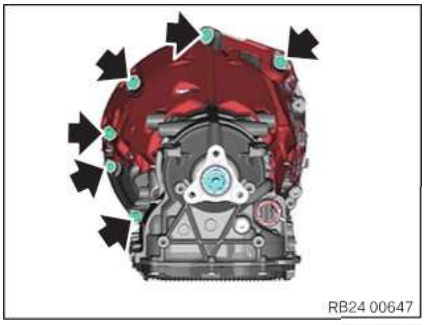
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TECHNICAL INFORMATION

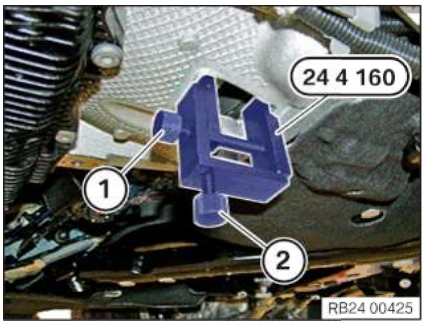
After completion of the work, program the control unit for the electronic transmission control (EGS).



- Check the fitting sleeves (1) for correct fit and damage and renew as needed.



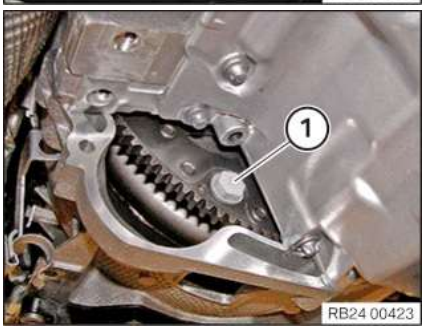
- Transmission flange-mount.
- Rotate the torque converter until the bore hole of the torque converter is flush with bore hole in drive plate.
- Fit the transmission bolts (arrows) and apply lightly.



- Release screw (1) and screw (2).
- Remove special tool 0 494 451 (24 4 160).



- Install the sealing cap (1).



TECHNICAL INFORMATION

Only G05 and G07

In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

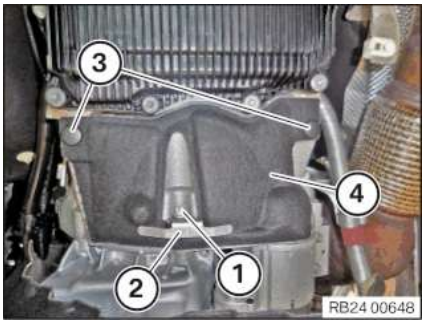
- Renew screws.

  Parts: Bolts
- Crank the engine on the vibration damper in the direction of rotation using special tool 0 493 380 (11 6 480) to tighten all six screws (1).
- Tighten all 6 screws (1) of the torque converter using special tool 0 491 667 (24 1 110) .

Torque converter to flywheel

M10	Renew screws.	Tightening torque	56 Nm

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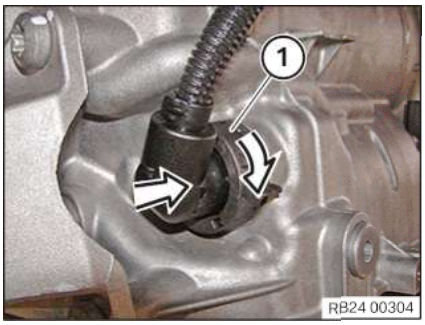
- Install acoustic cover (4).
- Install expanding rivet (3).
- Install the holder (2) and tighten the screw (1).

Transmission to engine

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm



- Remove the special tool 0 494 213 (24 2 390) from the sealing sleeve in direction of arrow.

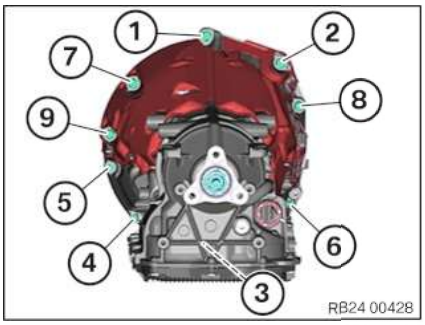


TECHNICAL INFORMATION

Notes on mechatronics are a fundamental requirement for these repair instructions and must be complied with at all times.

For additional information see: 24 34 ... Notes on mechatronics (GA8HP50Z/GA8HP51Z/GA8HP75Z/GA8HP76Z/GA8HP95Z)

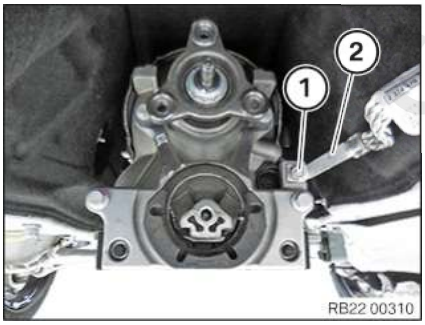
- Slide the connector (1) on and turn it to lock.



- Tighten the transmission bolts in sequence (1) to (9).

Transmission to engine

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm

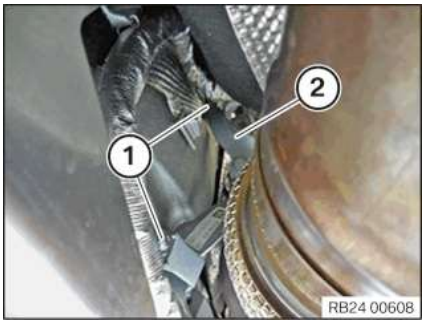


- Install the ground strap (2).
- Tighten down screw (1).

Ground strap to transmission or body

M8		Tightening torque	19 Nm

56 – Install the exhaust bracket

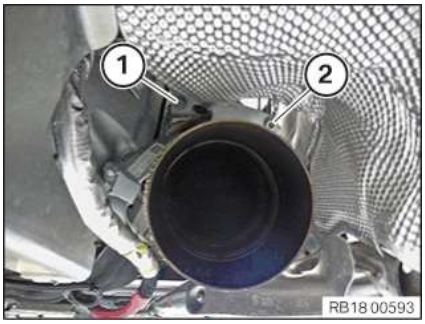


- Install the exhaust bracket (2).
- Tighten the screws (1).

Transmission to engine

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm

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- Tighten down screw (1).

Catalytic converter to holder

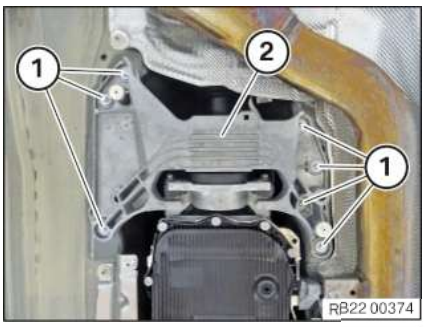
M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (1).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm

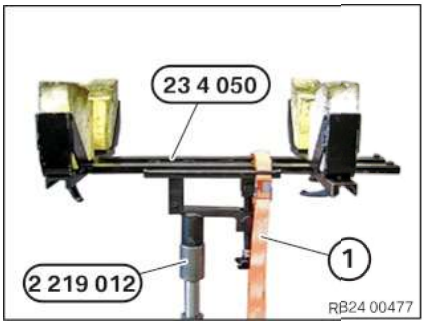
57 – Install transmission cross member.



- Install the transmission cross member (2).
- Tighten the screws (1).

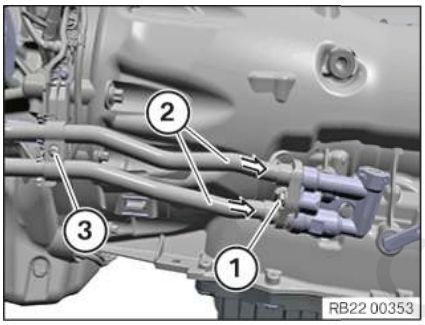
Transmission cross member to body

M8	Renew screws.	Tightening torque	19 Nm



- Loosen the tensioning strap (1) from the transmission.
- Remove the special tools 0 495 498 (23 4 050) and 2 219 012 from the transmission.

58 – Fix hydraulic lines



- Renew sealing rings.

  Parts: Sealing ring
- Install hydraulic lines (2) on transmission.
- Position and tighten the screw (1).

Transmission oil line to transmission

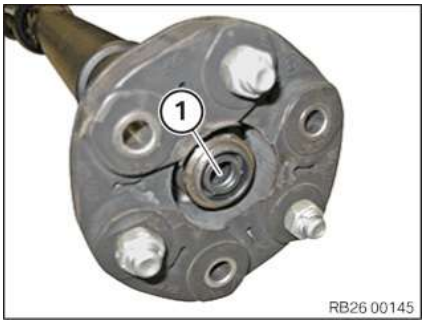
M6x25	Renew the sealing ring.	Tightening torque	8 Nm

- Position and tighten the screw (3).

Transmission oil line on holder

M6		Tightening torque	8 Nm

59 – Partially installing the propeller shaft



- Check centring (1) for damage; renew if necessary.

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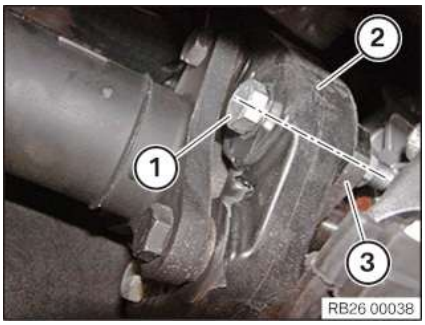


- Apply a thin coat of grease to the soft centring (1), if necessary.

  Do not grease the hard centring (2).

Expendable materials

Lubricating grease Olistamoly 2 LN 584 LO	100 g, Tube	83 19 0 447 919

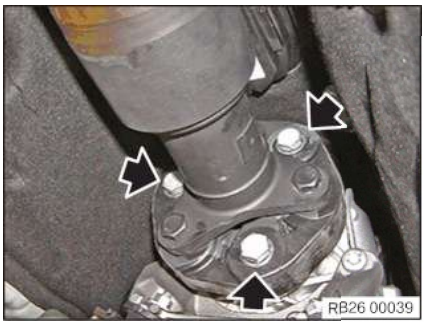


- Renew screws and the self-locking nuts.

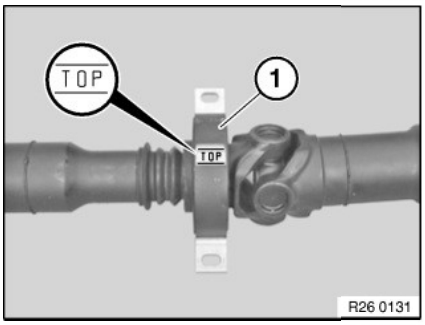
  Parts: Screws, self-locking nuts

- Assemble the screw connections (1) of the flexible disc (2) and the three-hole flange (3) according to the self-affixed identification.

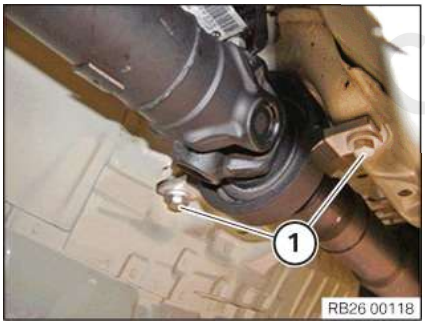
  This should prevent a humming noise from the drive train during driving.



- Hand-tighten the screws and nuts (arrows), but do not tighten fully.



- **Centre mount with TOP marking:**
- The centre mount (1) must be installed with the TOP marking at the top in the gearbox tunnel.



- Position centre mount.
- Hand-tighten the bolts (1), but do not tighten fully.



- Renew screws.

  Parts: Bolts

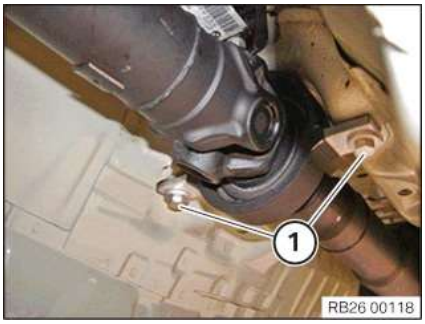
- Provide counter support for the bolts of the flexible disc on the nut and tighten with the bolts.

Front flexible disc to propeller shaft

M12	Renew screws. Comply with jointing torque and angle of rotation. Tightening via screw.	Jointing torque Angle of rotation	55 Nm 90 °

- Secure the special tool 0 490 504 (00 9 120) with the special tool on the vehicle underbody and continue to screw it in according to the angle of rotation.

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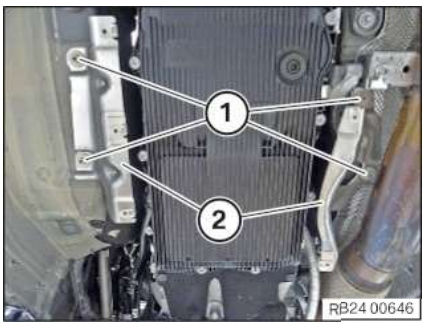


- Tighten the screws (1).

Centre mount to body

M8		Tightening torque	19 Nm

60 – Install the retaining plates

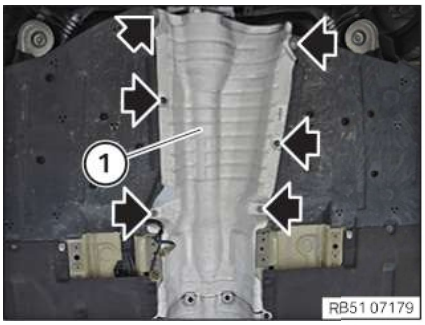


- Feed in retaining plate (2) and install.
- Tighten nuts (1).

Retaining plates for vehicle underbody cover

Sheet metal nut	Replace nuts.	Tightening torque	3 Nm

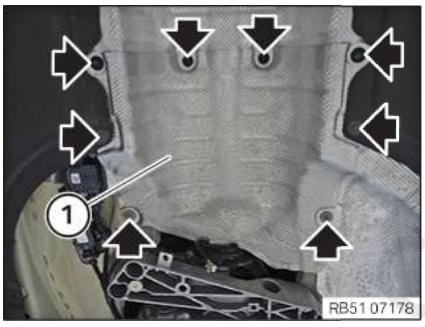
61 – Install the heat shields



- Install heat shield (1).
- Tighten the nuts and bolts (arrows).

Heat shield to vehicle underbody

Screws and nuts		Tightening torque	3 Nm

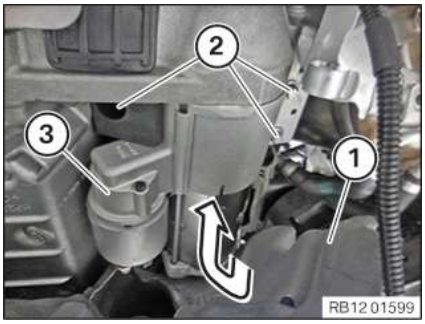


- Install heat shield (1).
- Tighten the nuts and bolts (arrows).

Heat shield to vehicle underbody

Screws and nuts		Tightening torque	3 Nm

62 – Installing starter motor

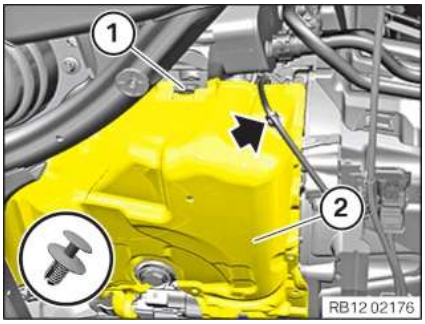


- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Feed in and install the starter motor (3) in the direction of the arrow.
- Tighten the screws (2).

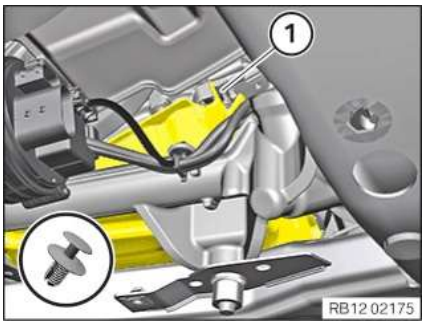
Starter motor to engine

M8X60		Tightening torque	19 Nm

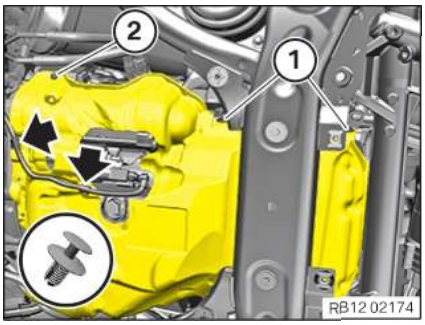
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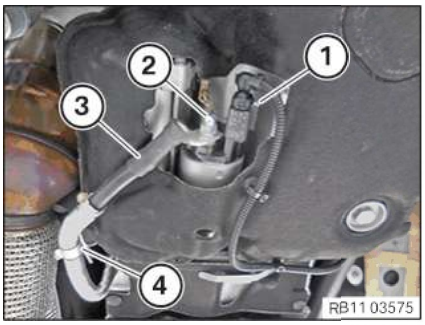
- Position the acoustic cover (2).
- Fasten expanding rivet (1).
- Secure clamp (arrow).



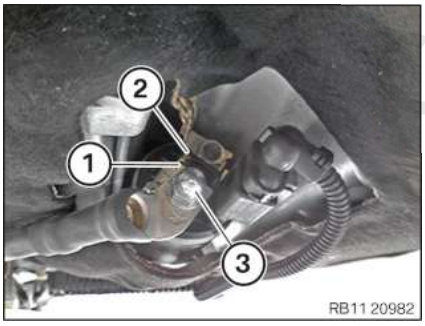
- Fasten expanding rivet (1).



- Secure fir tree clip (2).
- Secure expanding rivet (1).
- Secure the clamps (arrows).



- Secure the positive battery cable (3) in the holder (4) and position it at the starter motor.
- Tighten the nut (2) hand-tight.
- Connect the connector (1) and audibly lock it.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

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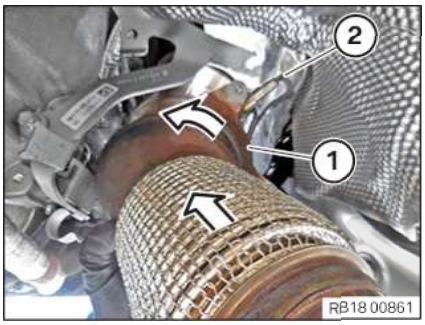
- Renew the V-clip (1).

  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket



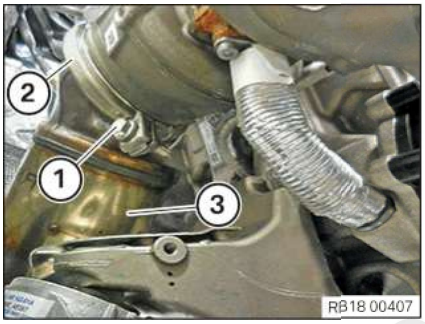
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

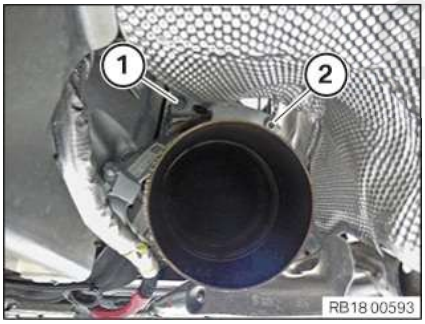
- Remove and install heavy components with the aid of another person/other persons.

- Guide in and install the catalytic converter (1) in the direction of arrow.
- Make sure that the monitoring oxygen sensor (2) **is not damaged.**



- Renew the V-clip (2).

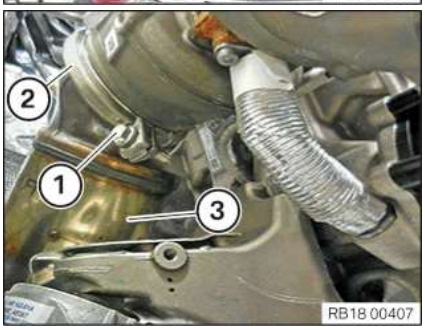
  Parts: V-band clamp
- Feed in and install V-clip (2) on the catalytic converter (3).
- Position the bolt (1).



- Renew the screw (1).

  Parts: Screw
- Position the bolt (1).
- Renew nut (2).

  Parts: Nut
- Position the nut (2).



- Position the catalytic converter (3).
- Position V-clip (2).

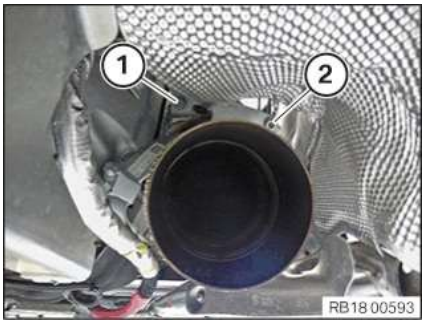
Note: Ensure correct mounting orientation of the V-clip.

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

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- Tighten down screw (1).

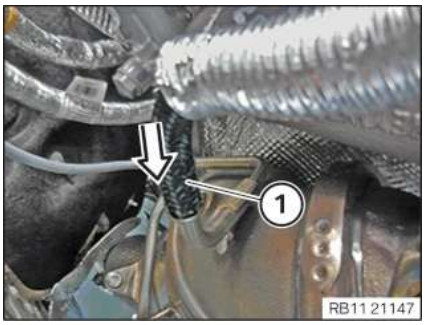
Catalytic converter to holder

M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm



- Check the pressure hose (1) for damage and renew hardened pressure hose (1) if necessary.
- Connect the pressure hose (1) in direction of arrow to the limit position.

64 – Installing the complete exhaust system

CAUTION

Component with heavy weight.

Danger of injury!

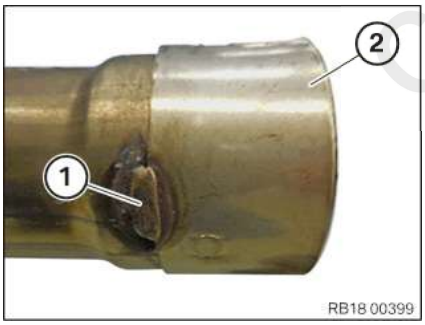
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



CAUTION

Swarf resulting from sawing or grinding components.

Danger of injury!

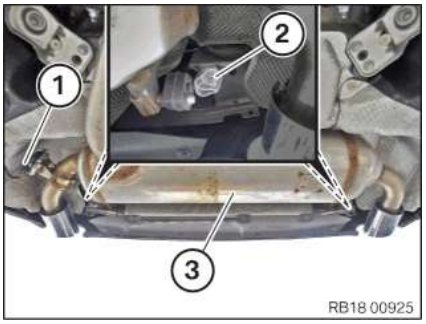
- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp

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- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

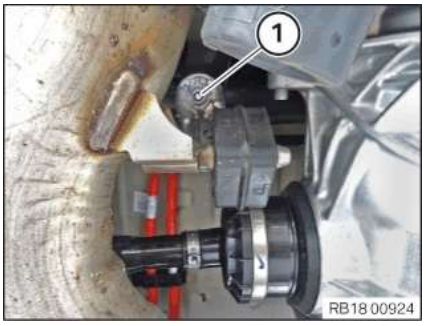
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

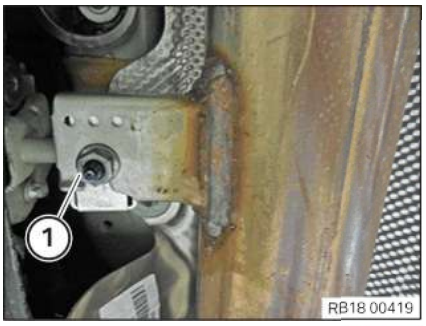


- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm

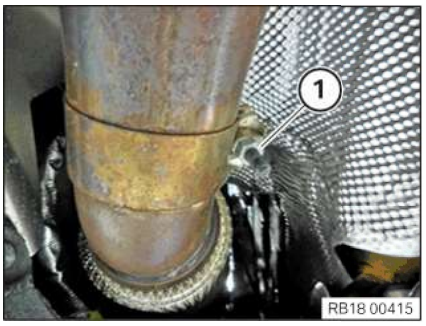


- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

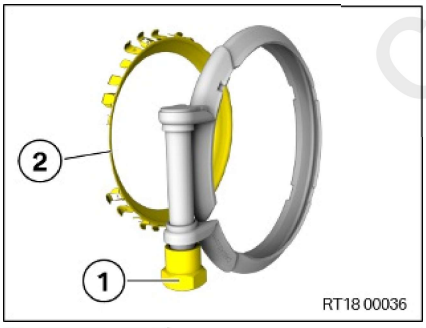
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

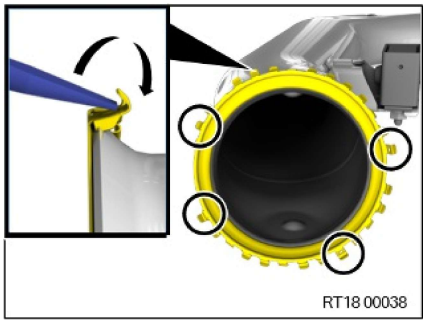


- **Equipment specification 2 (V-clips)**

  Renew V-band clamp.

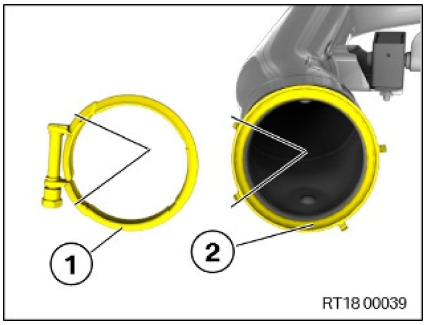
  Parts: V-band clamp

  Unscrew the nut (1) and remove the sealing ring (2).

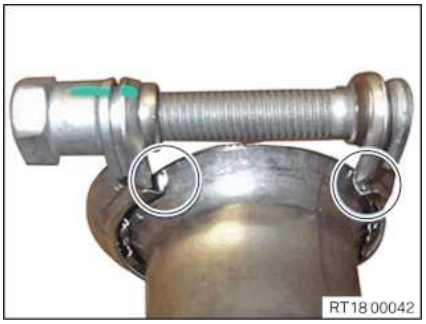


- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.

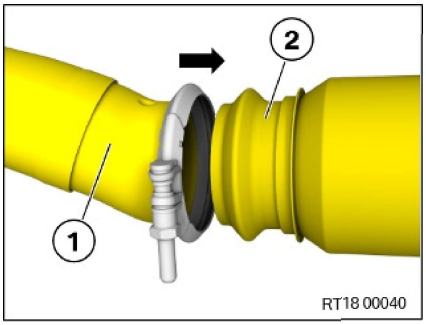
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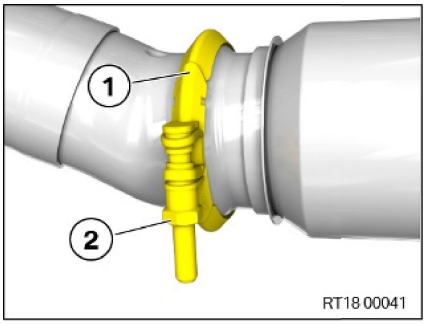
- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).



- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.



- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).

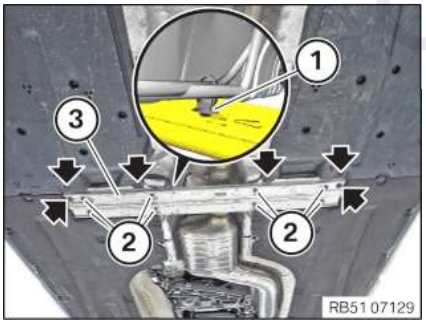


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

65 – Install the connecting supports on the tunnel



- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- Tighten screws (arrows).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

66 – Install the control sensor

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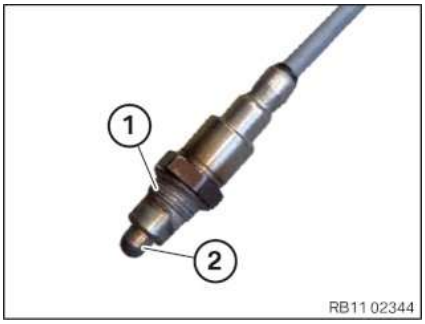
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

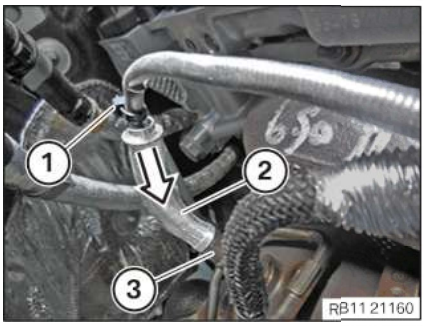
  (2) = Sensor ceramics



- Screw the control sensor (1) in and tighten it with the special tool 0 491 074 (11 7 020).

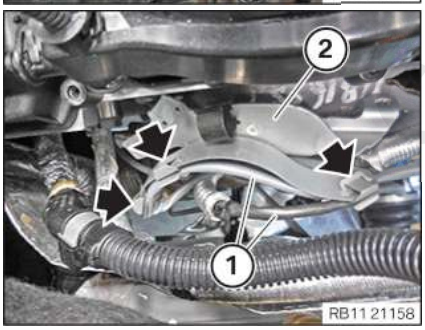
Control sensor

M18x1.5		Tightening torque	50 Nm



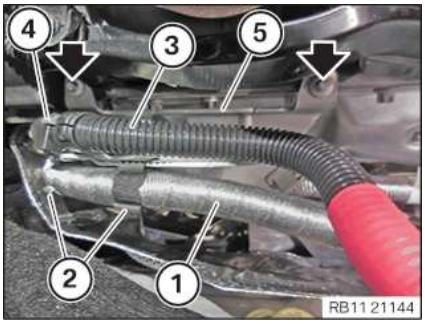
- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

  Parts: Cable strap
- Guide in and install the cable strap (1).



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).

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CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

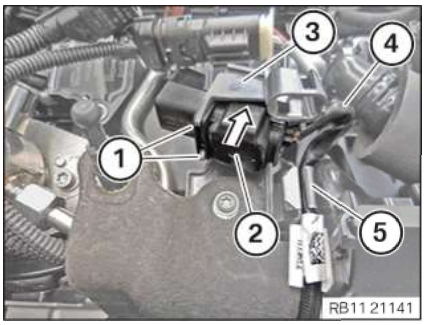
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

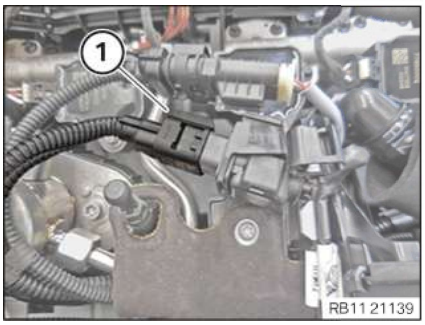
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).



- Guide in the connector (2) in the direction of arrow at the carrier plate (3) and install.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).

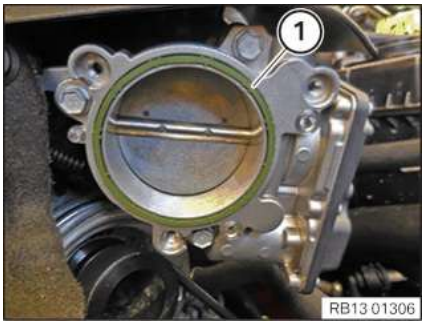


- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Connect and lock the connector (1).
- Guide the connector (1) into the carrier plate in the direction of arrow.
- Ensure the connector (1) audibly engages with the carrier plate.

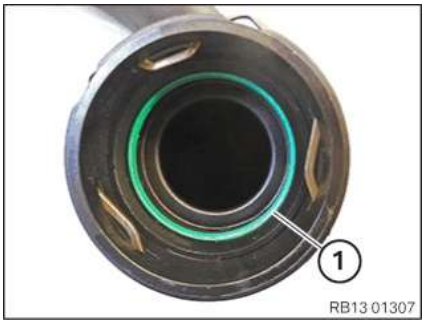
67 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring

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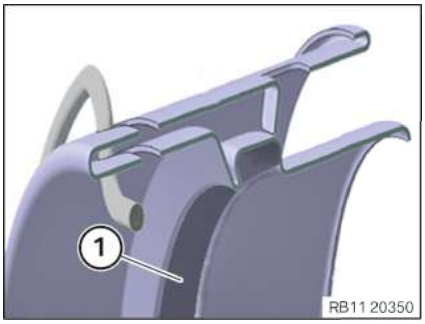


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▸ **Replace damaged gasket**

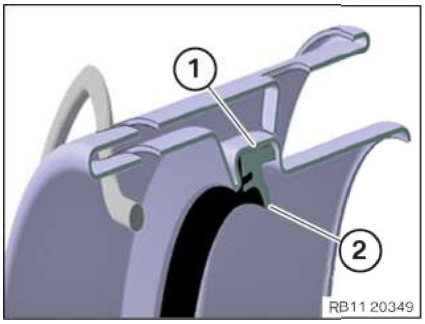
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



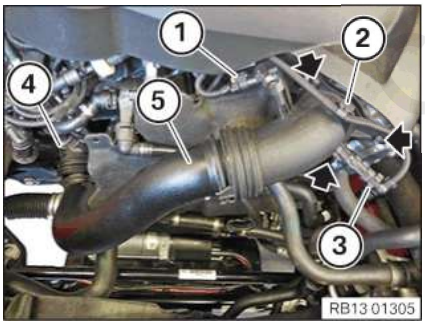
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

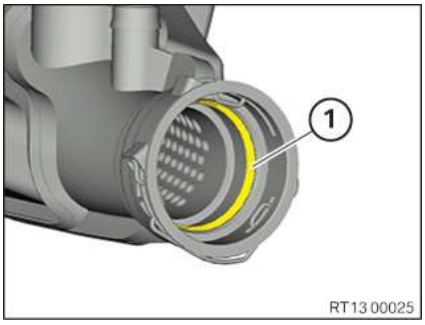
Charge air line to throttle body

M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

68 – Installing the clean air pipe with resonator

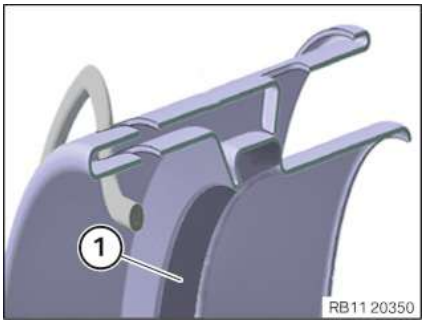


- Check the seal (1) for damages, replace if necessary.

▶ **Replace damaged gasket**

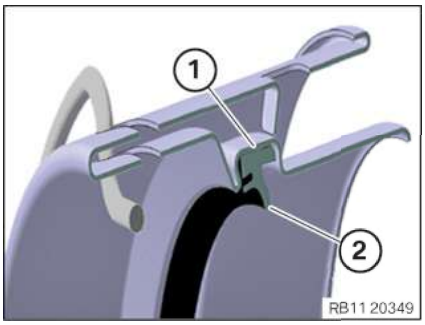
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



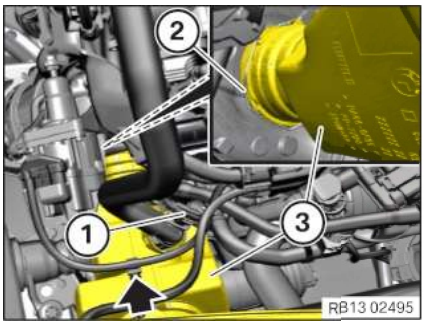
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

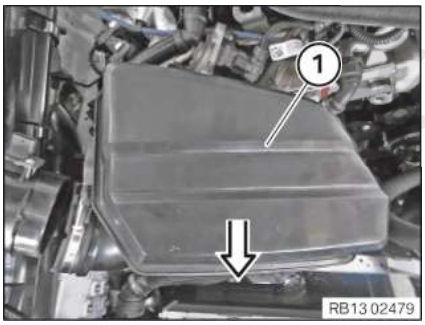
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



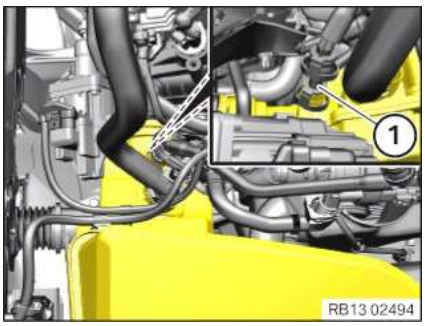
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Secure clamp (arrow).

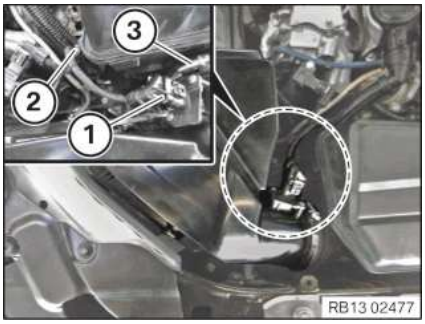


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).

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- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

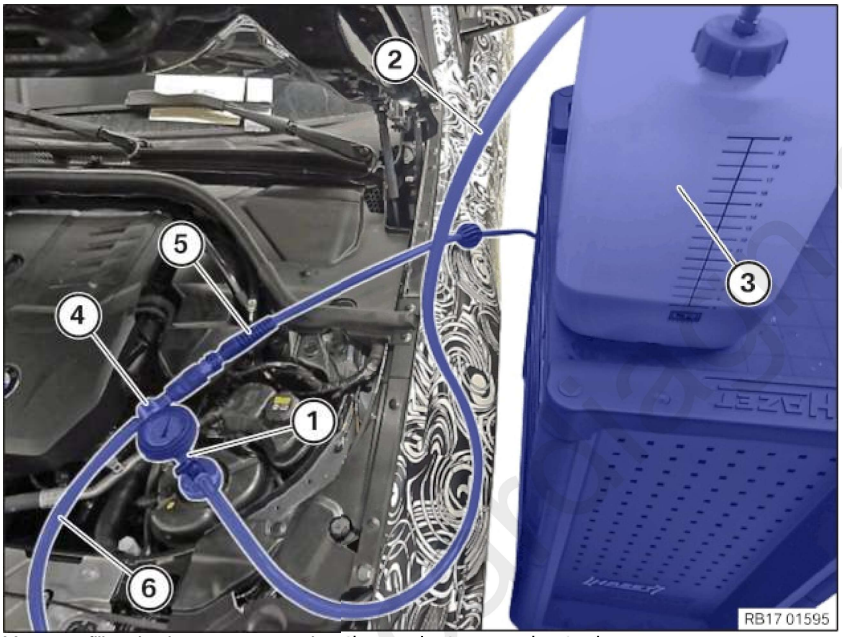
  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

69 – Fill the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.
For additional information see:
Main group 17
17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

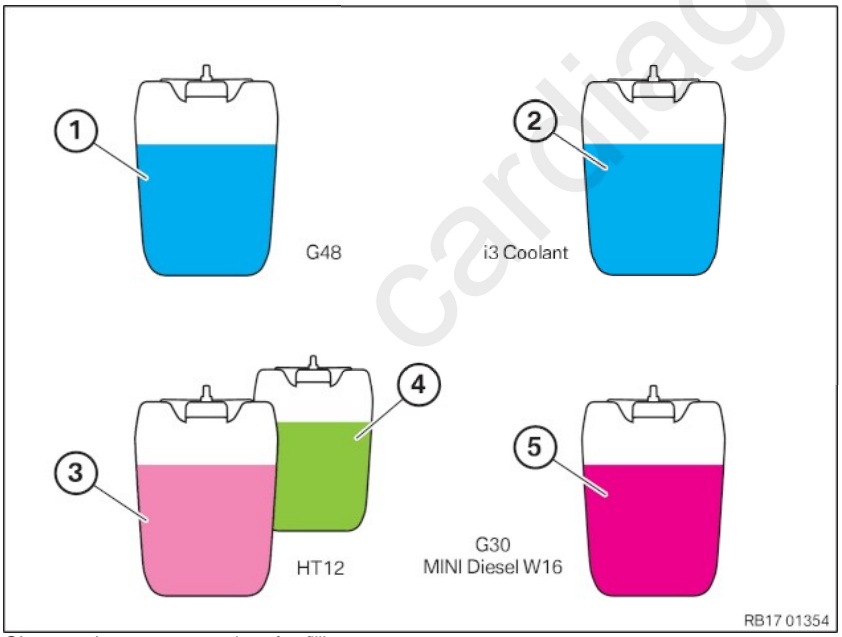
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. **G48 (Blue)** G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.
2. **i3 coolant (blue)** is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.
3. **HT12 (Pink)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
4. **HT12 (Green)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
5. **G30 (Pink)** must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

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RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

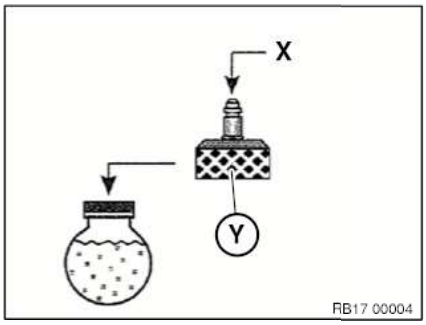
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

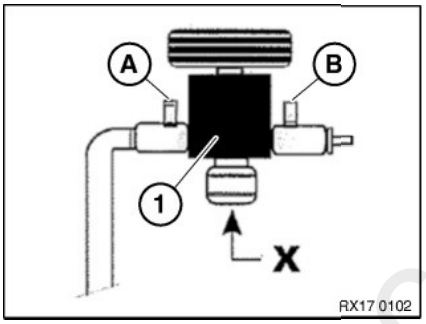
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

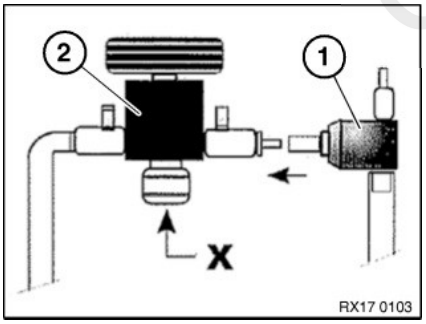
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

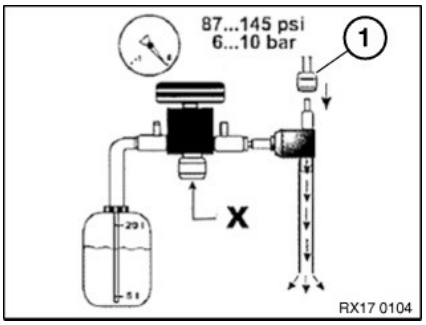


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

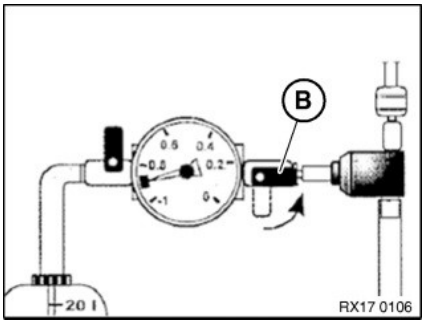
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

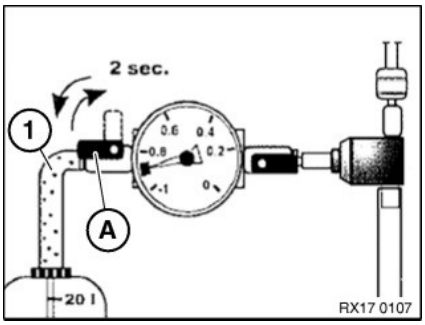
  (X)is the connection on the coolant expansion tank.

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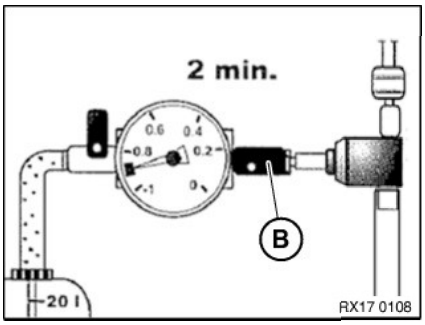
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

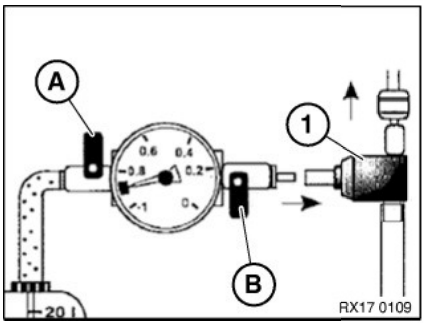


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

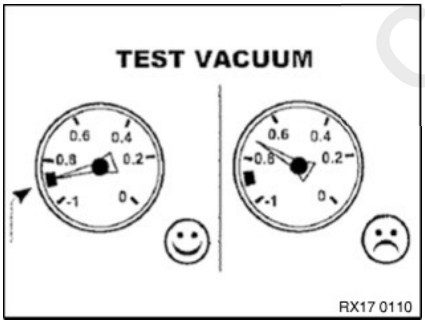
TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).



Check

- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

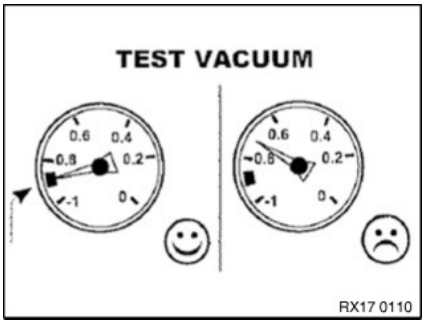
» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check

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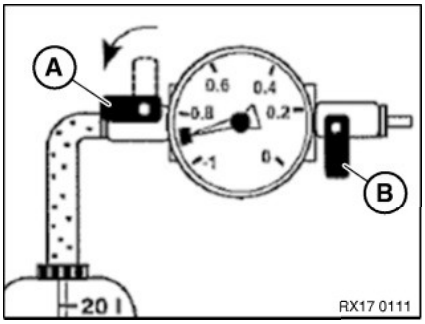
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

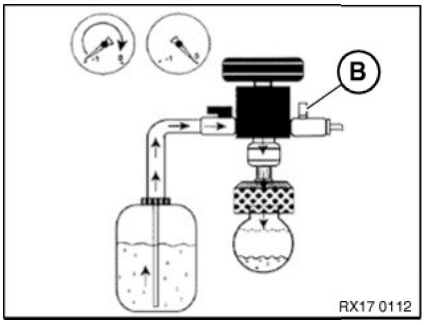
» Vacuum remains constant.

Measure

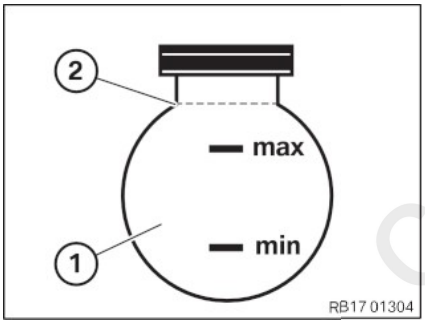
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).

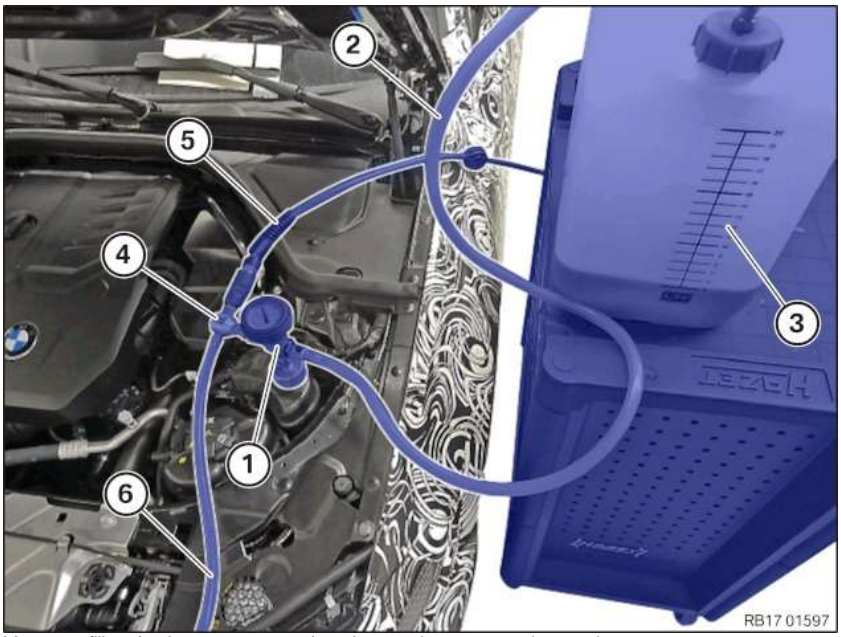


- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

70 – Filling the low-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

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TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

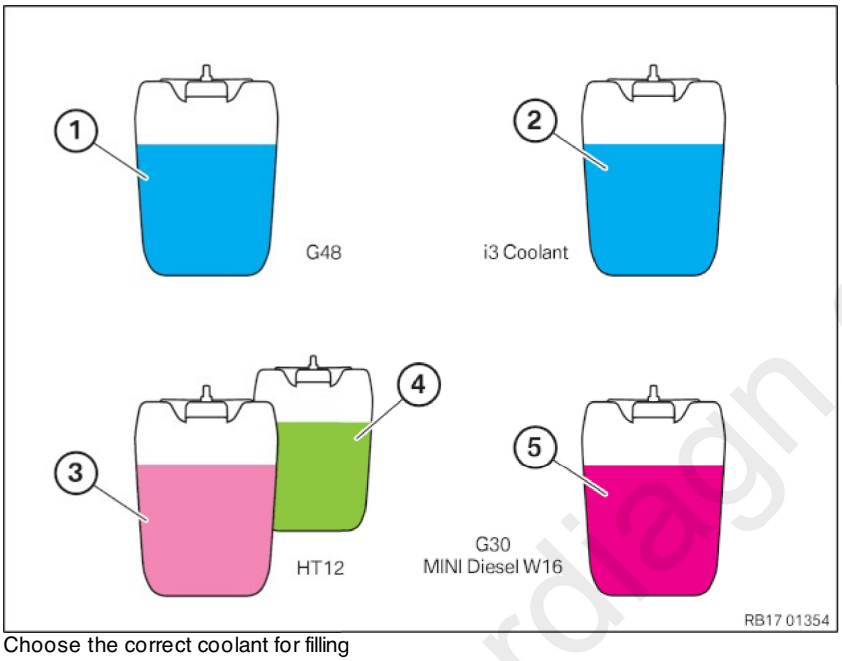
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. **G48 (Blue)** G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.
2. **i3 coolant (blue)** is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.
3. **HT12 (Pink)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
4. **HT12 (Green)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
5. **G30 (Pink)** must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

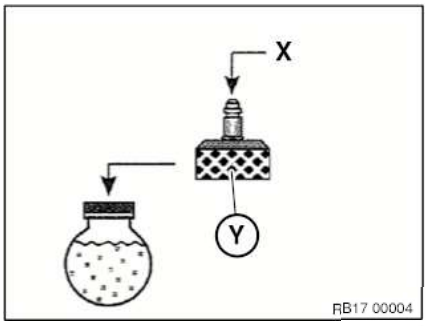
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

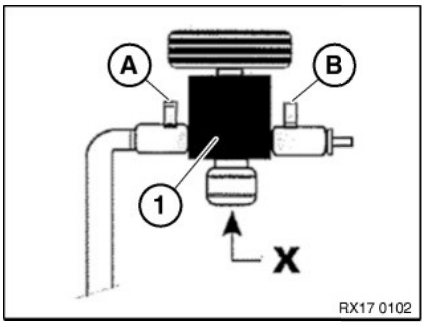
Capacity of low-temperature coolant circuit G20

B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

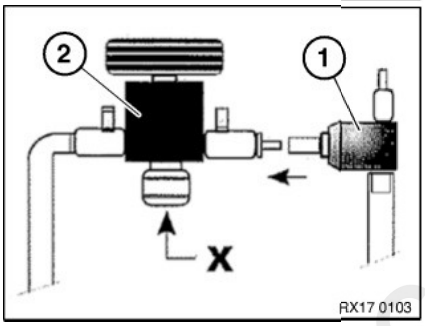
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

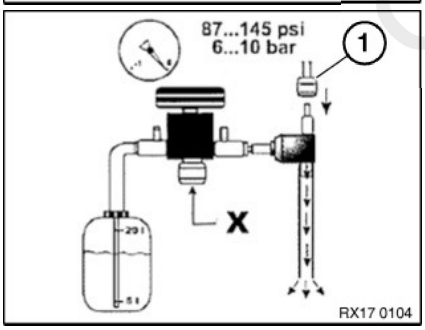


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



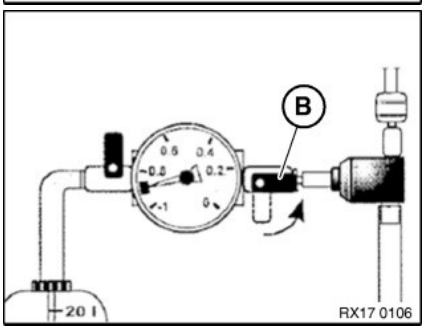
- Connect Venturi nozzle (1) to the vacuum filler device (2).

  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

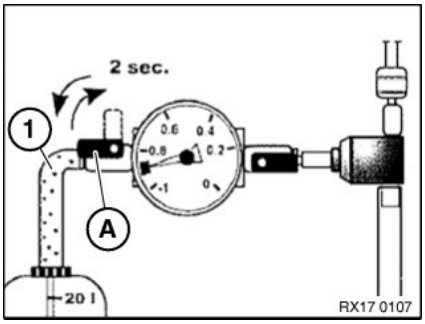
  (X)is the connection on the coolant expansion tank.



- Open shut-off valve (B).

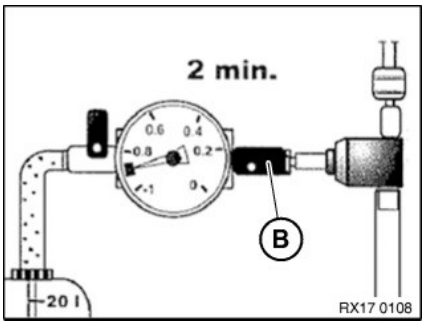
  The venturi nozzle produces a flow noise.

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- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

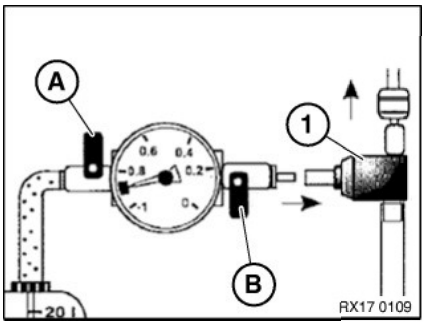


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

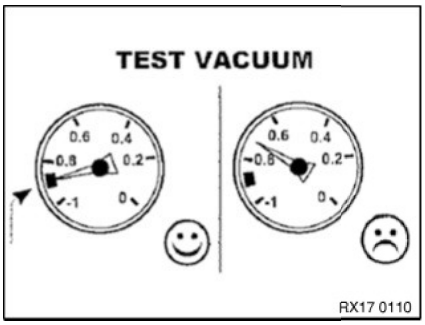
TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).



Check

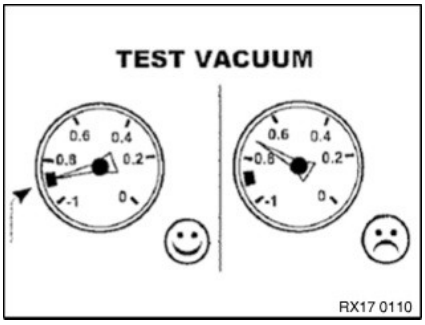
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.



Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

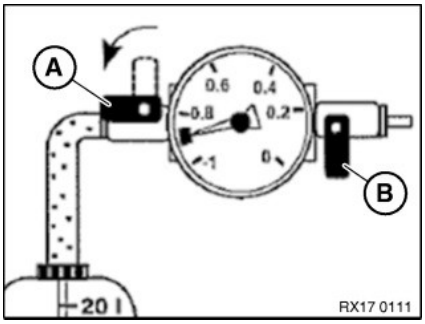
Result

» Vacuum remains constant.

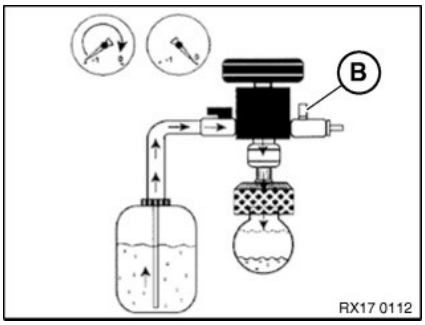
Measure

- Continue with filling.

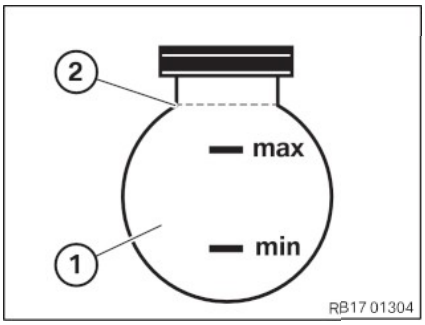
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- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

71 – Disconnecting all battery earth leads



- See additional information.

72 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

73 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

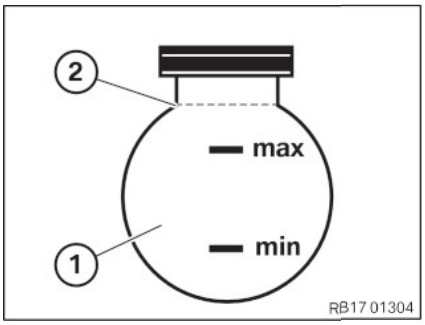
Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

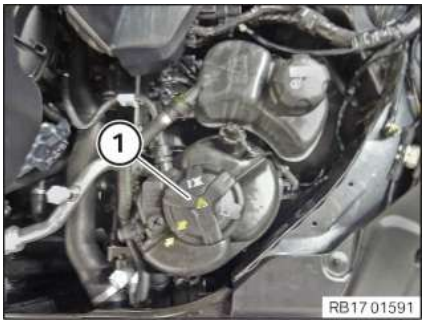
  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

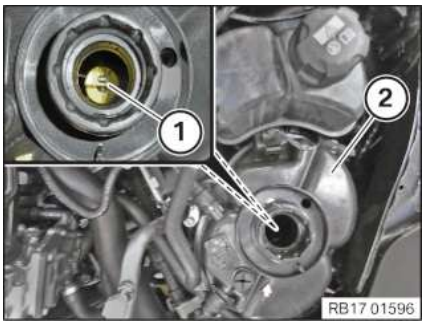
  The engine speed **drops** to the idle speed.
- Observe the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.

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- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

74 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

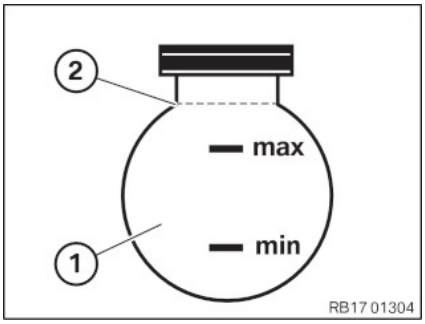
Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

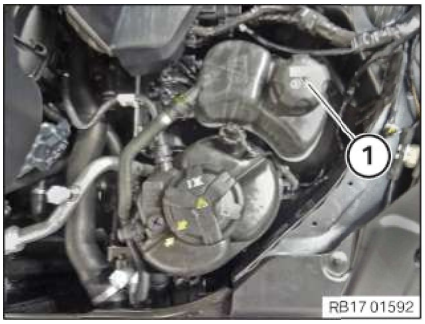
  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.
Overfilling the cooling system serves to balance the remaining air in the cooling system.
The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

75 – Check the high-temperature cooling system for watertightness

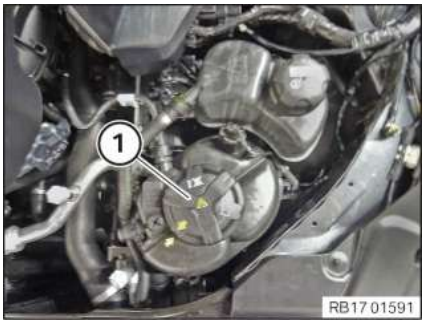
WARNING

Hot surfaces.

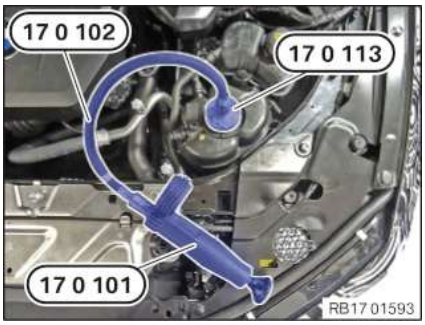
Risk of burning!

- Perform all work only on components that have cooled down.

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- Loosen sealing cap (1).



- Attach the special tool 0 494 418 (17 0 101) with special tools 0 494 419 (17 0 102) and 0 494 642 (17 0 113) from the set of special tools 0 494 417 (17 0 100).
- Build up excess pressure and wait for approximately 2 minutes.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



TECHNICAL INFORMATION

If the described test step is not completed successfully: repeat test step twice. Only replace the sealing cap after three tests with an incorrect opening pressure.

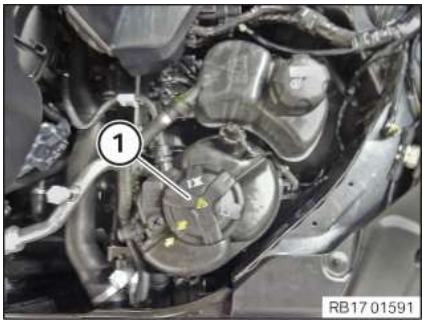
When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has cooled down. These traces of coolant do not indicate whether the sealing cap is defective or not.

Escaping coolant vapours when the vehicle is at standstill may cause the pressure relief valve to stick to the sealing cap. This may cause an incorrect opening pressure.

- Screw on sealing cap (1) on special tool 0 494 643 (17 0 114) from the set of special tools 0 494 417 (17 0 100).
- Build up the pressure with special tools 0 494 418 (17 0 101) and 0 494 419 (17 0 102) from the set of special tools 0 494 417 (17 0 100).
- Observe on the pressure measuring device when the opening pressure has been reached.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

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WARNING

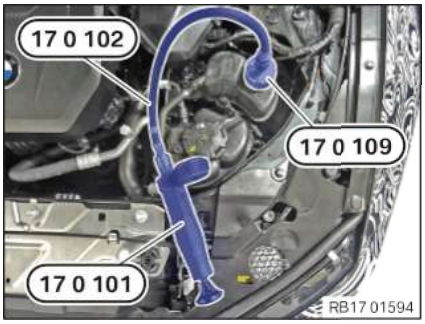
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



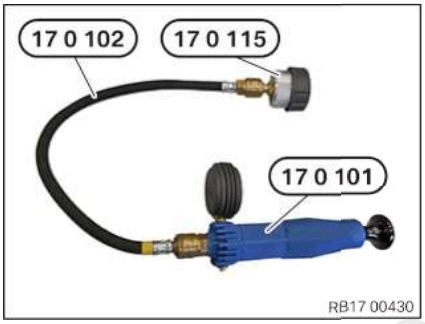
- Loosen sealing cap (1).



- Attach the special tool 0 494 418 (17 0 101) with special tools 0 494 419 (17 0 102) and 0 494 426 (17 0 109) from the set of special tools 0 494 417 (17 0 100).
- Build up excess pressure and wait for approximately 2 minutes.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



TECHNICAL INFORMATION

If the described test step is not completed successfully: repeat test step twice. Only replace the sealing cap after three tests with an incorrect opening pressure.

When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has cooled down. These traces of coolant do not indicate whether the sealing cap is defective or not.

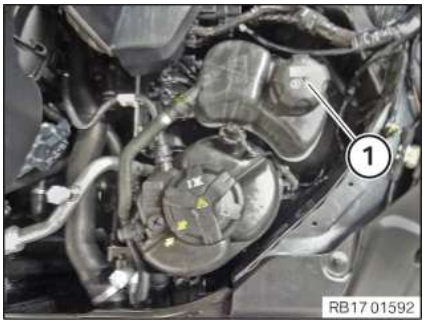
Escaping coolant vapours when the vehicle is at standstill may cause the pressure relief valve to stick to the sealing cap. This may cause an incorrect opening pressure.

- Screw on sealing cap (1) on special tool 0 495 889 (17 0 115) from the set of special tools 0 494 417 (17 0 100).
- Build up the pressure with special tools 0 494 418 (17 0 101) and 0 494 419 (17 0 102) from the set of special tools 0 494 417 (17 0 100).
- Observe on the pressure measuring device when the opening pressure has been reached.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

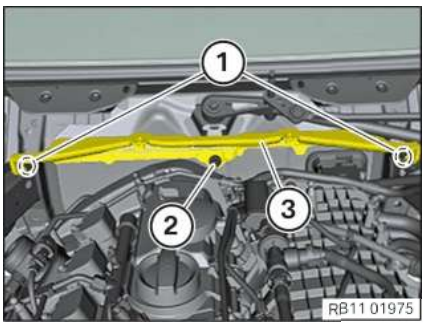
Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

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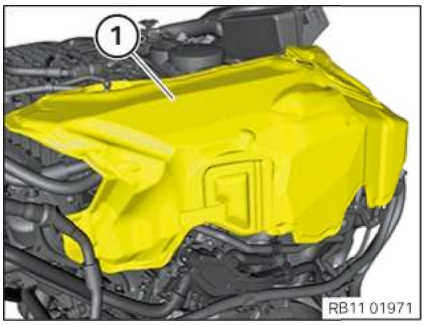
- Close sealing cap (1).

77 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

78 – Installing acoustic cover at rear

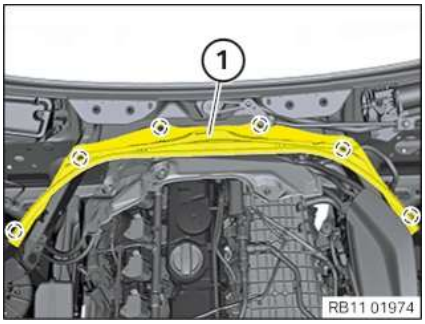


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

79 – Installing the centre bulkhead upper part

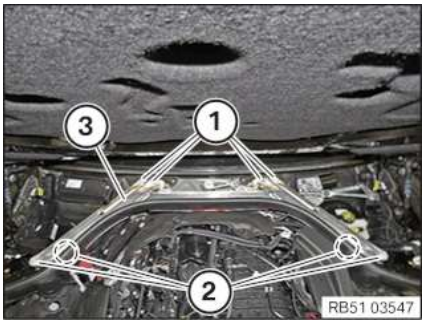


- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

	Tightening torque	3 Nm

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- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

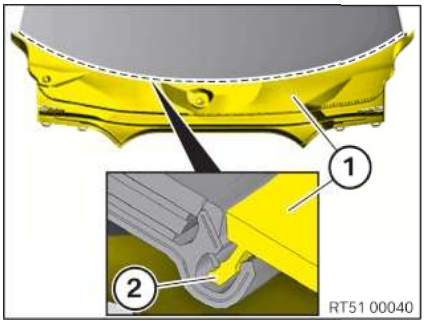
80 – Installing cowl panel cover

RISK OF DAMAGE

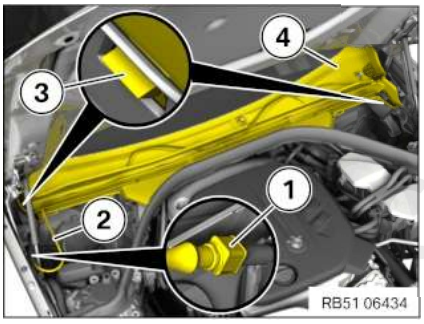
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

81 – Installing both wiper arms

NOTICE

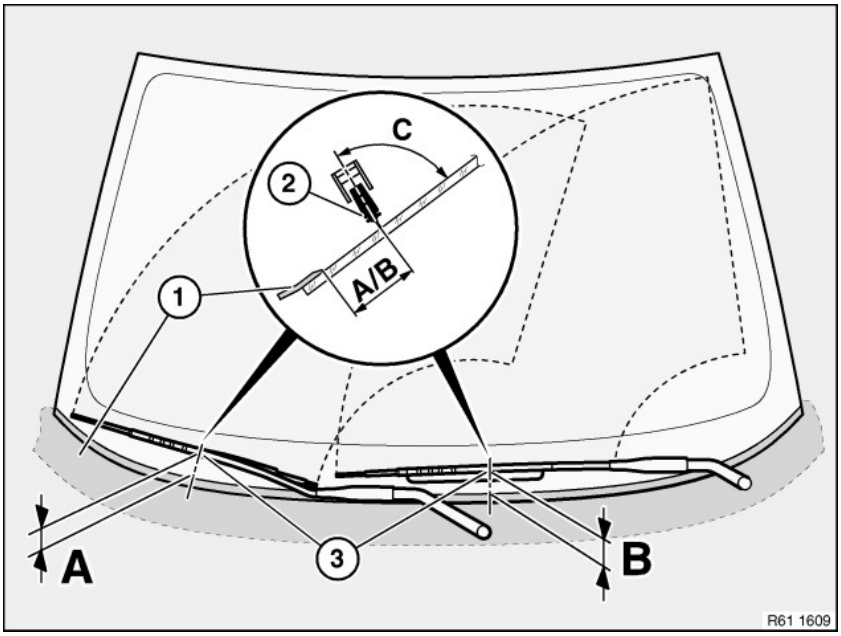
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.

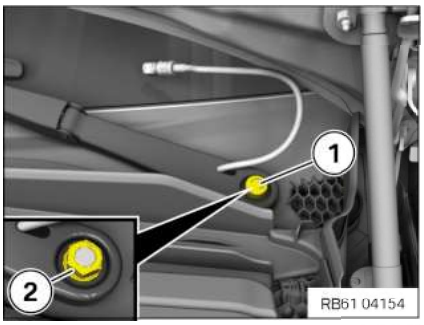
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

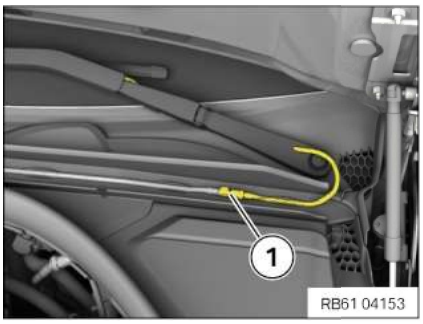


- Tighten nut (2).

Windscreen wiper arm

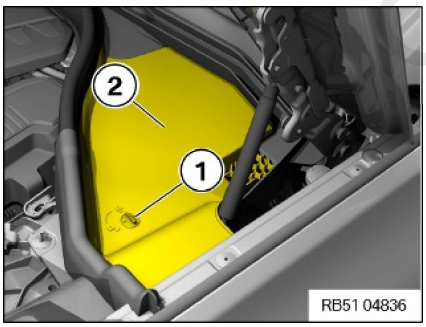
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



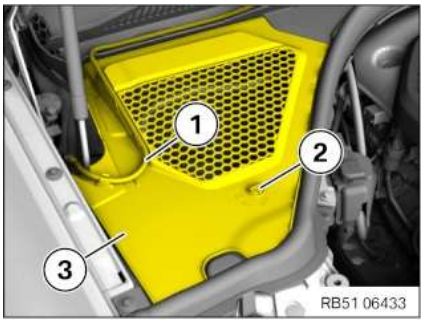
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

82 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

83 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

84 – Install the seal for the bonnet

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- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

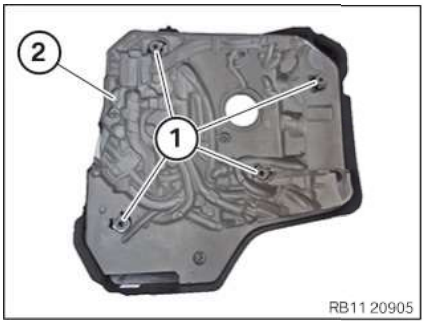
85 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



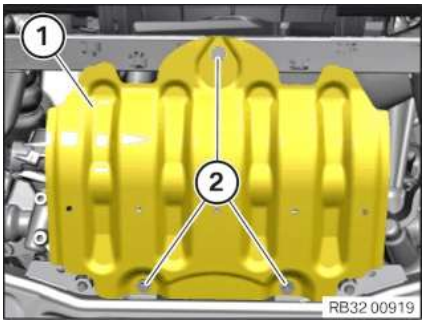
- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

86 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



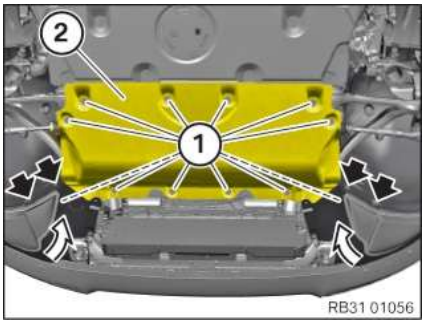
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

87 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

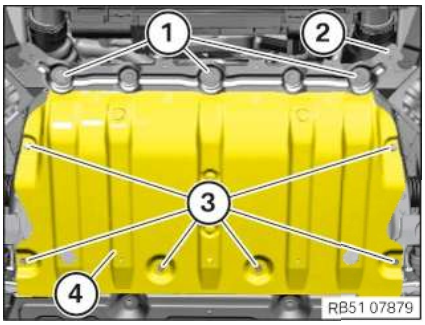
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

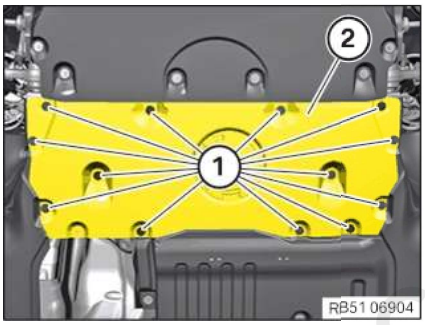
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

88 – Installing the centre underbody protection



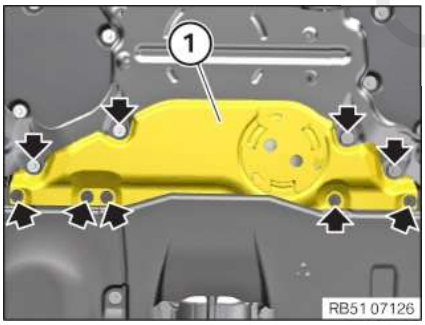
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

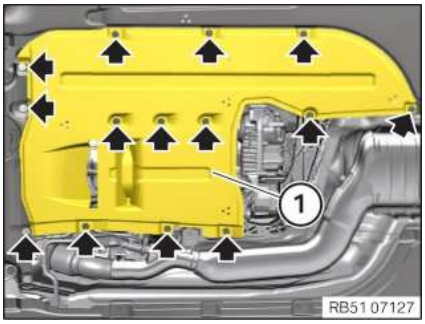
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

89 – Installing underbody protection at rear



- **Version 1:**

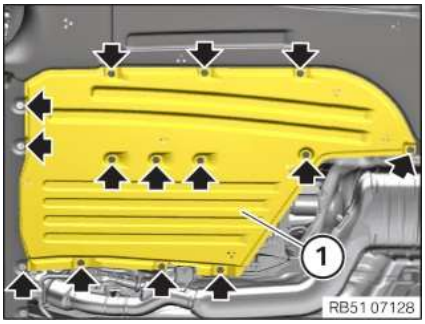
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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- **Version 2:**

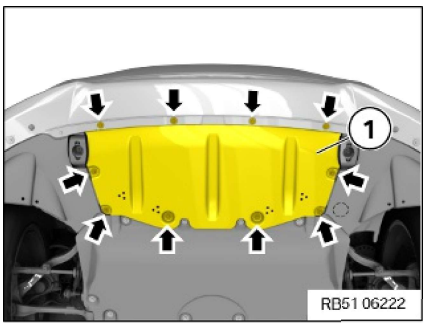
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

90 – Installing the front underbody protection



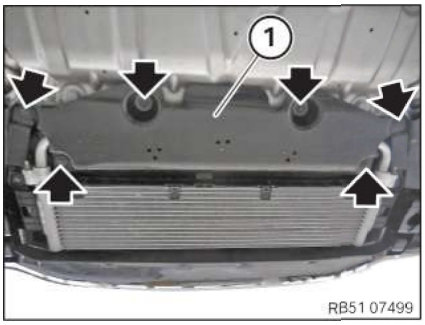
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



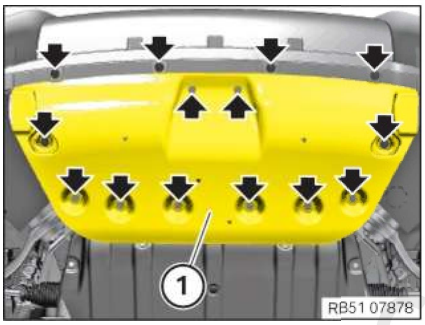
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

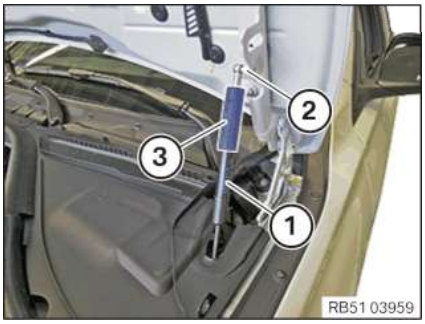
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

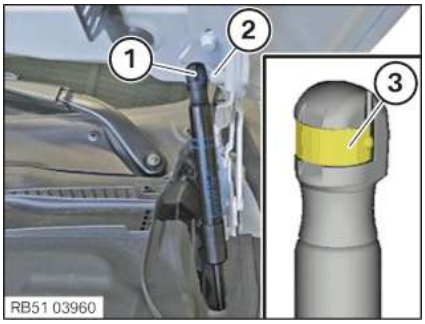
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

91 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Special tool to cylinder head			Used in step 41
M8		Tightening torque	21,5 Nm

Engine mount to engine mounting bracket			Used in step 43
M12		Tightening torque	100 Nm

Holder for transmission oil line			Used in step 43
Screw	*Renew screw.*	Tightening torque	5 Nm

Intake plenum to support			Used in step 43
M6X25		Tightening torque	8 Nm

Manifold support to crankcase			Used in step 43
M6x16		Tightening torque	8 Nm

Positive battery cable			Used in step 43
Flange nutM8		Tightening torque	15 Nm

Air conditioning compressor in component carrier			Used in step 43
M10		Tightening torque	38 Nm

Transmission oil line holders to component carrier			Used in step 43
M6X16		Tightening torque	12 Nm

Fuel delivery line to high pressure pump			Used in step 45
M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover			Used in step 45
M6 screw		Tightening torque	6,5 Nm

Ignition coil			Used in step 46
Screw		Tightening torque	8 Nm

Control unit holder on spring strut dome			Used in step 47
Hexagon screw		Tightening torque	8 Nm

Cover, front bottom on side			Used in step 52
Hexagon screw for thermoplastic		Tightening torque	3 Nm

Electric coolant pump to holder			Used in step 54
M6		Tightening torque	8 Nm

Torque converter to flywheel			Used in step 55
M10	Renew screws.	Tightening torque	56 Nm

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Transmission to engine — Used in step 5556

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm

Ground strap to transmission or body — Used in step 55

M8		Tightening torque	19 Nm

Catalytic converter to holder — Used in step 5663

M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder — Used in step 5663

M8	Renew nut.	Tightening torque	19 Nm

Transmission cross member to body — Used in step 57

M8	Renew screws.	Tightening torque	19 Nm

Transmission oil line to transmission — Used in step 58

M6x25	Renew the sealing ring.	Tightening torque	8 Nm

Transmission oil line on holder — Used in step 58

M6		Tightening torque	8 Nm

Front flexible disc to propeller shaft — Used in step 59

M12	Renew screws. Comply with jointing torque and angle of rotation. Tightening via screw.	Jointing torque Angle of rotation	55 Nm 90 °

Centre mount to body — Used in step 59

M8		Tightening torque	19 Nm

Retaining plates for vehicle underbody cover — Used in step 60

Sheet metal nut	Replace nuts.	Tightening torque	3 Nm

Heat shield to vehicle underbody — Used in step 61

Screws and nuts		Tightening torque	3 Nm

Starter motor to engine — Used in step 62

M8X60		Tightening torque	19 Nm

Battery positive lead to starter — Used in step 62

M8		Tightening torque	13,5 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger — Used in step 63

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Rear silencer to body / bumper support — Used in step 64

M8	Replace nuts.	Tightening torque	19 Nm

Exhaust system to rear axle carrier — Used in step 64

Nut M8	Renew nut.	Tightening torque	19 Nm

Front silencer / petrol particulate filter on transmission bracket — Used in step 64

M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter — Used in step 64

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter — Used in step 64

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

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Connecting support to tunnel			Used in step 65
M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Control sensor			Used in step 66
M18x1.5		Tightening torque	50 Nm

Holder, positive battery cable to cylinder head cover			Used in step 66
6X18		Tightening torque	6 Nm

Charge air line to throttle body			Used in step 67
M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 68
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 79
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 79
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 79
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 81
Combination hexagon nut		Tightening torque	35 Nm

Bumper buffer device steering on front axle support			Used in step 86
M10		Tightening torque	56 Nm

Underbody protection of the steering gear			Used in step 87
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 87
Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support			Used in step 87
M10		Tightening torque	56 Nm

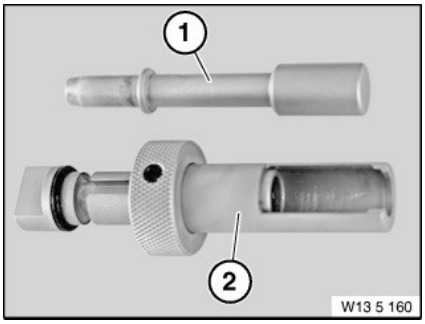
Underbody protection			Used in step 8889
Hexagon screw		Tightening torque	3 Nm

Underbody protection front			Used in step 90
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

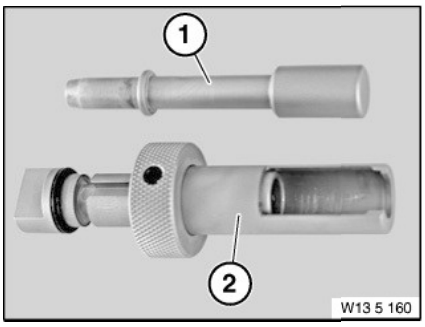
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0 496 567 (13 5 161) Fastener



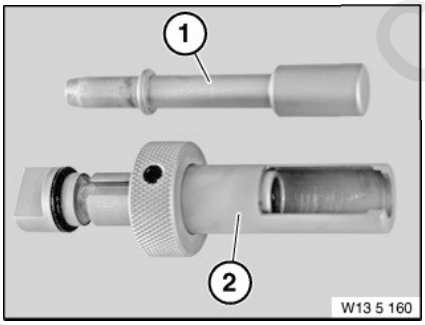
Common	Used in step 13
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 568 (13 5 162) Fastener



Common	Used in step 13
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener



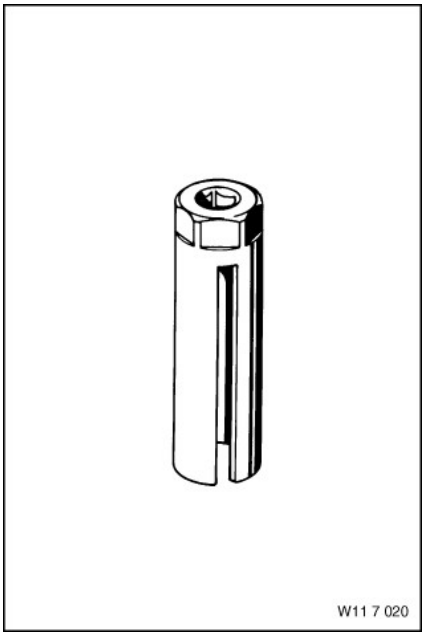
Common	Used in step 13
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

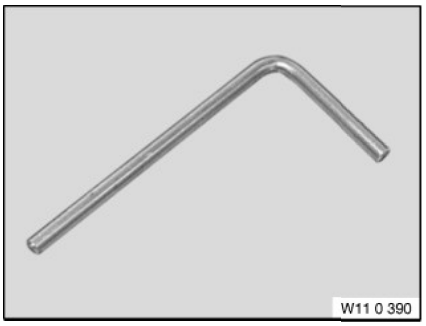
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0 491 074 (11 7 020) Socket wrench insert



Common	Used in step 1666
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

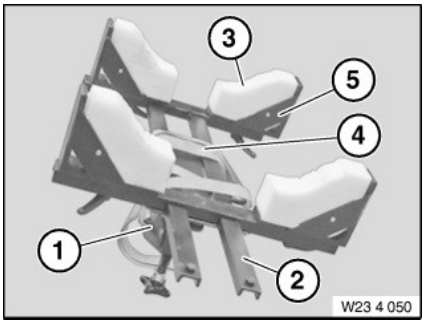
0 496 268 (11 0 390) Pin



Common	Used in step 1950
Usage	(roll pin) For securing new tensioning pulley (poly-V belt)
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 15 07 (390)

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0 495 498 (23 4 050) Support



Common Used in step 3857

Usage	(universal gearbox holder) Support for removing and installing manual gearboxes and automatic transmissions for BMW & RR.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 06 (256)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
3	0 495 549 (23 4 053)		**Insert** (Foam material insert (1 set = 4 pieces)) deleted, can be ordered only via tool set	
1	0 495 547 (23 4 051)		**Joint** Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	
2	0 495 548 (23 4 052)		**Frame** (Basic frame) Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	
4	0 495 550 (23 4 054)		**Belt** (Tensioning strap) Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	
5	0 496 018 (23 4 055)		**Support** (Fixture for foam insert) Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	

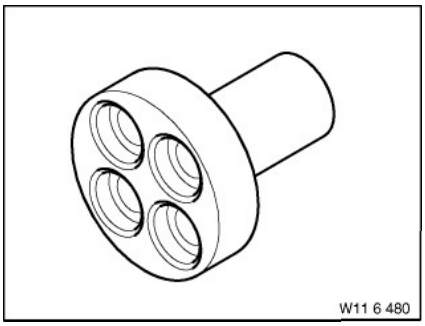
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2 219 012 Hydraulic lifter



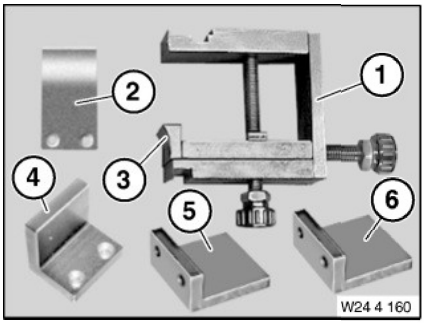
Common	Used in step 3857
Usage	For raising and lowering various vehicle components.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 90 (207)

0 493 380 (11 6 480) Connector



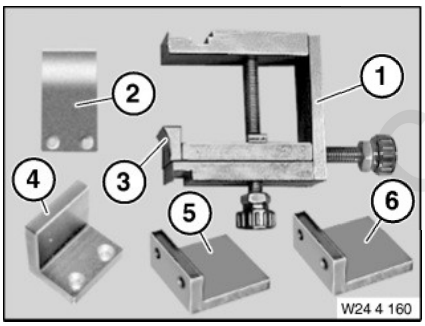
Common	Used in step 4055
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

0 494 478 (24 4 161) Basic body



Common	Used in step 40
Usage	
Included in the tool or work	0 494 451
Storage location	C46
Replaced by	
In connection with	
SI-Number	

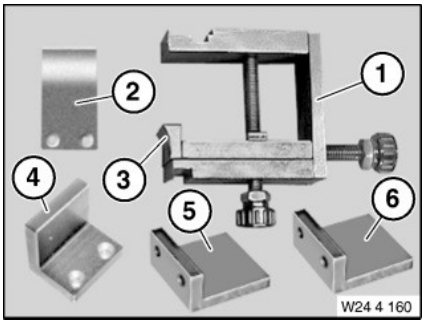
0 496 061 (24 4 166) Shaped element



Common	Used in step 40
Usage	Transmission: GA6L45R (GM6) in E83 / N52K Deletion, only available via tool set
Included in the tool or work	0 494 451
Storage location	C46
Replaced by	
In connection with	
SI-Number	01 02 07 (334)

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0 494 451 (24 4 160) Holder



Common Used in step 4055

Usage	For securing converter during removal and installation of transmission
Included in the tool or work	
Storage location	B45
Replaced by	
In connection with	
SI-Number	01 11 02 (908)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 494 479 (24 4 162)		**Shaped element** For converter version N73 discontinued, available as part of set of special tools only	
5	0 494 965 (24 4 165)		**Shaped element** Transmission: GA6 HP19 in E87, E90 Discontinued, available as part of set of special tools only	
3	0 494 477 (24 4 163)		**Shaped element** For converter version M57TU discontinued, available as part of set of special tools only	
1	0 494 478 (24 4 161)		**Basic body**	
4	0 494 622 (24 4 164)		**Shaped element** For converter version M54 discontinued, available as part of set of special tools only	
6	0 496 061 (24 4 166)		**Shaped element** Transmission: GA6L45R (GM6) in E83 / N52K Discontinued, available as part of set of special tools only	

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0 494 213 (24 2 390) Cap



Common	Used in step 4055
Usage	(protective cap) For sealing off the guide sleeve of the transmission connector
Included in the tool or work	
Storage location	C49
Replaced by	
In connection with	
SI-Number	01 14 01 (766)

2 459 012 Holder



Common	Used in step 41424344
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

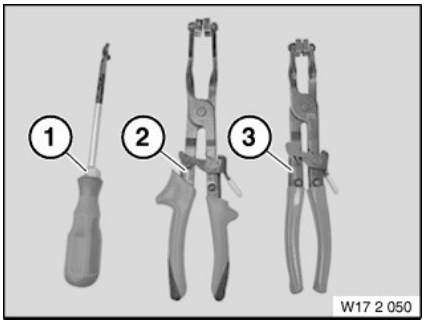
2 220 718 Workshop crane



Common	Used in step 4243
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

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0 495 794 (17 2 050) Pliers

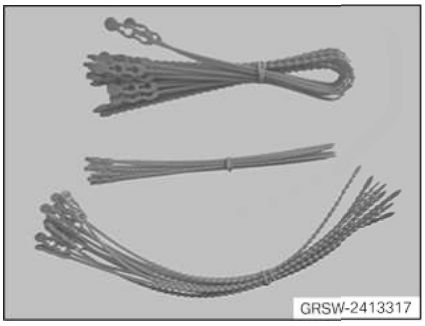


Common	Used in step 4243
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

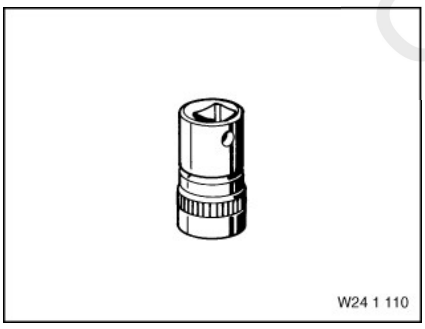
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

2 413 317 Cable strap



Common	Used in step 42
Usage	The "Cable ties" parts set consists of 3 items as follows: ABV232 Length: 320 mm colour: RedABV250 Length: 500 mm colour: RedABVS270 Length: 665 mm colour: Red
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 47 15 (332)

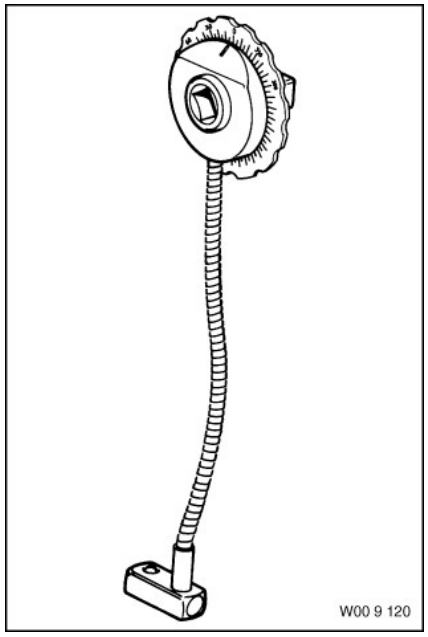
0 491 667 (24 1 110) Socket wrench insert



Common	Used in step 55
Usage	Loosening and fastening the converter fastener
Included in the tool or work	
Storage location	A14
Replaced by	
In connection with	
SI-Number	01 04 86 (566)

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0 490 504 (00 9 120) Torque angle measuring dial



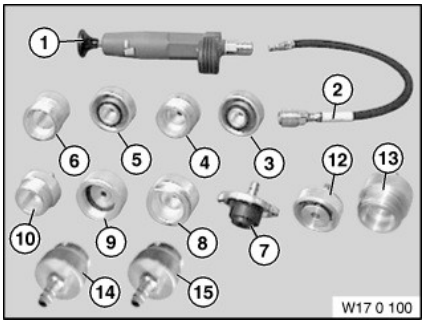
Common Used in step 59

Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

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0 494 417 (17 0 100) Tester

Used in step 69707576



Common

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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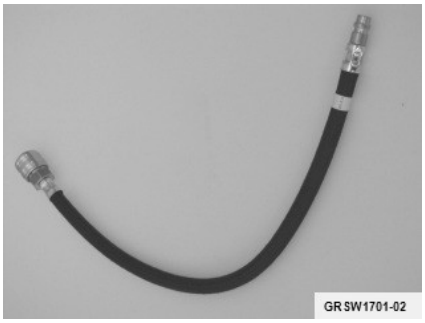
0 494 418 (17 0 101) Pump



Common Used in step 7576

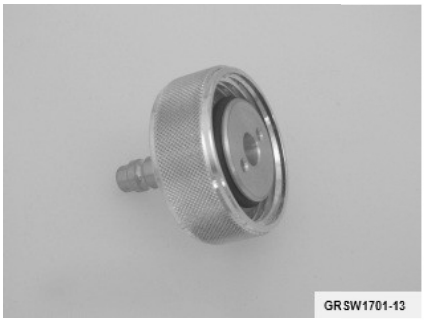
Usage	
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 419 (17 0 102) Hose



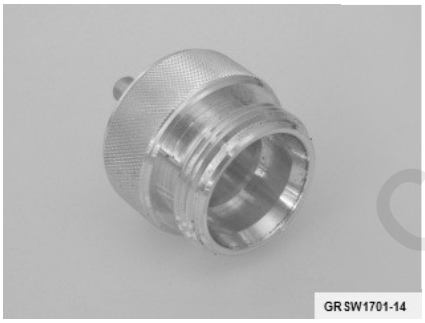
Common	Used in step 7576
Usage	(hose with quick-release coupling)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 642 (17 0 113) Adapter



Common	Used in step 75
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 643 (17 0 114) Adapter



Common	Used in step 75
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

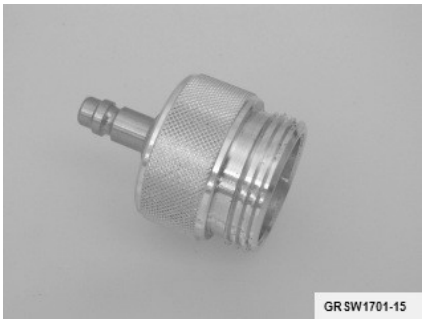
0 494 426 (17 0 109) Adapter



Common	Used in step 76
Usage	For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 495 889 (17 0 115) Adapter



Common		Used in step 76
Usage	For radiator cap Model series: N12, N14	
Included in the tool or work	0 494 417	
Storage location		
Replaced by		
In connection with		
SI-Number	01 26 06 (321)	

Overview Technical Data

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system	Used in step 7576
Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

Distance from window pane edge to wiper blade	Used in step 81
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Capacity of high-temperature coolant circuit G20	Used in step 69
B48B20O1/B46B20O1	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Capacity of low-temperature coolant circuit G20	Used in step 70
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	2049
11 00 ... Overview of consumables (Electronic Parts Catalogue)	66

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	171
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	171
61 20 900 Disconnecting and connecting battery earth lead	171

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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	171
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
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61 20 900 Disconnecting and connecting battery earth lead	171
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61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 20 900 Disconnecting and connecting battery earth lead	171
61 35 ... Notes on ESD protection (Electro Static Discharge)	1218202148
17 11 035 Removing and installing/replacing fan cowl with electric fan	40
00 02 001 Raising the vehicle using a vehicle lift	4243
61 00 730 Encode/program control unit(s) (after vehicle test)	49
17 00 ... Notes for working on cooling system.	6970

Operating materials	**Used in step**
Main group 17	6970

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00 Safety information for working on vehicles with automatic engine start-stop function (MSA)



Warning!

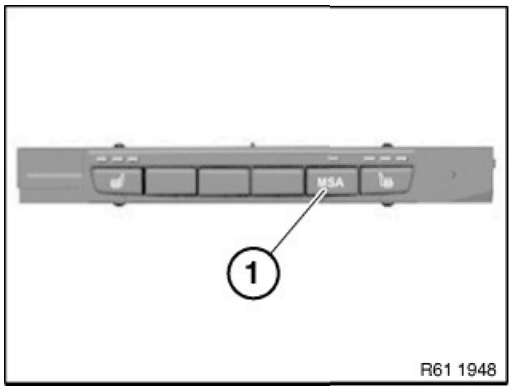
If the engine hood/bonnet contact is pulled upwards (workshop mode), the information "switch closed" is output. The automatic engine start-stop function is active.

An automatic engine start is possible.

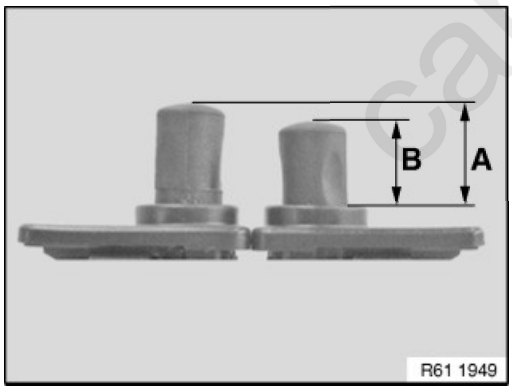
Observe safety precautions when working on MSA vehicles.

Before carrying out practical work on the engine, always ensure that the MSA functionality is deactivated so as to prevent automatic engine starting while work is being carried out in the engine compartment.

MSA function is deactivated by:



- Deactivate MSA by means of button (1) in passenger compartment
- Open seat belt buckle and driver's door



- Open engine bonnet/hood and ensure that engine hood/bonnet contact is not in workshop mode
  - Workshop mode

    A = 10 mm
  - Basic setting (engine hood/bonnet open)

    B = 7 mm

  To make sure that the engine hood/bonnet contact is at the basic setting, if necessary press the hood/bonnet contact up to the limit position before starting work and slowly release.



When working with diagnosis tools:

- Observe instructions in diagnosis tool

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Note:
For further information on automatic engine start-stop function (MSA):

- Refer to the Service Information (bulletin) (for manual transmissions) Service Information (bulletin) 61 01 07 335
- Refer to the Service Information (bulletin) (for automatic transmissions or twin-clutch gearboxes) Service Information (bulletin) 61 01 10 629

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11 00 670 Securing engine in installation position

PRELIMINARY WORK

1 – Bring front compartment lid in the service position

Prerequisite

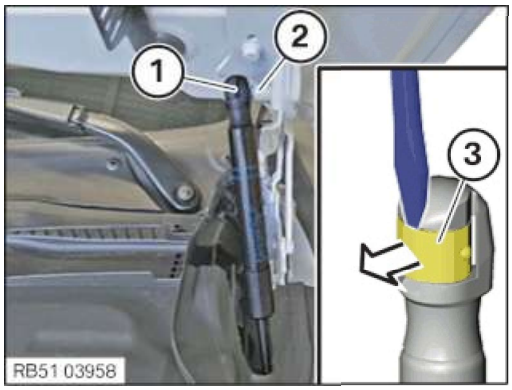
Engine compartment lid is open.

CAUTION

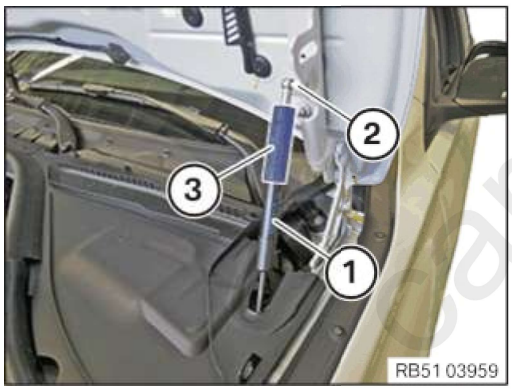
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

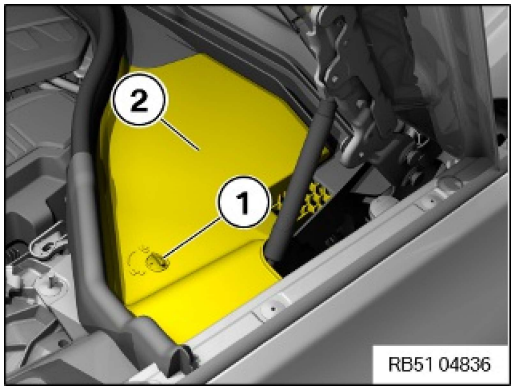


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

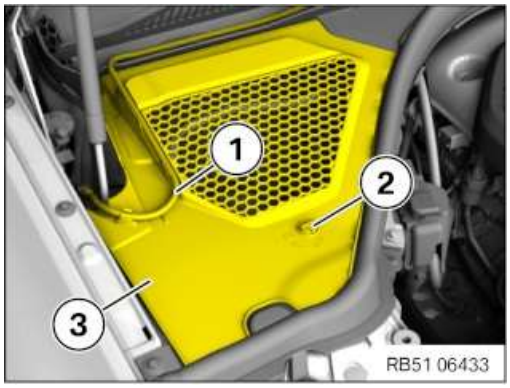
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

2 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

3 – Remove the cover of the rear right engine compartment

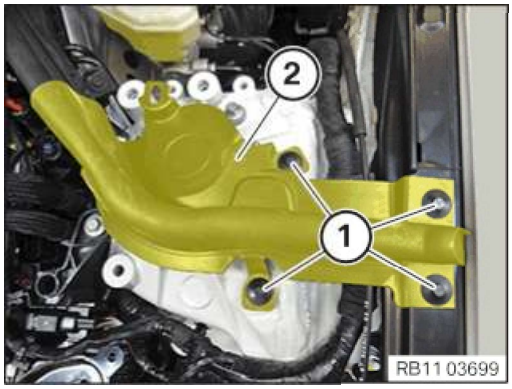


- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

4 – Removing side bonnet gaskets

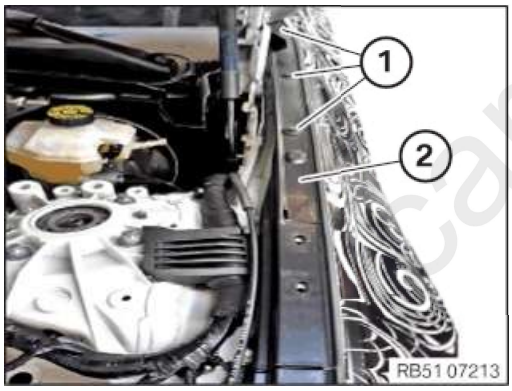
NOTICE

Perform the operations on the left and right side.



- Loosen the rivet (1).
- Remove side bonnet seal (2) from spring strut dome.

5 – Remove sealing of the side panel

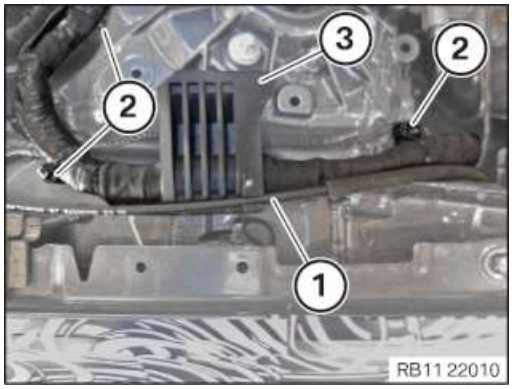


NOTICE

Description is for left component only. Procedure on the right side is identical.

- Loosen the expanding rivet (1).
- Guide out seal (2) and remove.

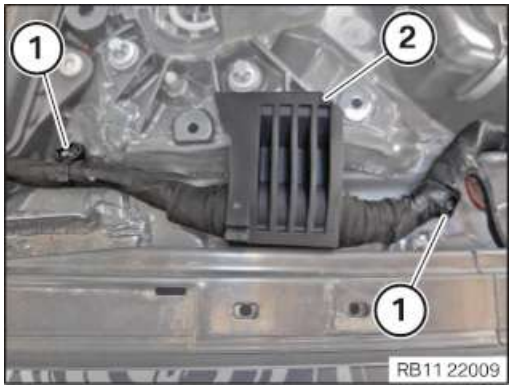
6 – Partially loosen the wiring harness section on the spring strut dome



- Feed out the cable (1) of the front flap and set it aside.
- Loosen clamps (2).
- Feed out wiring harness section (3) on the spring strut dome on left and set it aside.

7 – Releasing the wiring harness section on the right spring strut dome

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- Loosen clamps (1).
- Guide out wiring harness section (2) on the right spring strut dome and set it aside.

8 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

9 – Removing the clean air pipe with the resonator

WARNING

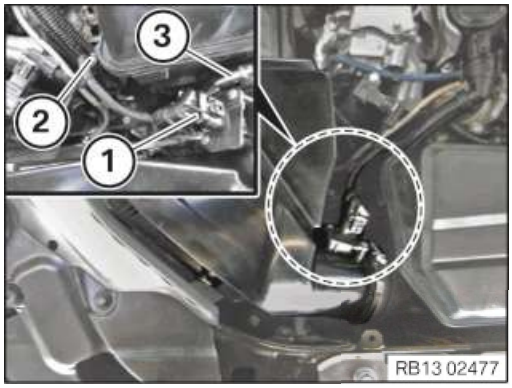
Hot surfaces.

Risk of burning!

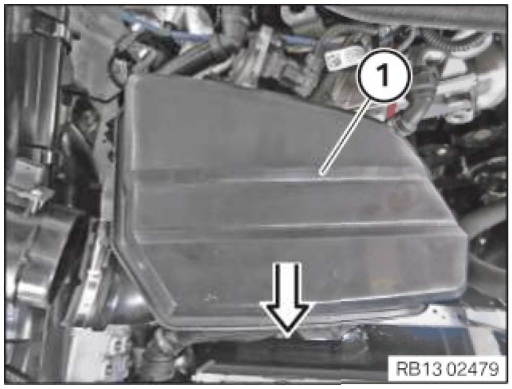
- Perform all work only on components that have cooled down.



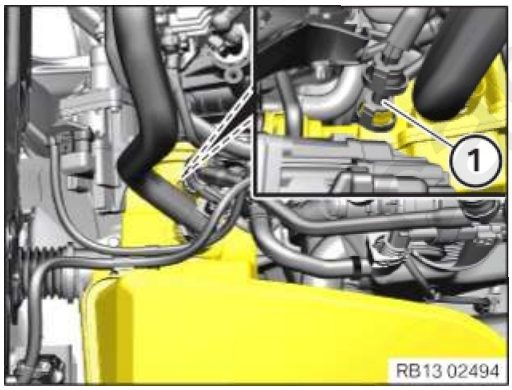
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



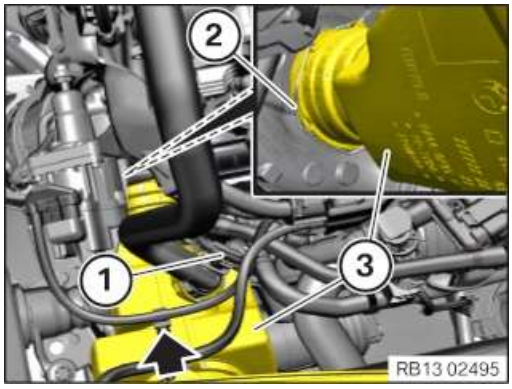
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



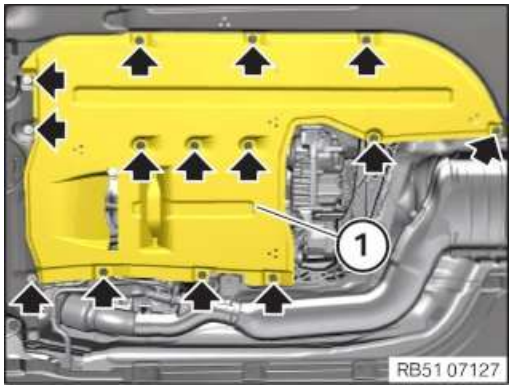
- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

10 – Remove rear underbody protection

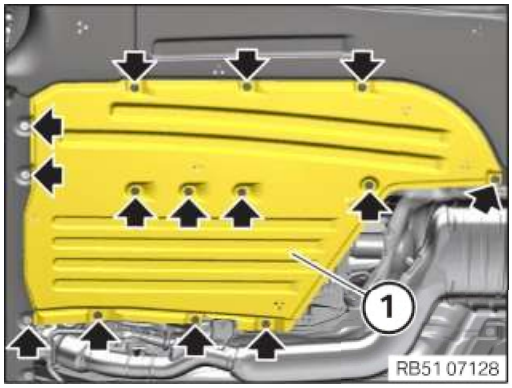
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- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

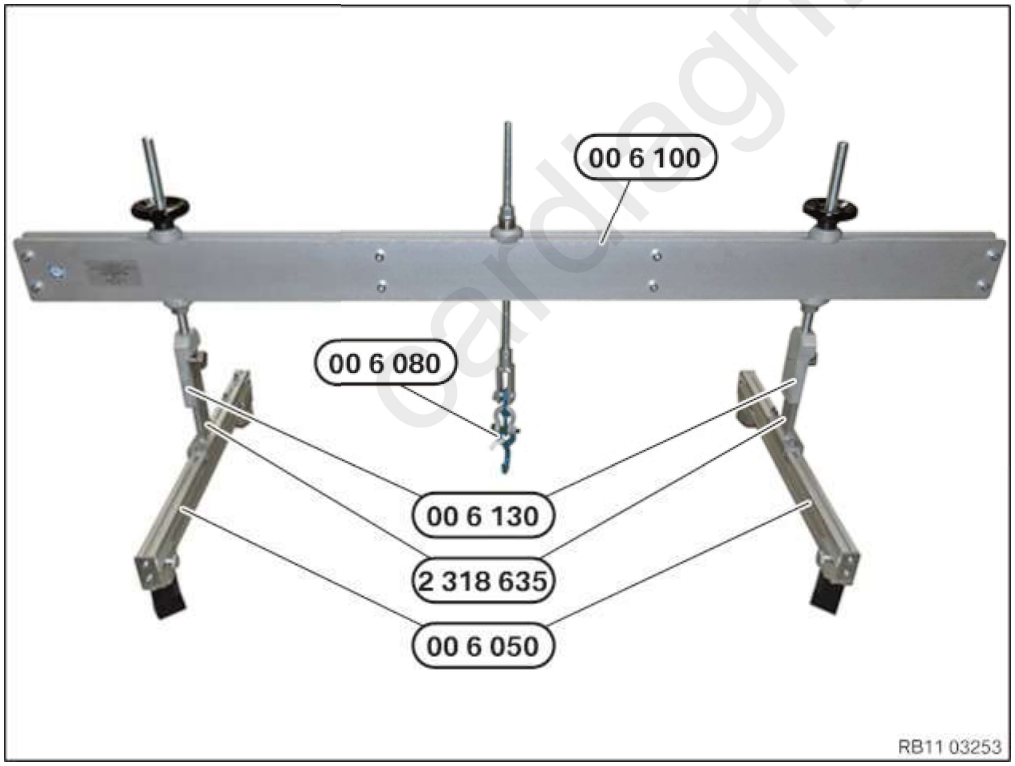
  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

MAIN WORK

11 – Securing engine in installation position

Overview: Prepared engine bridge



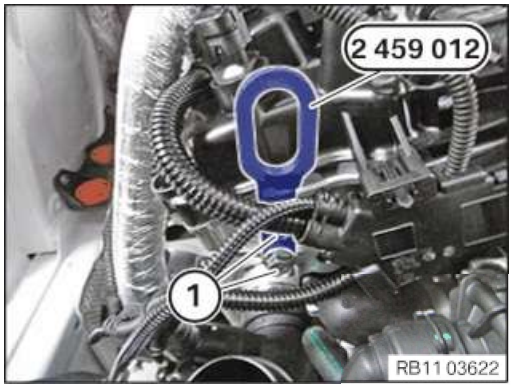
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CAUTION

Components connected to the engine joint or cross member.

Danger of injury!

- Check lifting eyes and engine mounting brackets for damage, e.g. cracks.
- Attach the component to correctly mounted engine joints or cross members only.
- Exclusively lift the component, do not move it forwards, backwards or in transverse direction.



- Guide in and position special tool 2 459 012 on cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm



- **Carefully** position engine bridge (1) with help from an auxiliary person.



- Make sure that special tool on the left is correctly positioned on the lock support.
- Make sure that special tool from the set of special tools , left, rests correctly on the spring strut dome.



- Make sure that special tool on the right is correctly positioned on the lock support.
- Make sure that special tool from the set of special tools , right, rests correctly on the spring strut dome.

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- Align the engine bridge by moving it on the profile strips of the special tool above the engine mounting bracket (1) and screw it down.
- Align the hook above the engine mounting bracket (1).
- Connect the hook to the engine mounting bracket (1).



- Check whether the special tool on the right is correctly positioned on the lock support.



- Check whether the special tool from the special tool kit , right, rests correctly on the spring strut dome.



- Check whether the special tool on the left is correctly positioned on the lock support.



- Check whether the special tool from the special tool kit , left, rests correctly on the spring strut dome.

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- Release screw (1) on the left engine mount from the top with a commercially available tool.



- Release screw (1) on the right engine mount from the top with a commercially available tool.



- Raise the engine by turning the special tool 2 361 506 (00 6 103) (spindle) by 10 mm.

12 – Loosen the attachment of the engine in installation position



- Lower engine by turning the spindle 2 361 506 (00 6 103) until the engine lies completely on the engine supports.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the engine bridge (1) with an auxiliary person.

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- Tighten bolt (1) of the left engine mount from the bottom using a standard tool.

Engine mount to engine mounting bracket

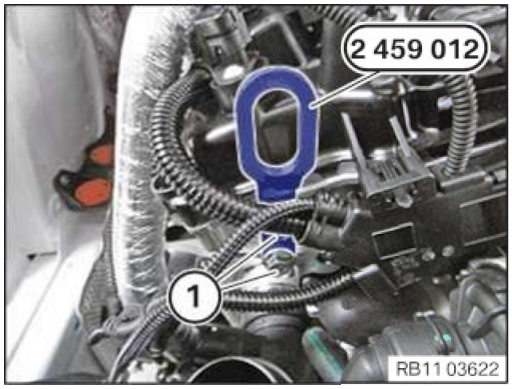
M12		Tightening torque	100 Nm



- Tighten bolt (1) of the right engine mount from the top using a standard tool.

Engine mount to engine mounting bracket

M12		Tightening torque	100 Nm



- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

POSTPROCESSES

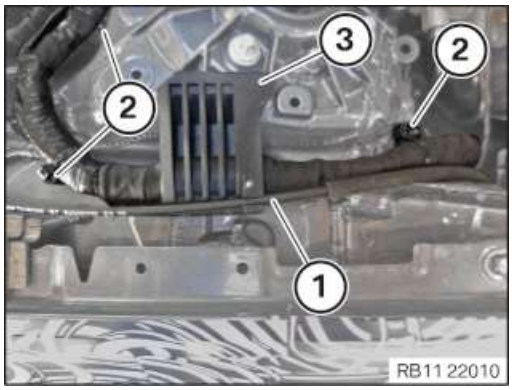
13 – Securing the wiring harness section to the left spring strut dome

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in and position wiring harness section (3) on the left spring strut dome.
- Secure clamps (2).
- Guide in and install cable (1) of the front flap.

14 – Secure wiring harness section on right spring strut dome

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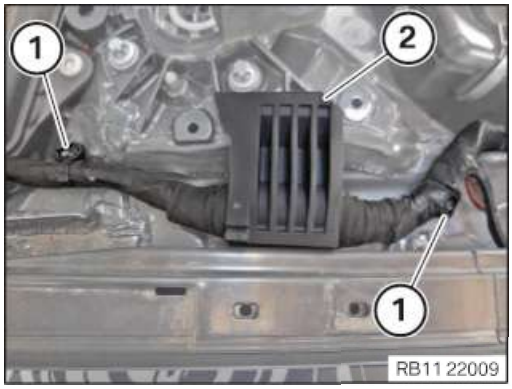
– Secure wiring harness section on right spring strut dome

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

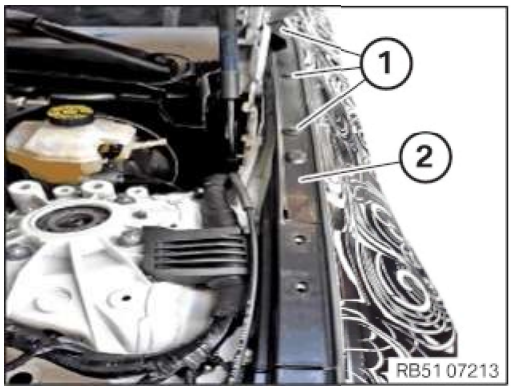
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in and position the wiring harness section (2) of right spring strut dome.
- Secure clamps (1).

15 – Installation of side panel sealing.



NOTICE

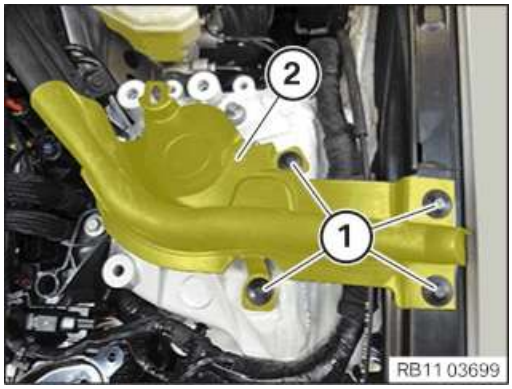
Description is for left component only. Procedure on the right side is identical.

- Guide the sealing (2) in and install it.
- Mount the expanding rivets (1).

16 – Install side bonnet seals

NOTICE

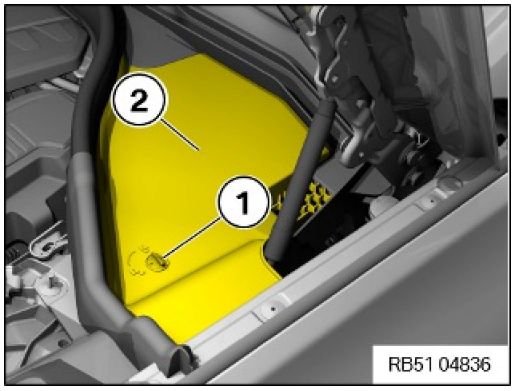
Perform the operations on the left and right side.



- Position the side bonnet seal (2) on the spring strut dome.
- Secure the rivet (1).

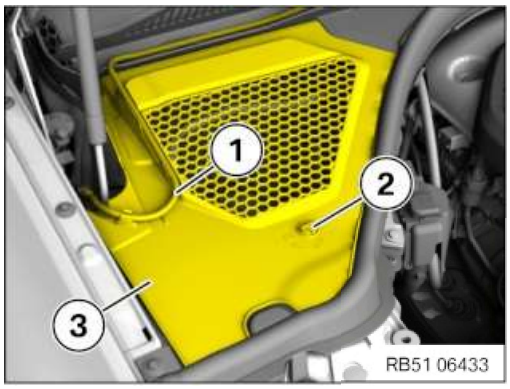
17 – Install the cover of the engine compartment on the rear left

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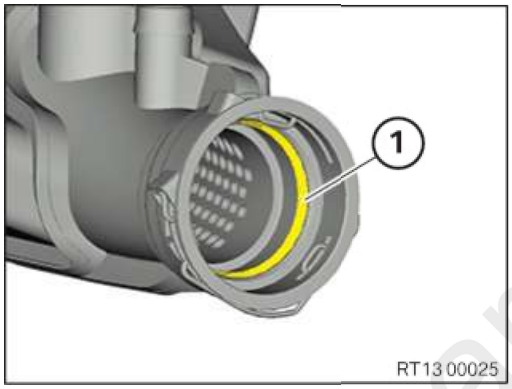
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

18 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

19 – Installing the clean air pipe with resonator

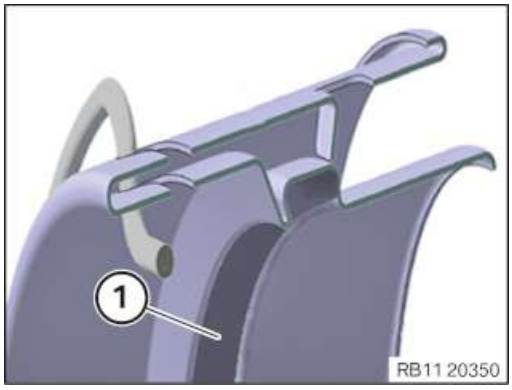


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

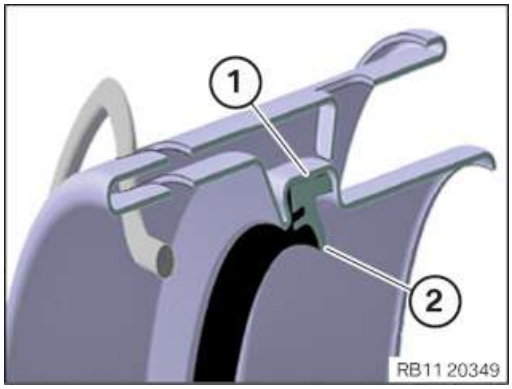
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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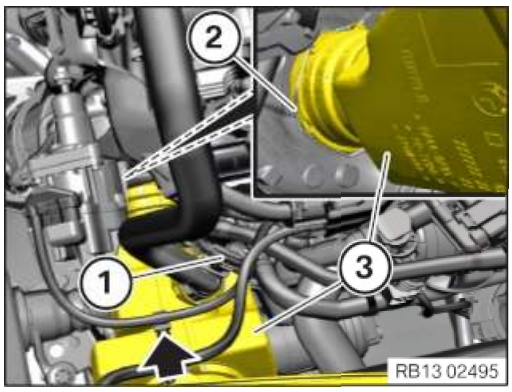
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

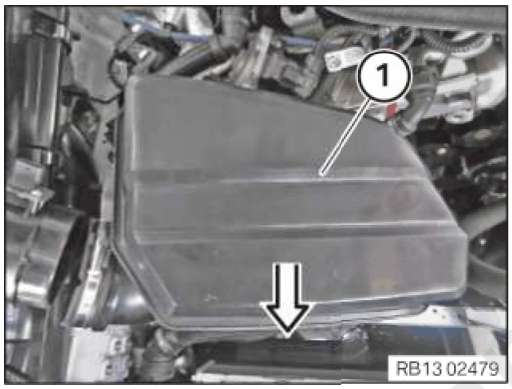
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



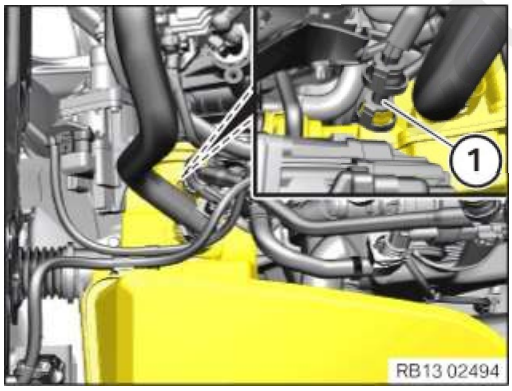
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

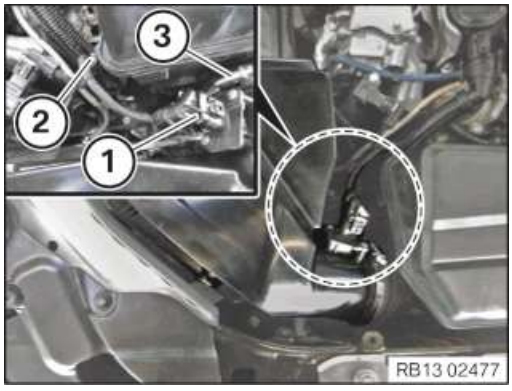
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

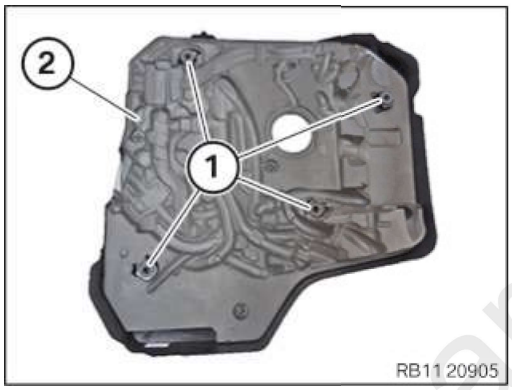
20 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

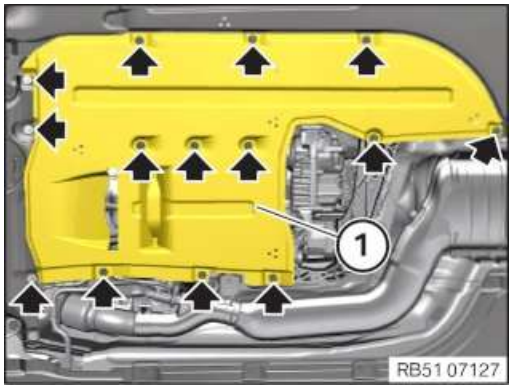


- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

21 – Installing underbody protection at rear

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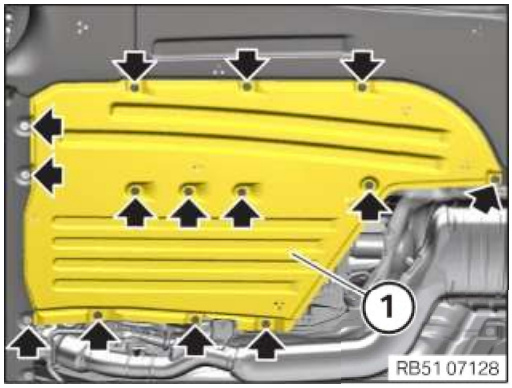
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

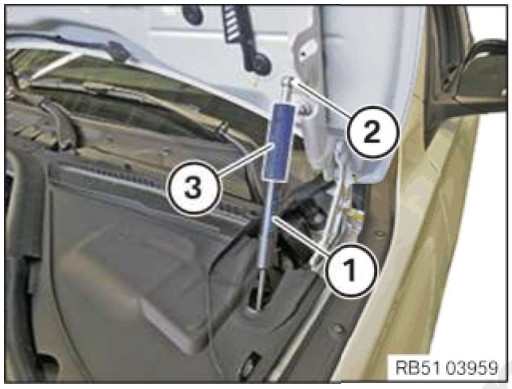
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

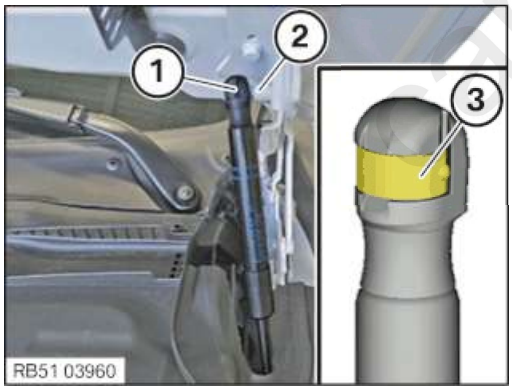
Underbody protection

Hexagon screw		Tightening torque	3 Nm

22 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Special tool to cylinder head Used in step 11

M8		Tightening torque	21,5 Nm

Engine mount to engine mounting bracket			Used in step 12
M12		Tightening torque	100 Nm

Clean air pipe to upper section of intake filter housing			Used in step 19
Clamp		Tightening torque	3 Nm

Underbody protection			Used in step 21
Hexagon screw		Tightening torque	3 Nm

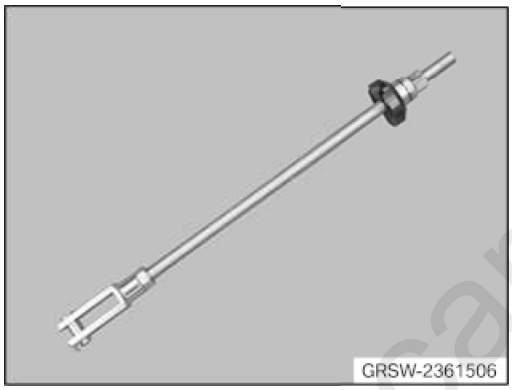
Overview of Special Tools

2 459 012 Holder



Common	Used in step 1112
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 361 506 (00 6 103) Spindle



Common	Used in step 1112
Usage	Spindle (central spindle) for Traverse 00 6 100.
Included in the tool or work	0 496 852
Storage location	
Replaced by	
In connection with	
SI-Number	01 17 10 (659)

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11 12 729 Checking cylinder head for watertightness

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

PRELIMINARY WORK

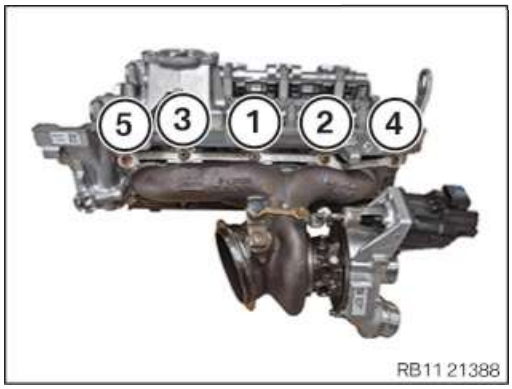
1 – Removing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

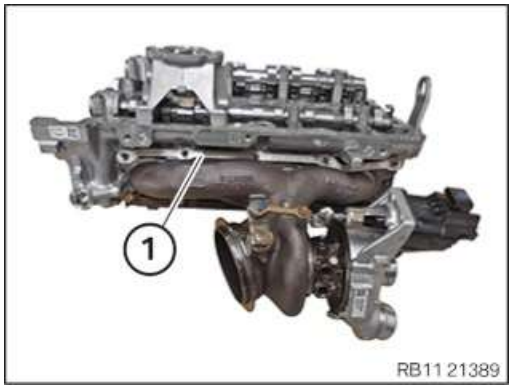


TECHNICAL INFORMATION

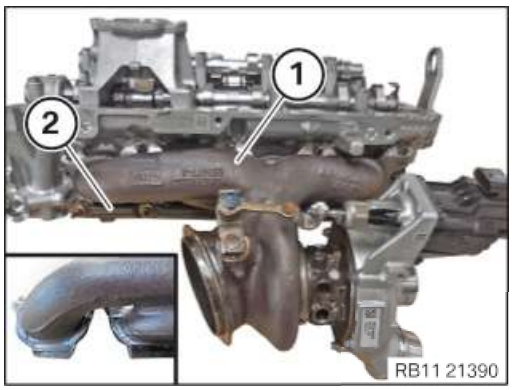
Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (5) to (1).

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- Remove reinforcement plate (1).



CAUTION

Heavy component.

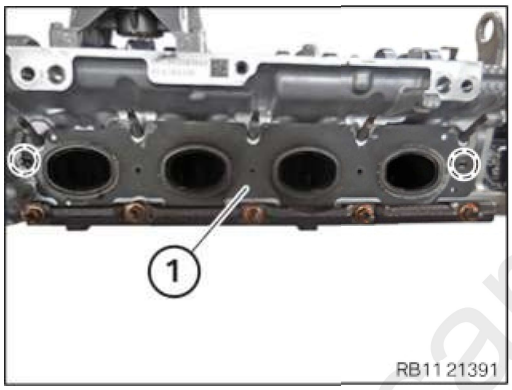
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Ensure that the clamping strip (2) remains screwed into place during the removal of the exhaust turbocharger (1).

  The exhaust turbocharger (1) is **not** screwed onto the bottom, but clamped in the clamping strip (2).

  Thread out and remove exhaust turbocharger (1).



- Guide seal (1) out of the **marked** area and remove it.

2 – Installing the cylinder head on the assembly stand

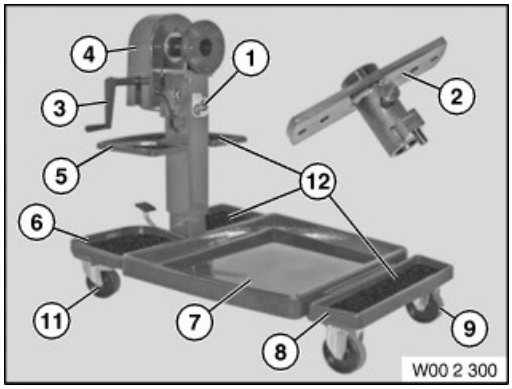
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

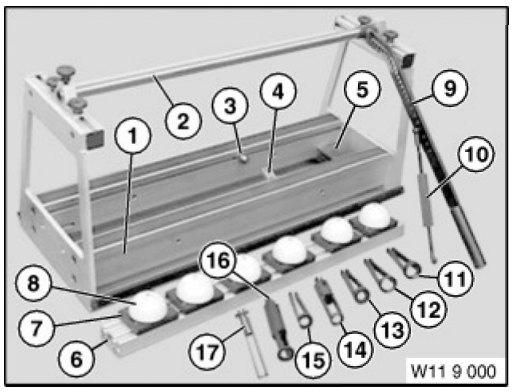
- Remove and install heavy components with the aid of another person/other persons.

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- Have the set of special tools 0 495 187 (00 2 300) ready.

Number	Description
1	Assembly stand
2	Flange
3	Crank
4	Cover
5	oddments tray
6	Shaped element rear
7	Collection pan
8	Shaped element front
9	Front wheel
10	Rear wheel with stop
11	Mat



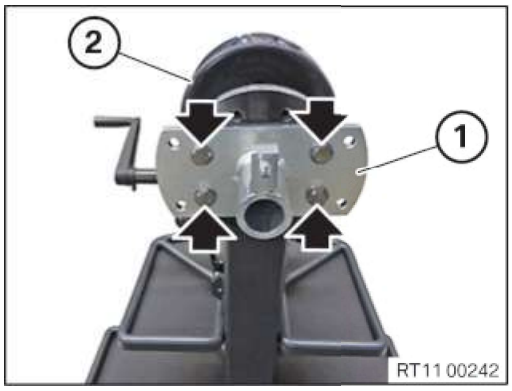
- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage

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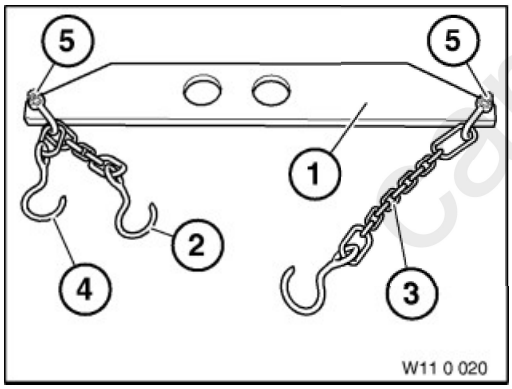
- Stage special tool (workshop crane) 2 220 718.



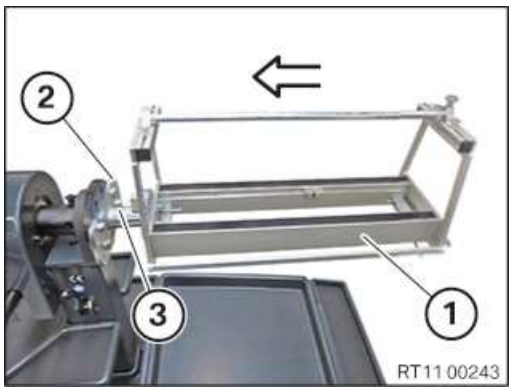
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

M14X30		Tightening torque	135 Nm

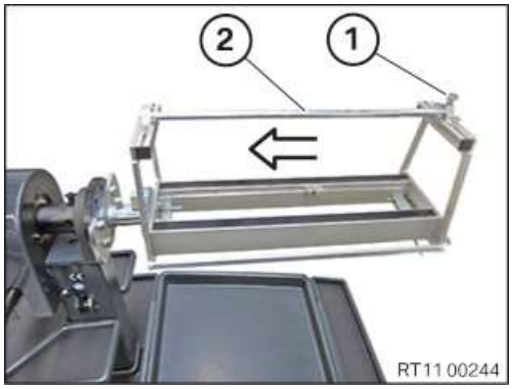


- Prepare the special tool .

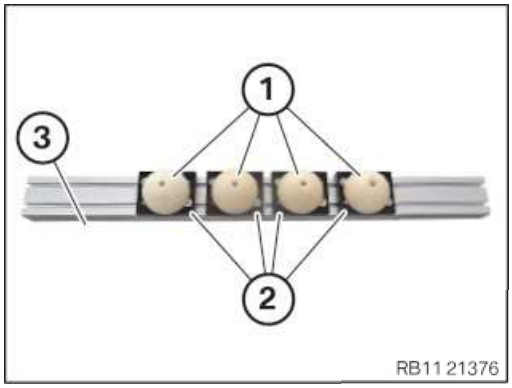


- Fit device (1) onto the flange (2) in the direction of the arrow and install.
- Make sure that the lock (3) engages audibly.

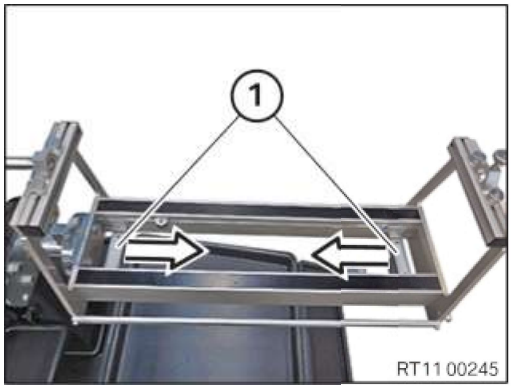
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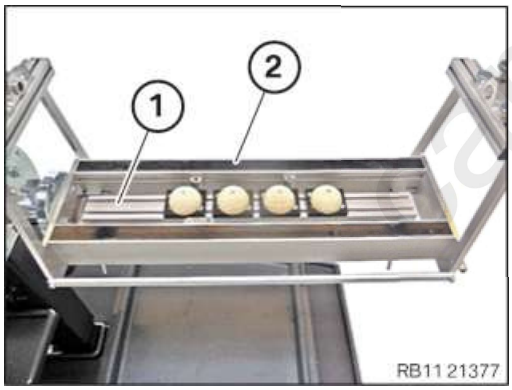
- Loosen screw (1).
- Pull out rod (2) in direction of arrow and set it aside.



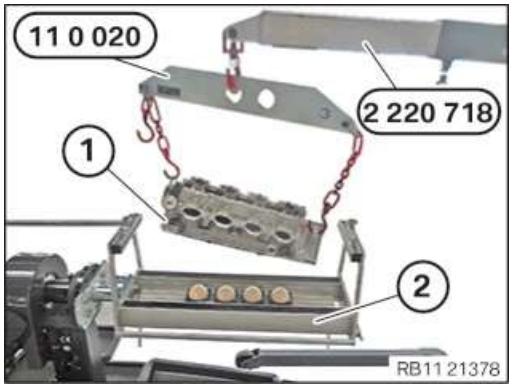
- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).



- Slide quick fastener (1) in the **direction of the arrow** up to the limit position.

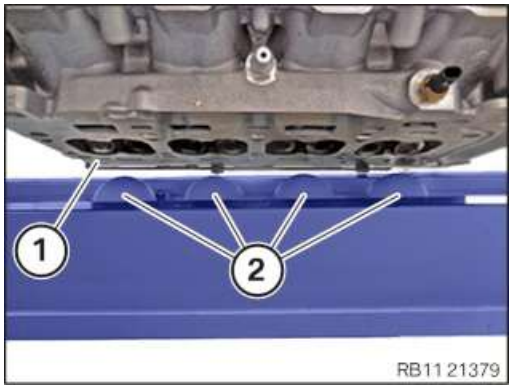


- Position completed aluminium strip (1) **centred** on the device (2).

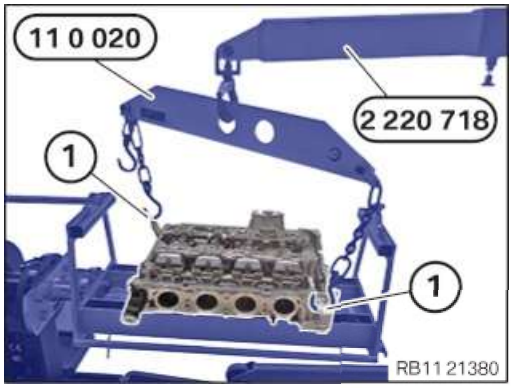


- Position cylinder head (1) with the work crane 2 220 718 and special tool on the device (2).

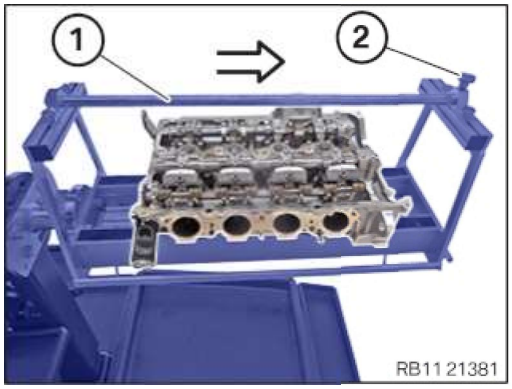
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- Position cylinder head (1) correctly on the completed aluminium strip (2).



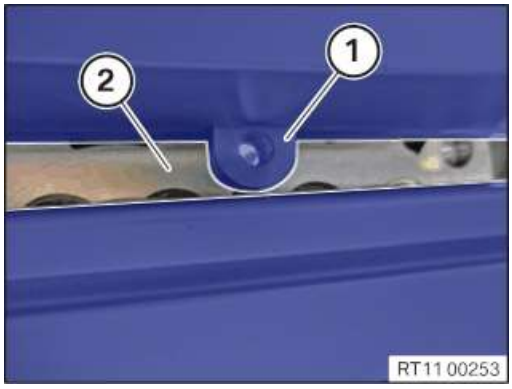
- Lower workshop crane 2 220 718.
- Pull out special tool at the cylinder head (1) and remove.
- Remove workshop crane 2 220 718 and set aside.



- Pull in rod (1) in the direction of the arrow and install.
- Hand-tighten the bolt (2).

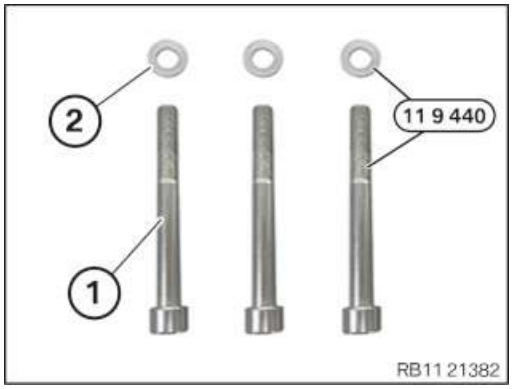


- Position screw connection (1) on cylinder head (2).

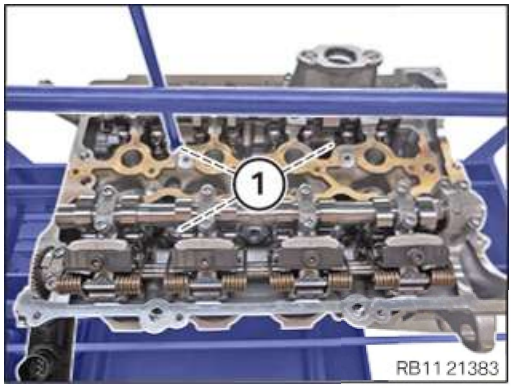


- Position screw connection (1) on cylinder head (2).

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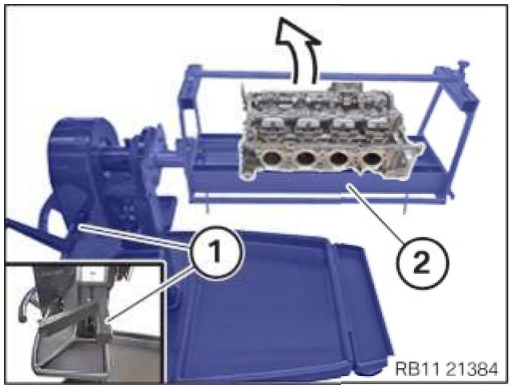
- Keep **M10x90** screws (1) from special tool ready.
- Keep washers (2) from special tool ready.



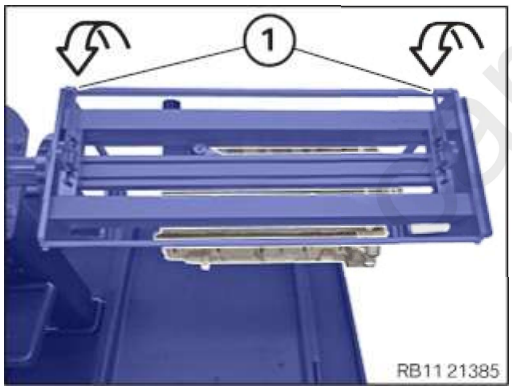
- Tighten the screws (1) from special tool .

Cylinder head on device

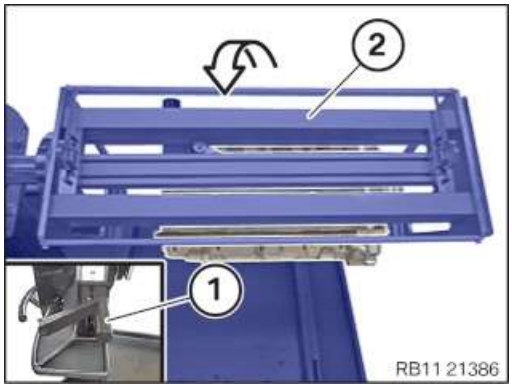
M10X90x1.5		Tightening torque	30 Nm



- Turn device (2) on the crank (1) by 180° in **direction of arrow**.



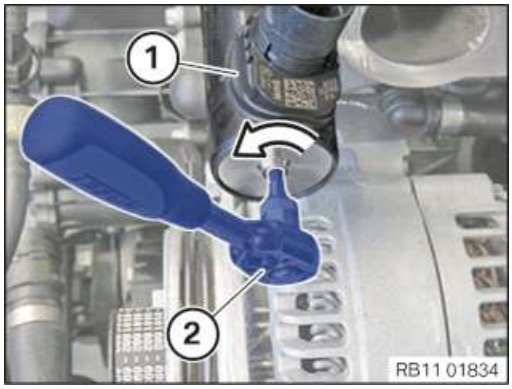
- Lock quick fastener (1) in the **direction of the arrow**.



- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

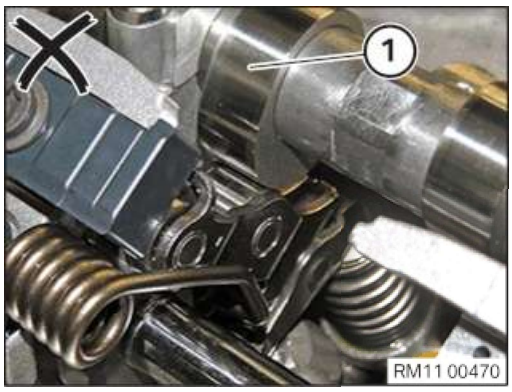
3 – Adjusting the servomotor to minimum lift

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- Slowly adjust the eccentric shaft with the servomotor (1) to the minimum lift using the tool (2).

4 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

5 – Remove all torsion springs

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

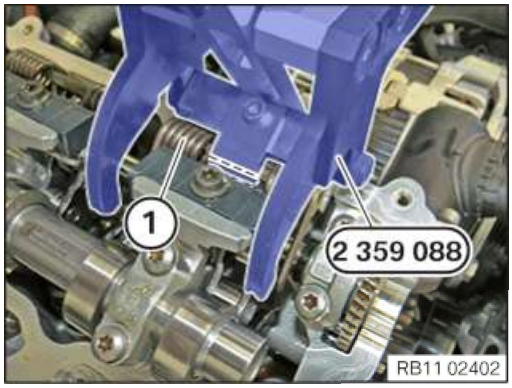
- Wear safety goggles.

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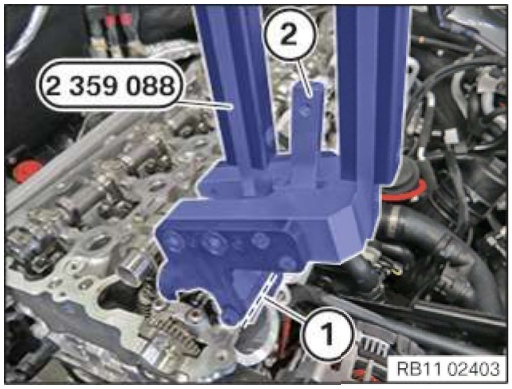


- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)



- Open the special tool 2 359 088 and position it at the torsion spring (1).



- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.

Check



- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

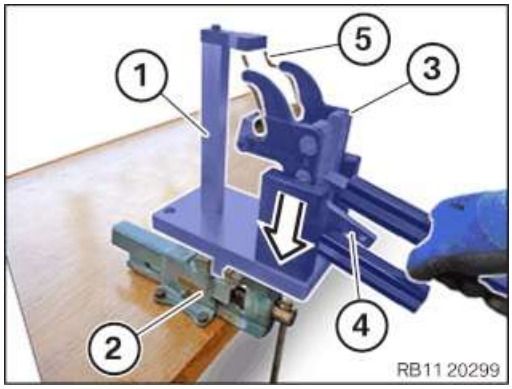
Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.

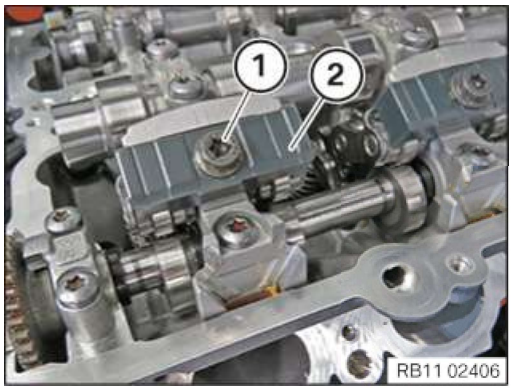
vwdiagn.com



- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

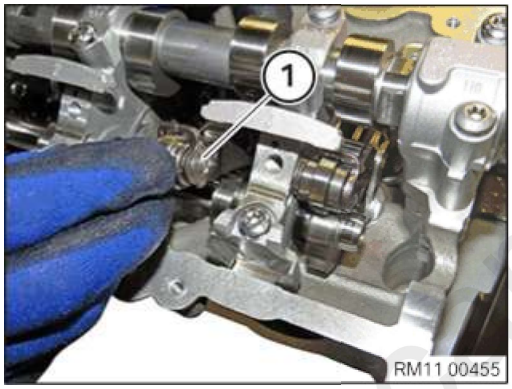
  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

6 – Removing all gates



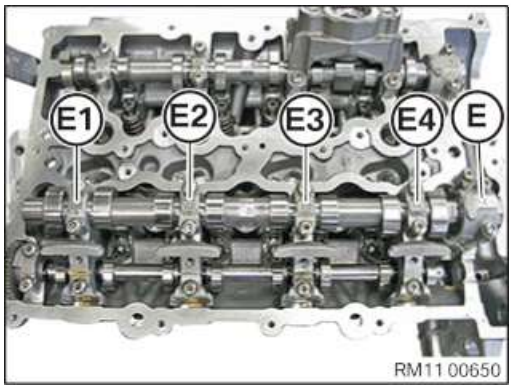
- Loosen screw (1).
- Remove the gate (2) and place it arranged in order into 0 495 105 (11 4 480).
- Repeat the step for all the gates.

7 – Removing all intermediate levers



- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

8 – Remove intake camshaft

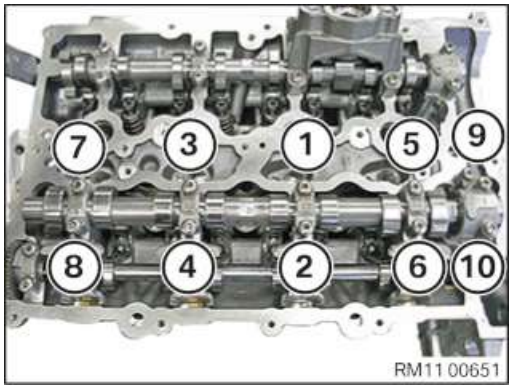


- Make sure that the exhaust camshaft bearing cap is placed in the correct position in the special tool 0 495 105 (11 4 480).

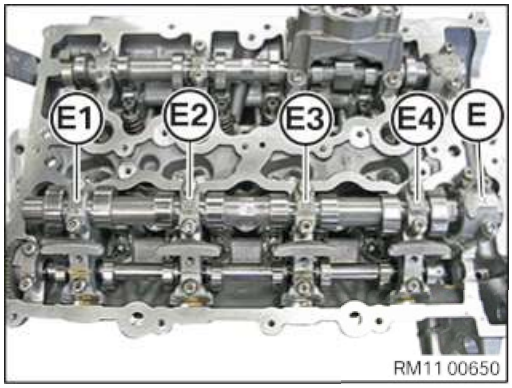
Note: The intake camshaft bearing caps are legibly labelled from the intake side with E1, E2, E3, E4 and E.

Note: Intake camshaft bearing cap E is a thrust bearing.

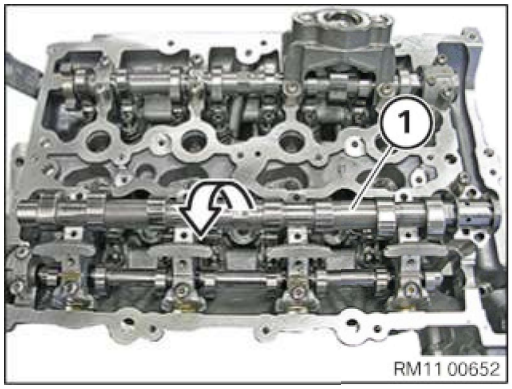
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- Loosen all screws on the intake camshaft bearing caps in sequence from (10) to (1).



- Take off intake camshaft bearing caps (E1), (E2), (E3), (E4) and (E) and place them in order in the special tool 0 495 105 (11 4 480).



- Remove the intake shaft (1)in the direction of the arrow.

9 – Remove the servomotor for the eccentric shaft (cylinder head removed)

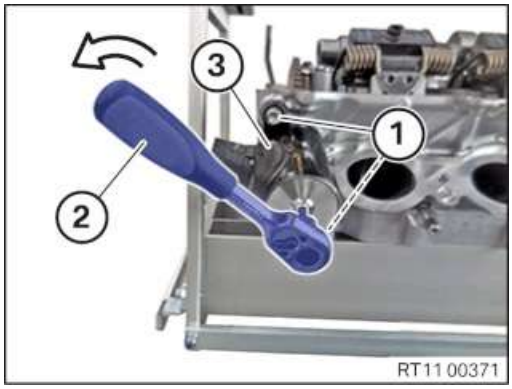
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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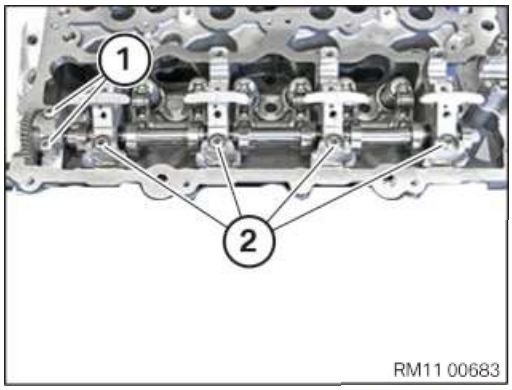


- Loosen screws (1).
- Use a standard hexagon socket wrench (2) to slowly adjust the servomotor for eccentric shaft (3) to the minimum lift at **4 mm** in direction of arrow.

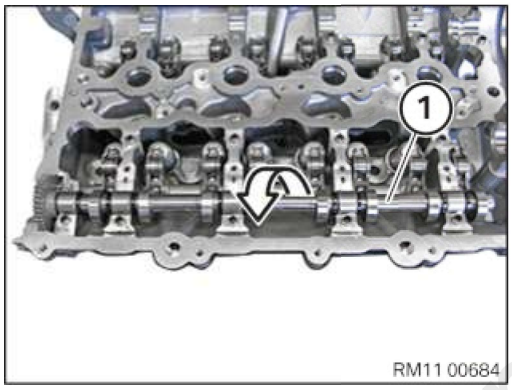
  This releases the tension of the eccentric shaft.

  Do **not** turn the eccentric shaft beyond the end stop.
- Guide out and remove the servomotor for eccentric shaft (3).

10 – Remove eccentric shaft

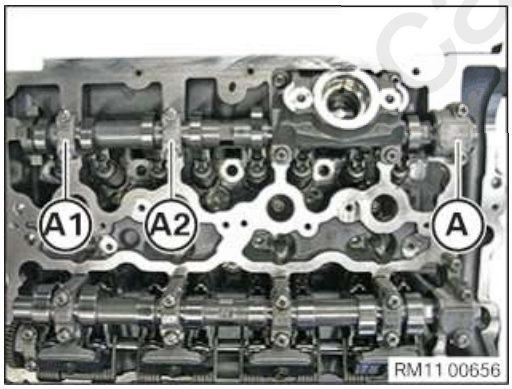


- Release screws (1) and set down the bearing cap neatly in special tool 0 495 105 (11 4 480).
- Release screws (2) and set down the bearing support neatly in special tool 0 495 105 (11 4 480).
- For an engine that has been in use, make sure all bearing supports are reinstalled in the same position.



- Remove eccentric shaft (1) in direction of arrow.

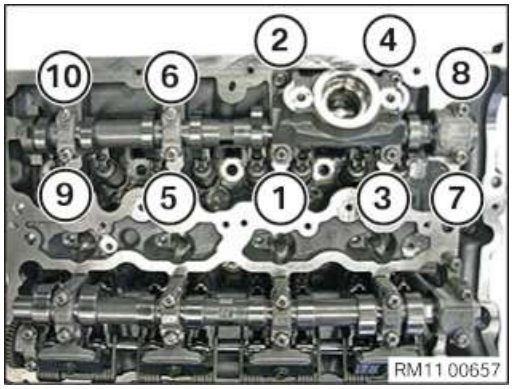
11 – Remove exhaust camshaft.



- Subsequently ensure that the exhaust camshaft bearing cap is placed in 0 495 105 (11 4 480) in the special tool.

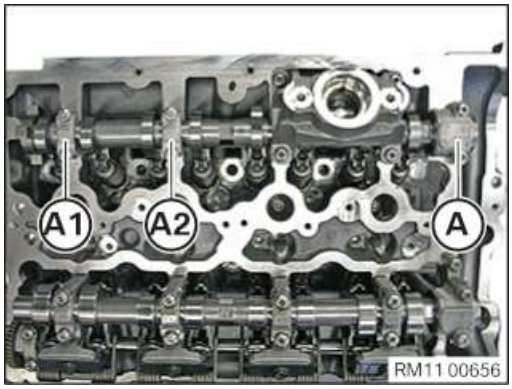
Note: The exhaust camshaft bearing caps are legibly labelled from the intake side and marked with A1, A2 and A.

Note: Exhaust camshaft bearing cap A is a thrust bearing.

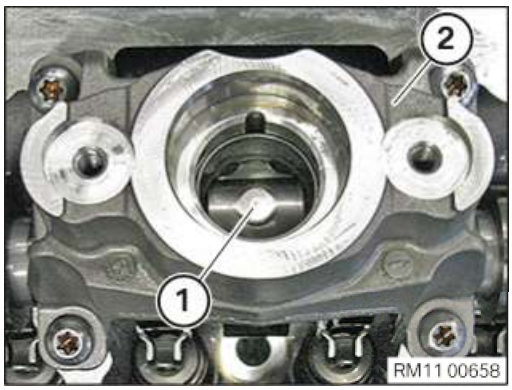


- Loosen all screws on the exhaust camshaft bearing cap in sequence from (10) to (1) in half turn.

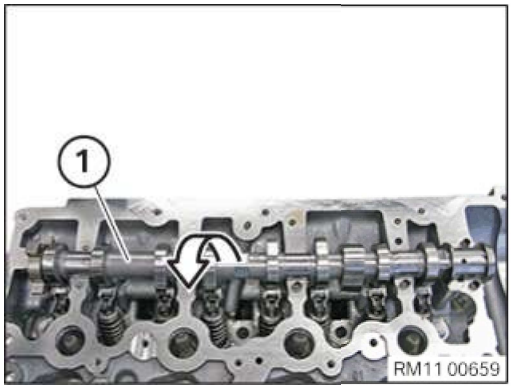
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- Drop the exhaust camshaft bearing cap (A1), (A2) and (A) and place in order in the special tool 0 495 105 (11 4 480).

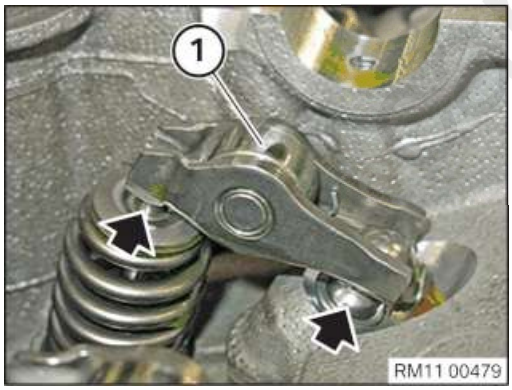


- Remove the roller tappet (1).
- Remove the high pressure pump bracket (2).

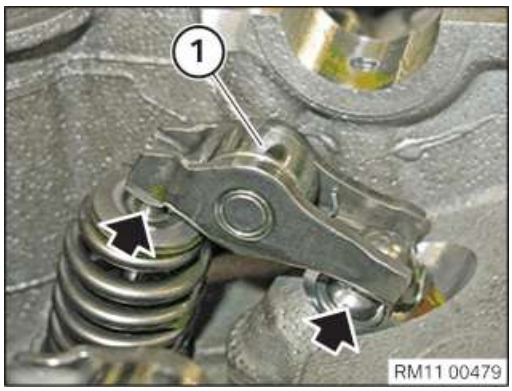


- Remove the exhaust camshaft (1) in the direction of the arrow.

12 – Remove all roller cam followers



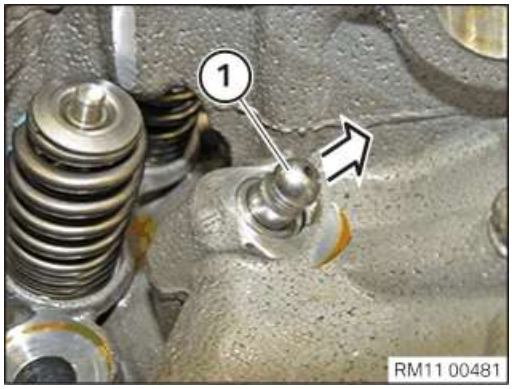
- Detach and remove the roller cam followers (1) on the intake side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).



- Detach and remove the roller cam followers (1) on the output side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).

13 – Removing all hydraulic valve clearance compensating elements

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- Remove all hydraulic valve clearance compensating elements (1) to the top.
- Lay the hydraulic valve clearance compensating elements, together with the rocker arms, orderly in the special tool 0 495 105 (11 4 480).

14 – Remove all valve springs

CAUTION

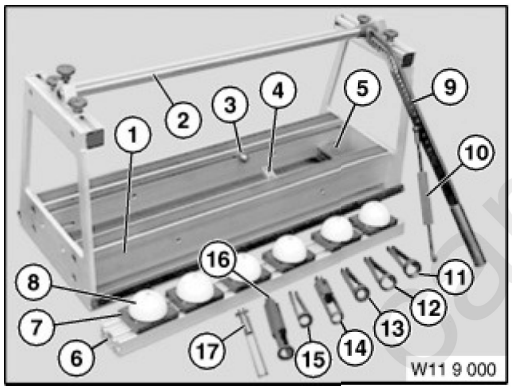
Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

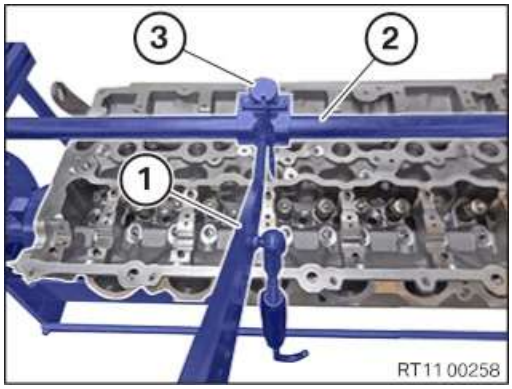
NOTICE

The description is for one component only. The procedure is identical for all further components.

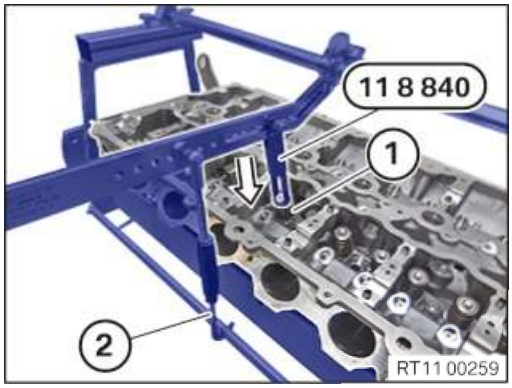


- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



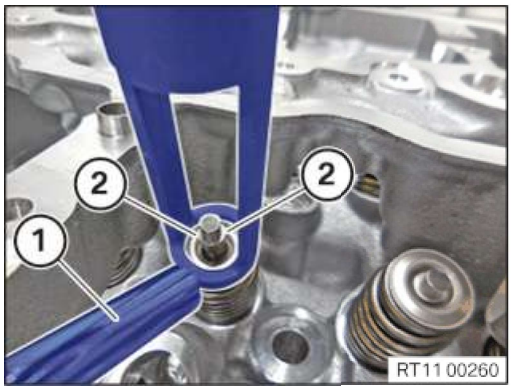
- Feed in and install lever (1) on the rod (2).
- Guide in and install lock (3).



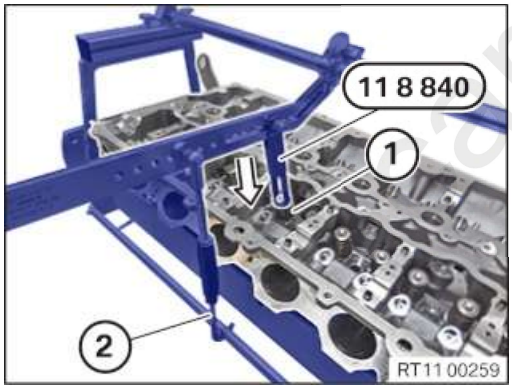
TECHNICAL INFORMATION

- Wear safety goggles.

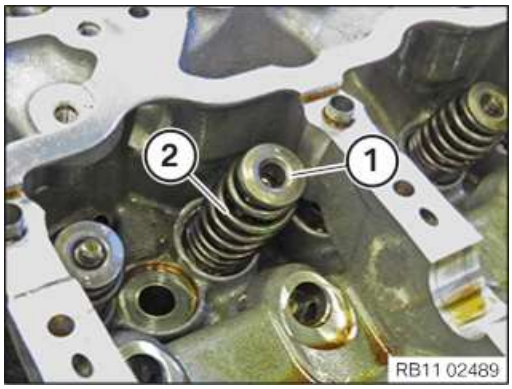
- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).



- Remove valve shims (2) with a magnet (1).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Remove the spring cup (1) and the valve spring (2) and position neatly in the special tool 0 495 105 (11 4 480).

15 – Remove valve stem seals

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RISK OF DAMAGE

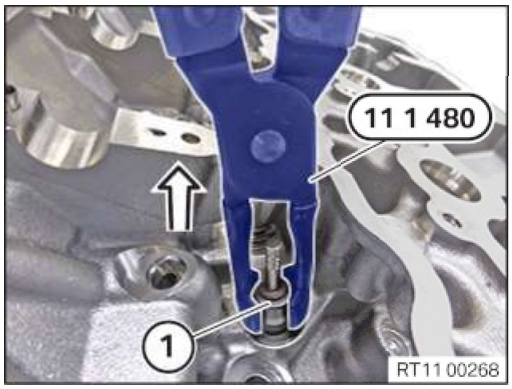
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Remove the valve stem seal (1) in the **direction of arrow** using the special tool 0 490 796 (11 1 480).

16 – Remove all valves

RISK OF DAMAGE

Contaminant or foreign body.

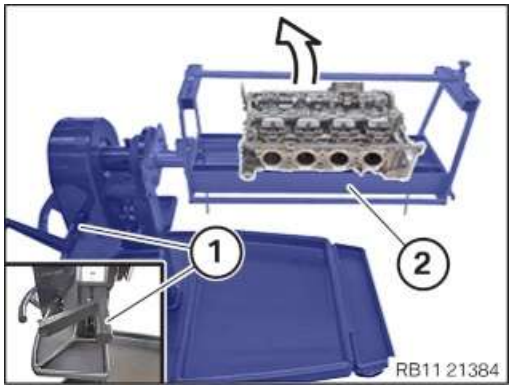
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- **Equipment specification B38**
- Twist the device (2) on the crank (1) 180°.

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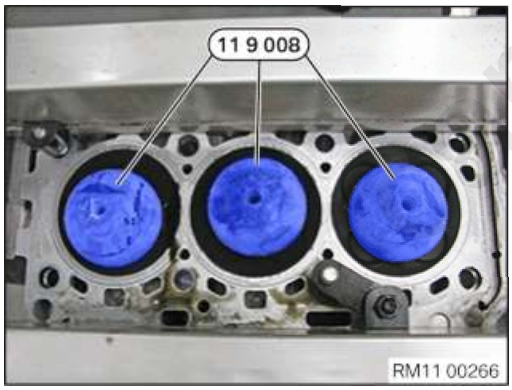
- **Equipment specification B46/B48**
- Turn device (2) on the crank (1) by 180° in **direction of arrow**.



- **Equipment specification B58**
- Turn device (2) on the crank (1) by 180° in direction of arrow.



- Unlock the special tool 0 494 370 (11 9 005) in **direction of arrow**.

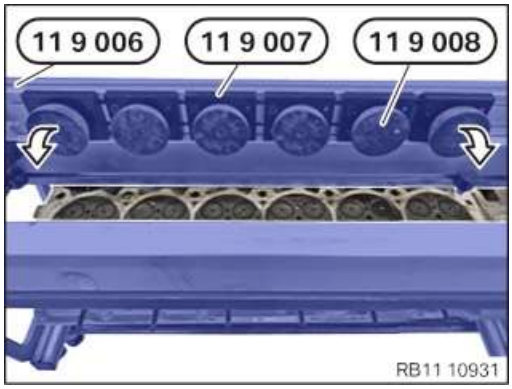


- **Equipment specification B38**
- Remove special tool 0 494 373 (11 9 008) if necessary.

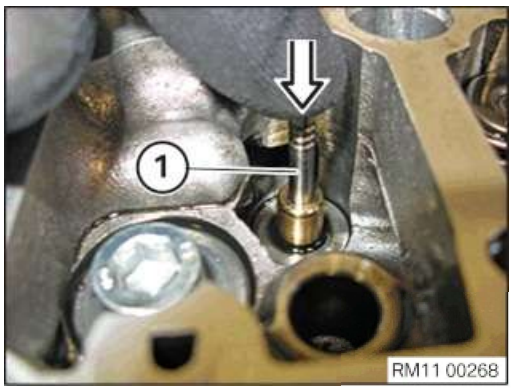


- **Equipment specification B46/B48**
- Remove special tool 0 494 373 (11 9 008) if necessary.

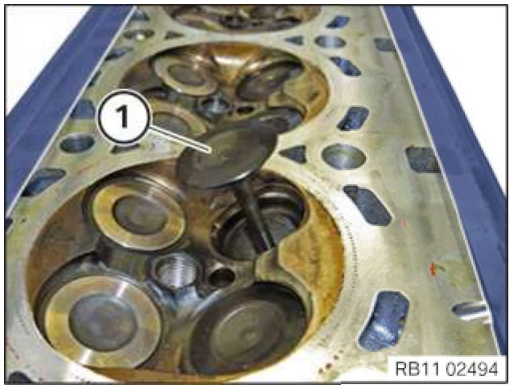
rdiagn.com



- **Equipment specification B58**
- Thread out and remove special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) in direction of arrow.



- Push the valve stem (1) into the cylinder head in **direction of arrow**.



- Remove the valve (1) and position in special tool 0 495 105 (11 4 480) in order.

MAIN WORK

17 – Checking cylinder head for watertightness

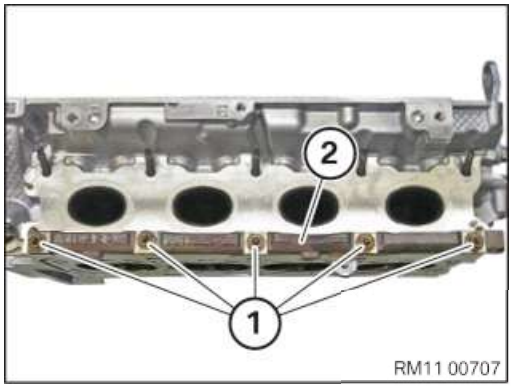


- Have the set of special tools 2 361 215 ready.

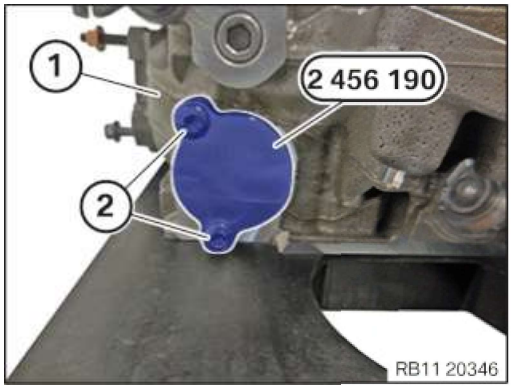
cardiagn.com



- Have special tool 2 456 190 ready.



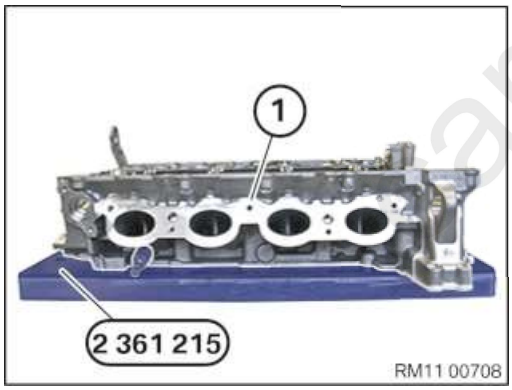
- Loosen nuts (1).
- Feed out and remove the clamping strip (2).



- Thread in and install the special tool 2 456 190 on the cylinder head (2).
- Tighten the screws (2).

Special tool 2 456 190 to cylinder head

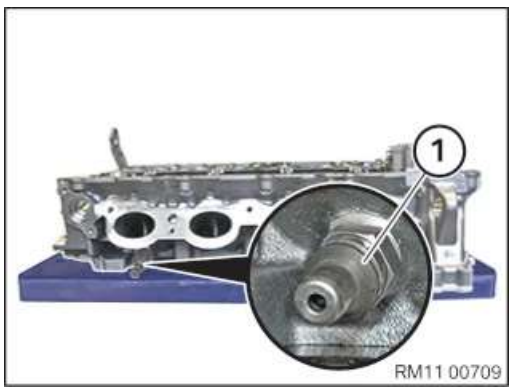
M6X20		Tightening torque	8 Nm



- Position the cylinder head (1) on the special tool 2 361 215 so that the rubber layer faces the cylinder head (1) and all water ducts at the cylinder head (1) are closed.
- Mount the cylinder head (1).

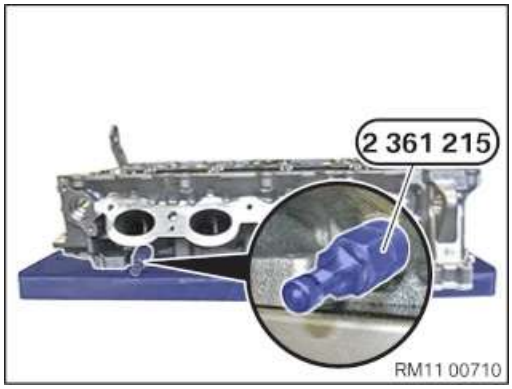
Cylinder head to special tool 2 361 215

			35 Nm



- Disassemble the ventilation connection (1).

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- Mount the valve of the special tool 2 361 215 on the cylinder head.

Ventilation connection/special tool to cylinder head

M10		18 Nm

Check

- Heat up the cylinder head.

Check for cylinder head watertightness

Temperature of the cylinder head	60 °C

- Connect compressed air .

Check for cylinder head watertightness

Testing pressure	max. 3,0 bar

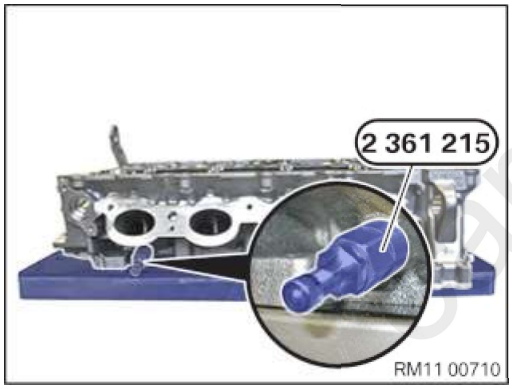
- Check the cylinder head in for tightness in a water bath.

Result

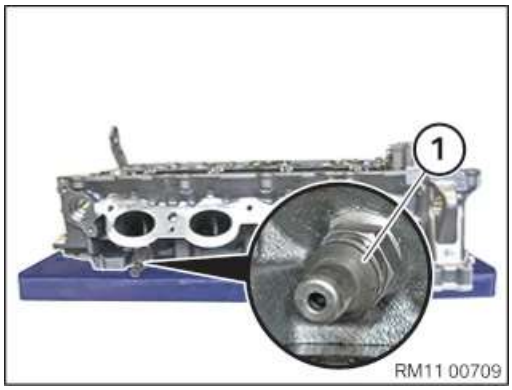
» Air bubbles develop.

Measure

- Check the cylinder head for damage at the point of exit of the air bubbles. If necessary, repair or renew the cylinder head.



- Disassemble the valve of the special tool 2 361 215.

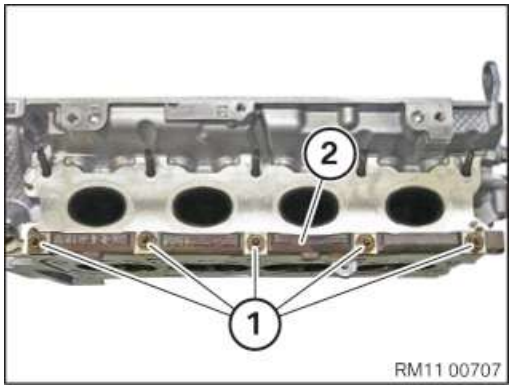


- Mount the ventilation connection (1).

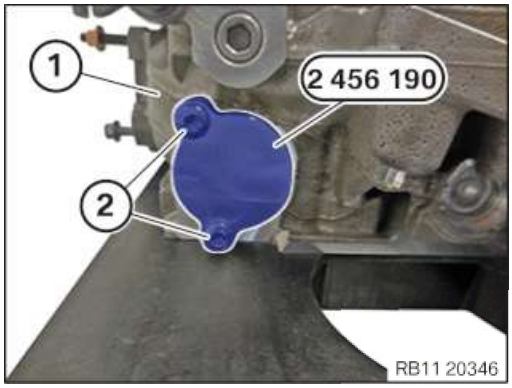
Ventilation connection/special tool to cylinder head

M10		18 Nm

carldiag.com



- Mount the clamping strip (2).
- Tighten nuts (1).



- Loosen screws (2).
- Feed out the special tool 2 456 190 from the cylinder head (2) and remove.

POSTPROCESSES

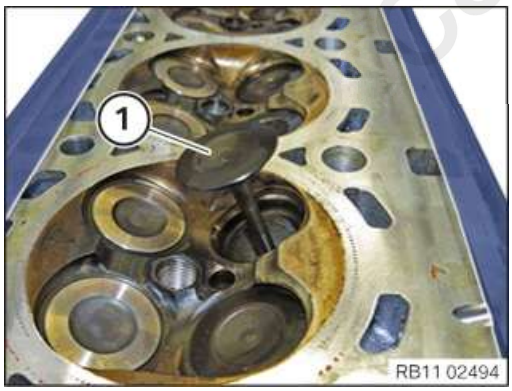
18 – Install all valves

RISK OF DAMAGE

Contaminant or foreign body.

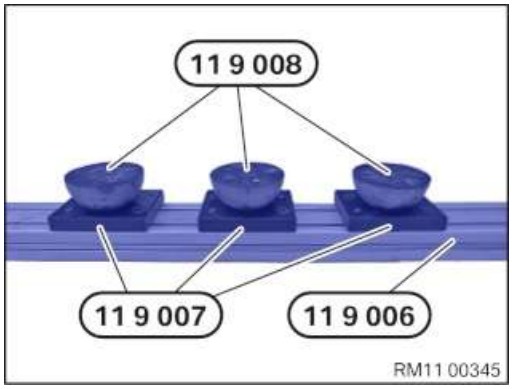
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

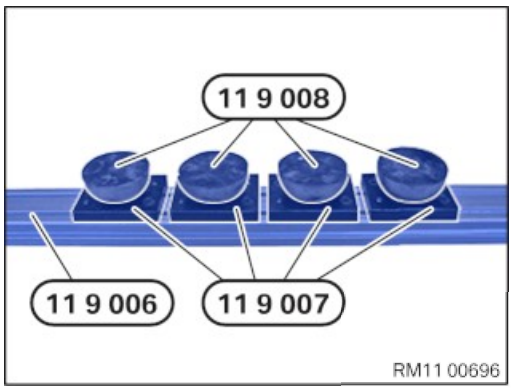


- Slide the valve (1) **carefully** into the cylinder head.

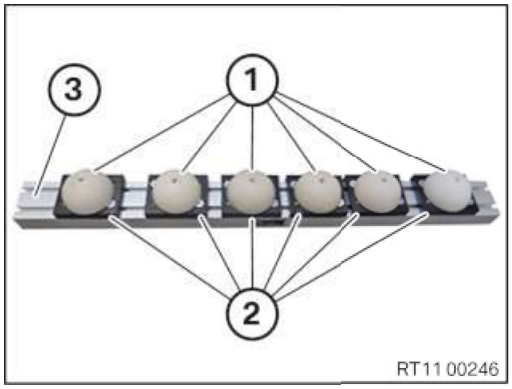
cardiagn.com



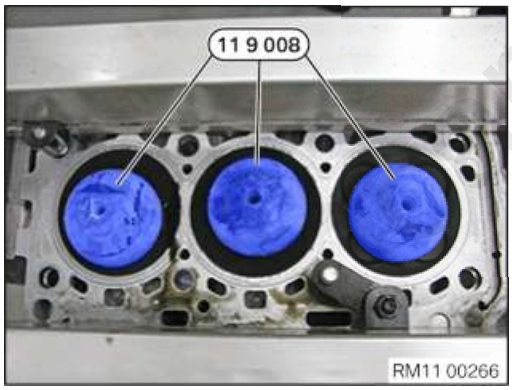
- **Equipment specification B38**
- Prepare the special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) as shown.



- **Equipment specification B46/B48**
- Prepare the special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) as shown.



- **Equipment specification B58**
- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).

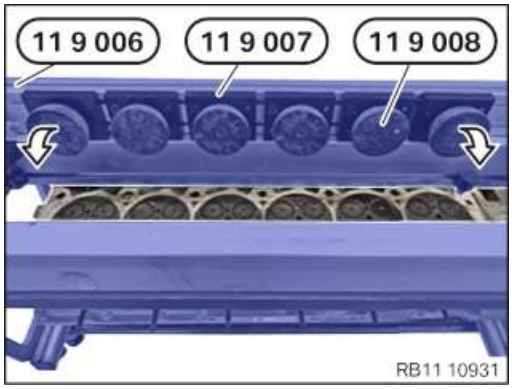


- **Equipment specification B38**
- The special tools 0 494 373 (11 9 008) must be set up accordingly in the next operation.



- **Equipment specification B46/B48**
- The special tools 0 494 373 (11 9 008) must be set up accordingly in the next operation.

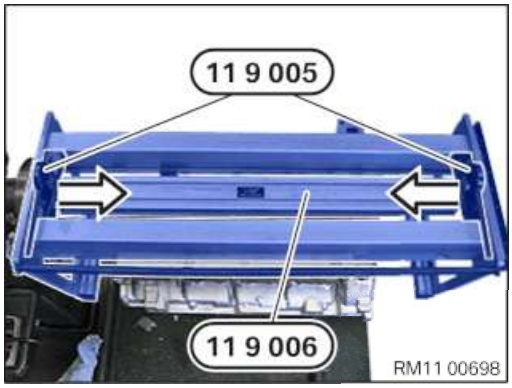
rdiagn.com



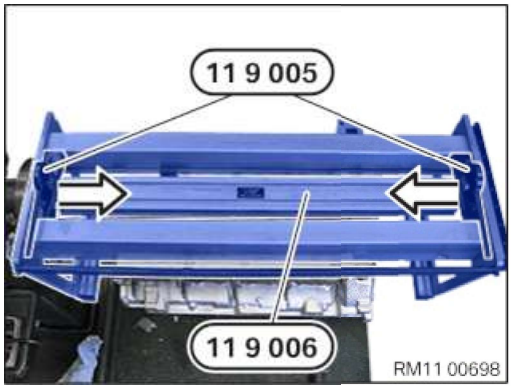
TECHNICAL INFORMATION

The figure shows the engine B58.

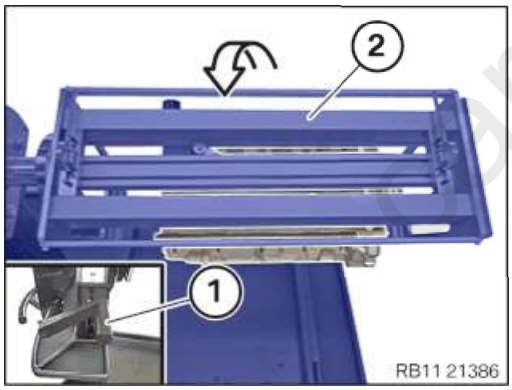
- Position special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) in the centre on the cylinder head in the direction of the arrow.



- Turn round special tool 0 494 371 (11 9 006) and insert as shown.
- Lock special tool 0 494 370 (11 9 005)in direction of arrow.



- Move and lock special tool 0 494 370 (11 9 005) in the direction of the arrow over the edges of special tool 0 494 371 (11 9 006).



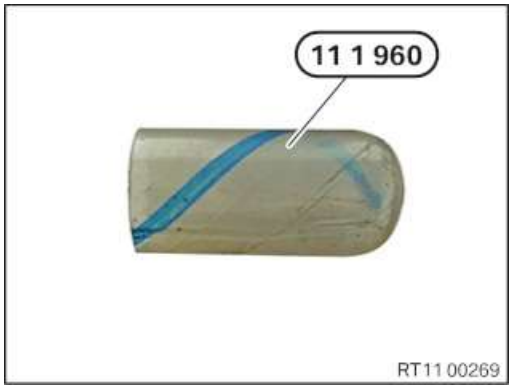
- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

19 – Installing valve stem seals



- Remove oil and dirt from the contact surface (1).

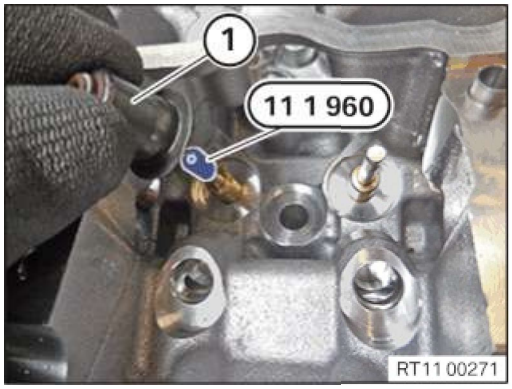
bmwdiagn.com



- Make sure that the special tool 0 490 797 (11 1 960) is used when installing the valve stem seal.



- Guide in and install the special tool 0 490 797 (11 1 960) on valve (1).



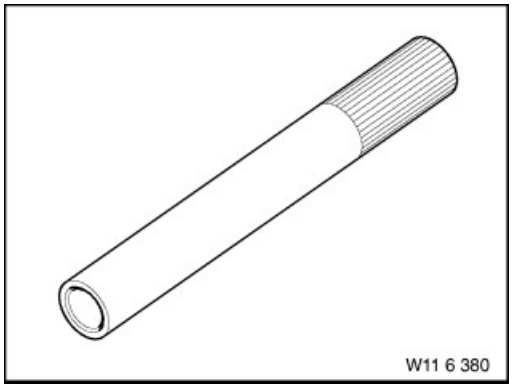
- Renew the valve stem seal (1).

  Parts: Valve stem seal

- Guide in and install valve stem seal (1) on the special tool 0 490 797 (11 1 960).

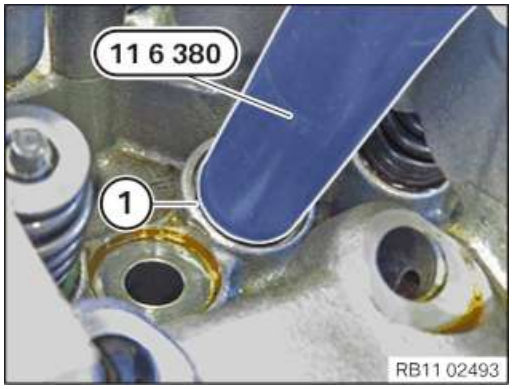


- Guide the special tool 0 490 797 (11 1 960) out and remove.

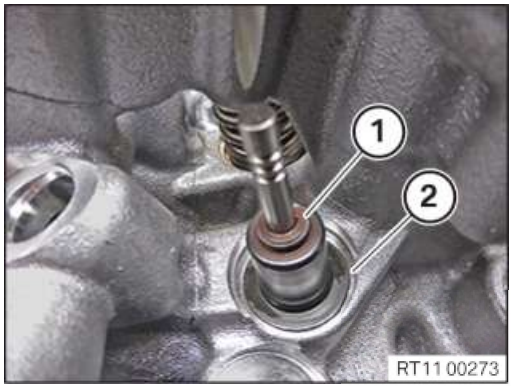


- Prepare special tool 0 493 249 (11 6 380).

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- Press the valve stem seal (1) onto the cylinder head till the limit position using special tool 0 493 249 (11 6 380).



- Make sure that valve stem seal (1) is positioned correctly on cylinder head (2).

20 – Install all valve springs

CAUTION

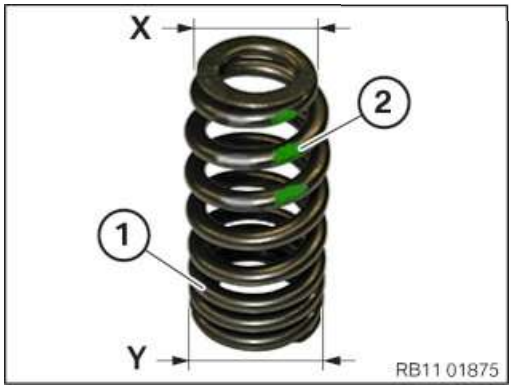
Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

NOTICE

The description is for one component only. The procedure is identical for all further components.



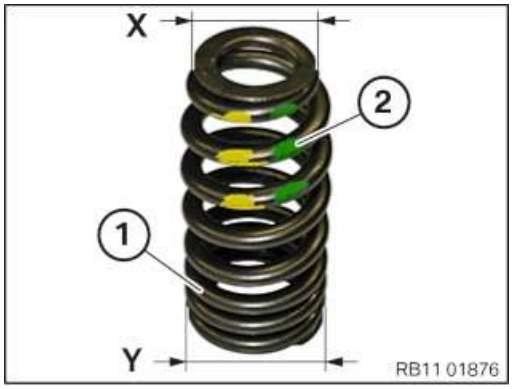
- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the intake valves: Green

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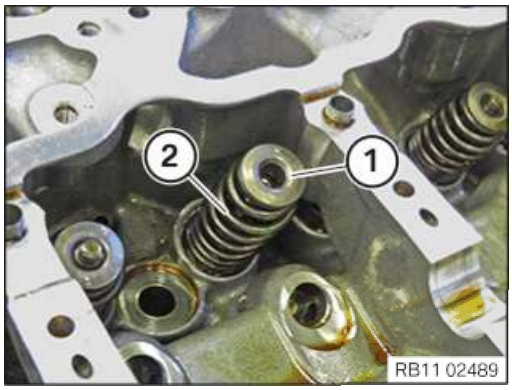


- Note the installation position of the valve spring.

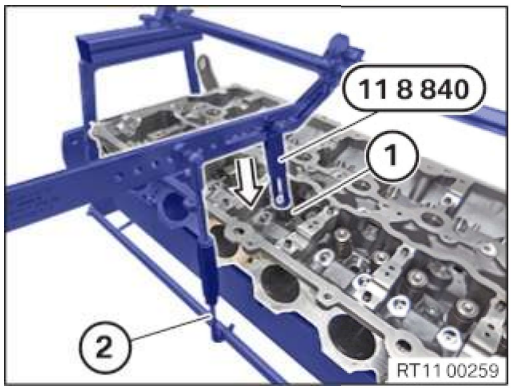
Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the exhaust valves: green/yellow



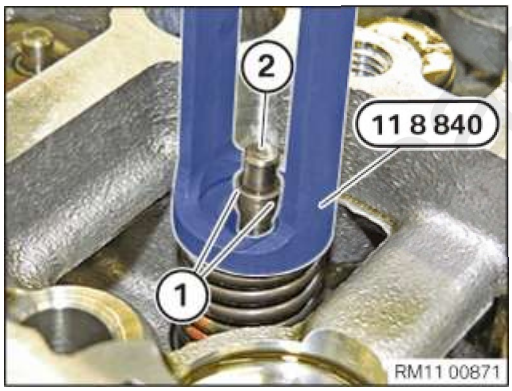
- Install the valve spring (2) and the spring cup (1).



TECHNICAL INFORMATION

- Wear safety goggles.

- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).

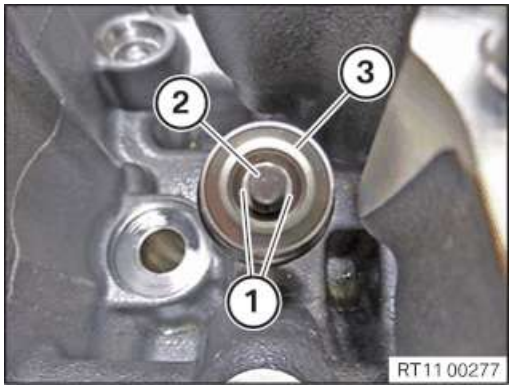


- Position the valve shims (1) on the valve (2).



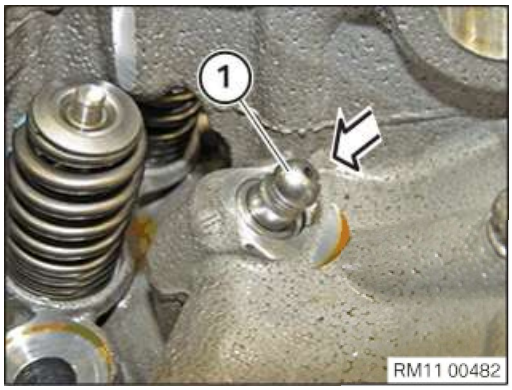
- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.

mydiagram.com



- Make sure that the valve shims (1) are positioned correctly on the valve (2) and on the valve spring (3).

21 – Installing all hydraulic valve clearance compensating elements

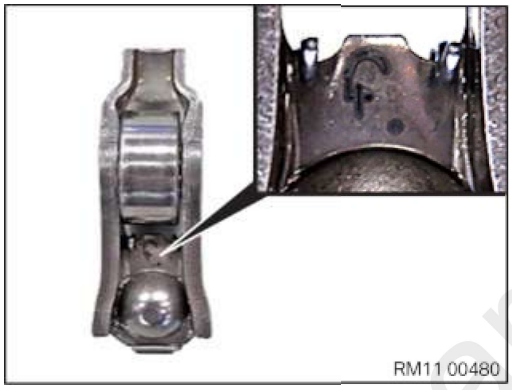


TECHNICAL INFORMATION

If the hydraulic valve clearance compensating elements are reused, they must be reinstalled at the same position.

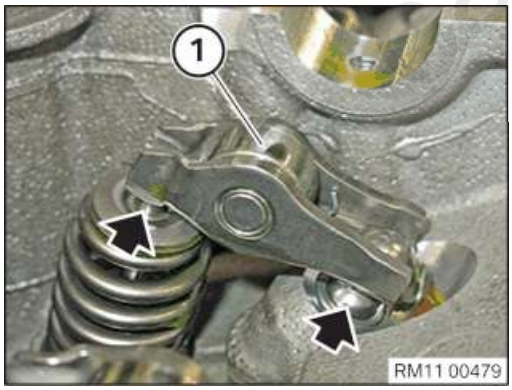
- Install all hydraulic valve clearance compensating elements (1).

22 – Install all roller cam followers

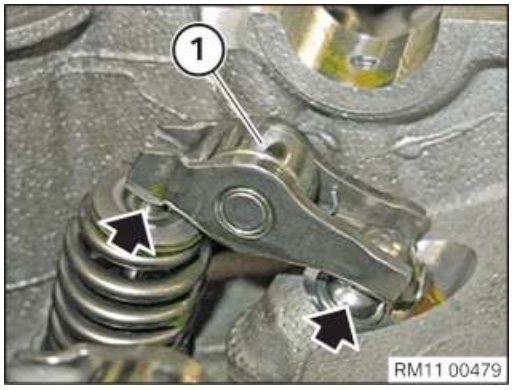


- The classification in digits from 1 to 5 has been printed on the roller cam follower.

Classification	Idle speed
1	Repair case - slow engine speed when idling
2	Installed as standard/initial installation
3	Installed as standard/initial installation
4	Installed as standard/initial installation
5	Repair case - high engine speed when idling



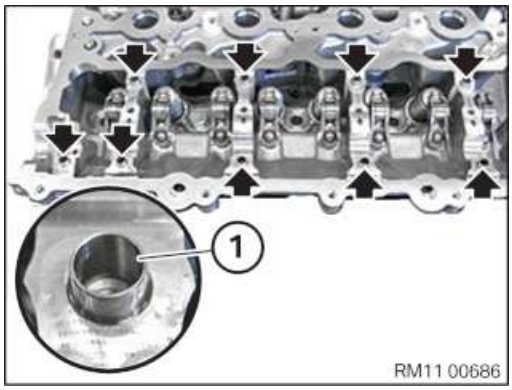
- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.



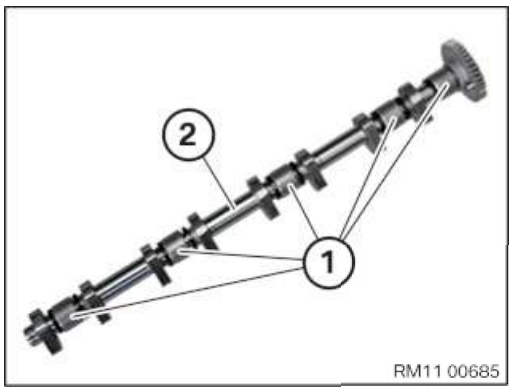
- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

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23 – Install eccentric shaft



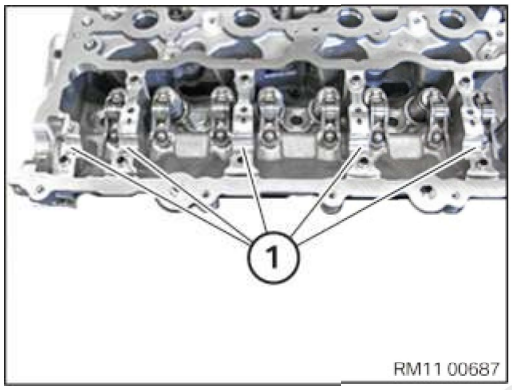
- Check guide sleeves (1) for damage and renew faulty guide sleeves (1).



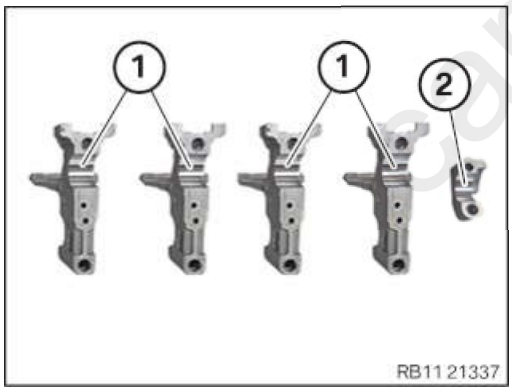
- Check needle bearing (1) for ease of movement.

Note: In the event of tight needle bearings, replace eccentric shaft 2.

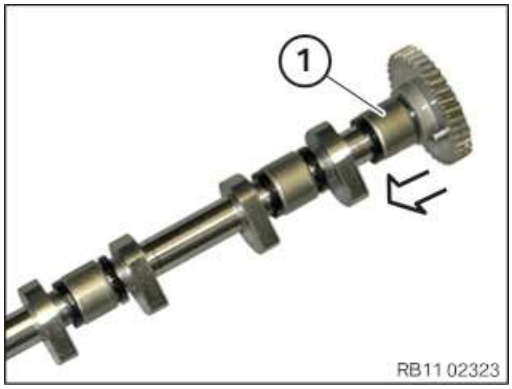
- Coat the needle bearing (1) with **new** engine oil.



- Clean the bearing positions (1) and coat with **new** engine oil.

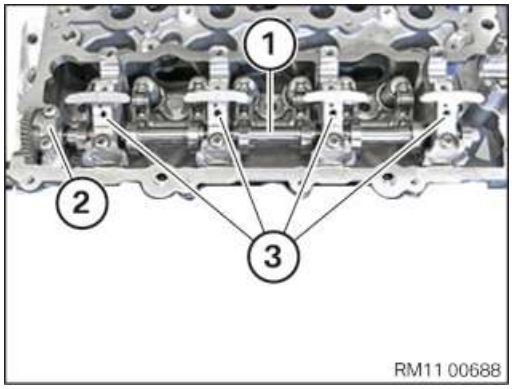


- Clean bearing positions of the bearing supports (1) and coat with fresh engine oil.
- Clean the bearing position of the bearing cap (1) and coat with **new** engine oil.

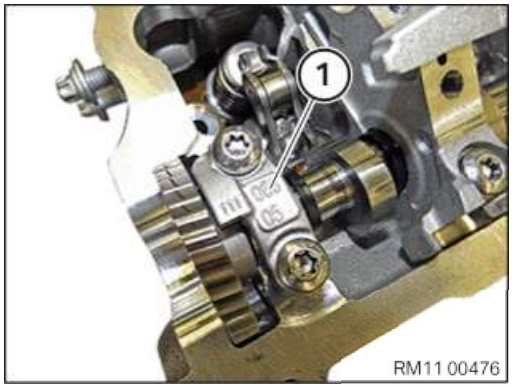


- Before installing the eccentric shaft, push needle bearing (1) in direction of arrow up to the limit position.

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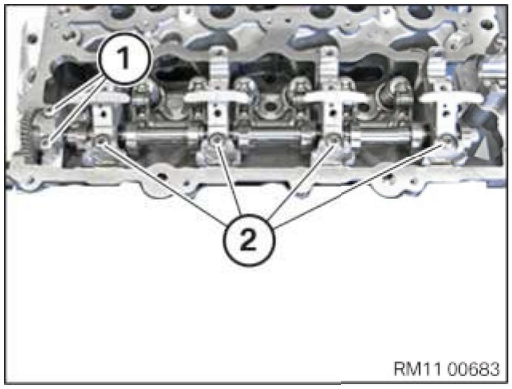


- Insert eccentric shaft (1) in the cylinder head.
- Attach bearing cap (2) and bearing supports (3) on the cylinder head.
- For an engine that has been in use, make sure all bearing supports are reinstalled in the same position.



- Ensure correct installation of bearing cap (1).

Note: Bearing cap 1 is provided with a limit position.

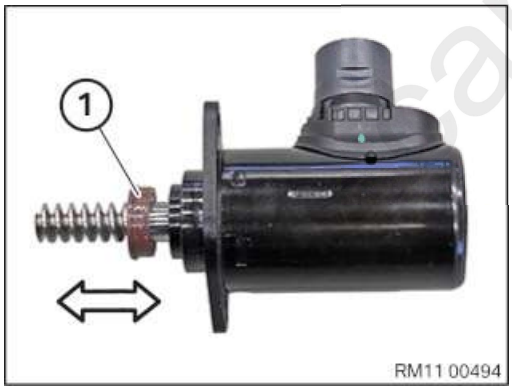


- Tighten down screws (1) and (2) uniformly.

Eccentric shaft to bearing support/cylinder head

M6		10 Nm

24 – Install the servomotor for the eccentric shaft (cylinder head removed)



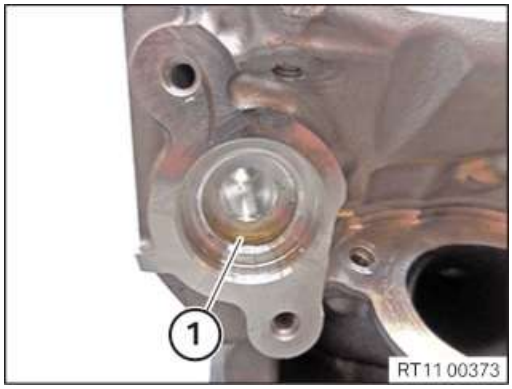
- Renew gasket (1).

Parts: Gasket

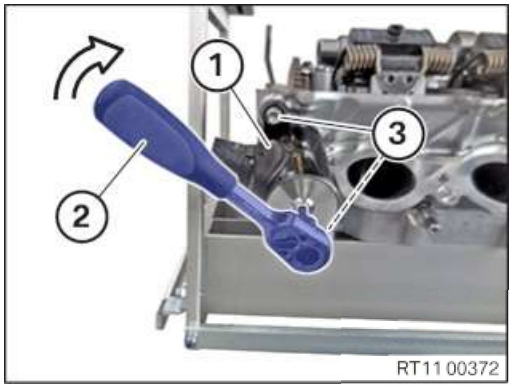


- Press the gasket (1) in to the limit position on the housing.

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- Clean sealing surface (1).

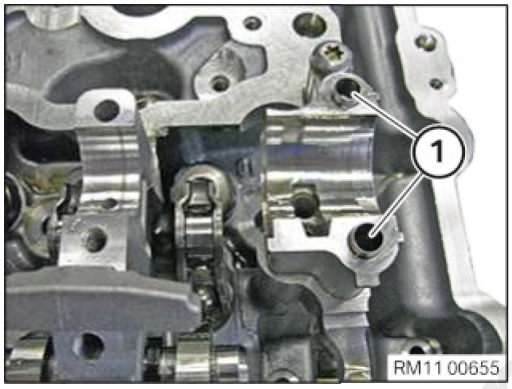


- Slide servomotor for the eccentric shaft (1) up to the limit position and install it.
- Turn servomotor for the eccentric shaft (1) using a standard hexagon socket wrench (2) of **4 mm** in the **direction of arrow** until the servomotor for the eccentric shaft (1) lies on the cylinder head.
- Tighten down screws (3).

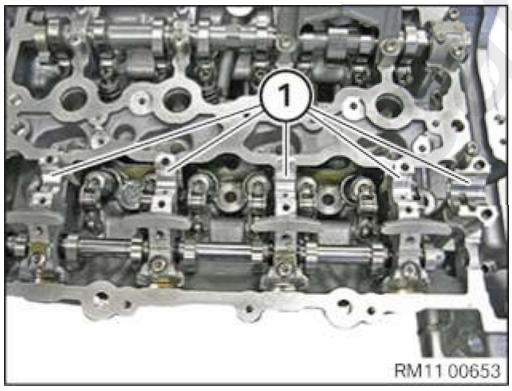
Electrical servomotor to cylinder head

M6		Tightening torque	8 Nm

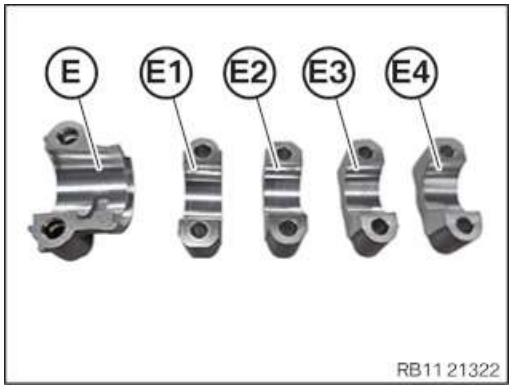
25 – Install intake camshaft



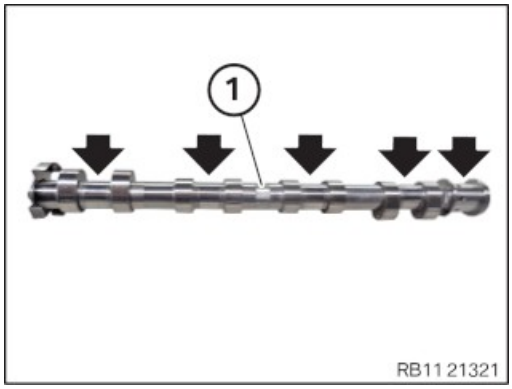
- Check the fitting sleeves for correct fit and damage and replace where required.



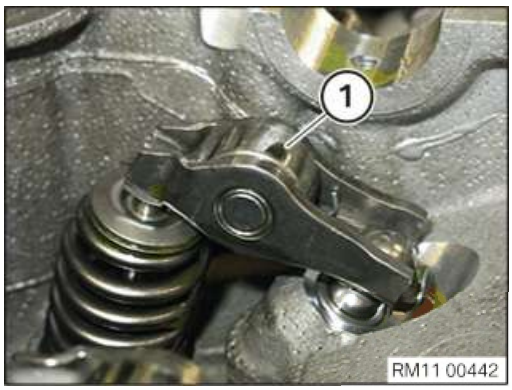
- Coat all bearing positions (1) with fresh engine oil.



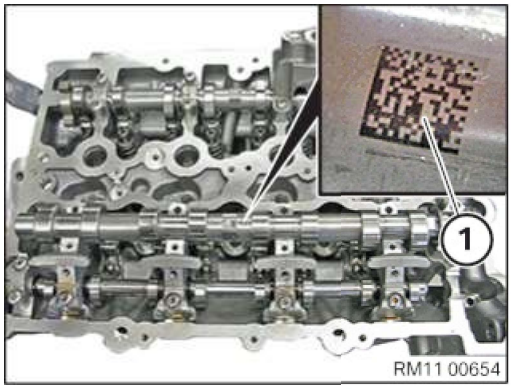
- Clean all the bearing positions of the intake camshaft bearing cap (E1) (E2) (E3), (E4) and (E) and coat with engine oil.



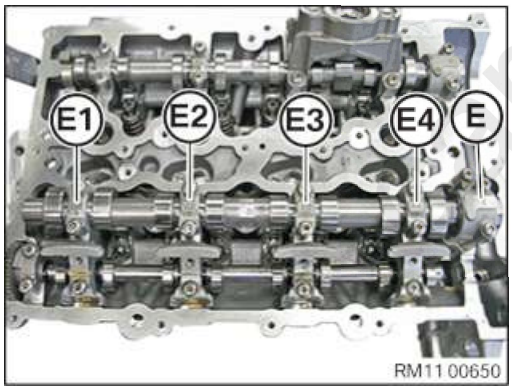
- Clean all bearing positions (arrows) of the intake camshaft (1) and coat with engine oil.



- Ensure the correct fit of the roller cam follower (1) before mounting the intake camshaft.
- Coat roller cam follower (1) with new engine oil.



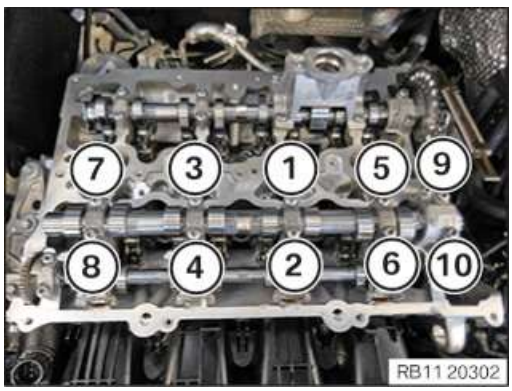
- Insert the intake camshaft into the cylinder head in such a way that the mark (1) points up.



- Position the intake camshaft bearing cap on the cylinder head.

Note: The intake camshaft bearing caps are legibly labelled from the intake side with E1, E2, E3, E4 and E.

Note: Intake camshaft bearing cap E is a thrust bearing.



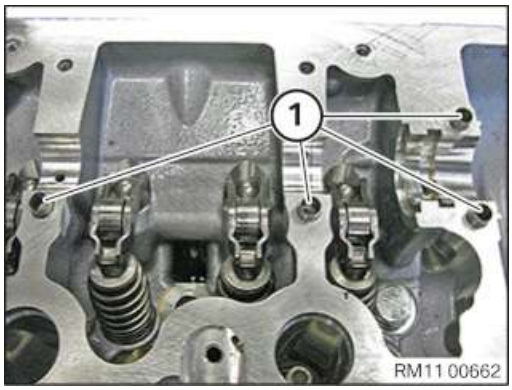
- Press intake camshaft bearing cap down and hand-tighten the screws incrementally in sequence (1) to (10).
- Join screws in sequence (1) to (10) **in half turns**.
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (10) **.**

Intake camshaft to cylinder head

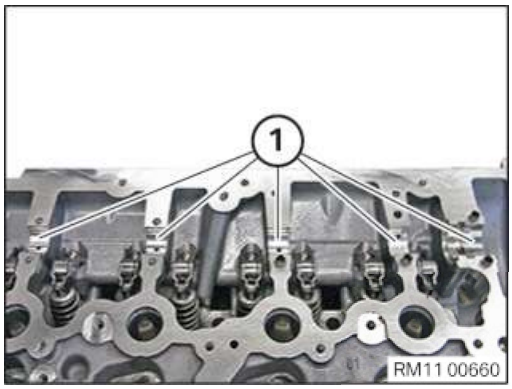
M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

mdiagn.com

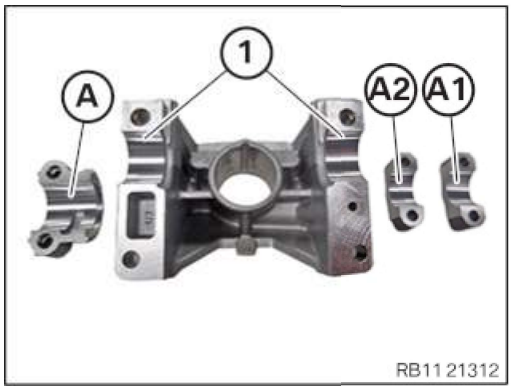
– Install exhaust camshaft



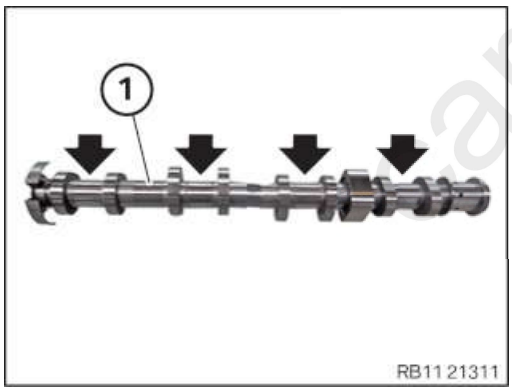
- Check the fitting sleeves (1) for **correct** fit and damage and replace where required.



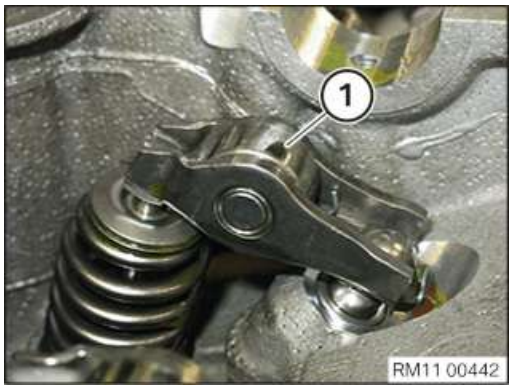
- Coat all bearing positions (1) with **fresh** engine oil.



- Clean all bearing positions of the exhaust camshaft bearing cap (A1), (A2) and (A) and coat with **fresh** engine oil.
- Clean the bearing positions (1) of the high pressure pump bracket and coat with **fresh** engine oil.

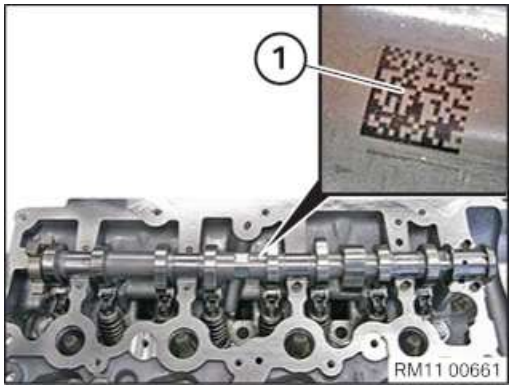


- Clean all the bearing positions (arrows) of the exhaust camshaft (1) and coat with **fresh** engine oil.

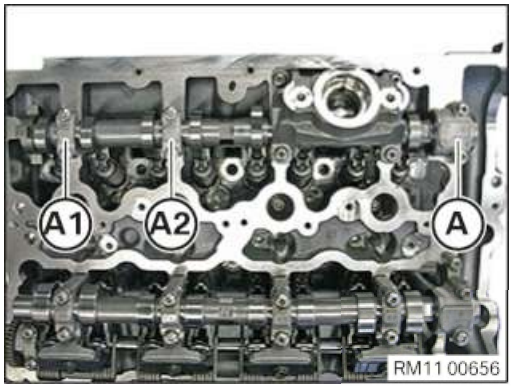


- Make sure that the roller cam follower (1) is fitted correctly before installing the exhaust camshaft.
- Coat the exhaust camshaft and the exhaust camshaft bearing cap with fresh engine oil.

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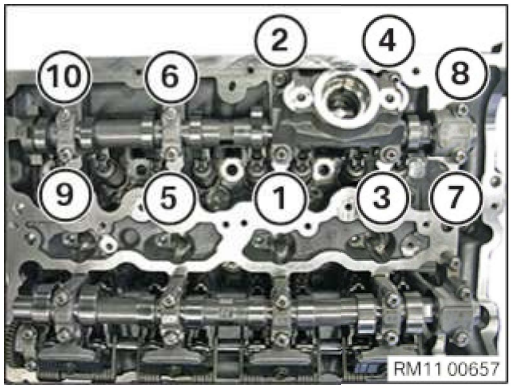
- Insert exhaust camshaft in the cylinder head, such that the mark (1) points **upwards**.



- Position all exhaust camshaft bearing caps on the cylinder head.

Note: The exhaust camshaft bearing caps are legibly labelled from the intake side and marked with A1, A2 and A.

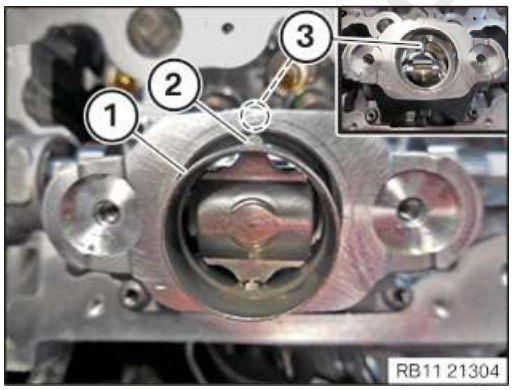
Note: Exhaust camshaft bearing cap A is a thrust bearing.



- Coat both bearing positions on the high pressure pump bracket with fresh engine oil.
- Position the high pressure pump bracket on the cylinder head.
- Join all bolts of the exhaust camshaft bearing caps in sequence (1) to (10) in half **turns**.
- **Adhere to the jointing torque.**
- Tighten all bolts of the exhaust camshaft bearing caps in sequence (1) to (10) **.**

Exhaust camshaft to cylinder head

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm



- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

27 – Checking the intermediate lever classification

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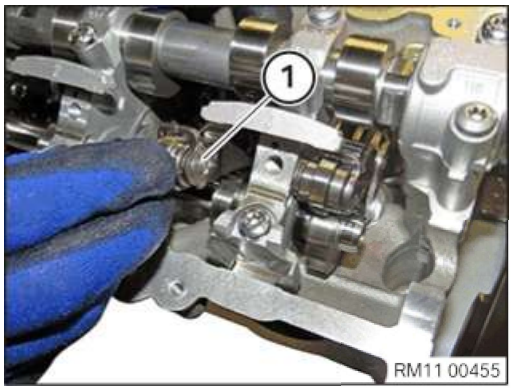
TECHNICAL INFORMATION

All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

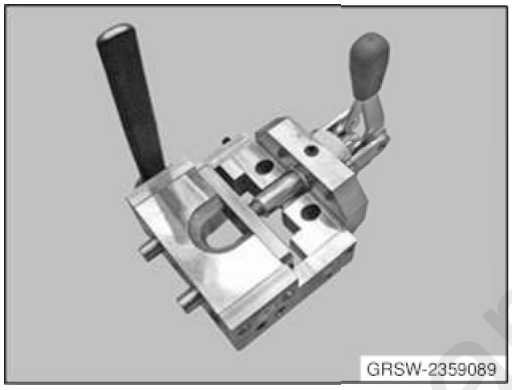
- Check classification (arrow) of intermediate lever.

28 – Installing all intermediate levers

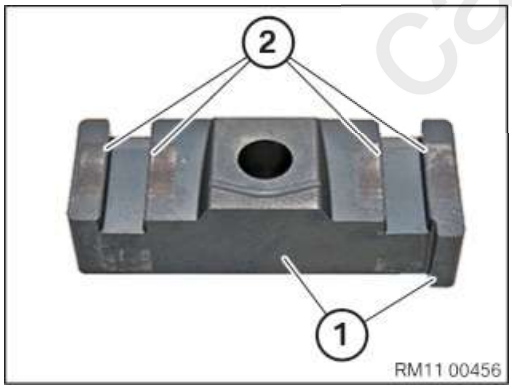


- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

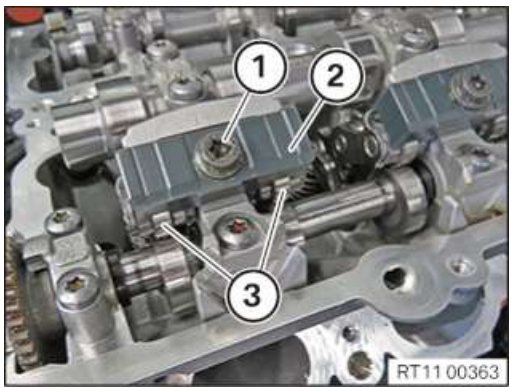
29 – Installing all gates



- Have the special tool 2 359 089 ready.

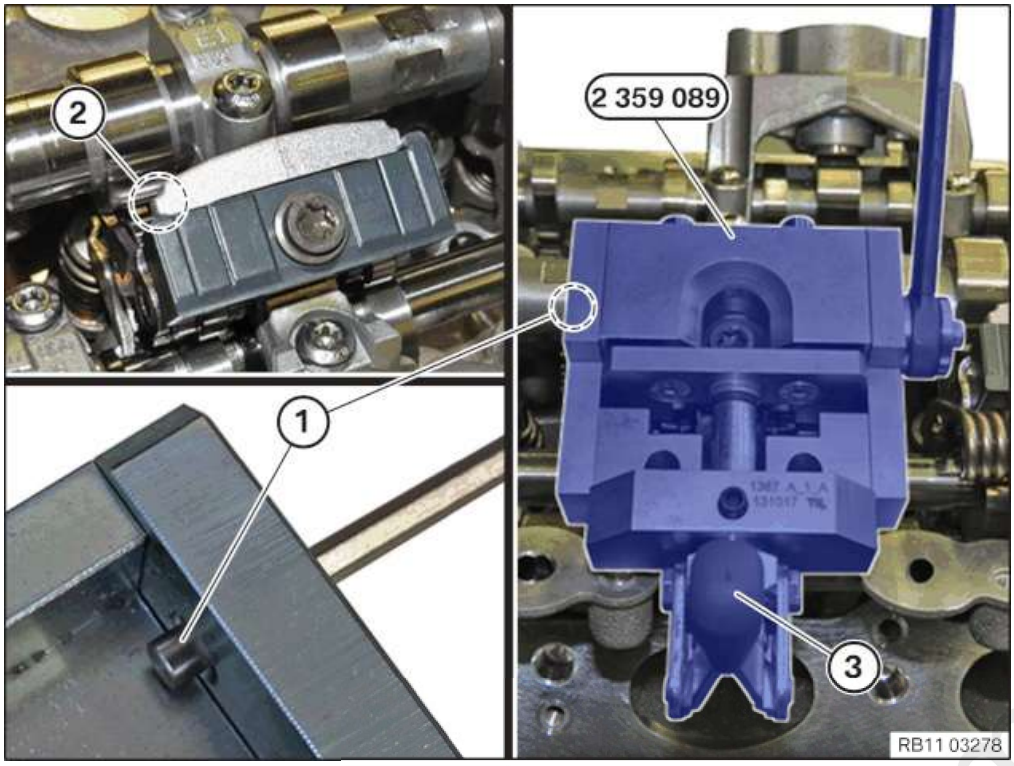


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

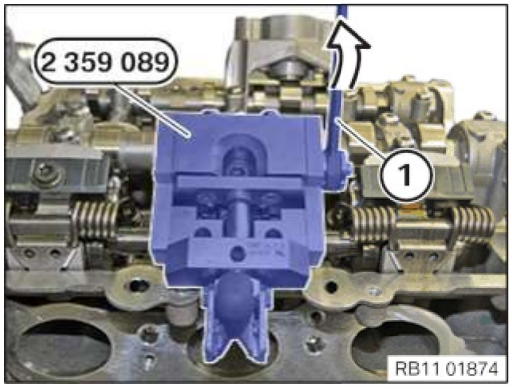


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.

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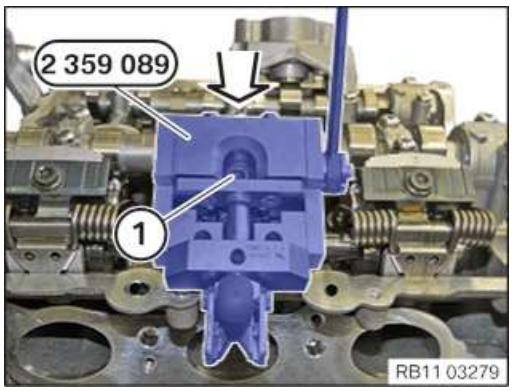
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1) in the direction of the arrow.



- Make sure that the special tool 2 359 089 rests flat against the cylinder head (arrows).

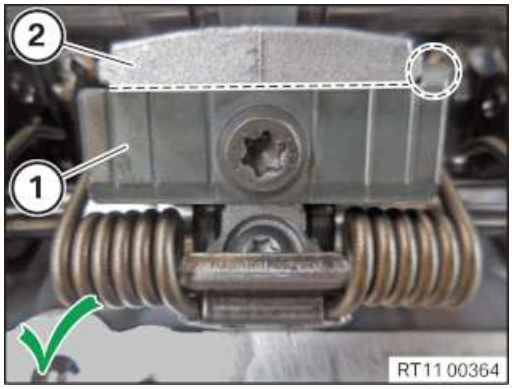


- Press the special tool 2 359 089 onto the cylinder head in the direction of the arrow.
- Tighten the bolt (1) at the same time.

Gate to bearing bracket

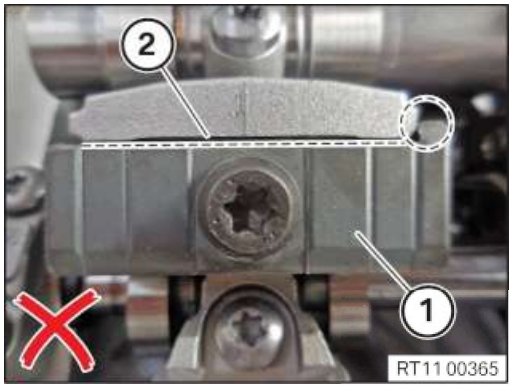
M8		20 Nm

rtdiagn.com



- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed correctly in the marked area.



- Ensure that gate (1) rests **correctly** against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area**.**

- Repeat the step for all the gates.

30 – Install all torsion springs

CAUTION

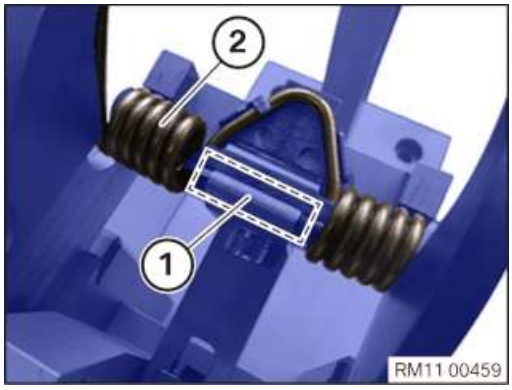
Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

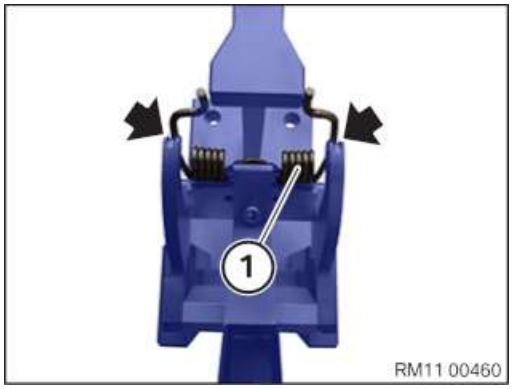
TECHNICAL INFORMATION

- Wear safety goggles.

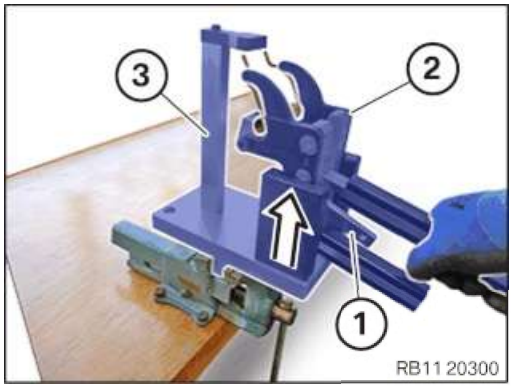


- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.

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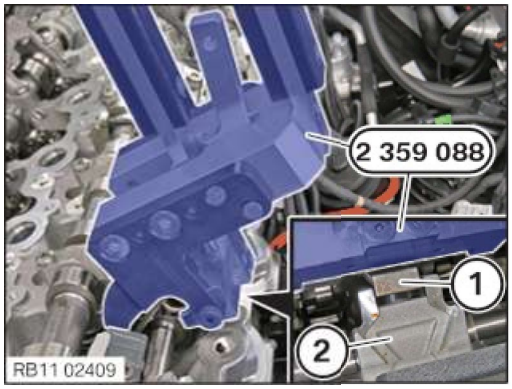


- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

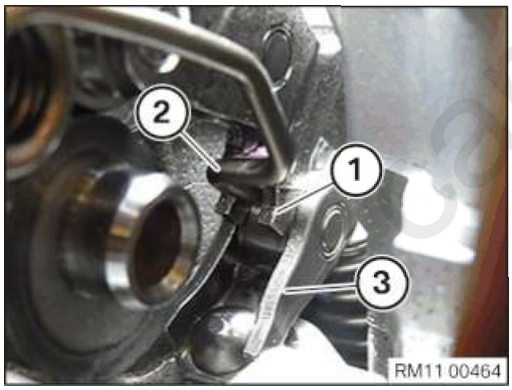


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the lever (1) audibly engages.

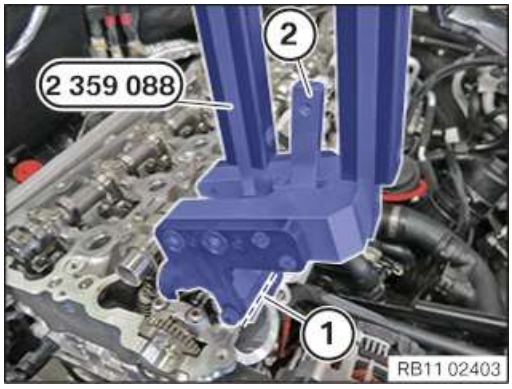
  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.



- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).

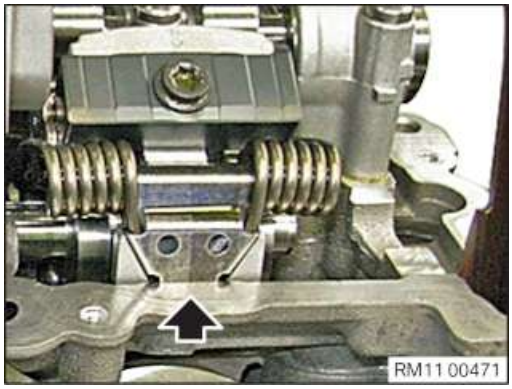


- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.

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- Check the correct mounting orientation of the torsion spring (arrow).
- Repeat the operations for the remaining torsion springs.

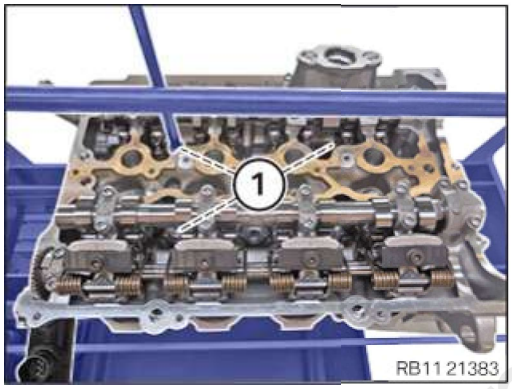
31 – Removing cylinder engine from assembly stand

CAUTION

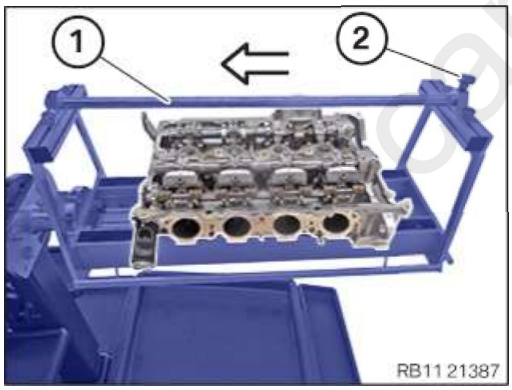
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



- Release screws (1) from special tool .

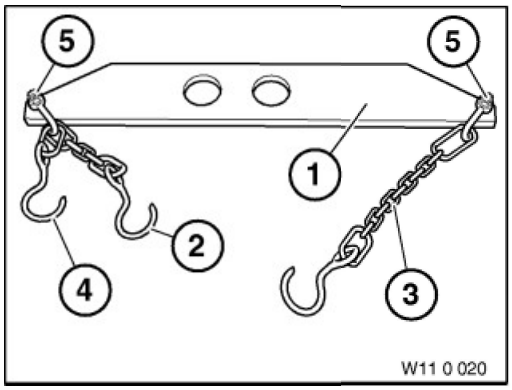


- Loosen screw (2).
- Pull out rod (1) in **direction of arrow** and set it aside.

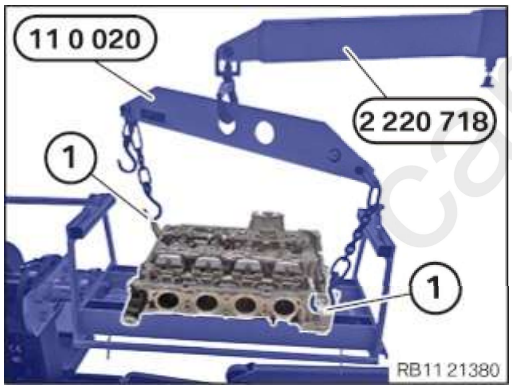
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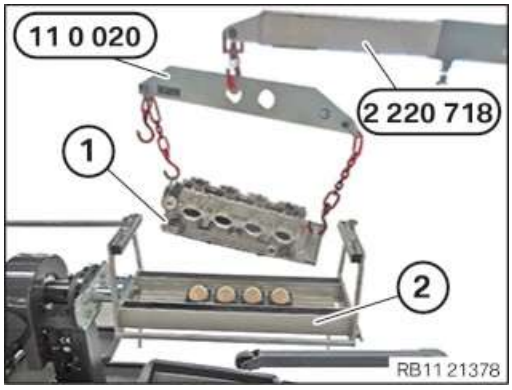
- Stage special tool (workshop crane) 2 220 718.



- Prepare the special tool .



- Thread in and install the special tool on the cylinder head (1).
- Attach the special tool to the workshop crane 2 220 718.



- Feed cylinder head (1) out of device (2) using workshop crane 2 220 718 and special tool and lift.

32 – Installing the exhaust turbocharger (cylinder head removed)

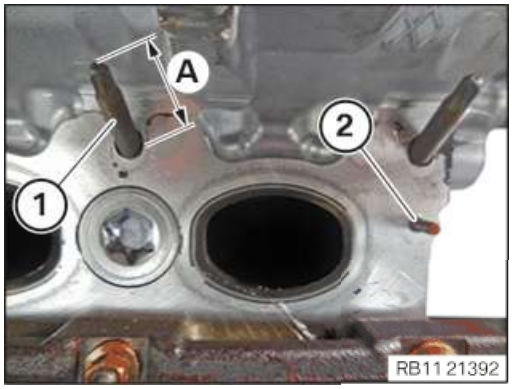
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RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.



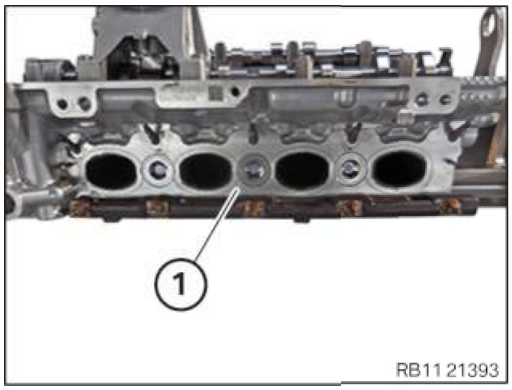
- Check stud bolt (1) for damage, renew stud bolt (1) if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1); if necessary screw in stud bolt further.

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm

- Check for correct fit of stud bolt (2).



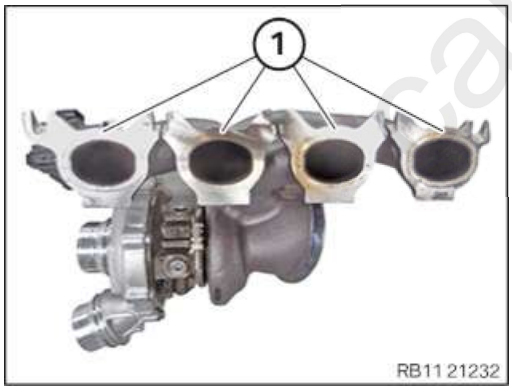
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the cylinder head (1) using the special tool 0 495 102 (11 4 470).



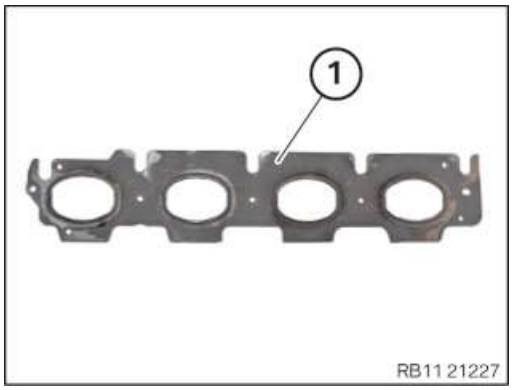
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

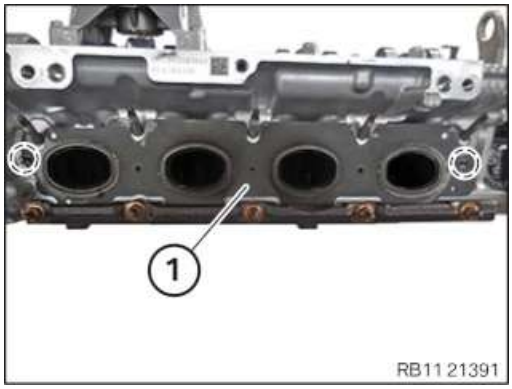
- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the exhaust turbocharger (1) using the special tool 0 495 102 (11 4 470).

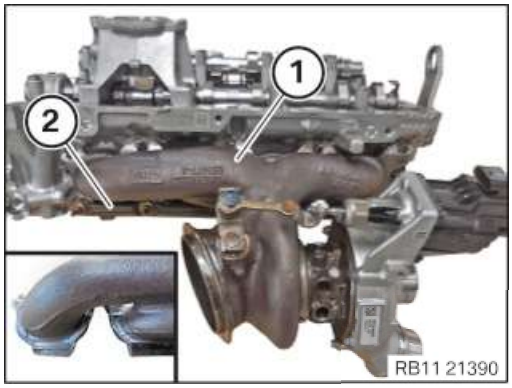


- Renew gasket (1).

  Parts: Seals



- Insert and install the gasket (1).
- Make sure the seal (1) has been **correctly** installed in the guide pins in the **marked** area.



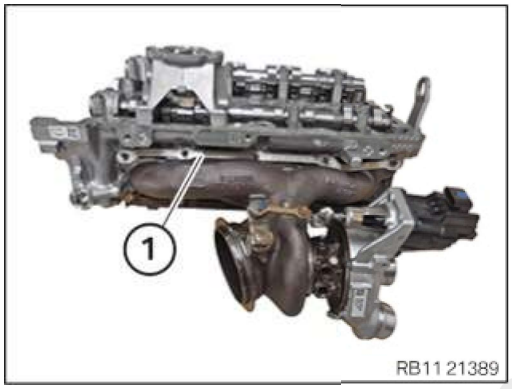
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide the exhaust turbocharger (1) toward the bottom into the clamping strip (2) and align it flush on the cylinder head.

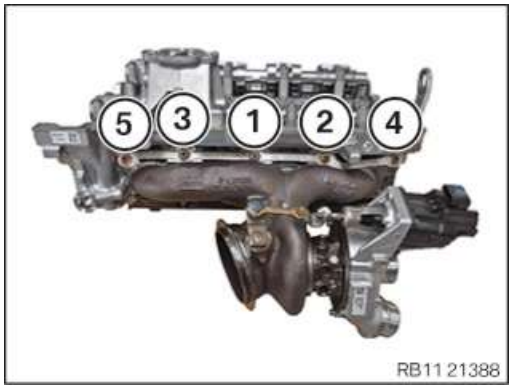


TECHNICAL INFORMATION

- Note the installation position of the component. The component may be installed in various installation positions.

- Mount sliding rail (1).
- The original BMW part number of the sliding rail (1) must be **legible** from the rear.

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Renew nuts (1) to (5).

  Parts: Nuts

- Tighten the nuts in sequence (1) to (5).

Exhaust turbocharger to cylinder head

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Additional Information

Overview of Tightening Torques

Flange to assembly stand — Used in step 2

M14X30		Tightening torque	135 Nm

Cylinder head on device — Used in step 2

M10X90x1.5		Tightening torque	30 Nm

Special tool 2 456 190 to cylinder head — Used in step 17

M6X20		Tightening torque	8 Nm

Cylinder head to special tool 2 361 215 — Used in step 17

			35 Nm

Ventilation connection/special tool to cylinder head — Used in step 17

M10			18 Nm

Eccentric shaft to bearing support/cylinder head — Used in step 23

M6			10 Nm

Electrical servomotor to cylinder head — Used in step 24

M6		Tightening torque	8 Nm

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Intake camshaft to cylinder head — Used in step 25

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Exhaust camshaft to cylinder head — Used in step 26

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Gate to bearing bracket — Used in step 29

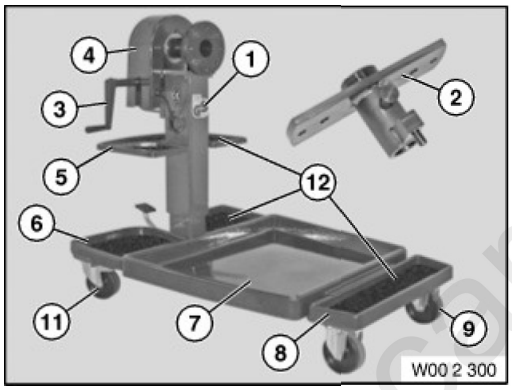
M8			20 Nm

Exhaust turbocharger to cylinder head — Used in step 32

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Overview of Special Tools

0 495 187 (00 2 300) Assembly stand



Common — Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

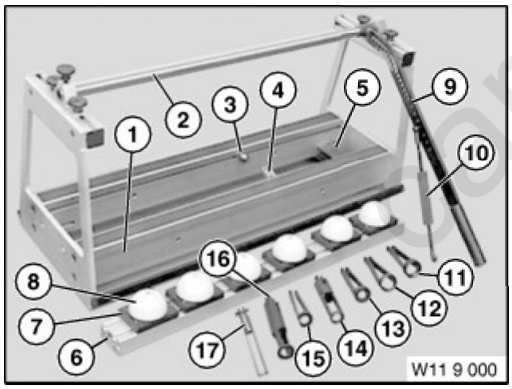
Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	

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2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	
7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	

0 494 362 (11 9 000) Device



Common

Used in step 214

Usage	(Cylinder head expander tool)
Included in the tool or work	**Adapter** New adapter for the
Storage location	Individual
Replaced by	Replacement for 83 30 0 495 189 - 00 2 302.
In connection with	002300 = 0495187
SI-Number	01 03 02 (833)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 366 (11 9 001)		**Device**	
6	0 494 371 (11 9 006)		**Insert** (Aluminium strip)	
11	0 494 376 (11 9 012)		**Basket** (Valve spring cage) Engine M41, M51, S50	
17	0 495 028 (11 9 017)		**Basket** (Valve spring cage) Engine N52	

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2	0 494 367 (11 9 002)		**Rod**	
3	0 494 368 (11 9 003)		**Adapter** (Sliding block)	
4	0 494 369 (11 9 004)		**Tab**	
5	0 494 370 (11 9 005)		**Quick fastener**	
7	0 494 372 (11 9 007)		**Shaped part** (shaped part)	
8	0 494 373 (11 9 008)		**Shaped part** (Shaped part) Shaped part made of plastic	
9	0 494 374 (11 9 009)		**Lever**	
10	0 494 375 (11 9 011)		**Hook**	
12	0 494 377 (11 9 013)		**Basket** (Valve spring cage) Engine M43, M73	
13	0 494 378 (11 9 014)		**Basket** (Valve spring cage) Engine M44, M52, M54, M56, M62, S52, S54, S62	
14	0 494 379 (11 9 015)		**Basket** (Valve spring cage) Engine M47, M47TU, M57, M57TU, N40, N42, N62, N73	
15	0 494 380 (11 9 016)		**Basket** (Valve spring cage) Engine M21, M40	

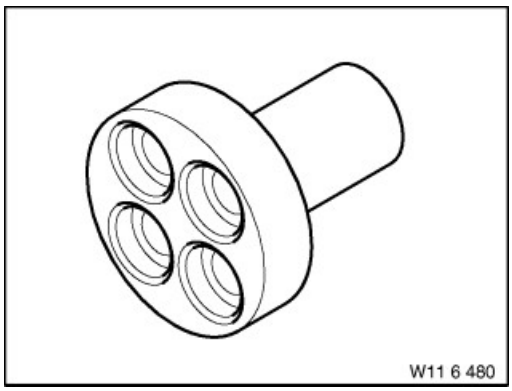
2 220 718 Workshop crane



Common	Used in step 231
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

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0 493 380 (11 6 480) Connector



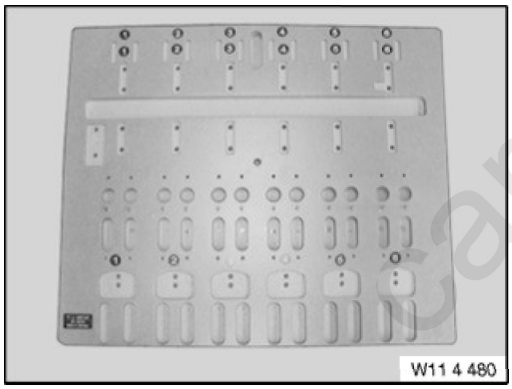
Common	Used in step 4
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 359 088 Device



Common	Used in step 530
Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 105 (11 4 480) oddments tray



Common	Used in step 5678101112131416
Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

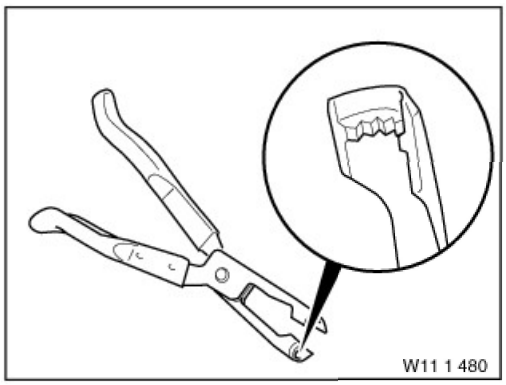
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0 496 143 (11 8 840) Basket



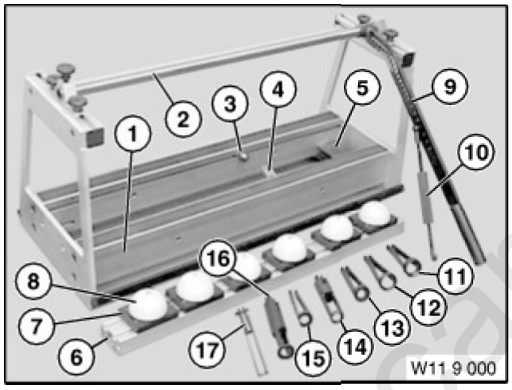
Common	Used in step 1420
Usage	(Valve spring cage) For removing and fitting the valves.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 490 796 (11 1 480) Pliers



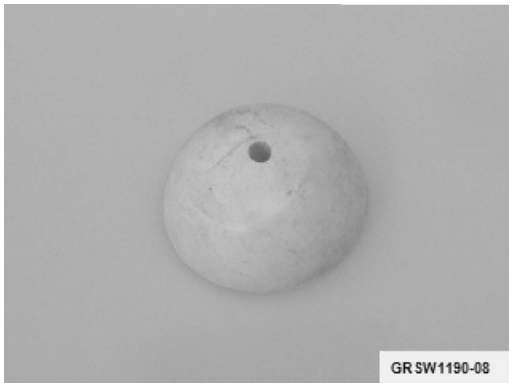
Common	Used in step 15
Usage	For removing valve stem seal
Included in the tool or work	
Storage location	A10
Replaced by	
In connection with	
SI-Number	01 01 93 (621)

0 494 370 (11 9 005) Quick fastener



Common	Used in step 1618
Usage	
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

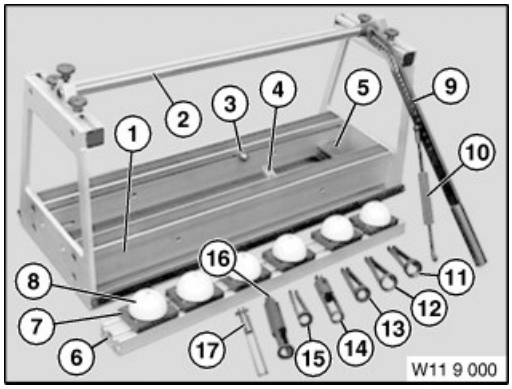
0 494 373 (11 9 008) Shaped part



Common	Used in step 1618
Usage	(Shaped part) Shaped part made of plastic
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

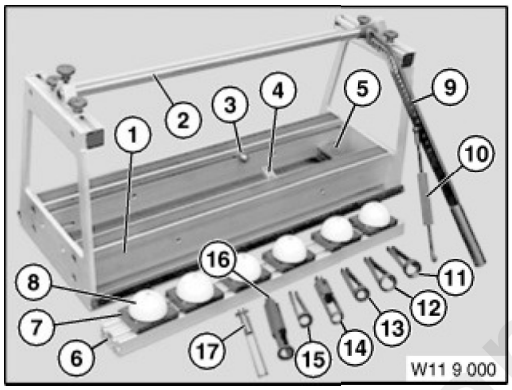
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0 494 371 (11 9 006) Insert



Common	Used in step 1618
Usage	(Aluminium strip)
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 372 (11 9 007) Shaped part



Common	Used in step 1618
Usage	(Shaped part)
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

2 361 215 Device



Common	Used in step 17
Usage	For leak-testing cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

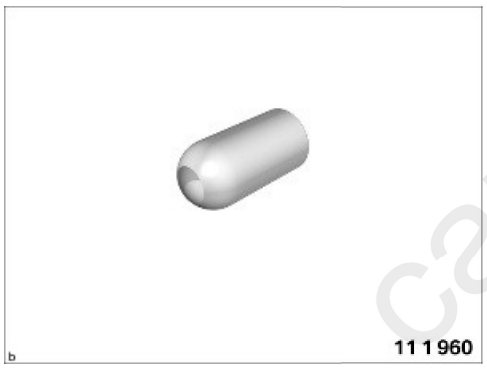
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2 456 190 Fastener



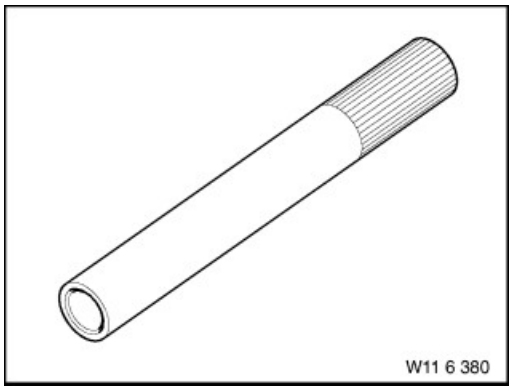
Common	Used in step 17
Usage	For water tightness check of cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 490 797 (11 1 960) Holding sleeve



Common	Used in step 19
Usage	(Assembly sleeve) For fitting valve stem seals, 6 mm diameter
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

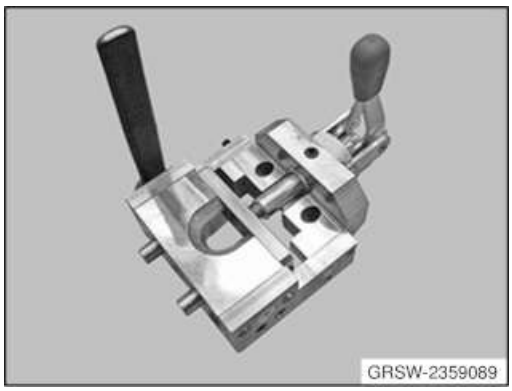
0 493 249 (11 6 380) Bush



Common	Used in step 19
Usage	For fitting valve stem seal
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 98 (306)

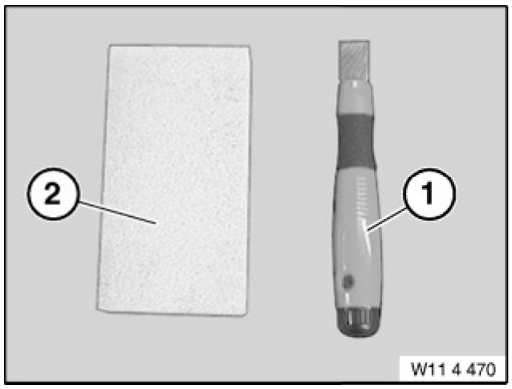
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2 359 089 Device



Common	Used in step 29
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 102 (11 4 470) Tool



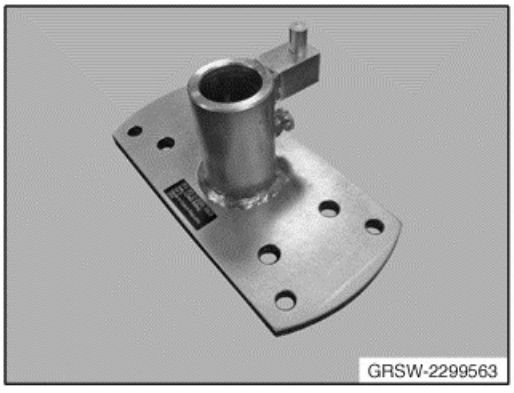
Common	Used in step 32
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

Replacement tools:

2 299 563 Adapter



Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

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Overview Technical Data

Check for cylinder head watertightness	Used in step 17
Temperature of the cylinder head	60 °C

Check for cylinder head watertightness	Used in step 17
Testing pressure	max. 3,0 bar

Screw-in depth of upper stud bolt on cylinder head	Used in step 32
Dimension A	30 mm

Links

Repair instructions	**Used in step**
61 35 ... Notes on ESD protection (Electro Static Discharge)	9

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11 12 502 Disassemble and assemble cylinder head

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

1 – Removing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

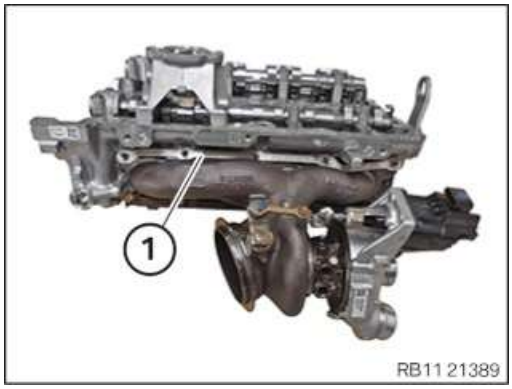


TECHNICAL INFORMATION

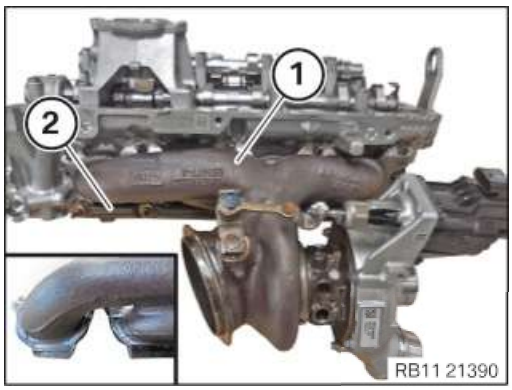
Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (5) to (1).

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- Remove reinforcement plate (1).



CAUTION

Heavy component.

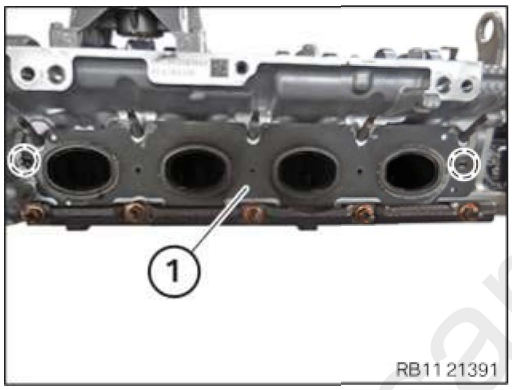
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Ensure that the clamping strip (2) remains screwed into place during the removal of the exhaust turbocharger (1).

  The exhaust turbocharger (1) is **not** screwed onto the bottom, but clamped in the clamping strip (2).

  Thread out and remove exhaust turbocharger (1).



- Guide seal (1) out of the **marked** area and remove it.

2 – Installing the cylinder head on the assembly stand

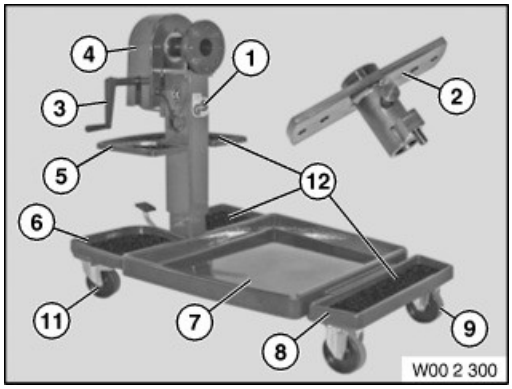
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

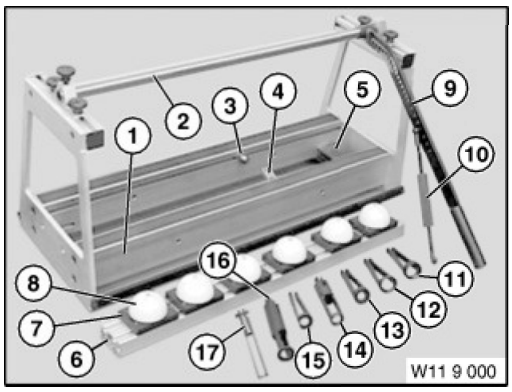
- Remove and install heavy components with the aid of another person/other persons.

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- Have the set of special tools 0 495 187 (00 2 300) ready.

Number	Description
1	Assembly stand
2	Flange
3	Crank
4	Cover
5	oddments tray
6	Shaped element rear
7	Collection pan
8	Shaped element front
9	Front wheel
10	Rear wheel with stop
11	Mat



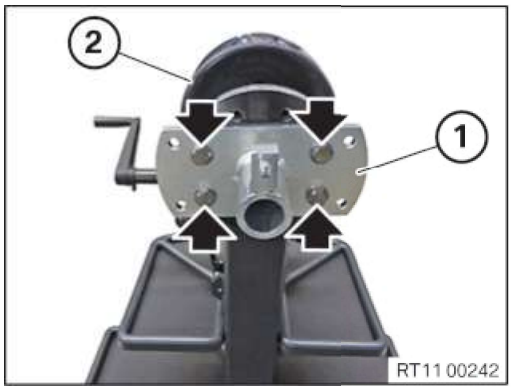
- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage

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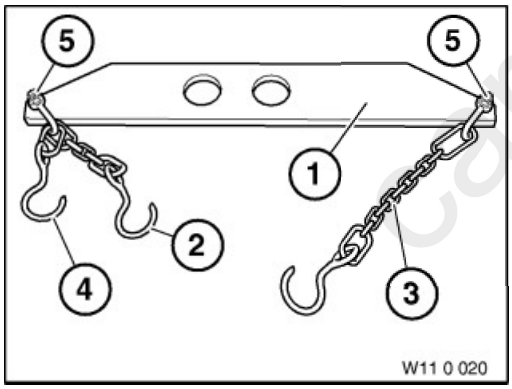
- Stage special tool (workshop crane) 2 220 718.



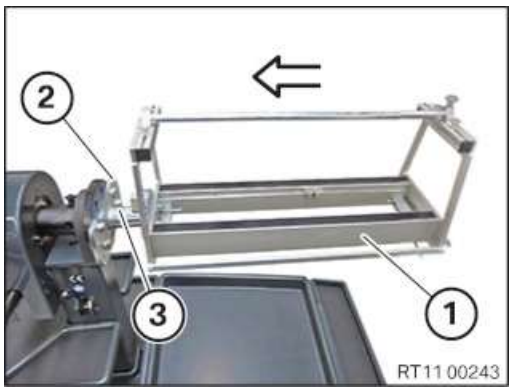
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

M14X30		Tightening torque	135 Nm

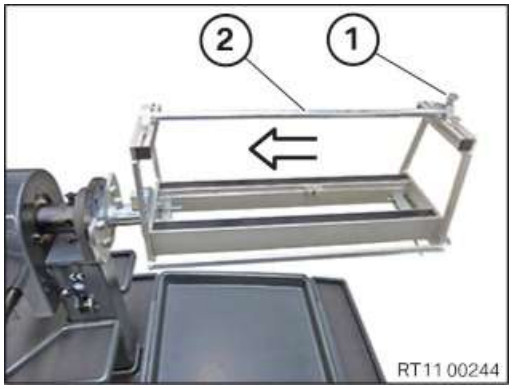


- Prepare the special tool .

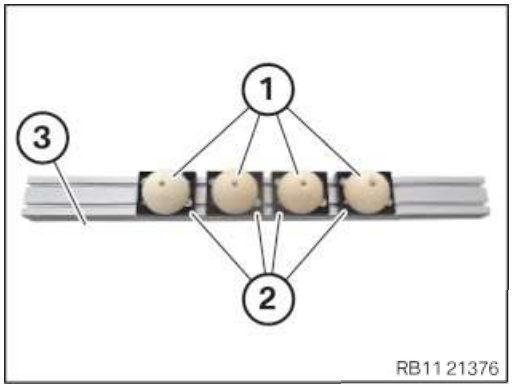


- Fit device (1) onto the flange (2) in the direction of the arrow and install.
- Make sure that the lock (3) engages audibly.

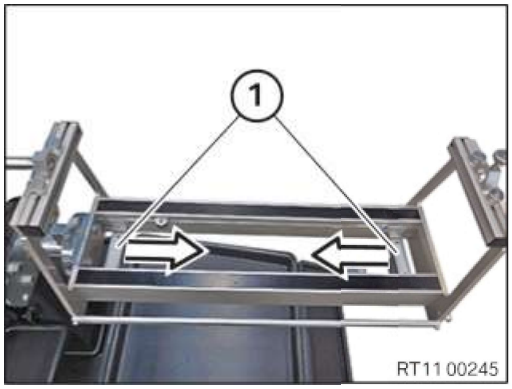
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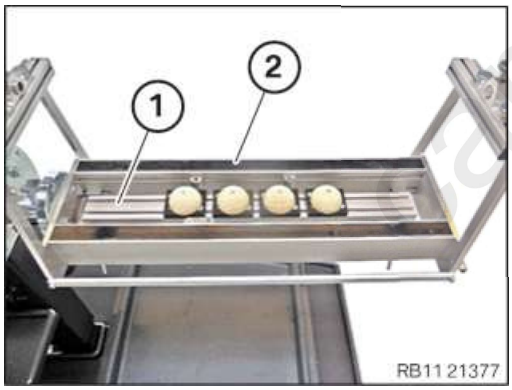
- Loosen screw (1).
- Pull out rod (2) in direction of arrow and set it aside.



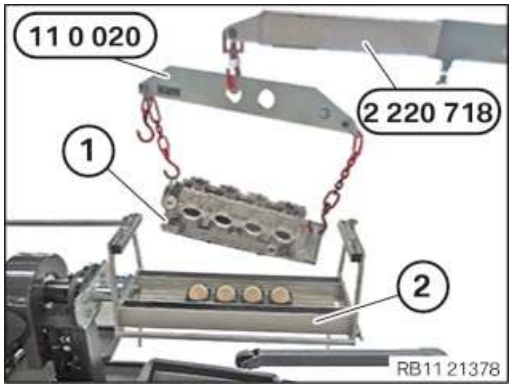
- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).



- Slide quick fastener (1) in the **direction of the arrow** up to the limit position.

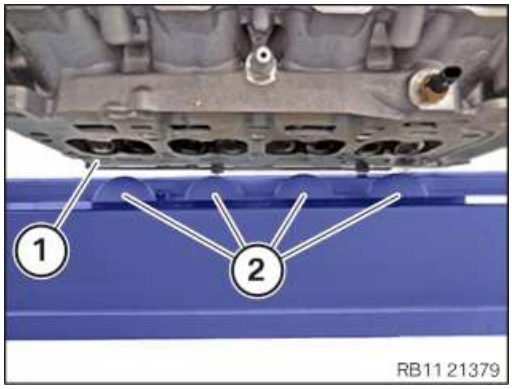


- Position completed aluminium strip (1) **centred** on the device (2).

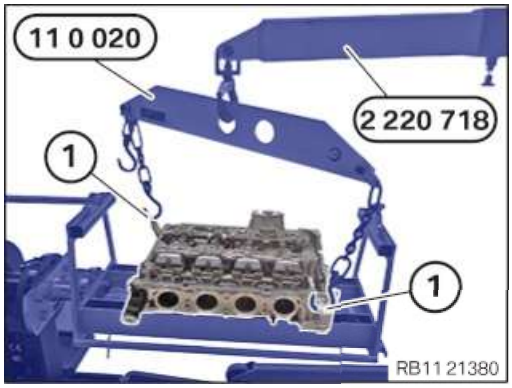


- Position cylinder head (1) with the work crane 2 220 718 and special tool on the device (2).

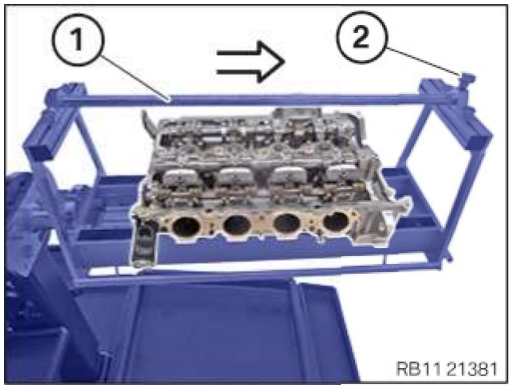
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- Position cylinder head (1) correctly on the completed aluminium strip (2).



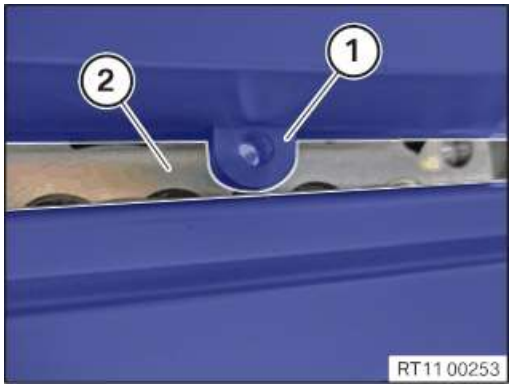
- Lower workshop crane 2 220 718.
- Pull out special tool at the cylinder head (1) and remove.
- Remove workshop crane 2 220 718 and set aside.



- Pull in rod (1) in the direction of the arrow and install.
- Hand-tighten the bolt (2).

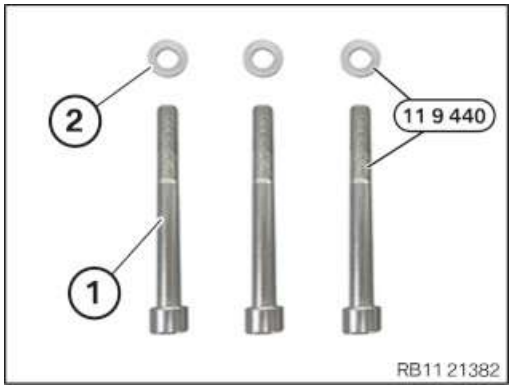


- Position screw connection (1) on cylinder head (2).

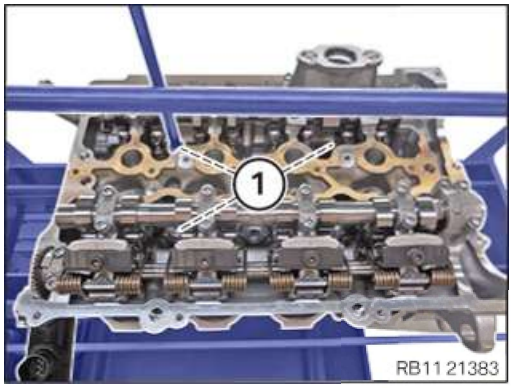


- Position screw connection (1) on cylinder head (2).

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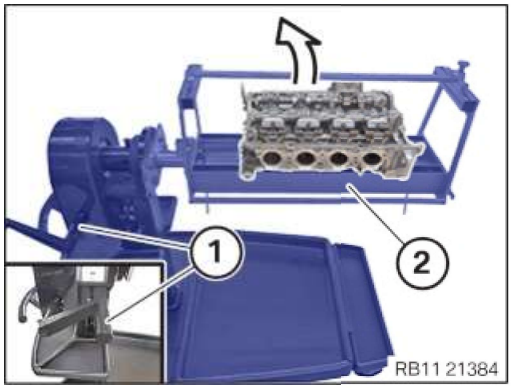
- Keep **M10x90** screws (1) from special tool ready.
- Keep washers (2) from special tool ready.



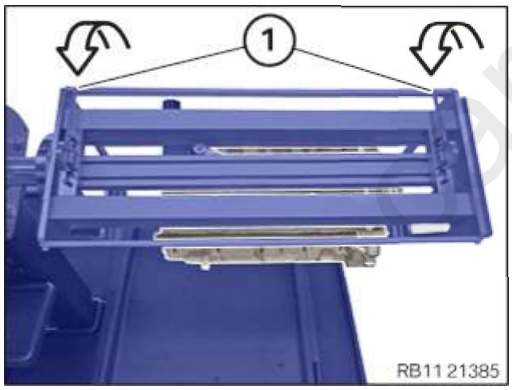
- Tighten the screws (1) from special tool .

Cylinder head on device

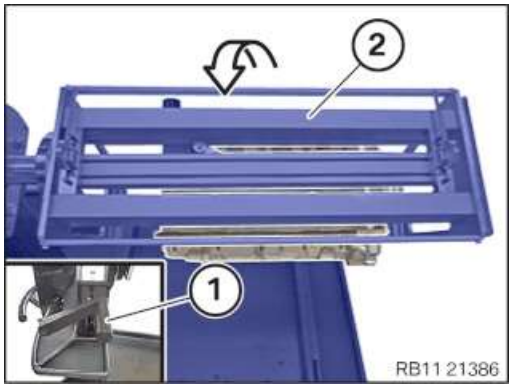
M10X90x1.5		Tightening torque	30 Nm



- Turn device (2) on the crank (1) by 180° in **direction of arrow**.



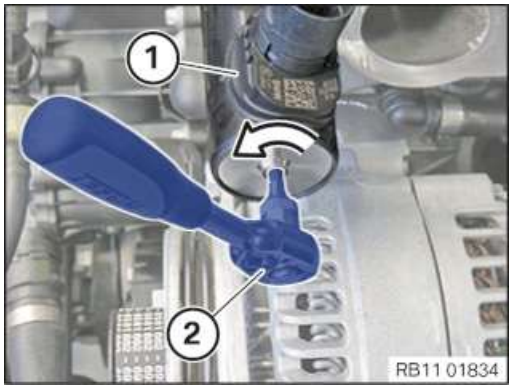
- Lock quick fastener (1) in the **direction of the arrow**.



- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

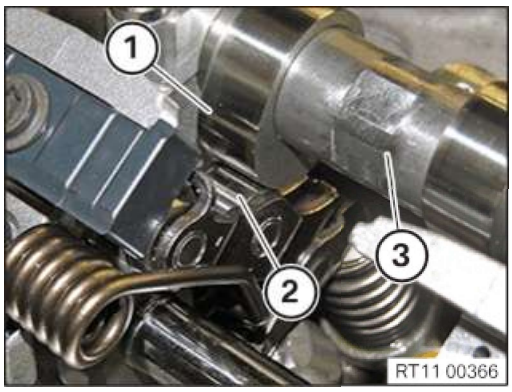
3 – Adjusting the servomotor to minimum lift

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- Slowly adjust the eccentric shaft with the servomotor (1) to the minimum lift using the tool (2).

4 – Checking the position of the intake camshaft (cylinder head removed)



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

5 – Remove all torsion springs

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

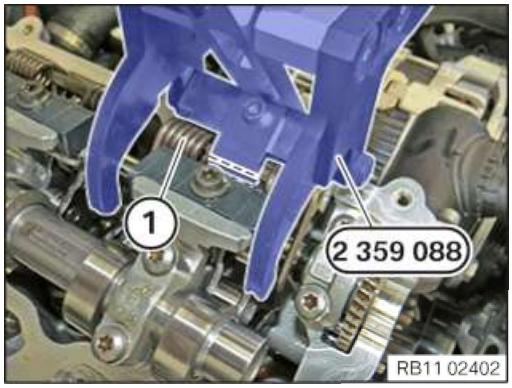
- Wear safety goggles.

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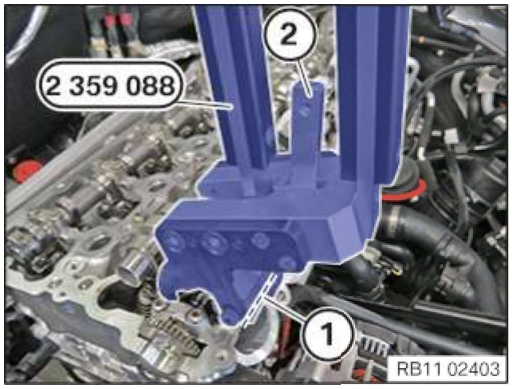


- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)



- Open the special tool 2 359 088 and position it at the torsion spring (1).



- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.

Check



- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

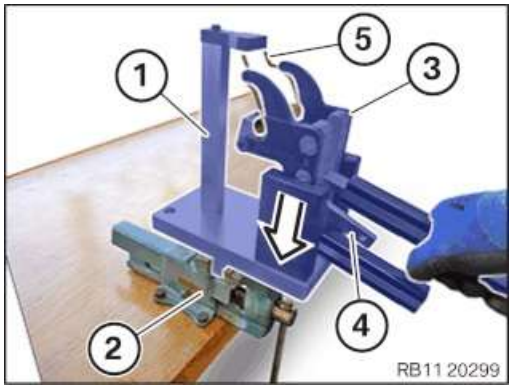
Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.

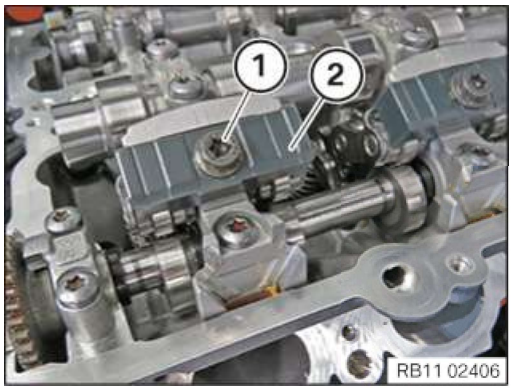
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- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

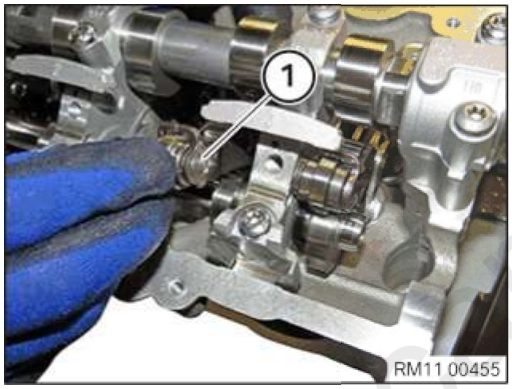
  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

6 – Removing all gates



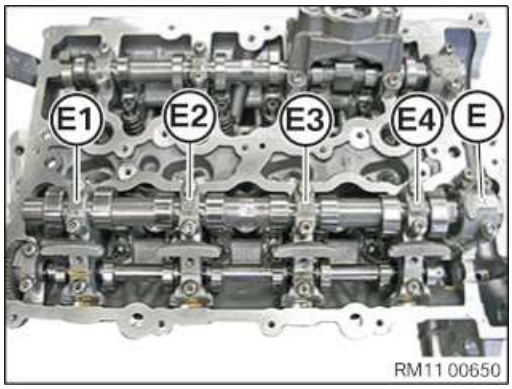
- Loosen screw (1).
- Remove the gate (2) and place it arranged in order into 0 495 105 (11 4 480).
- Repeat the step for all the gates.

7 – Removing all intermediate levers



- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

8 – Remove intake camshaft

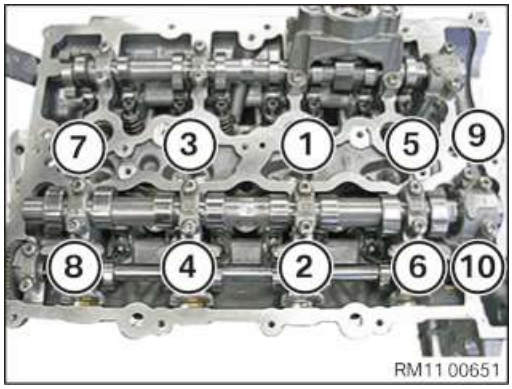


- Make sure that the exhaust camshaft bearing cap is placed in the correct position in the special tool 0 495 105 (11 4 480).

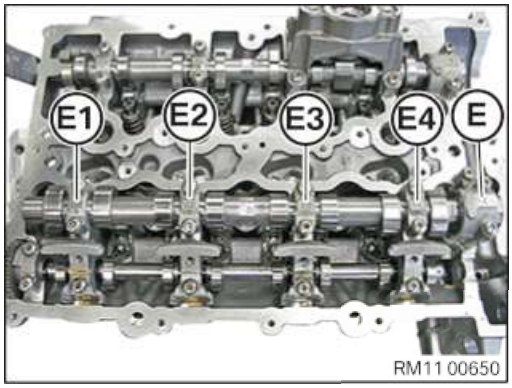
Note: The intake camshaft bearing caps are legibly labelled from the intake side with E1, E2, E3, E4 and E.

Note: Intake camshaft bearing cap E is a thrust bearing.

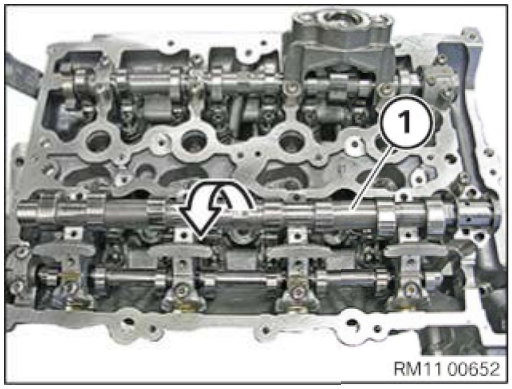
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- Loosen all screws on the intake camshaft bearing caps in sequence from (10) to (1).



- Take off intake camshaft bearing caps (E1), (E2), (E3), (E4) and (E) and place them in order in the special tool 0 495 105 (11 4 480).



- Remove the intake shaft (1)in the direction of the arrow.

9 – Remove the servomotor for the eccentric shaft (cylinder head removed)

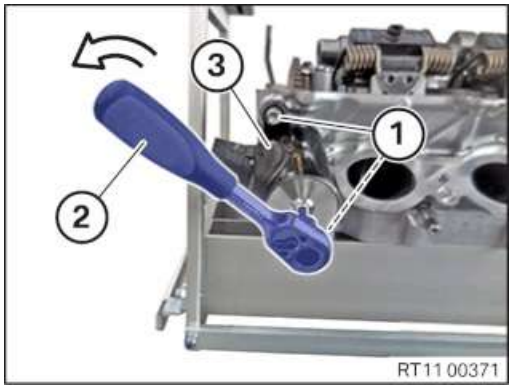
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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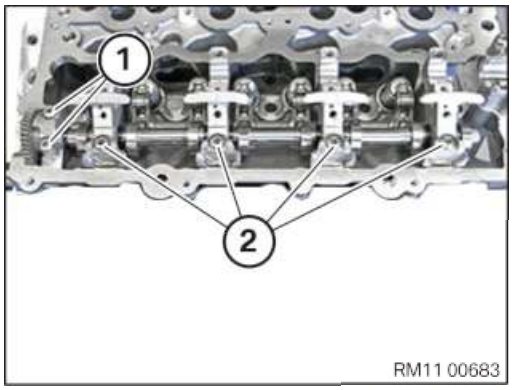


- Loosen screws (1).
- Use a standard hexagon socket wrench (2) to slowly adjust the servomotor for eccentric shaft (3) to the minimum lift at **4 mm** in direction of arrow.

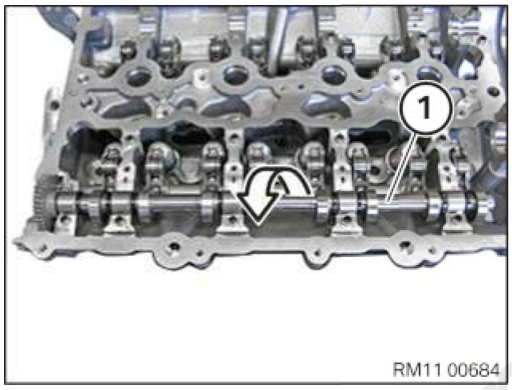
  This releases the tension of the eccentric shaft.

  Do **not** turn the eccentric shaft beyond the end stop.
- Guide out and remove the servomotor for eccentric shaft (3).

10 – Remove eccentric shaft

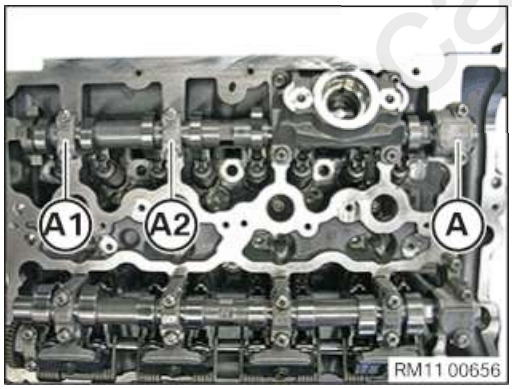


- Release screws (1) and set down the bearing cap neatly in special tool 0 495 105 (11 4 480).
- Release screws (2) and set down the bearing support neatly in special tool 0 495 105 (11 4 480).
- For an engine that has been in use, make sure all bearing supports are reinstalled in the same position.



- Remove eccentric shaft (1) in direction of arrow.

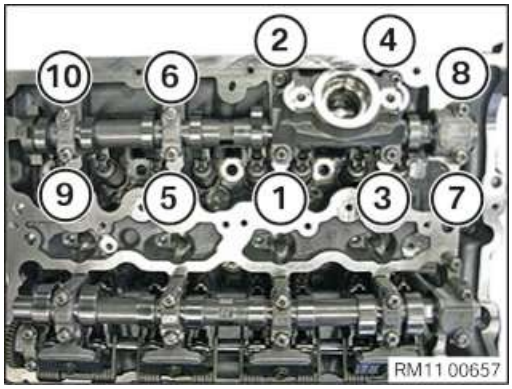
11 – Remove exhaust camshaft.



- Subsequently ensure that the exhaust camshaft bearing cap is placed in 0 495 105 (11 4 480) in the special tool.

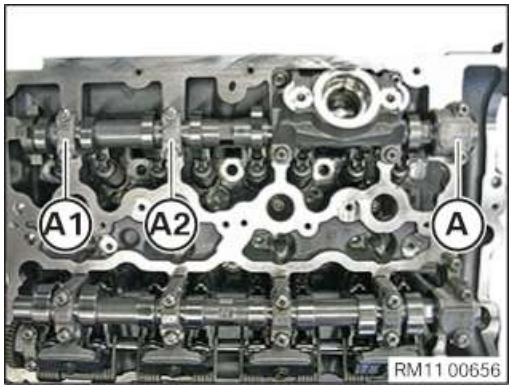
Note: The exhaust camshaft bearing caps are legibly labelled from the intake side and marked with A1, A2 and A.

Note: Exhaust camshaft bearing cap A is a thrust bearing.

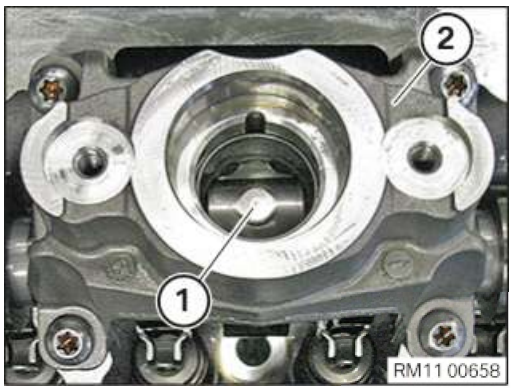


- Loosen all screws on the exhaust camshaft bearing cap in sequence from (10) to (1) in half turn.

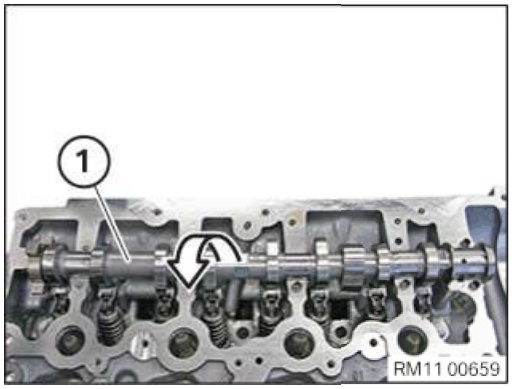
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- Drop the exhaust camshaft bearing cap (A1), (A2) and (A) and place in order in the special tool 0 495 105 (11 4 480).

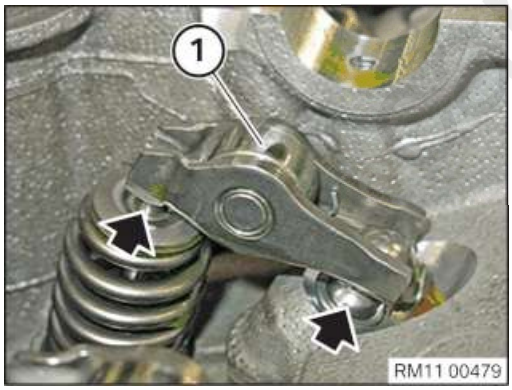


- Remove the roller tappet (1).
- Remove the high pressure pump bracket (2).

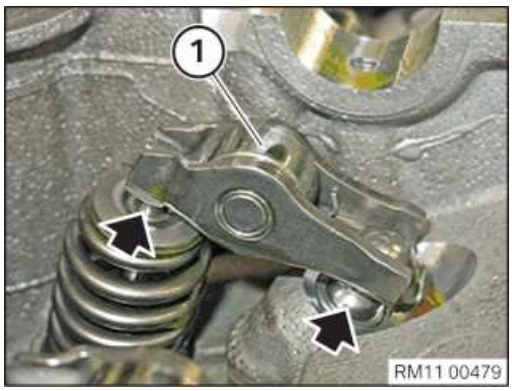


- Remove the exhaust camshaft (1) in the direction of the arrow.

12 – Remove all roller cam followers



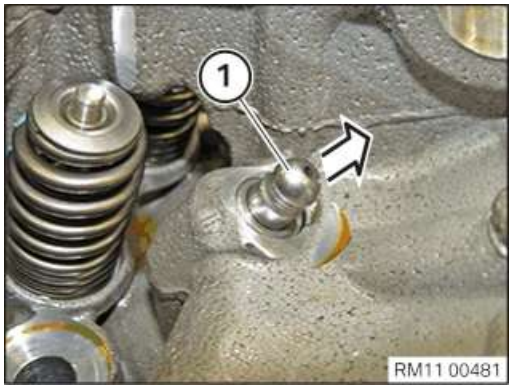
- Detach and remove the roller cam followers (1) on the intake side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).



- Detach and remove the roller cam followers (1) on the output side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).

13 – Removing all hydraulic valve clearance compensating elements

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- Remove all hydraulic valve clearance compensating elements (1) to the top.
- Lay the hydraulic valve clearance compensating elements, together with the rocker arms, orderly in the special tool 0 495 105 (11 4 480).

14 – Remove all valve springs

CAUTION

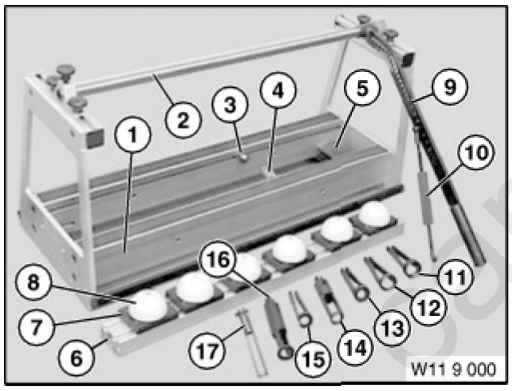
Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

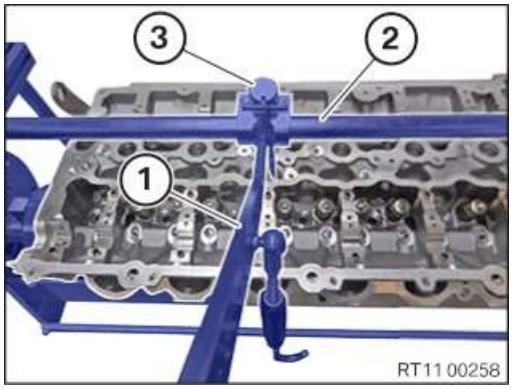
NOTICE

The description is for one component only. The procedure is identical for all further components.

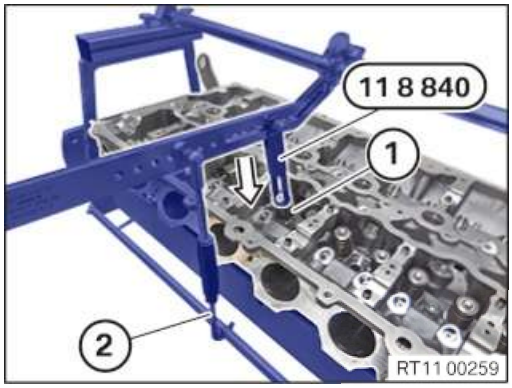


- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



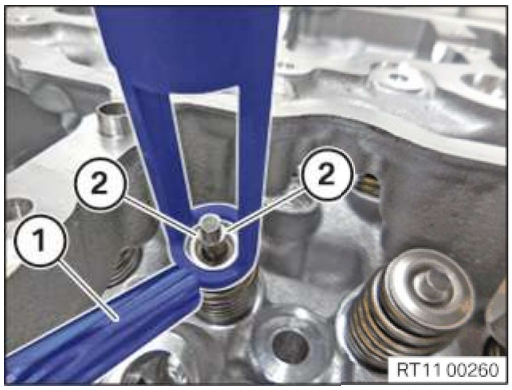
- Feed in and install lever (1) on the rod (2).
- Guide in and install lock (3).



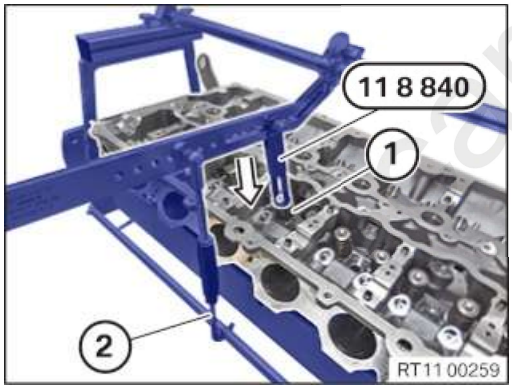
TECHNICAL INFORMATION

- Wear safety goggles.

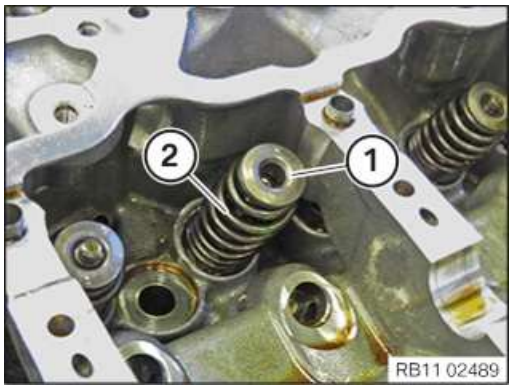
- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).



- Remove valve shims (2) with a magnet (1).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Remove the spring cup (1) and the valve spring (2) and position neatly in the special tool 0 495 105 (11 4 480).

15 – Remove valve stem seals

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RISK OF DAMAGE

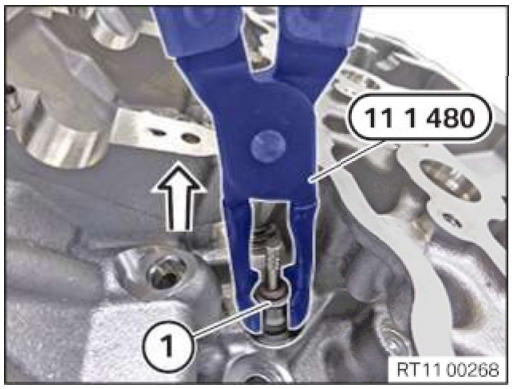
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Remove the valve stem seal (1) in the **direction of arrow** using the special tool 0 490 796 (11 1 480).

16 – Remove all valves

RISK OF DAMAGE

Contaminant or foreign body.

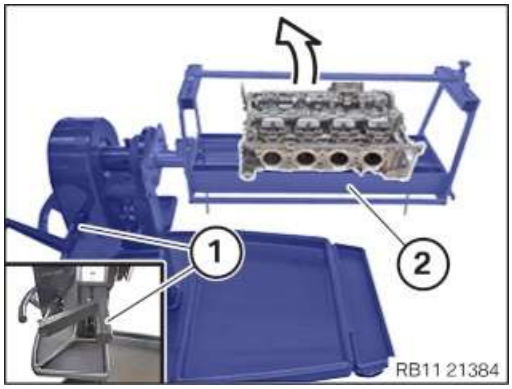
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- **Equipment specification B38**
- Twist the device (2) on the crank (1) 180°.

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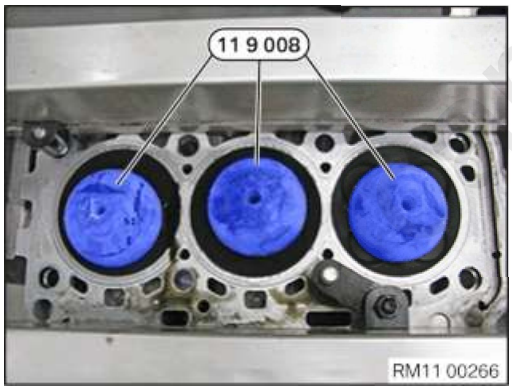
- **Equipment specification B46/B48**
- Turn device (2) on the crank (1) by 180° in **direction of arrow**.



- **Equipment specification B58**
- Turn device (2) on the crank (1) by 180° in direction of arrow.



- Unlock the special tool 0 494 370 (11 9 005) in **direction of arrow**.

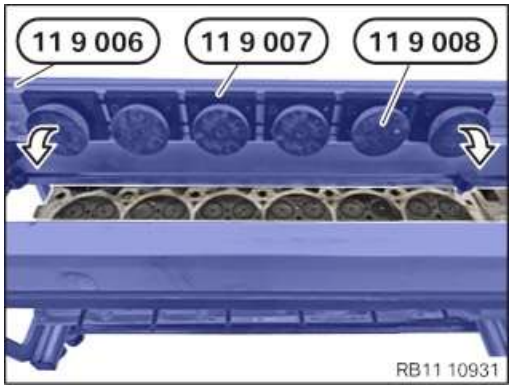


- **Equipment specification B38**
- Remove special tool 0 494 373 (11 9 008) if necessary.

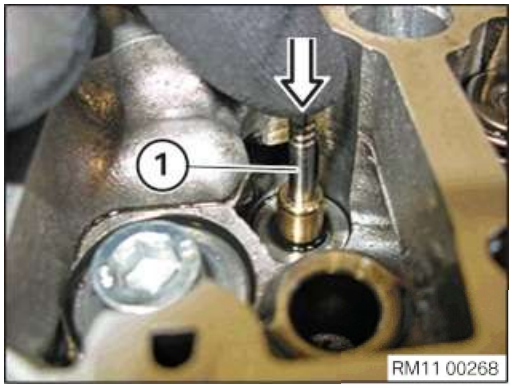


- **Equipment specification B46/B48**
- Remove special tool 0 494 373 (11 9 008) if necessary.

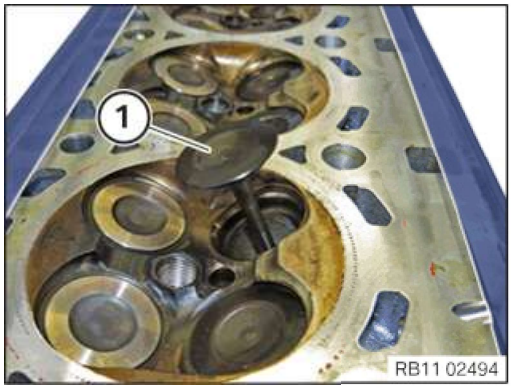
rdiagn.com



- **Equipment specification B58**
- Thread out and remove special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) in direction of arrow.



- Push the valve stem (1) into the cylinder head in **direction of arrow**.



- Remove the valve (1) and position in special tool 0 495 105 (11 4 480) in order.

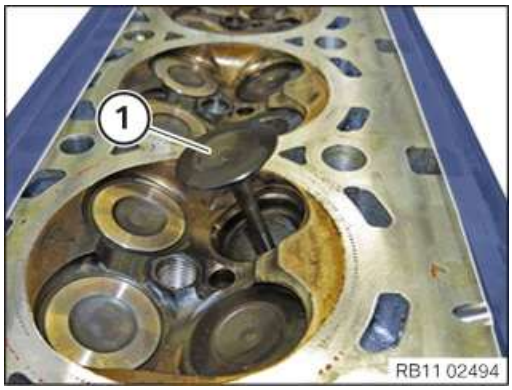
17 – Install all valves

RISK OF DAMAGE

Contaminant or foreign body.

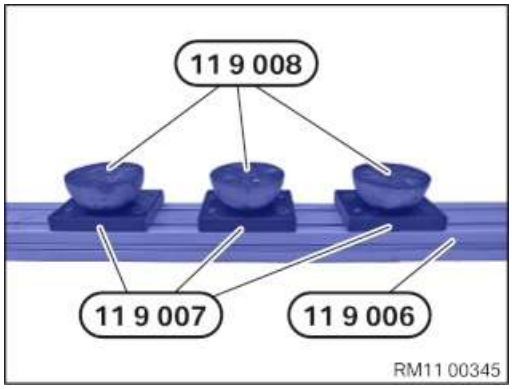
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

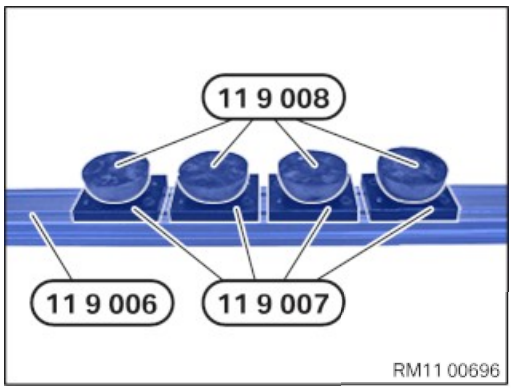


- Slide the valve (1) **carefully** into the cylinder head.

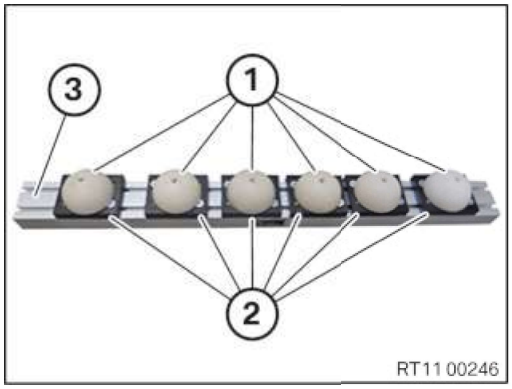
cardiagn.com



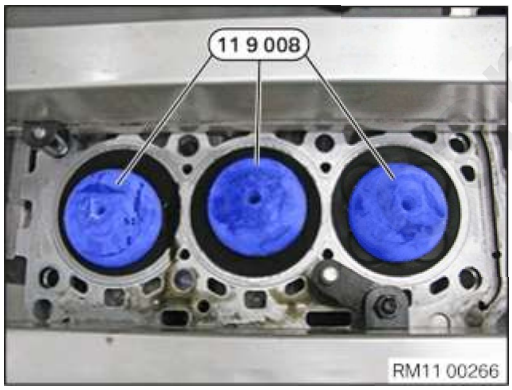
- **Equipment specification B38**
- Prepare the special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) as shown.



- **Equipment specification B46/B48**
- Prepare the special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) as shown.



- **Equipment specification B58**
- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).

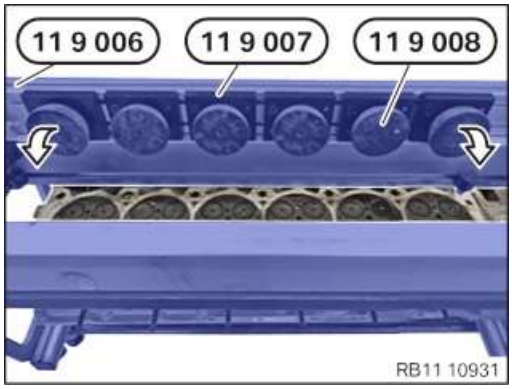


- **Equipment specification B38**
- The special tools 0 494 373 (11 9 008) must be set up accordingly in the next operation.



- **Equipment specification B46/B48**
- The special tools 0 494 373 (11 9 008) must be set up accordingly in the next operation.

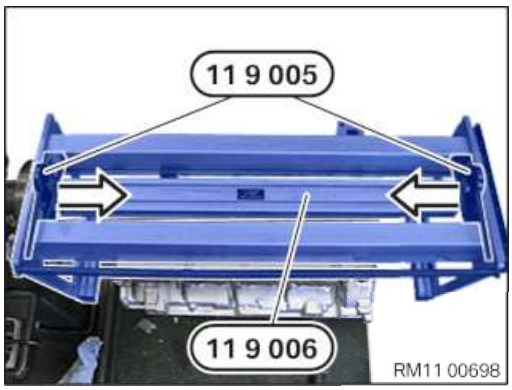
rdiagn.com



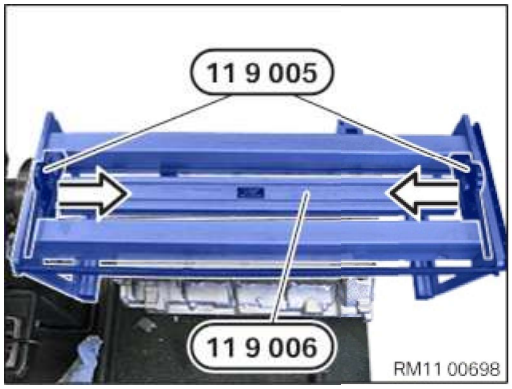
TECHNICAL INFORMATION

The figure shows the engine B58.

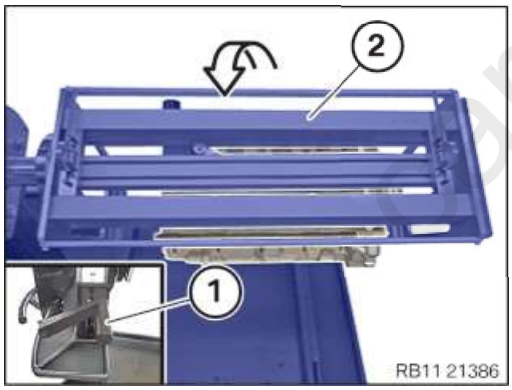
- Position special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) in the centre on the cylinder head in the direction of the arrow.



- Turn round special tool 0 494 371 (11 9 006) and insert as shown.
- Lock special tool 0 494 370 (11 9 005)in direction of arrow.



- Move and lock special tool 0 494 370 (11 9 005) in the direction of the arrow over the edges of special tool 0 494 371 (11 9 006).



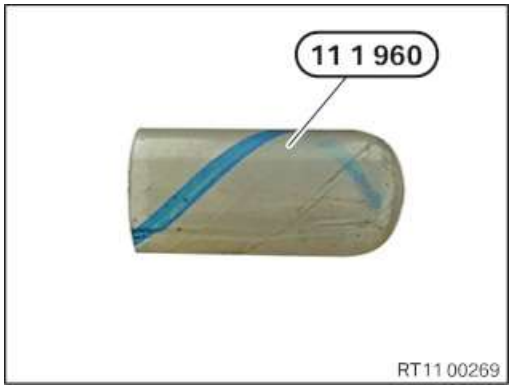
- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

18 – Installing valve stem seals

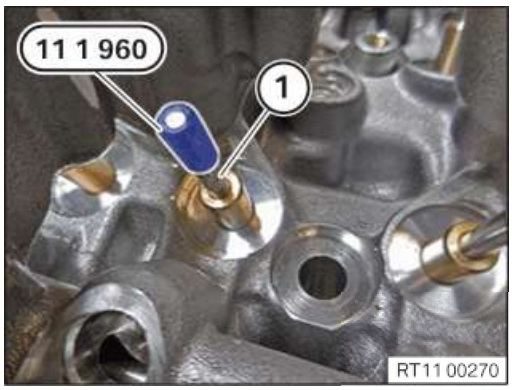


- Remove oil and dirt from the contact surface (1).

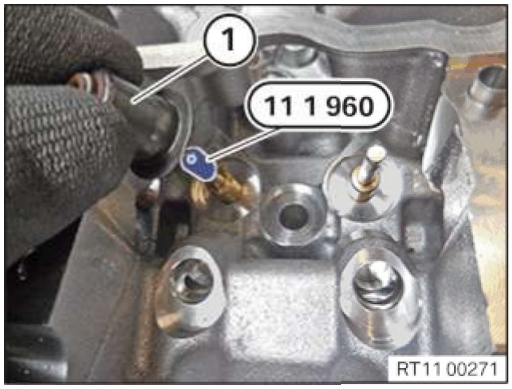
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- Make sure that the special tool 0 490 797 (11 1 960) is used when installing the valve stem seal.



- Guide in and install the special tool 0 490 797 (11 1 960) on valve (1).



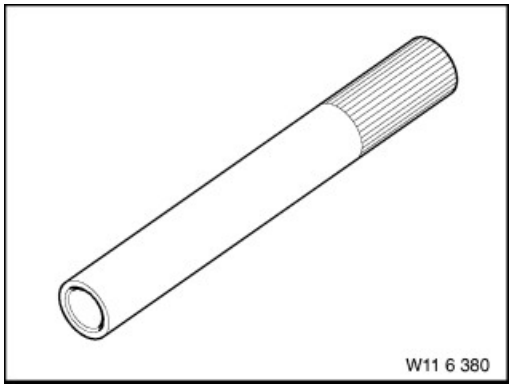
- Renew the valve stem seal (1).

  Parts: Valve stem seal

- Guide in and install valve stem seal (1) on the special tool 0 490 797 (11 1 960).

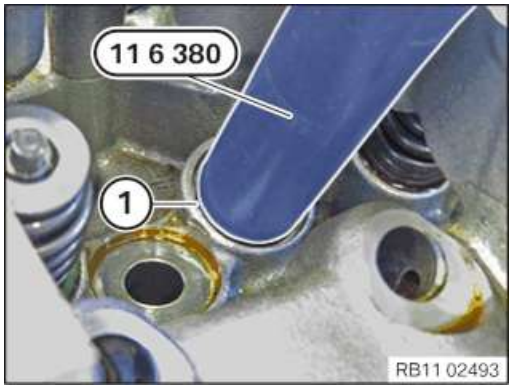


- Guide the special tool 0 490 797 (11 1 960) out and remove.

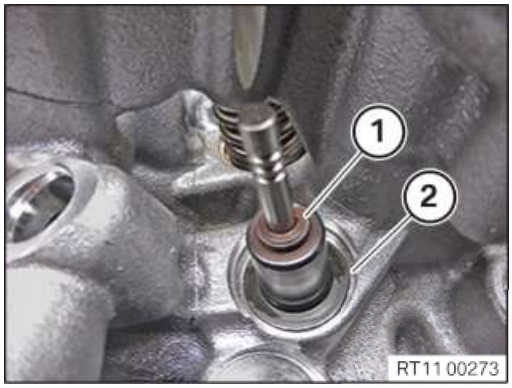


- Prepare special tool 0 493 249 (11 6 380).

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- Press the valve stem seal (1) onto the cylinder head till the limit position using special tool 0 493 249 (11 6 380).



- Make sure that valve stem seal (1) is positioned correctly on cylinder head (2).

19 – Install all valve springs

CAUTION

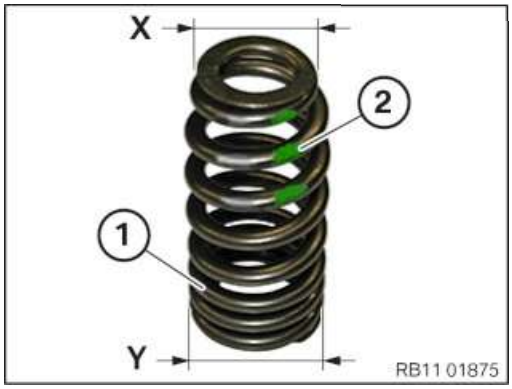
Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

NOTICE

The description is for one component only. The procedure is identical for all further components.



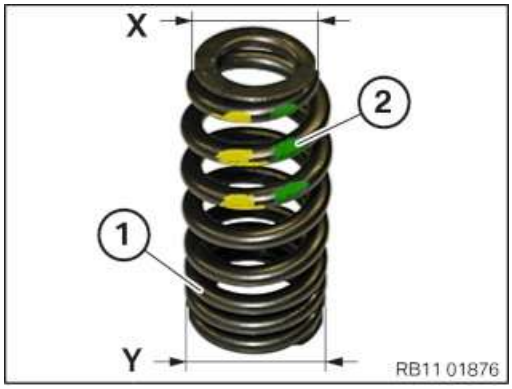
- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the intake valves: Green

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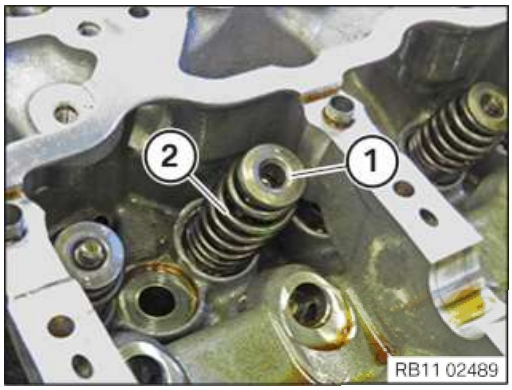


- Note the installation position of the valve spring.

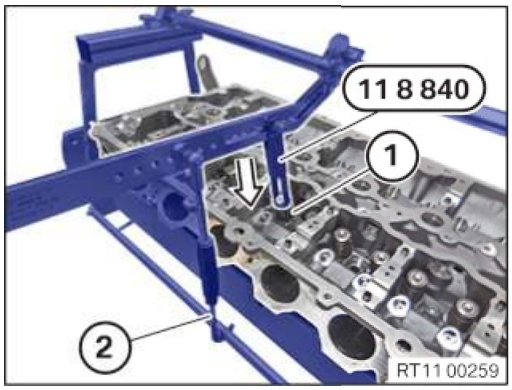
Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the exhaust valves: green/yellow



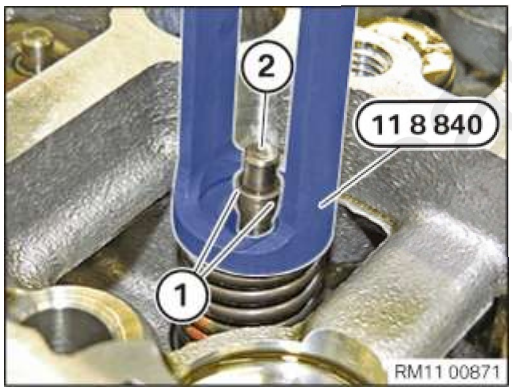
- Install the valve spring (2) and the spring cup (1).



TECHNICAL INFORMATION

- Wear safety goggles.

- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).

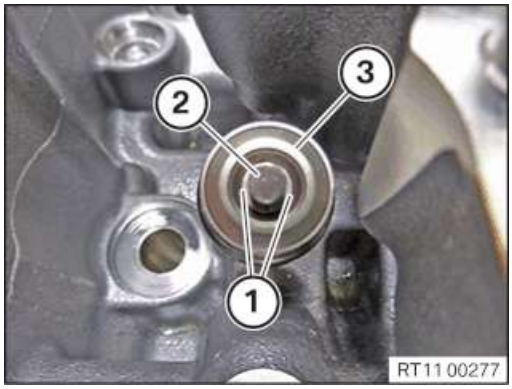


- Position the valve shims (1) on the valve (2).



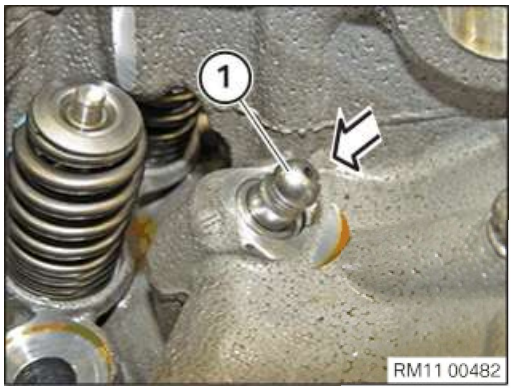
- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.

mydiagram.com



- Make sure that the valve shims (1) are positioned correctly on the valve (2) and on the valve spring (3).

20 – Installing all hydraulic valve clearance compensating elements

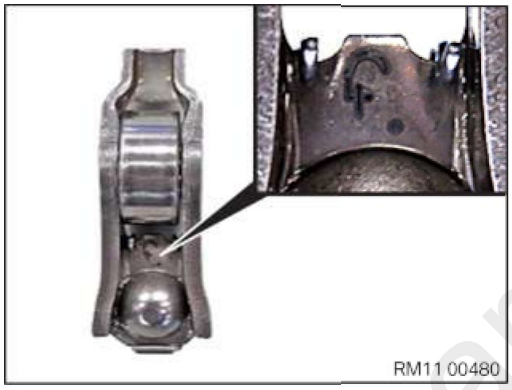


TECHNICAL INFORMATION

If the hydraulic valve clearance compensating elements are reused, they must be reinstalled at the same position.

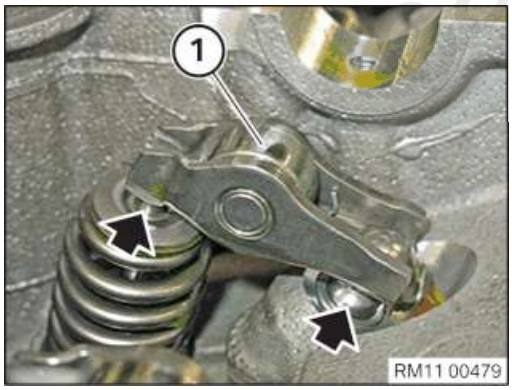
- Install all hydraulic valve clearance compensating elements (1).

21 – Install all roller cam followers

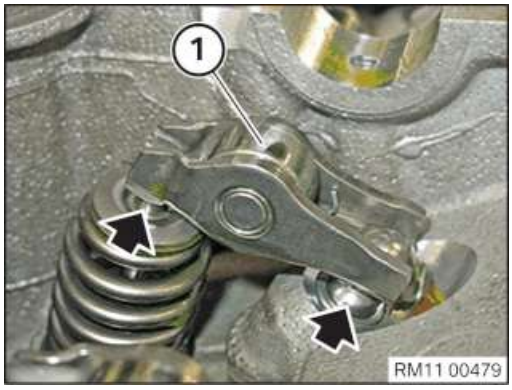


- The classification in digits from 1 to 5 has been printed on the roller cam follower.

Classification	Idle speed
1	Repair case - slow engine speed when idling
2	Installed as standard/initial installation
3	Installed as standard/initial installation
4	Installed as standard/initial installation
5	Repair case - high engine speed when idling



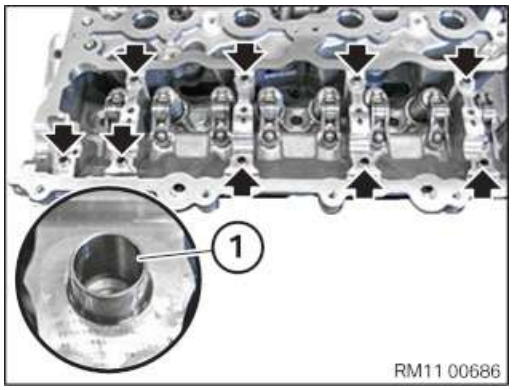
- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.



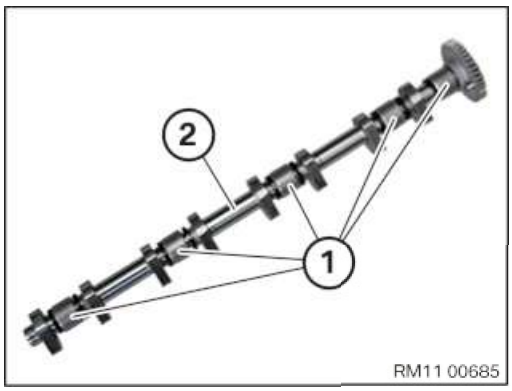
- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

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22 – Install eccentric shaft



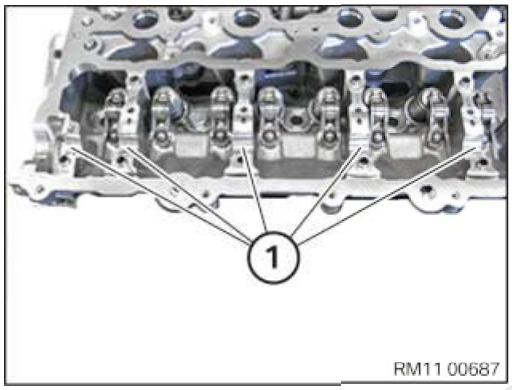
- Check guide sleeves (1) for damage and renew faulty guide sleeves (1).



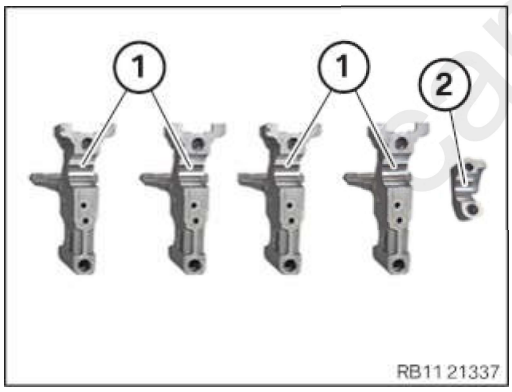
- Check needle bearing (1) for ease of movement.

Note: In the event of tight needle bearings, replace eccentric shaft 2.

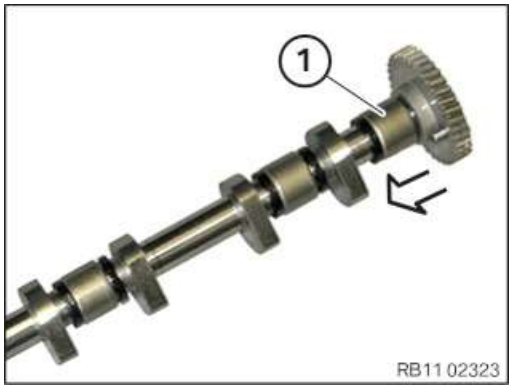
- Coat the needle bearing (1) with **new** engine oil.



- Clean the bearing positions (1) and coat with **new** engine oil.

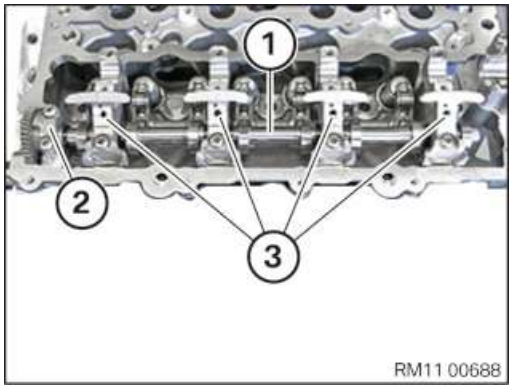


- Clean bearing positions of the bearing supports (1) and coat with fresh engine oil.
- Clean the bearing position of the bearing cap (1) and coat with **new** engine oil.

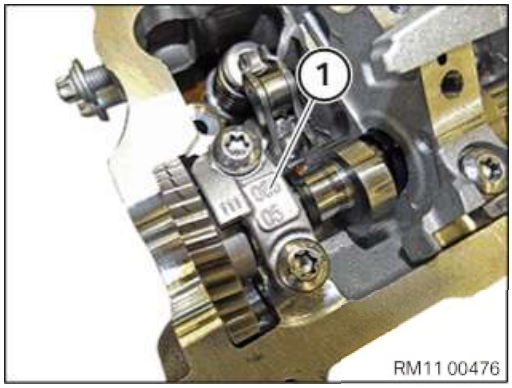


- Before installing the eccentric shaft, push needle bearing (1) in direction of arrow up to the limit position.

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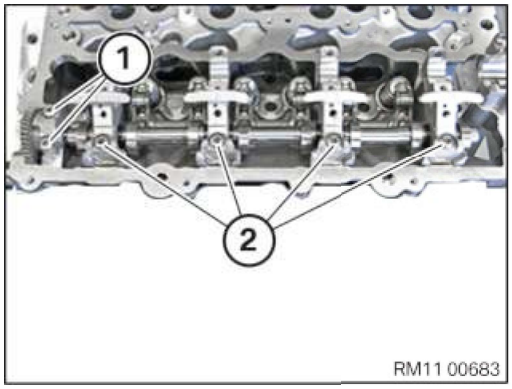


- Insert eccentric shaft (1) in the cylinder head.
- Attach bearing cap (2) and bearing supports (3) on the cylinder head.
- For an engine that has been in use, make sure all bearing supports are reinstalled in the same position.



- Ensure correct installation of bearing cap (1).

Note: Bearing cap 1 is provided with a limit position.

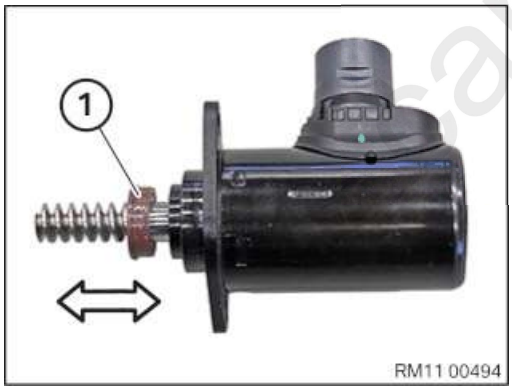


- Tighten down screws (1) and (2) uniformly.

Eccentric shaft to bearing support/cylinder head

M6		10 Nm

23 – Install the servomotor for the eccentric shaft (cylinder head removed)



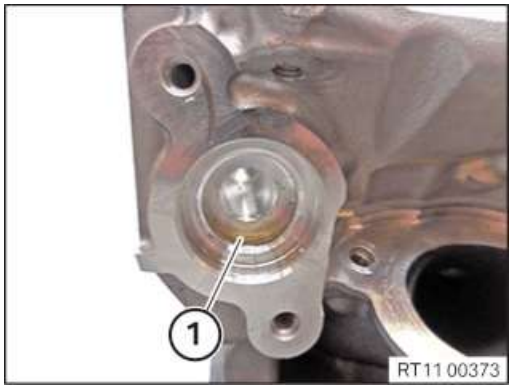
- Renew gasket (1).

Parts: Gasket

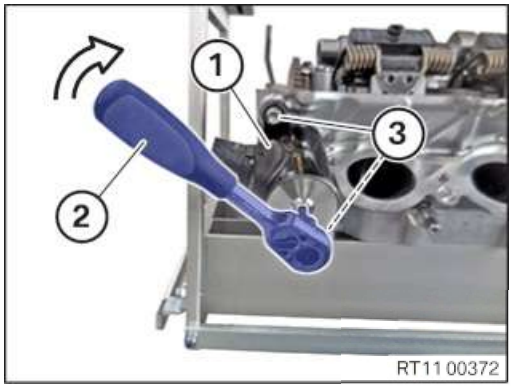


- Press the gasket (1) in to the limit position on the housing.

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- Clean sealing surface (1).

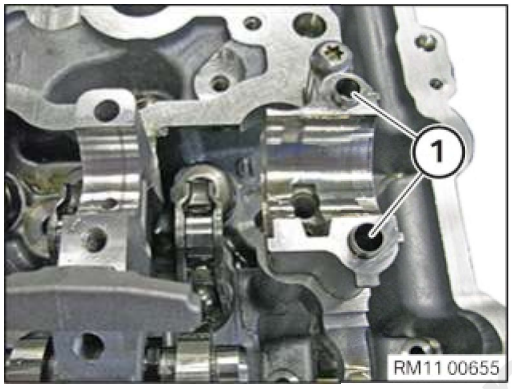


- Slide servomotor for the eccentric shaft (1) up to the limit position and install it.
- Turn servomotor for the eccentric shaft (1) using a standard hexagon socket wrench (2) of **4 mm** in the **direction of arrow** until the servomotor for the eccentric shaft (1) lies on the cylinder head.
- Tighten down screws (3).

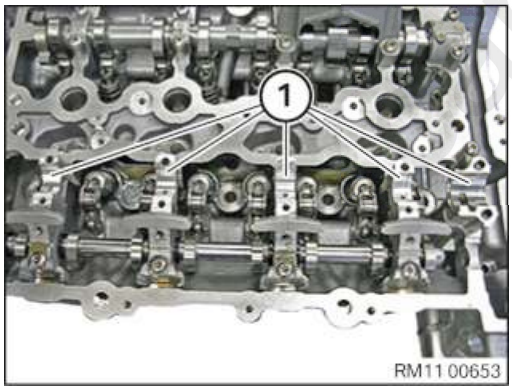
Electrical servomotor to cylinder head

M6		Tightening torque	8 Nm

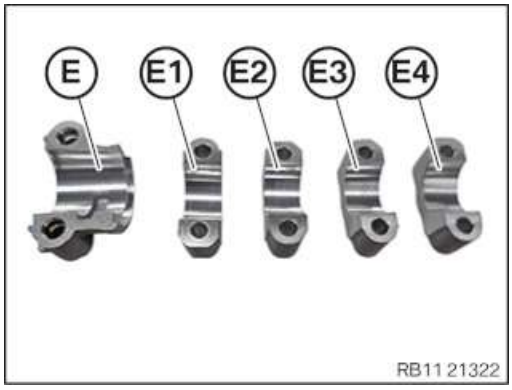
24 – Install intake camshaft



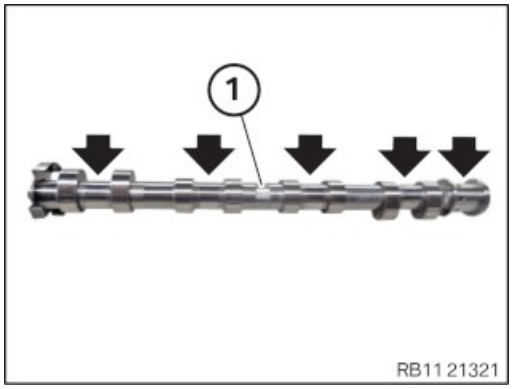
- Check the fitting sleeves for correct fit and damage and replace where required.



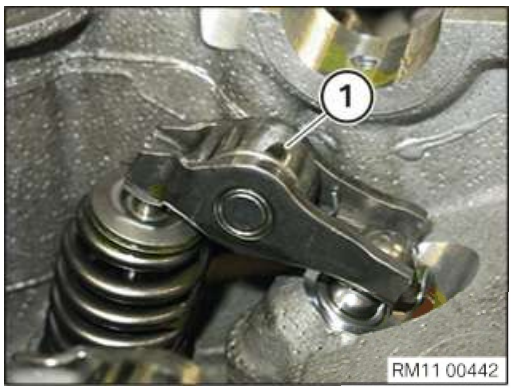
- Coat all bearing positions (1) with fresh engine oil.



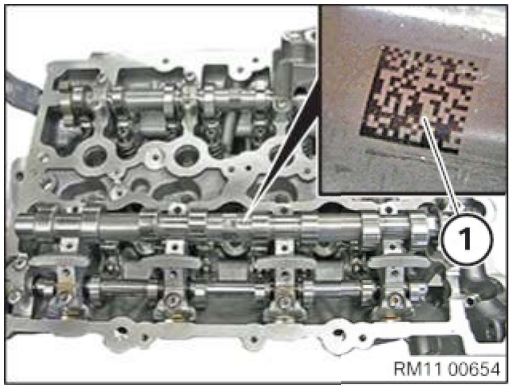
- Clean all the bearing positions of the intake camshaft bearing cap (E1) (E2) (E3), (E4) and (E) and coat with engine oil.



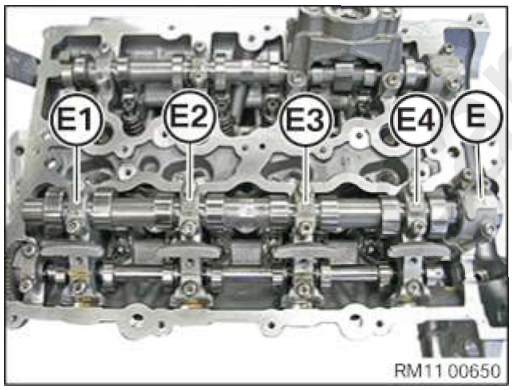
- Clean all bearing positions (arrows) of the intake camshaft (1) and coat with engine oil.



- Ensure the correct fit of the roller cam follower (1) before mounting the intake camshaft.
- Coat roller cam follower (1) with new engine oil.



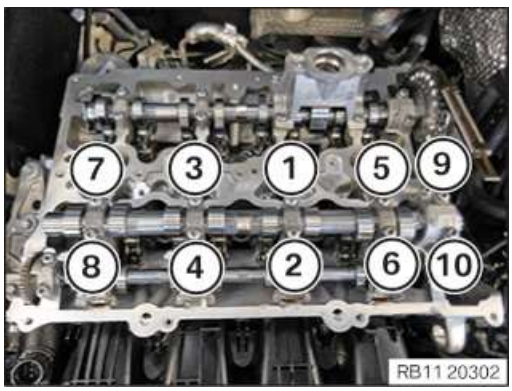
- Insert the intake camshaft into the cylinder head in such a way that the mark (1) points up.



- Position the intake camshaft bearing cap on the cylinder head.

Note: The intake camshaft bearing caps are legibly labelled from the intake side with E1, E2, E3, E4 and E.

Note: Intake camshaft bearing cap E is a thrust bearing.



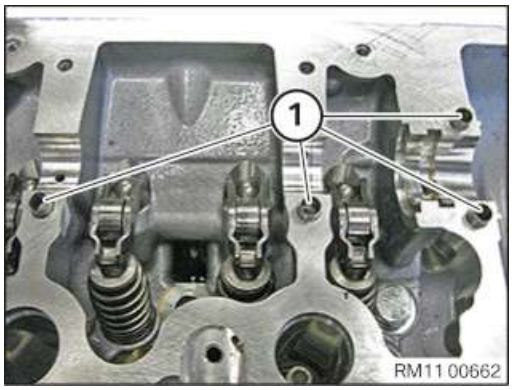
- Press intake camshaft bearing cap down and hand-tighten the screws incrementally in sequence (1) to (10).
- Join screws in sequence (1) to (10) **in half turns**.
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (10) **.**

Intake camshaft to cylinder head

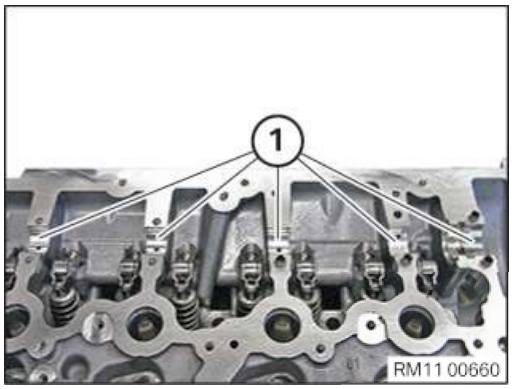
M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

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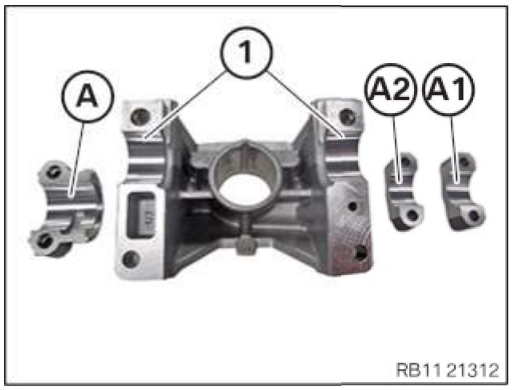
– Install exhaust camshaft



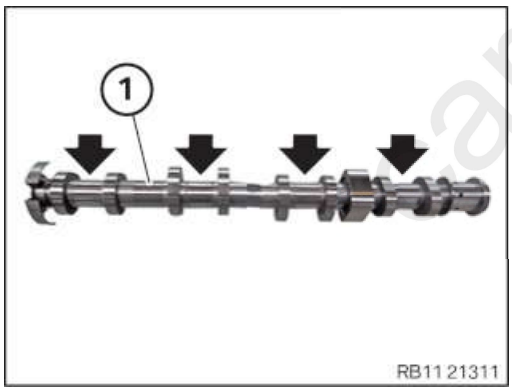
- Check the fitting sleeves (1) for **correct** fit and damage and replace where required.



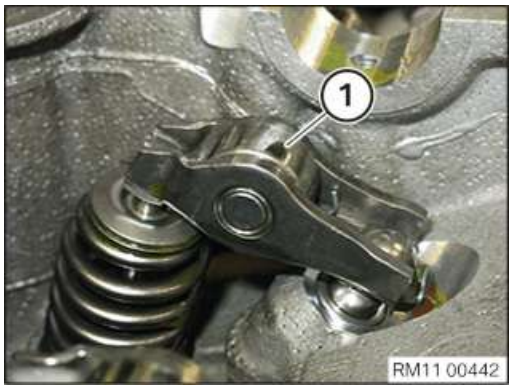
- Coat all bearing positions (1) with **fresh** engine oil.



- Clean all bearing positions of the exhaust camshaft bearing cap (A1), (A2) and (A) and coat with **fresh** engine oil.
- Clean the bearing positions (1) of the high pressure pump bracket and coat with **fresh** engine oil.

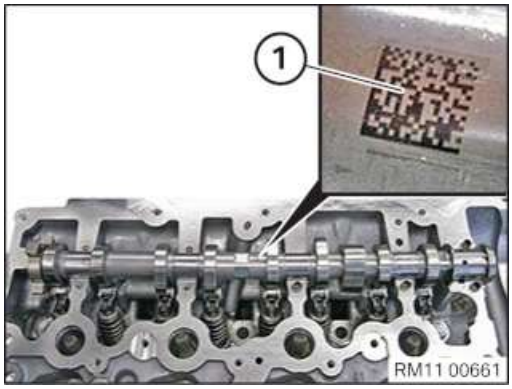


- Clean all the bearing positions (arrows) of the exhaust camshaft (1) and coat with **fresh** engine oil.

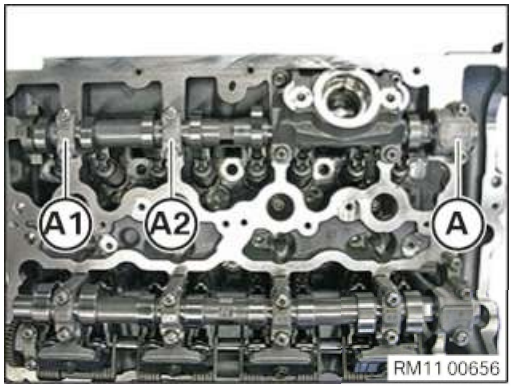


- Make sure that the roller cam follower (1) is fitted correctly before installing the exhaust camshaft.
- Coat the exhaust camshaft and the exhaust camshaft bearing cap with fresh engine oil.

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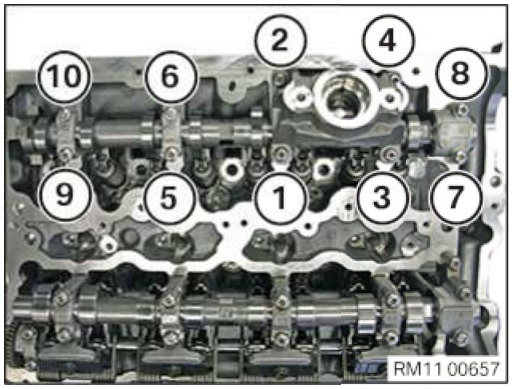
- Insert exhaust camshaft in the cylinder head, such that the mark (1) points **upwards**.



- Position all exhaust camshaft bearing caps on the cylinder head.

Note: The exhaust camshaft bearing caps are legibly labelled from the intake side and marked with A1, A2 and A.

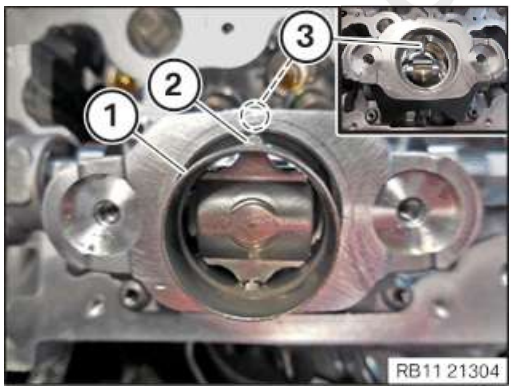
Note: Exhaust camshaft bearing cap A is a thrust bearing.



- Coat both bearing positions on the high pressure pump bracket with fresh engine oil.
- Position the high pressure pump bracket on the cylinder head.
- Join all bolts of the exhaust camshaft bearing caps in sequence (1) to (10) in half **turns**.
- **Adhere to the jointing torque.**
- Tighten all bolts of the exhaust camshaft bearing caps in sequence (1) to (10) **.**

Exhaust camshaft to cylinder head

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm



- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

26 – Checking the intermediate lever classification

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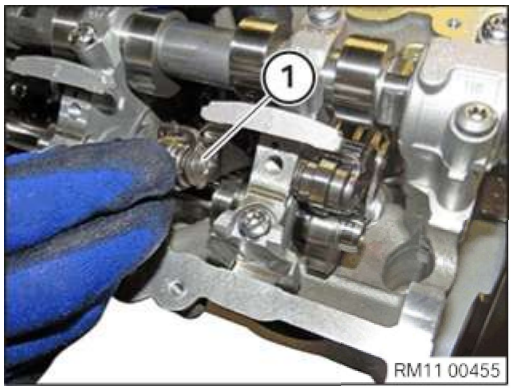
TECHNICAL INFORMATION

All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

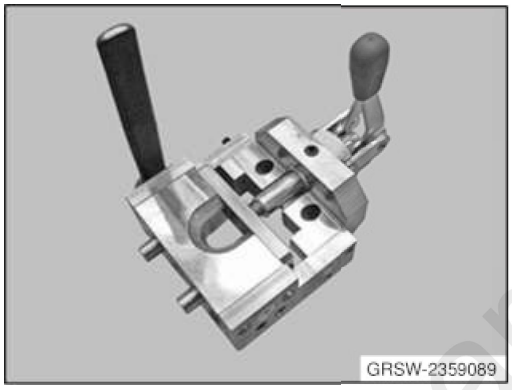
- Check classification (arrow) of intermediate lever.

27 – Installing all intermediate levers

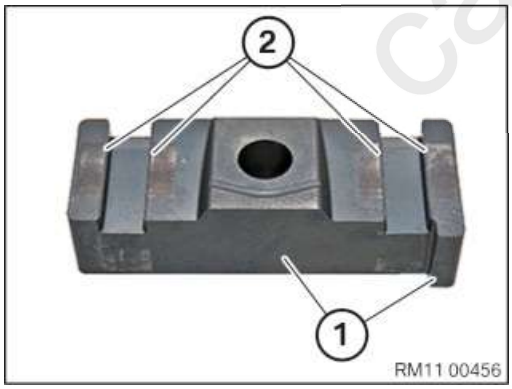


- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

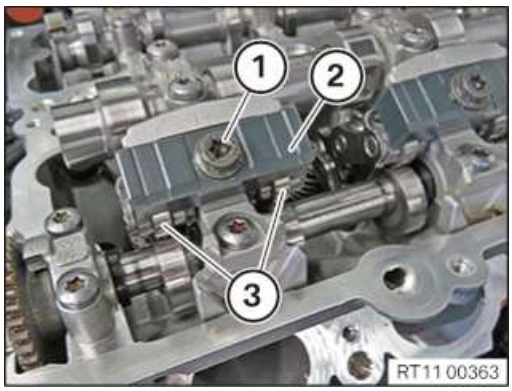
28 – Installing all gates



- Have the special tool 2 359 089 ready.

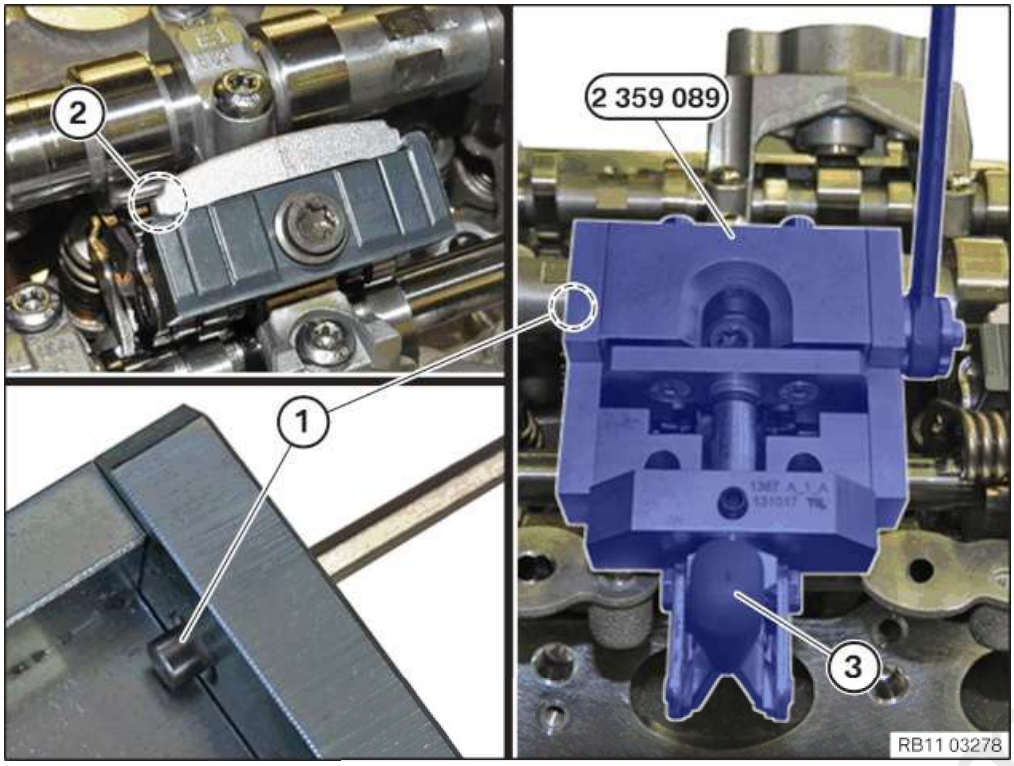


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

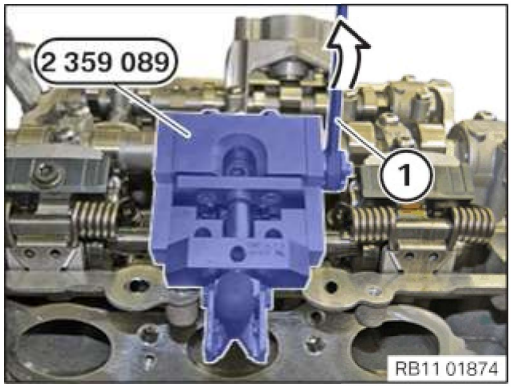


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.

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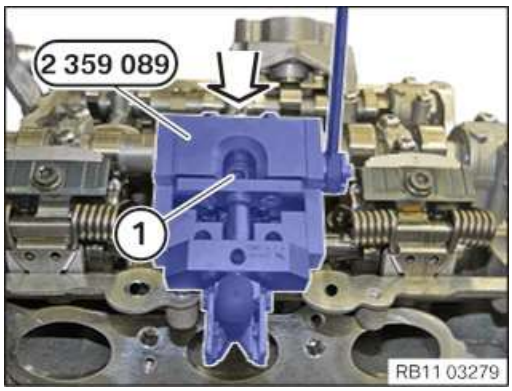
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1) in the direction of the arrow.



- Make sure that the special tool 2 359 089 rests flat against the cylinder head (arrows).

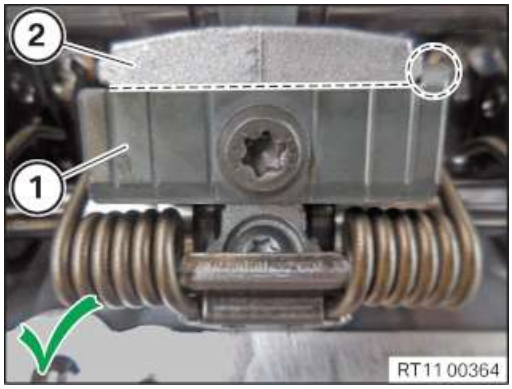


- Press the special tool 2 359 089 onto the cylinder head in the direction of the arrow.
- Tighten the bolt (1) at the same time.

Gate to bearing bracket

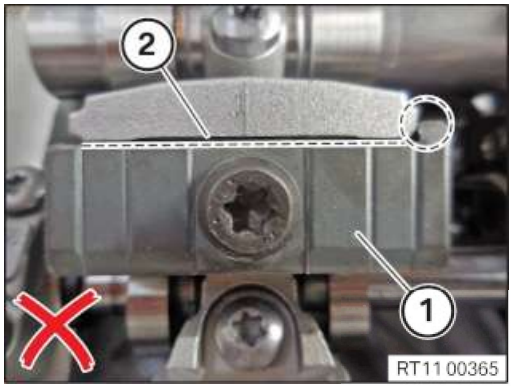
M8		20 Nm

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- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed correctly in the marked area.

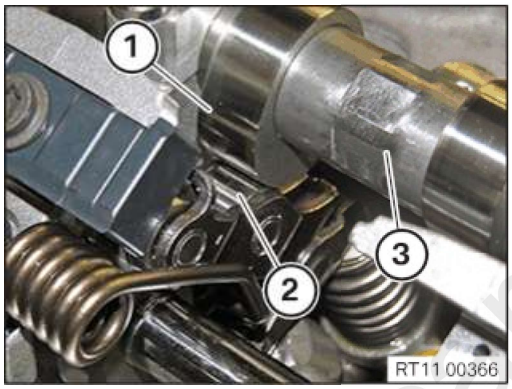


- Ensure that gate (1) rests **correctly** against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area**.**

- Repeat the step for all the gates.

29 – Checking the position of the intake camshaft (cylinder head removed)



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

30 – Install all torsion springs

CAUTION

Spring preload.

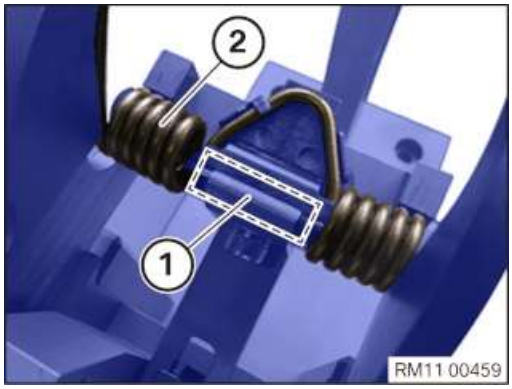
Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

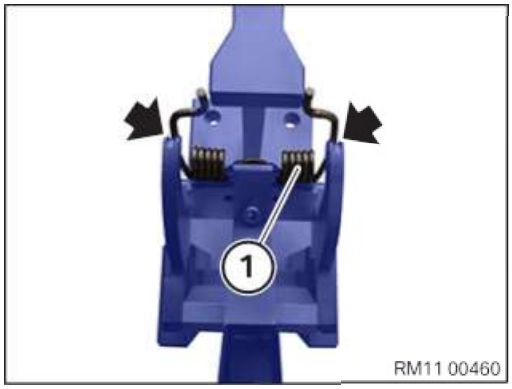
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TECHNICAL INFORMATION

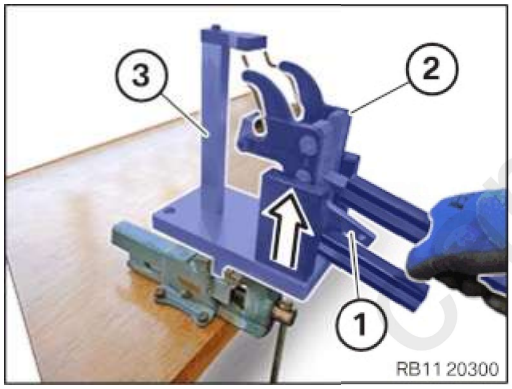
- Wear safety goggles.



- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.

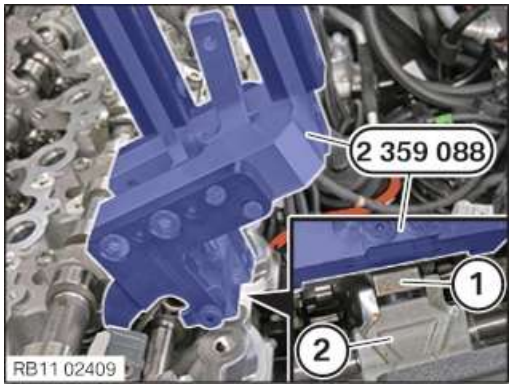


- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.



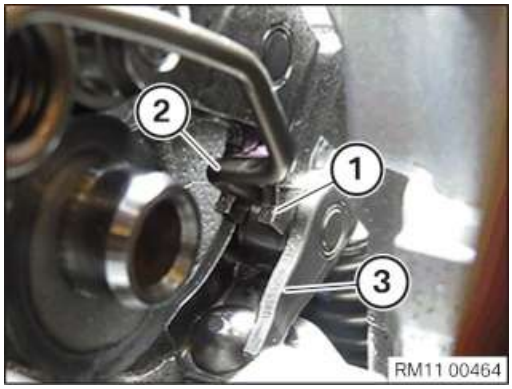
- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the lever (1) audibly engages.

  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.

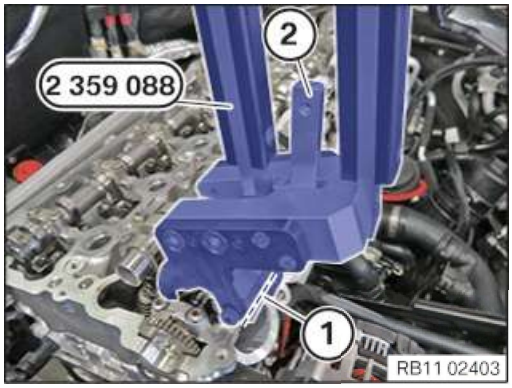


- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).

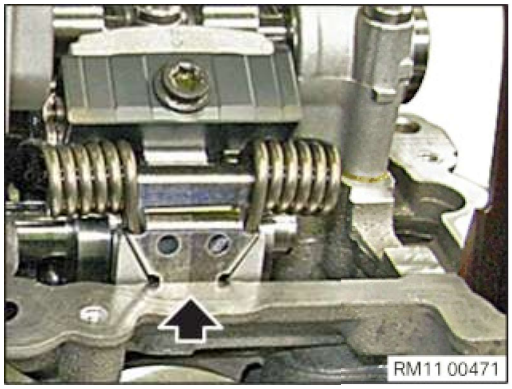
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- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).

- Repeat the operations for the remaining torsion springs.

31 – Removing cylinder engine from assembly stand

CAUTION

Heavy component.

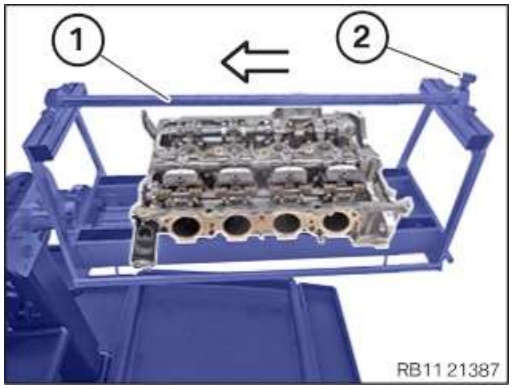
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



- Release screws (1) from special tool .

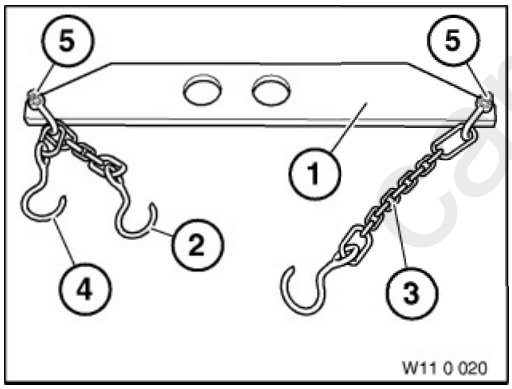
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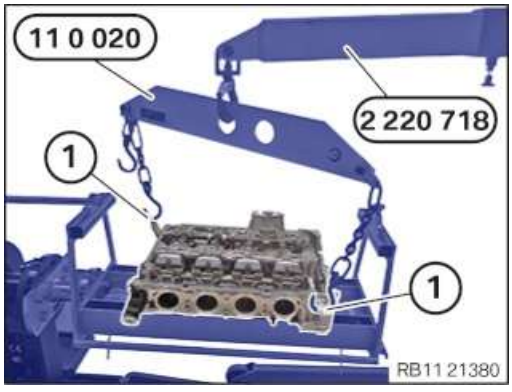
- Loosen screw (2).
- Pull out rod (1) in **direction of arrow** and set it aside.



- Stage special tool (workshop crane) 2 220 718.

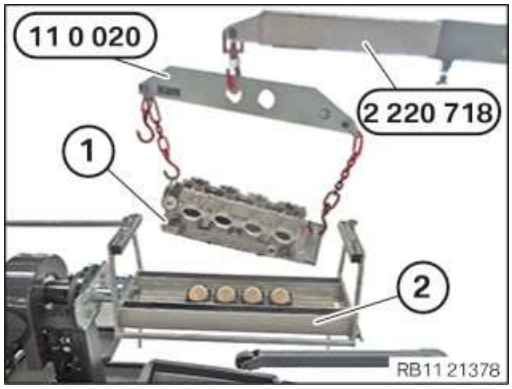


- Prepare the special tool .



- Thread in and install the special tool on the cylinder head (1).
- Attach the special tool to the workshop crane 2 220 718.

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- Feed cylinder head (1) out of device (2) using workshop crane 2 220 718 and special tool and lift.

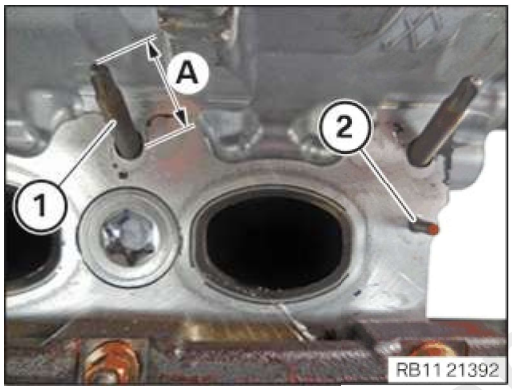
32 – Installing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.



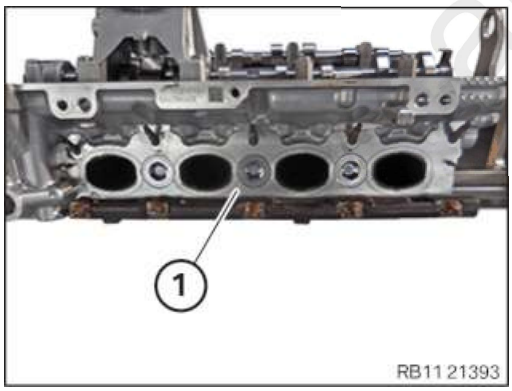
- Check stud bolt (1) for damage, renew stud bolt (1) if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1); if necessary screw in stud bolt further.

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm

- Check for correct fit of stud bolt (2).



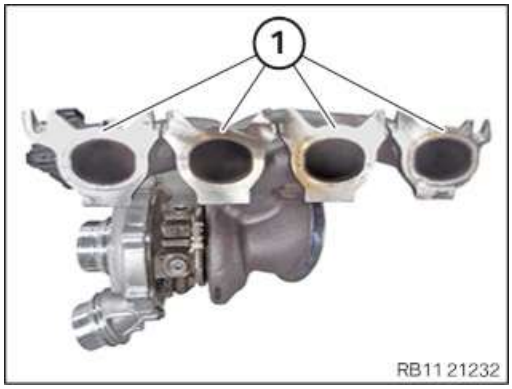
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the cylinder head (1) using the special tool 0 495 102 (11 4 470).



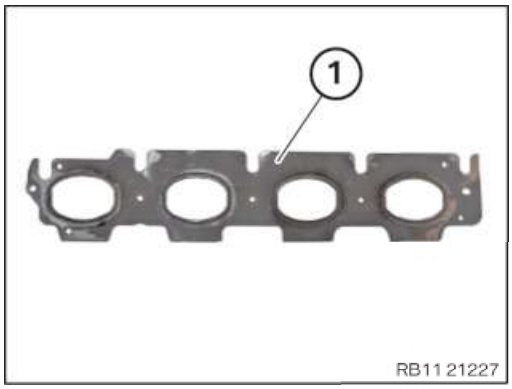
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

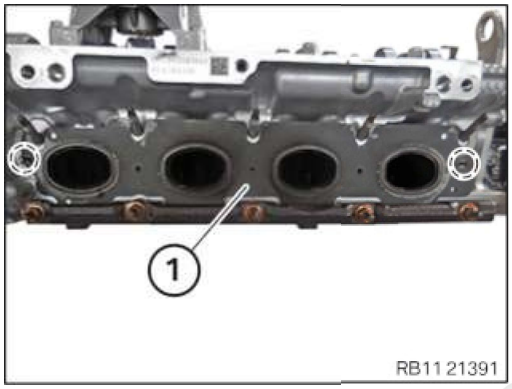
- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the exhaust turbocharger (1) using the special tool 0 495 102 (11 4 470).

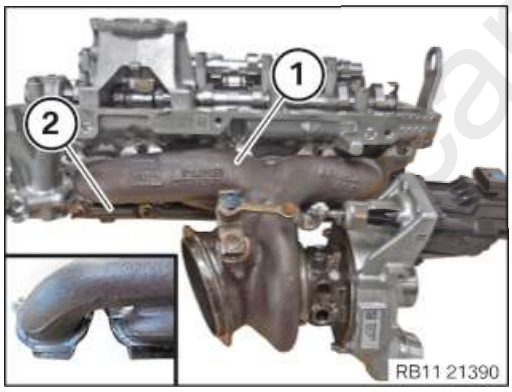


- Renew gasket (1).

  Parts: Seals



- Insert and install the gasket (1).
- Make sure the seal (1) has been **correctly** installed in the guide pins in the **marked** area.



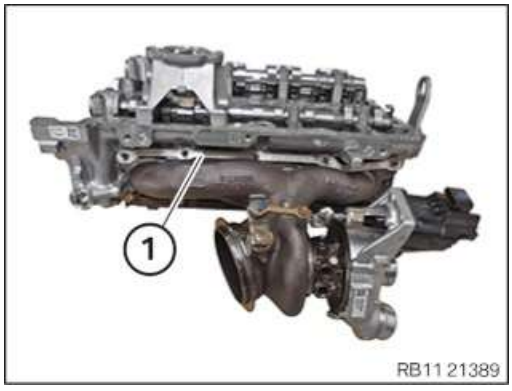
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide the exhaust turbocharger (1) toward the bottom into the clamping strip (2) and align it flush on the cylinder head.

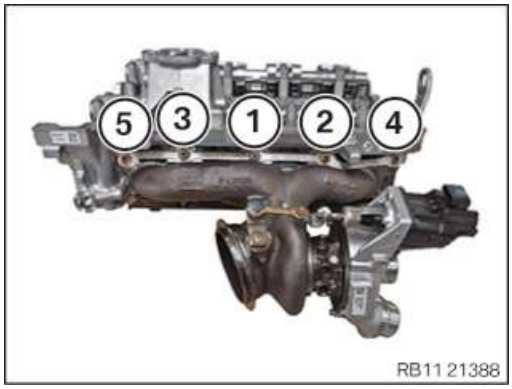


TECHNICAL INFORMATION

- Note the installation position of the component. The component may be installed in various installation positions.

- Mount sliding rail (1).
- The original BMW part number of the sliding rail (1) must be **legible** from the rear.

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Renew nuts (1) to (5).

  Parts: Nuts

- Tighten the nuts in sequence (1) to (5).

Exhaust turbocharger to cylinder head

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Additional Information

Overview of Tightening Torques

Flange to assembly stand — Used in step 2

M14X30		Tightening torque	135 Nm

Cylinder head on device — Used in step 2

M10X90x1.5		Tightening torque	30 Nm

Eccentric shaft to bearing support/cylinder head — Used in step 22

M6			10 Nm

Electrical servomotor to cylinder head — Used in step 23

M6		Tightening torque	8 Nm

Intake camshaft to cylinder head — Used in step 24

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Exhaust camshaft to cylinder head — Used in step 25

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

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Gate to bearing bracket Used in step 28

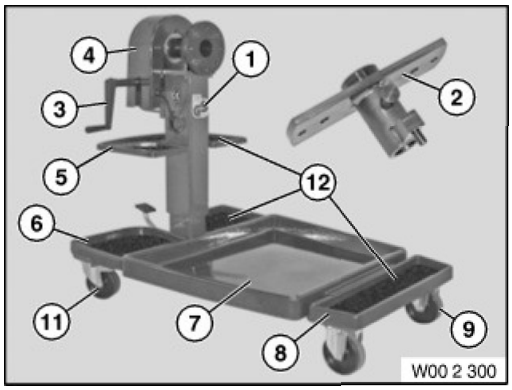
M8			20 Nm

Exhaust turbocharger to cylinder head Used in step 32

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Overview of Special Tools

0 495 187 (00 2 300) Assembly stand



Common Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

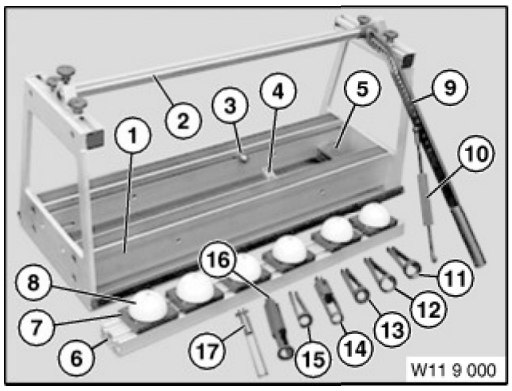
Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	
2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	

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7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

0 494 362 (11 9 000) Device



Common Used in step 214

Usage	(Cylinder head expander tool)
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 03 02 (833)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 366 (11 9 001)		**Device**	
6	0 494 371 (11 9 006)		**Insert** (Aluminium strip)	
11	0 494 376 (11 9 012)		**Basket** (Valve spring cage) Engine M41, M51, S50	
17	0 495 028 (11 9 017)		**Basket** (Valve spring cage) Engine N52	
2	0 494 367 (11 9 002)		**Rod**	
3	0 494 368 (11 9 003)		**Adapter** (Sliding block)	
4	0 494 369 (11 9 004)		**Tab**	
5	0 494 370 (11 9 005)		**Quick fastener**	
7	0 494 372 (11 9 007)		**Shaped part** (shaped part)	

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8	0 494 373 (11 9 008)		**Shaped part** (Shaped part) Shaped part made of plastic	
9	0 494 374 (11 9 009)		**Lever**	
10	0 494 375 (11 9 011)		**Hook**	
12	0 494 377 (11 9 013)		**Basket** (Valve spring cage) Engine M43, M73	
13	0 494 378 (11 9 014)		**Basket** (Valve spring cage) Engine M44, M52, M54, M56, M62, S52, S54, S62	
14	0 494 379 (11 9 015)		**Basket** (Valve spring cage) Engine M47, M47TU, M57, M57TU, N40, N42, N62, N73	
15	0 494 380 (11 9 016)		**Basket** (Valve spring cage) Engine M21, M40	

2 220 718 Workshop crane



Common	Used in step 231
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

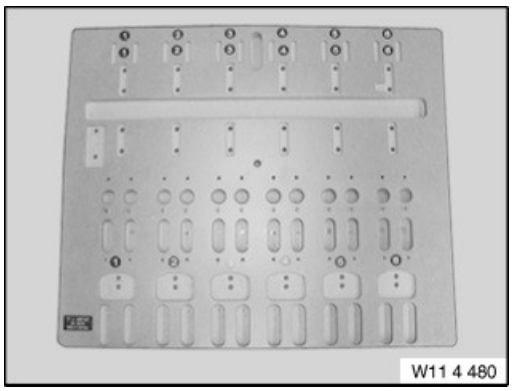
2 359 088 Device



Common	Used in step 530
Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 105 (11 4 480) oddments tray



Common Used in step 5678101112131416

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

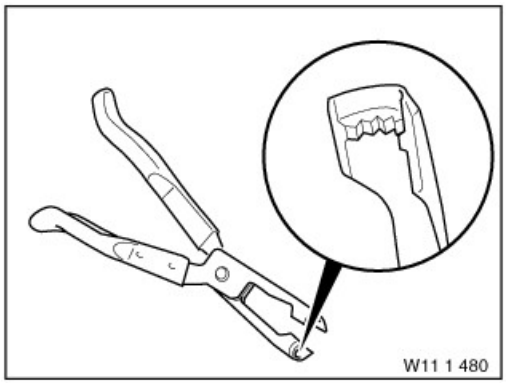
0 496 143 (11 8 840) Basket



Common Used in step 1419

Usage	(Valve spring cage) For removing and fitting the valves.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 490 796 (11 1 480) Pliers

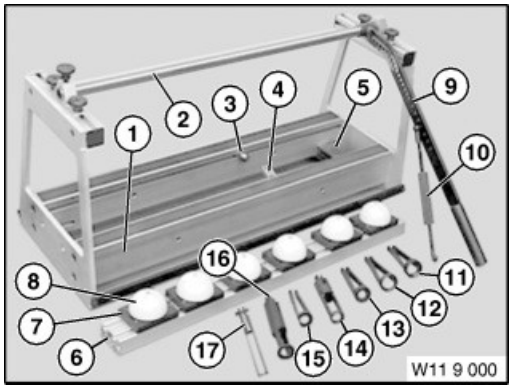


Common Used in step 15

Usage	For removing valve stem seal
Included in the tool or work	
Storage location	A10
Replaced by	
In connection with	
SI-Number	01 01 93 (621)

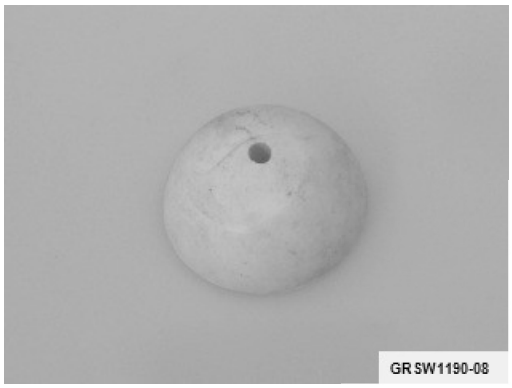
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0 494 370 (11 9 005) Quick fastener



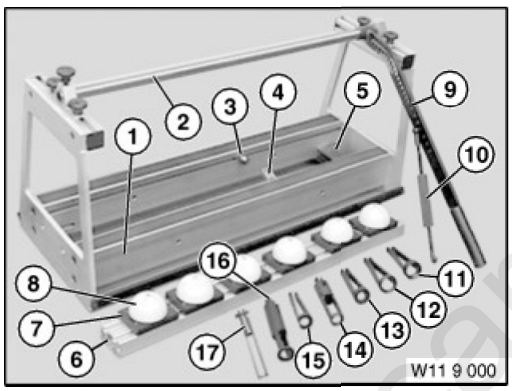
Common	Used in step 1617
Usage	
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 373 (11 9 008) Shaped part



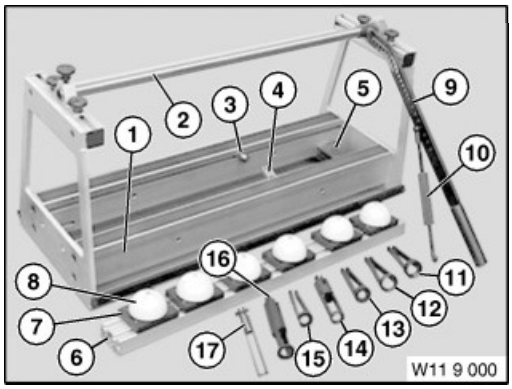
Common	Used in step 1617
Usage	(Shaped part) Shaped part made of plastic
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 371 (11 9 006) Insert



Common	Used in step 1617
Usage	(Aluminium strip)
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

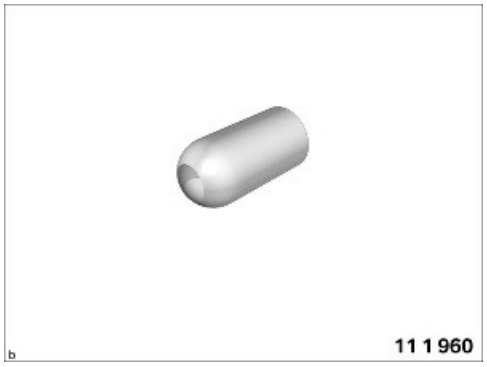
0 494 372 (11 9 007) Shaped part



Common	Used in step 1617
Usage	(Shaped part)
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

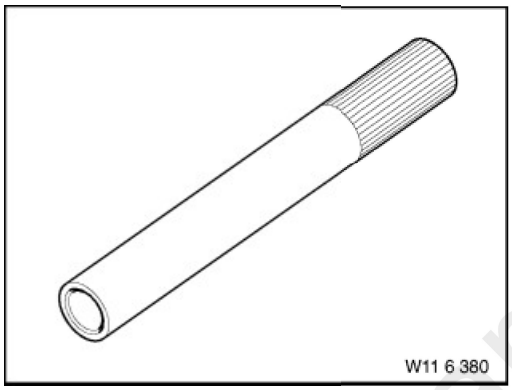
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0 490 797 (11 1 960) Holding sleeve



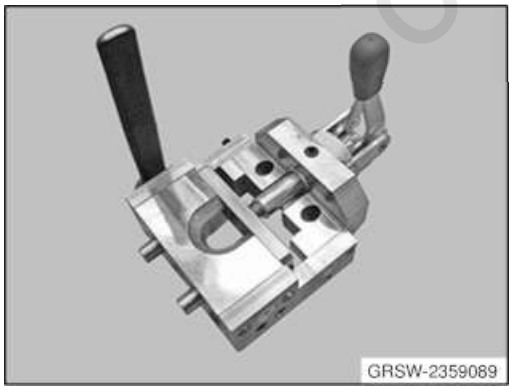
Common	Used in step 18
Usage	(Assembly sleeve) For fitting valve stem seals, 6 mm diameter
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 493 249 (11 6 380) Bush



Common	Used in step 18
Usage	For fitting valve stem seal
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 98 (306)

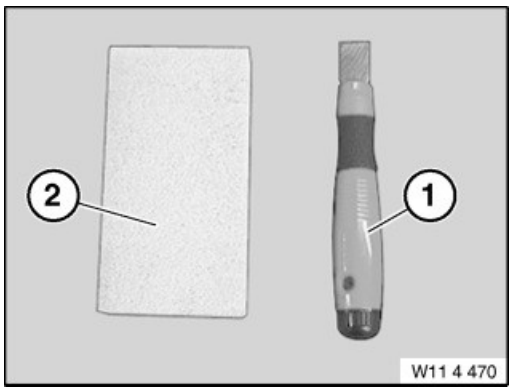
2 359 089 Device



Common	Used in step 28
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 102 (11 4 470) Tool



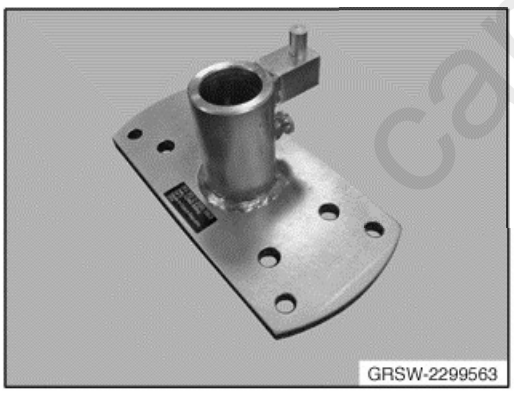
Common	Used in step 32
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

Replacement tools:

2 299 563 Adapter



Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

Overview Technical Data

Screw-in depth of upper stud bolt on cylinder head	Used in step 32
Dimension A	30 mm

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	9

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11 12 070 Remove and install/replace acoustic cover

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Install acoustic cover

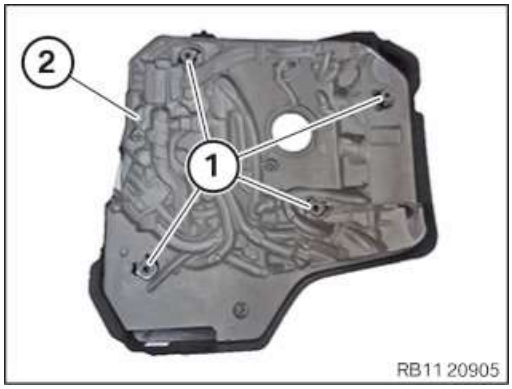
RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

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11 12 100 Removing and installing cylinder head

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

RISK OF DAMAGE

Engine damage due to lack of engine oil.

Lack of engine oil after the cylinder head or the engine has been renewed may cause damage to the valve gear.

- Do not start the engine after renewing the cylinder head or the engine without following the repair notes.
- The repair notes on renewing the cylinder head or the engine must be followed.
- For additional information, see: Repair notes on renewing the cylinder head or the engine

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

Engine compartment lid is open.

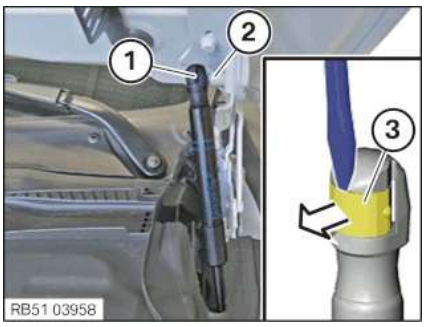
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CAUTION

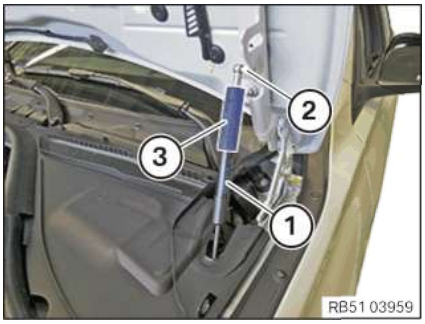
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

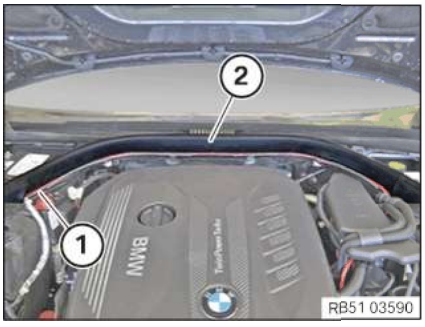


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

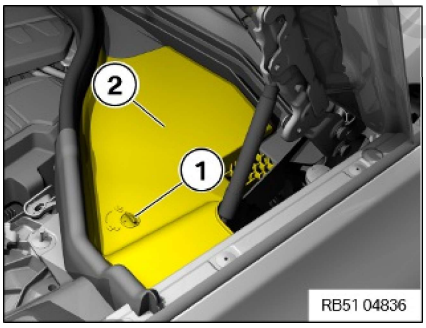
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



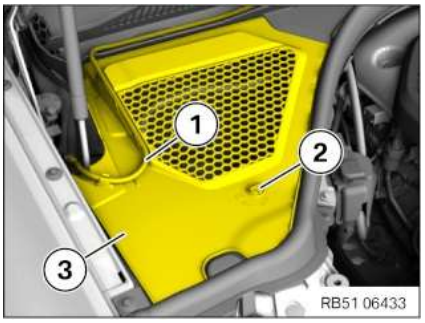
- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment



- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

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6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

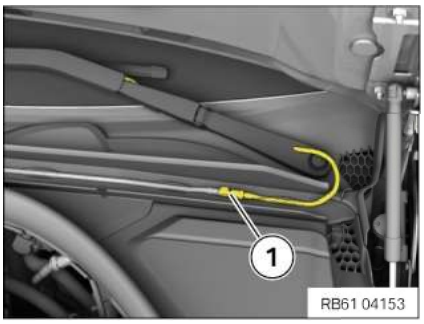
▸ **Remove the wiper arm**

RISK OF DAMAGE

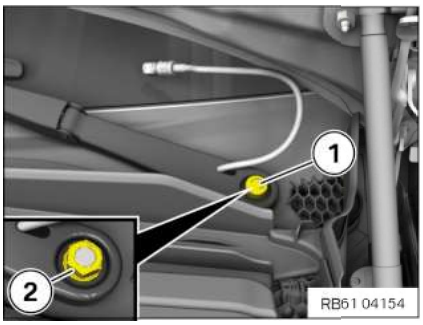
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

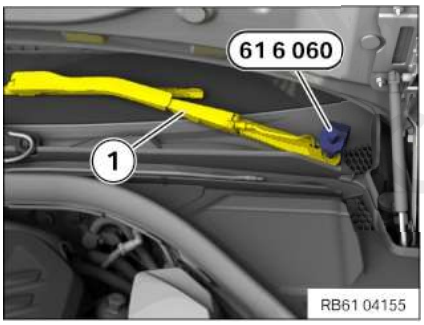
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.

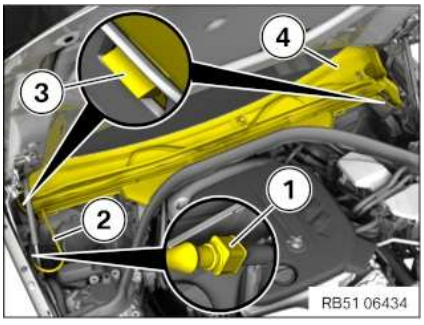


- Remove the protective cap (1).
- Loosen nut (2).



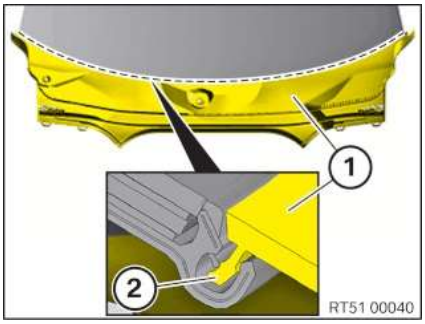
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover



- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

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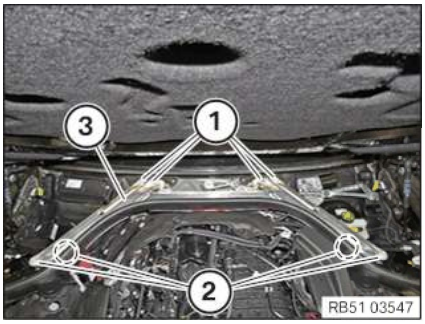


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

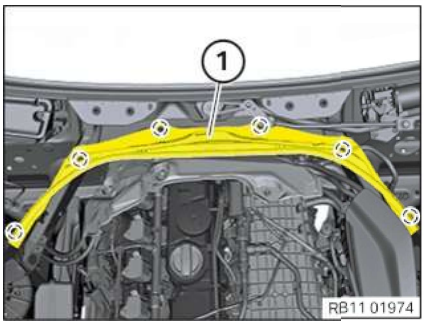
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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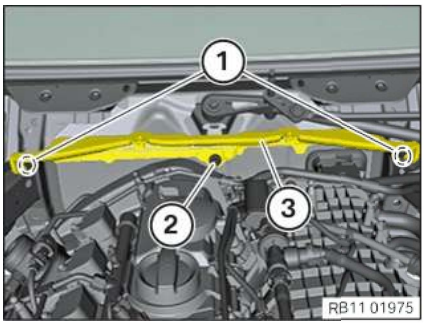
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing the clean air pipe with the resonator

WARNING

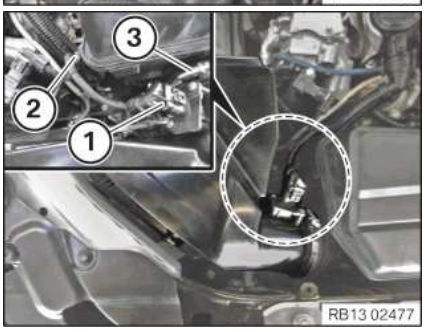
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

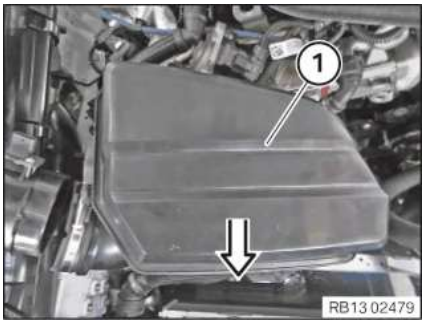


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

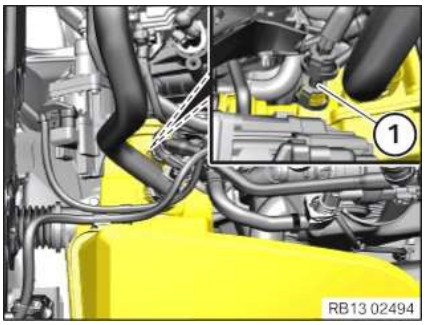


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

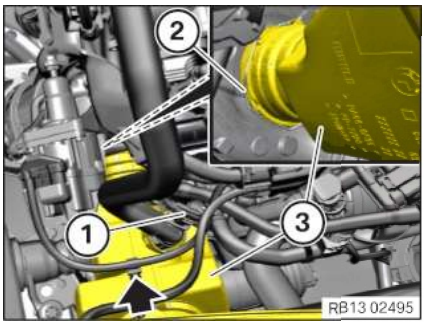
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- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

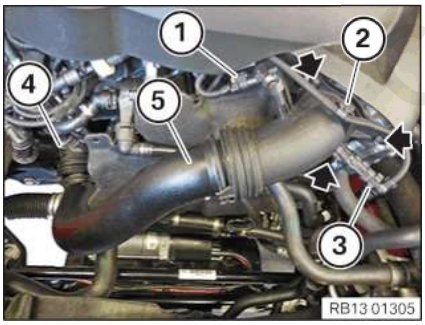
13 – Remove charge air line

WARNING

Hot surfaces.

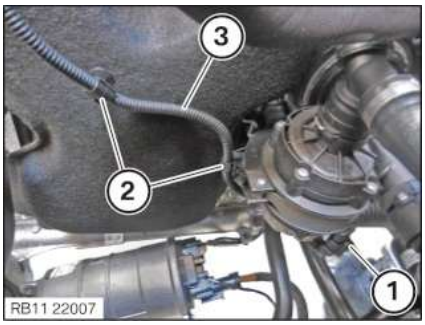
Risk of burning!

- Perform all work only on components that have cooled down.



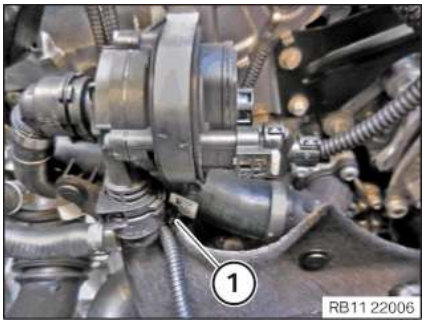
- Unlock and loosen the connector (1) on the charging pressure sensor.
- Unlock and loosen clamp (2).
- Unlock and disconnect the connector (3) from the charge-air temperature sensor.
- Remove screws (arrows).
- Unlock and loosen the clamp (4) on the exhaust turbocharger.
- Guide out and remove charge air line (5).

14 – Removing the acoustic cover for the engine at the front

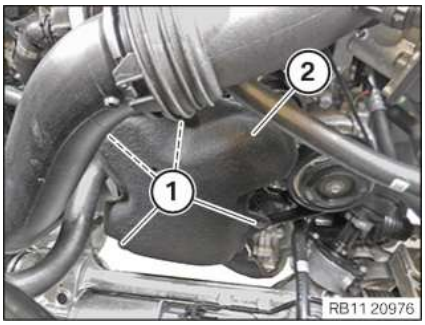


- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

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- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.
For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

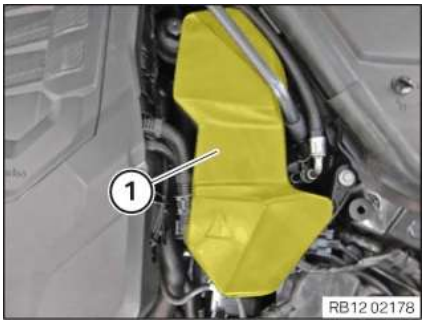
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.
For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

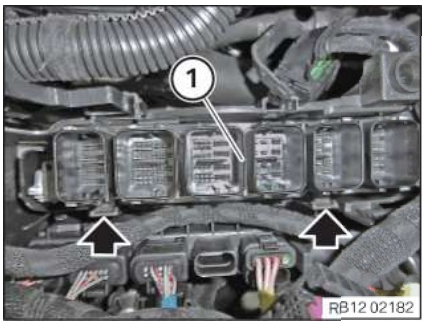
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- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

16 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

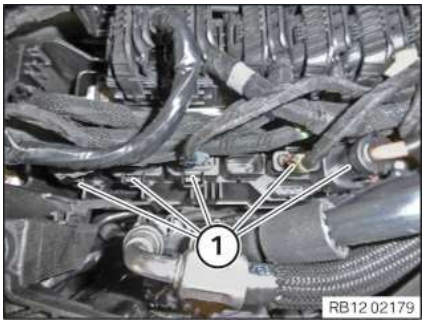
RISK OF DAMAGE

Electrostatic discharge.

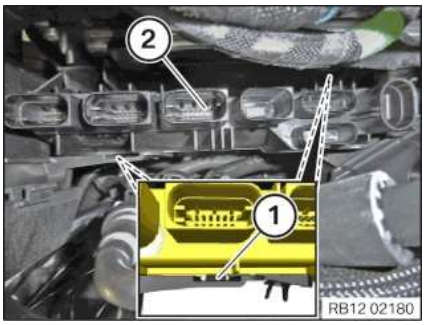
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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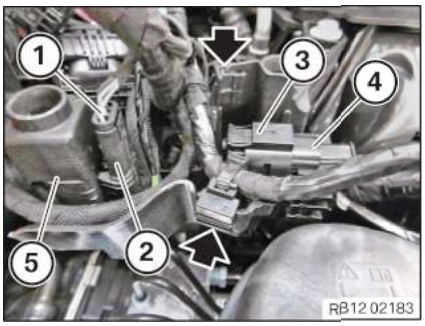


- Unlock and disconnect plug connections (1).

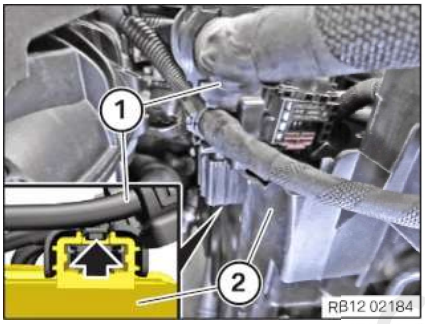


- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

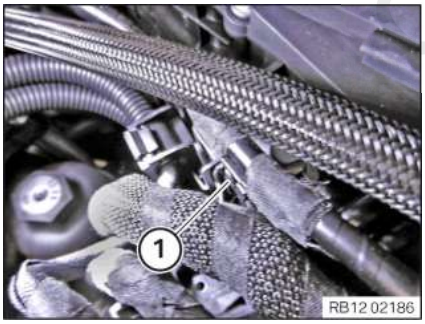
17 – Removing the control unit holder



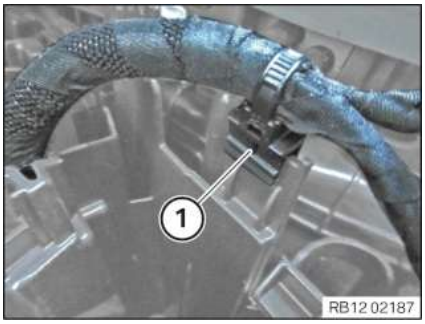
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).



- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).

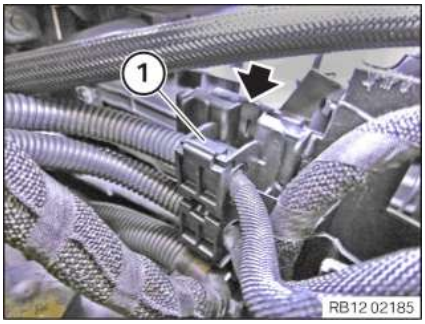


- Loosen clamp (1).

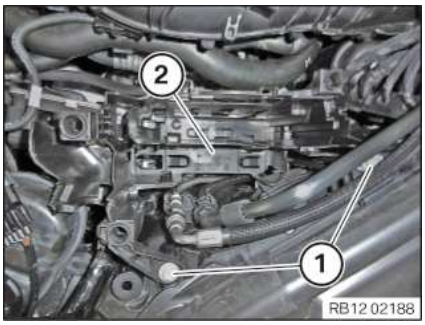


- Loosen clamp (1).

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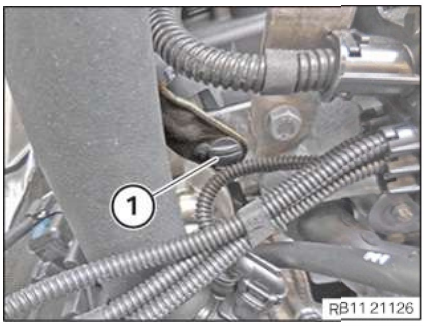


- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.

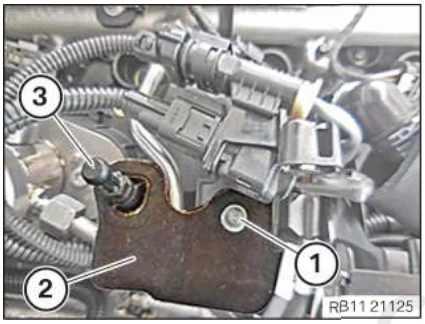


- Loosen screws (1).
- Guide out and remove the control unit holder (2).

18 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

19 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

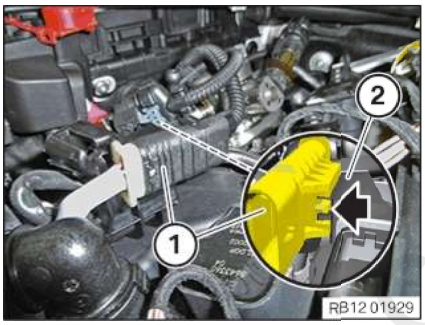
Electrostatic discharge.

Damage to or destruction of electrical components.

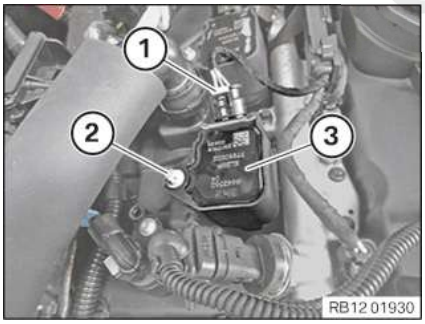
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

20 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

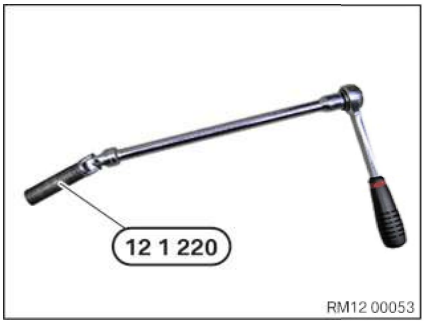
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

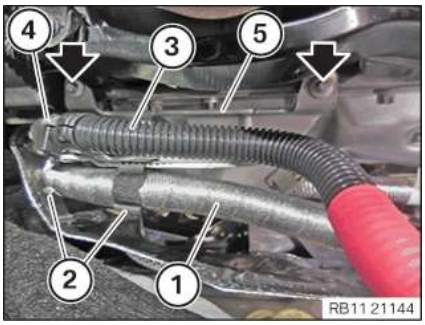
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.



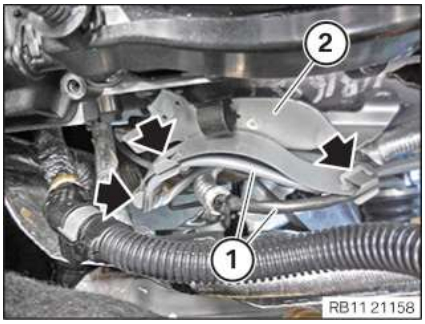
- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

21 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.

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- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

22 – Remove the heat shield on the cylinder head

WARNING

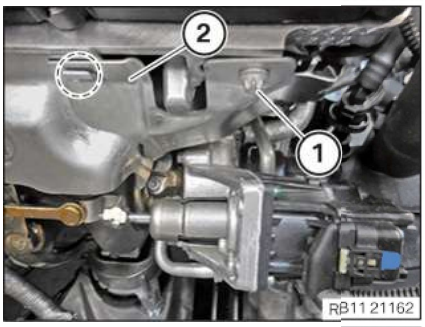
Hot surfaces.

Risk of burning!

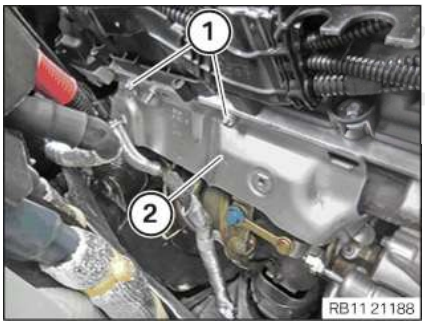
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.



- Loosen screws (1).
- Feed out and remove the heat shield (2).

23 – Remove the control sensor

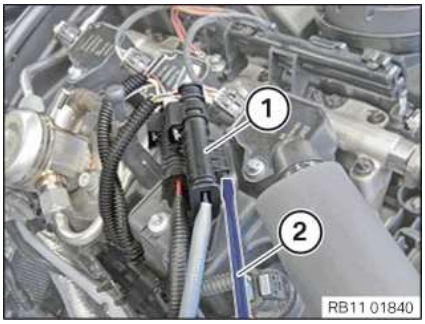
WARNING

Hot surfaces.

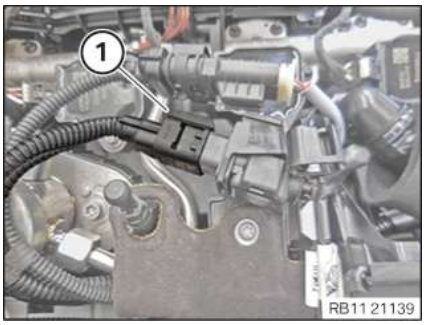
Risk of burning!

- Perform all work only on components that have cooled down.

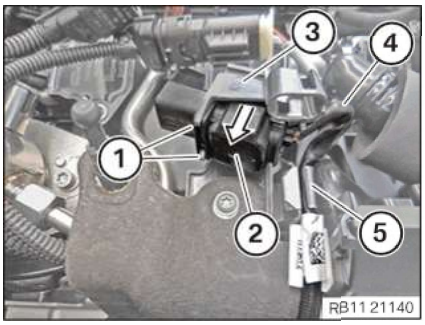
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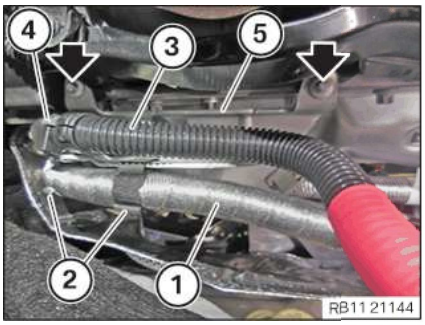
- Unlock connector (1) with screwdriver (2) and remove from the carrier plate.
- Unlock and loosen connector (1).



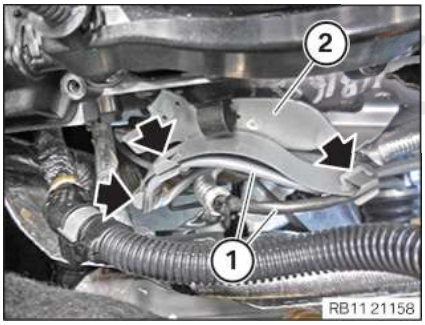
- Unlock and loosen connector (1).



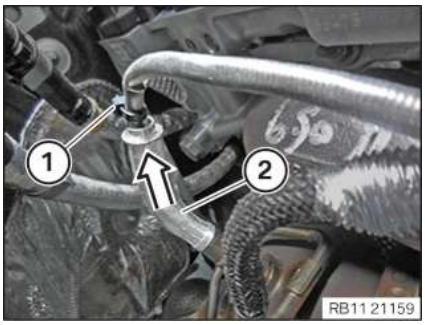
- Unlock the locks (1).
- Guide the connector (2) out of the bracket (3)in the **direction of the arrow** and set it aside.
- Release the cable (4) from the clamp (5).



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.



- Unfasten cable strap (1).
- Feed out the heat shield (2) **in direction of arrow** and set it aside.

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- Release and remove the control sensor (1) with the special tool 0 491 074 (11 7 020).

24 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

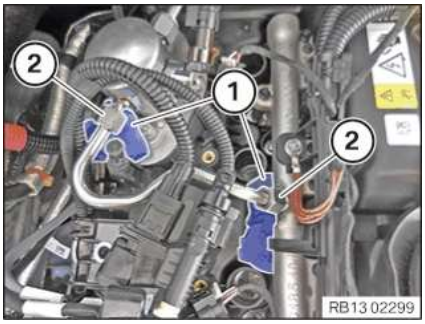
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

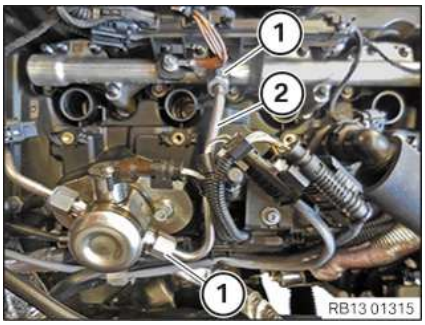


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

25 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

RISK OF DAMAGE

Contaminant or foreign body.

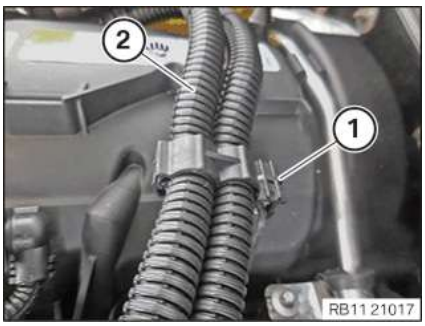
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

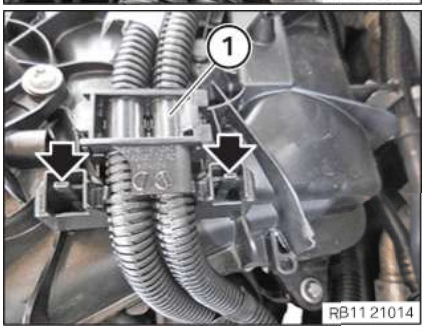
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TECHNICAL INFORMATION

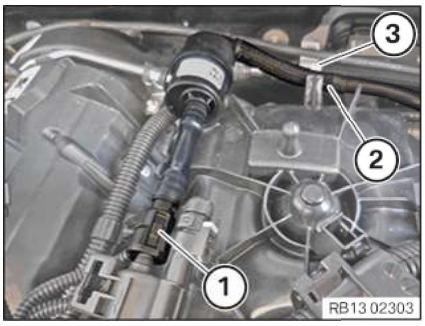
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



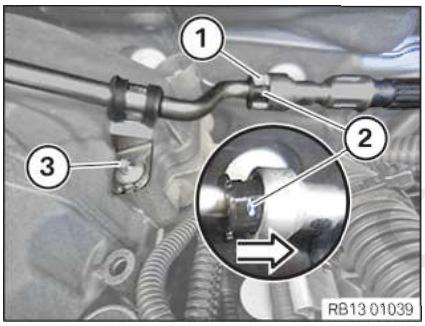
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



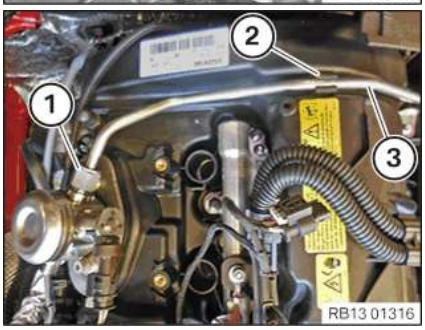
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).



- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

26 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

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RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

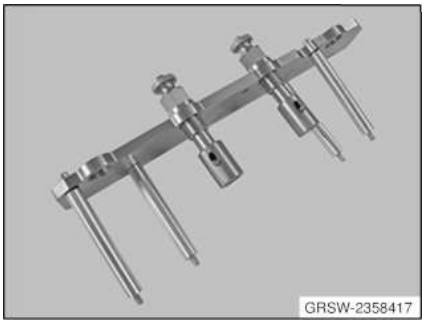
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Prepare special tool .

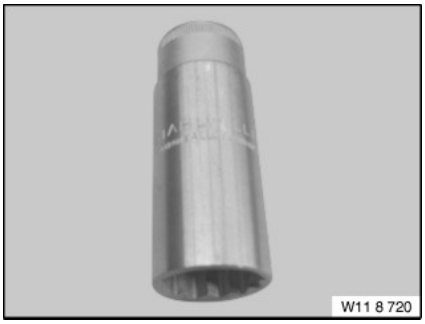


- Prepare special tool 2 358 417.

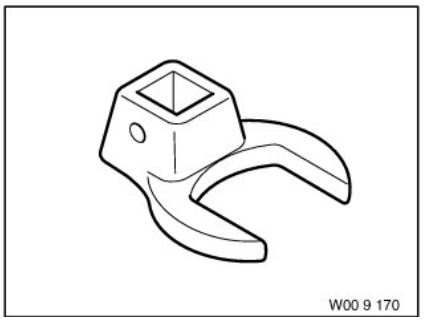


- Prepare special tool .

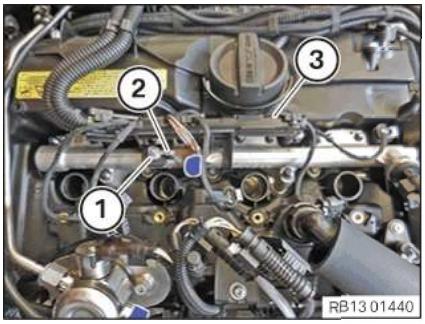
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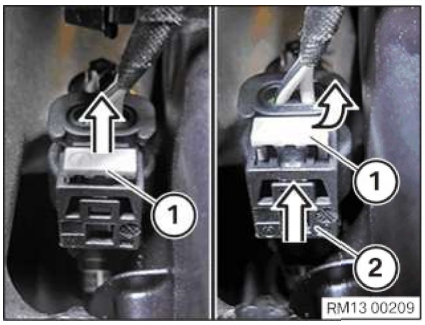
- Prepare special tool 0 496 106 (11 8 720).



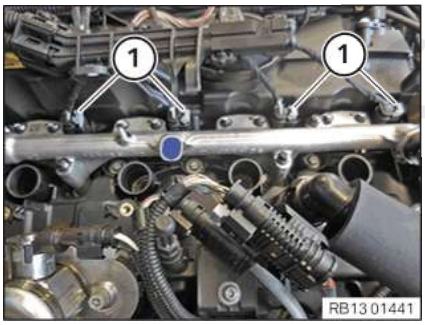
- Prepare special tool .



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.



- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



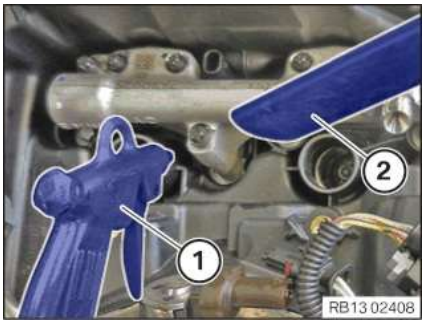
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.



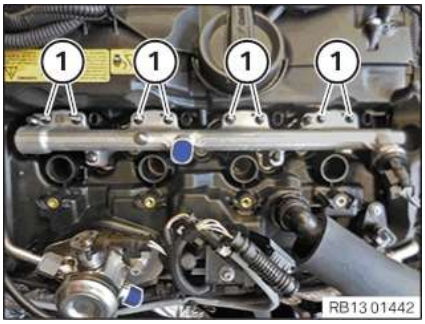
TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.

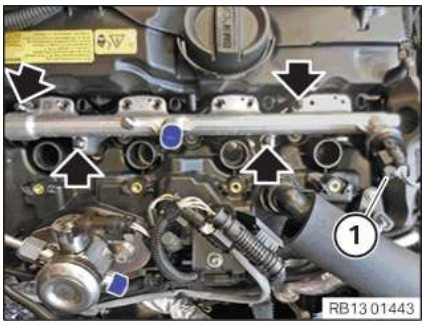
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- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

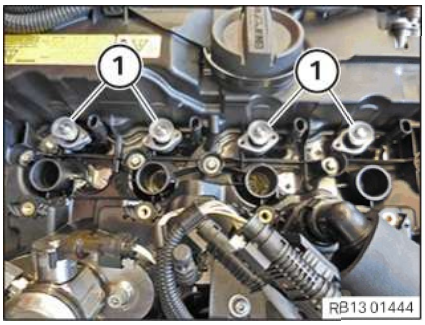


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

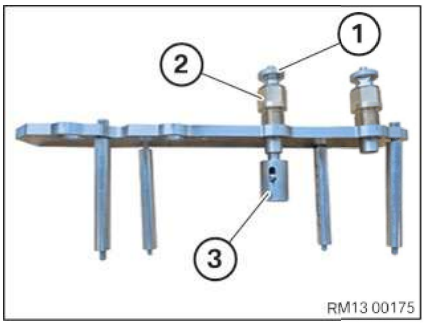
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

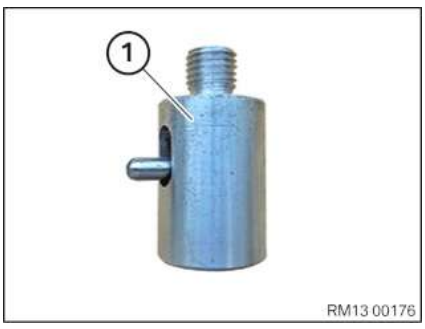
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

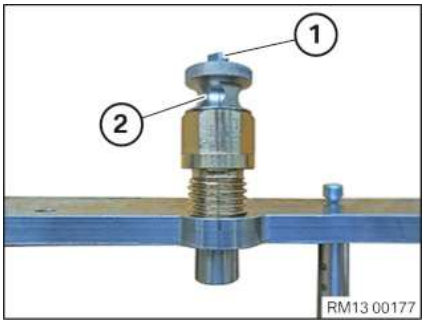
  The special tool 2 358 417 consists of:

  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector

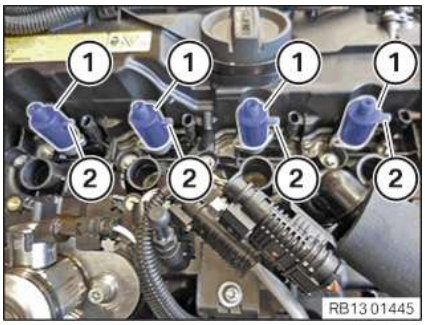


- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

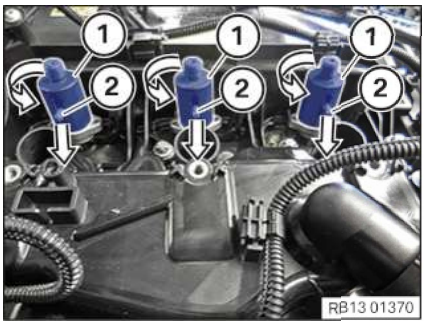
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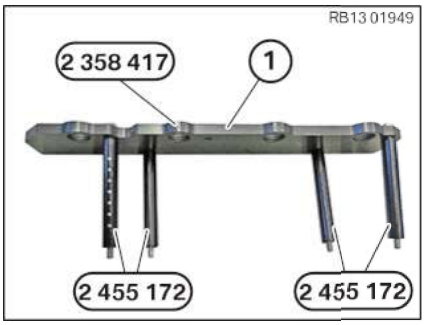
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



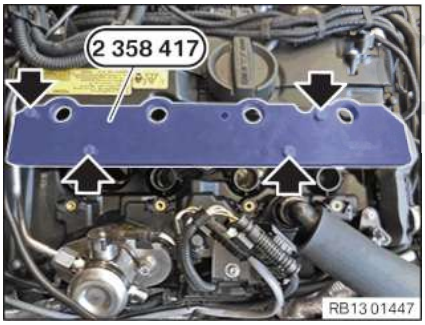
- Install all fixtures (1) for the injectors.
  The fixtures (1) are not locked when the levers (2) are up.



- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



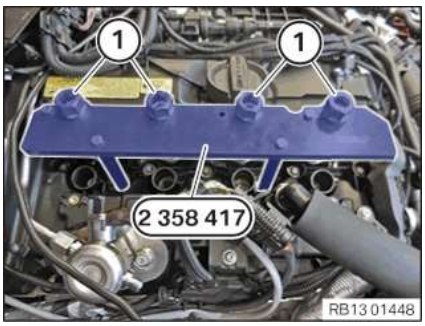
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).

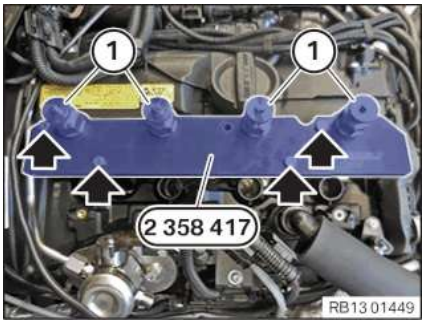


TECHNICAL INFORMATION

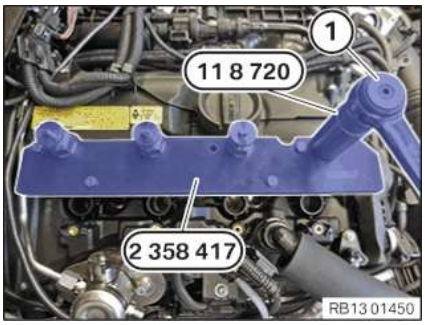
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.

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- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.



- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

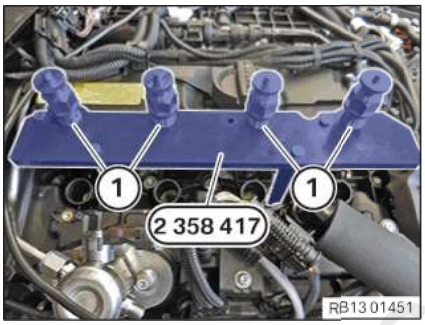


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

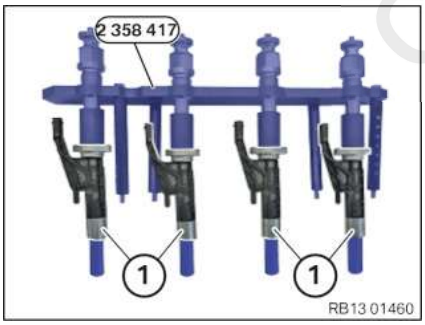
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

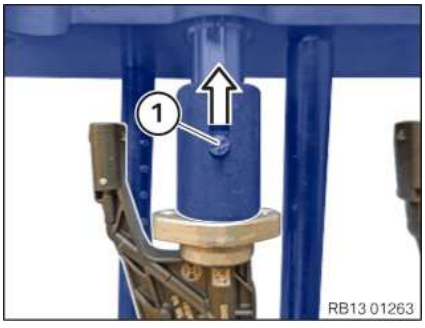


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

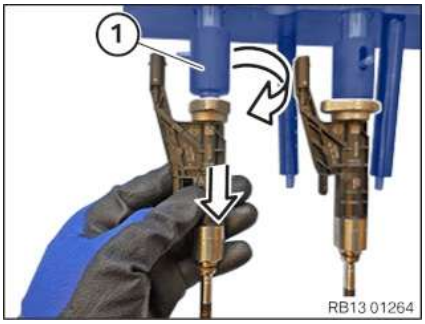


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

27 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

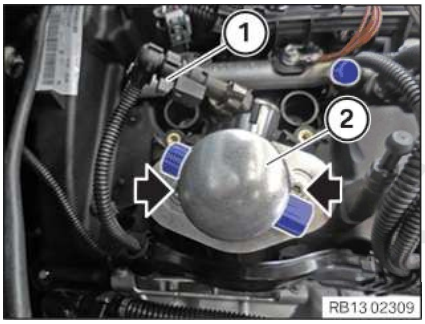
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

28 – Removing both actuators

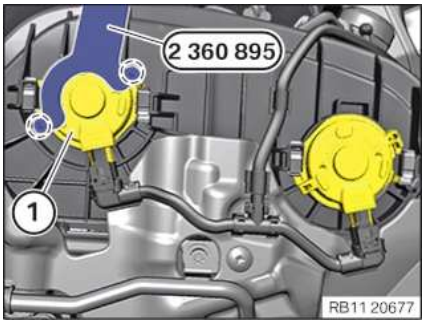
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

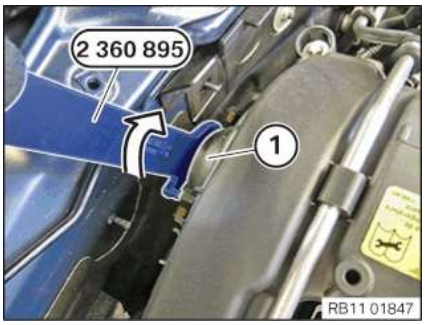
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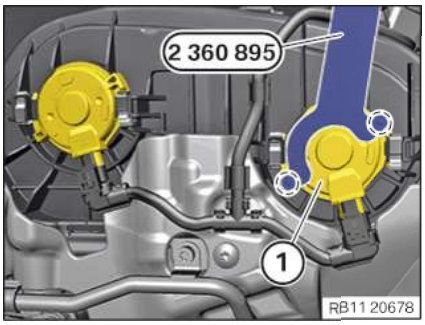
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



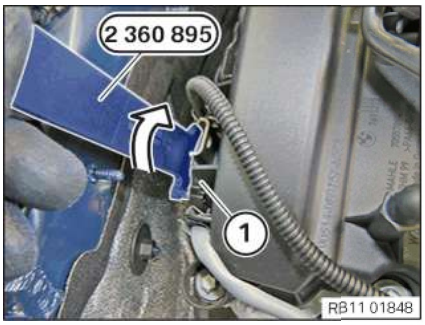
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



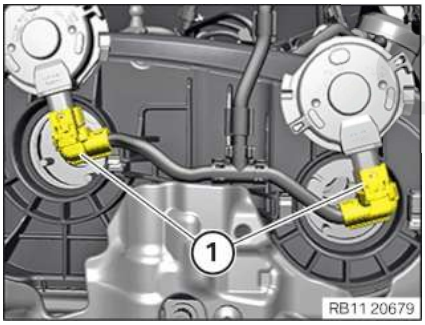
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

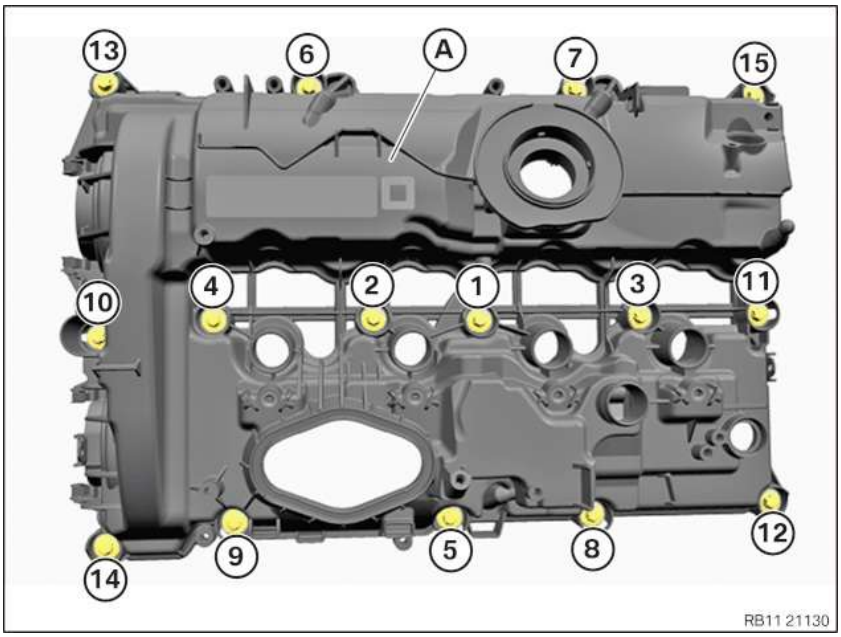
The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

29 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

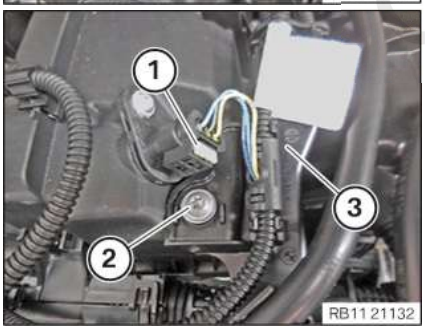
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

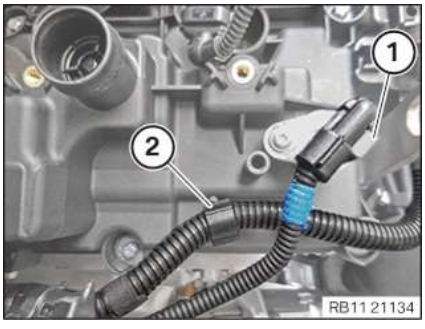
- Do not pull on the wires when disconnecting connectors and plug connections.



- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

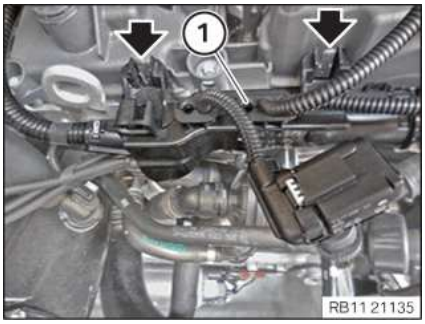


- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.

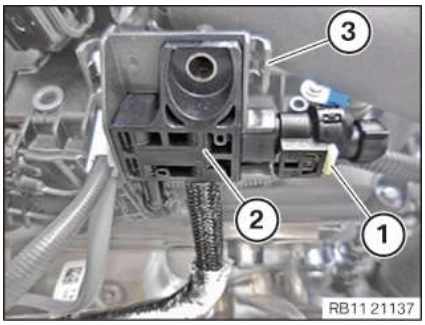


- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).

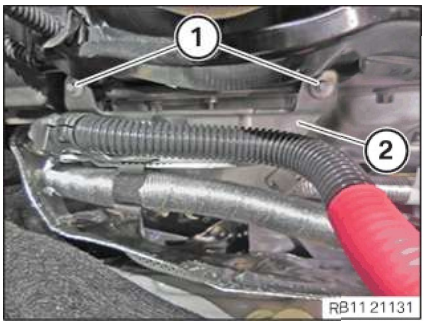
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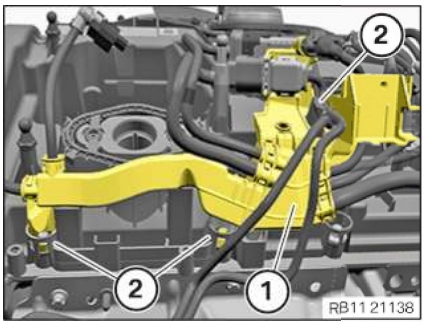
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



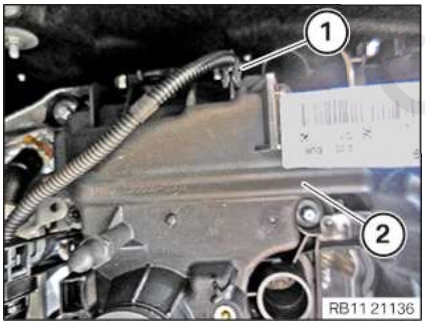
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



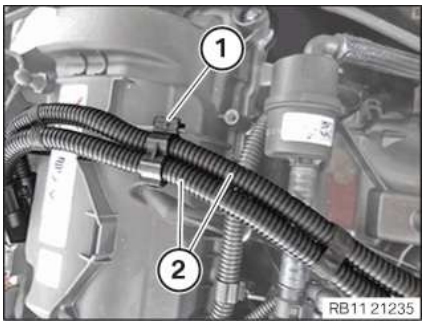
- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.



- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

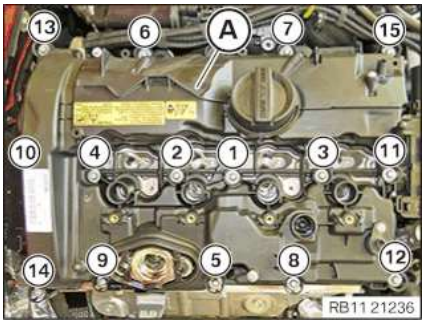


- Loosen clamp (1).



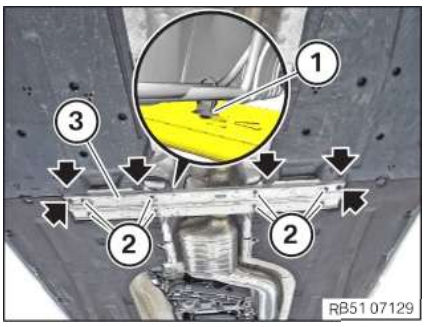
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.

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- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

30 – Remove the connecting support from the tunnel



- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

31 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

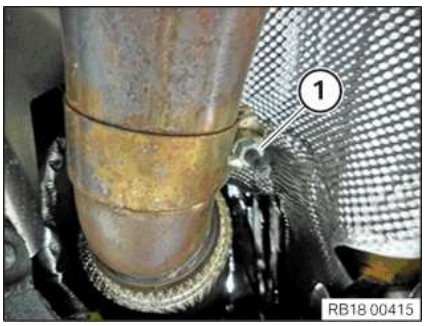
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

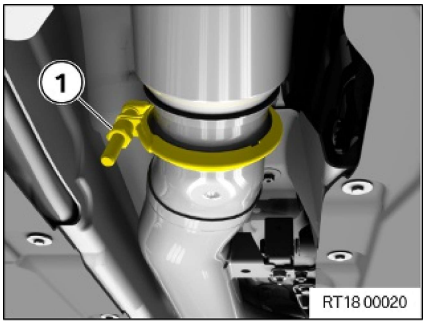
- Remove and install heavy components with the aid of another person/other persons.



- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).

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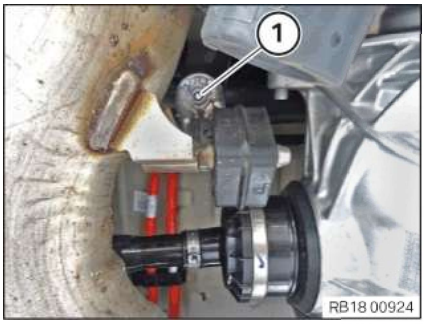


- **Equipment specification 2 (V-clips)**

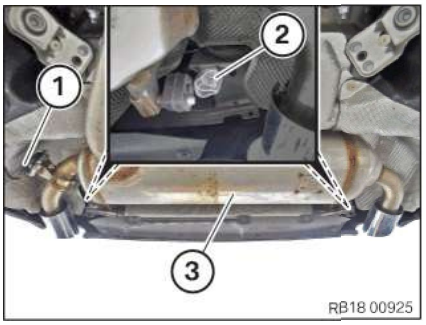
  Unfasten clamp (1).



- Loosen nut (1).

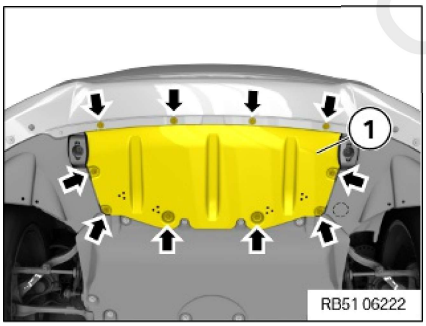


- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

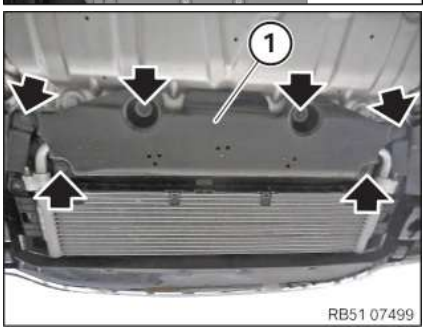
32 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed front underbody protection (1) backwards out of the bumper panel.

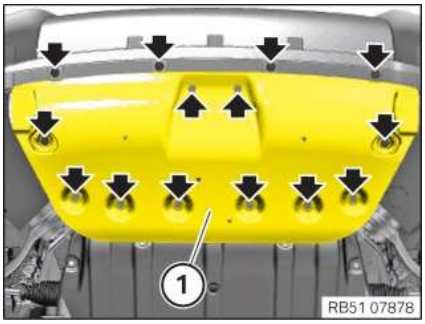


- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

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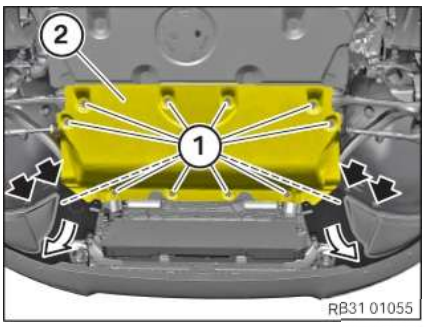


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

33 – Remove the underbody protection of the steering gear



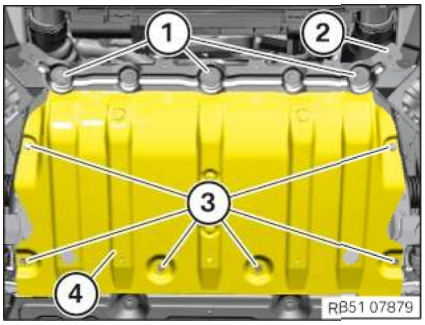
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

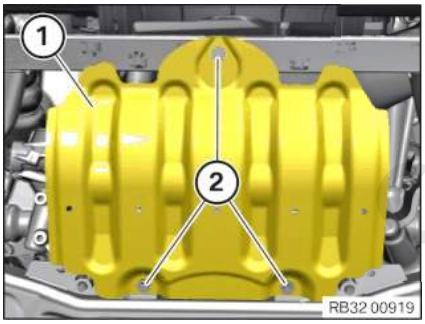
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

34 – If installed: Removing the steering start protection

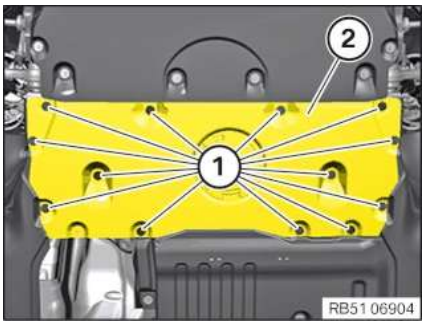
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

35 – Removing the centre underbody protection

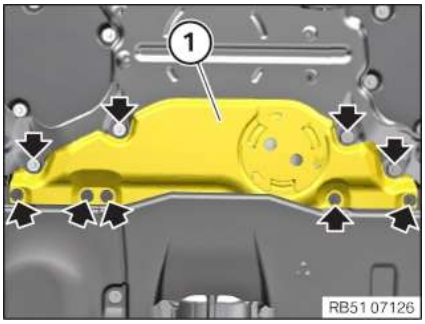


- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

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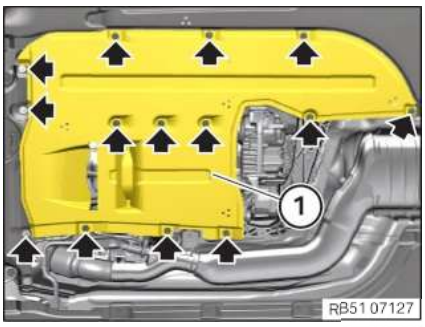


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

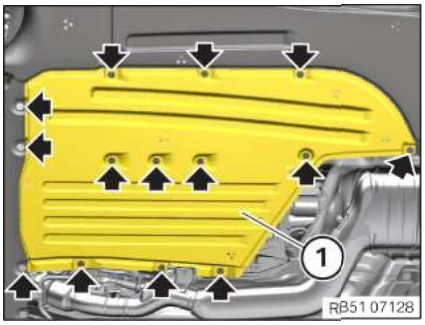
36 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

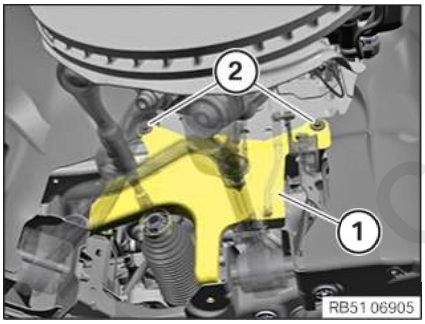
  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

37 – Remove the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.



- Loosen screws (2).
- Remove the cover (1).

38 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

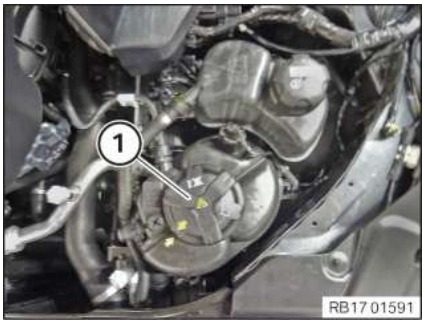
When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

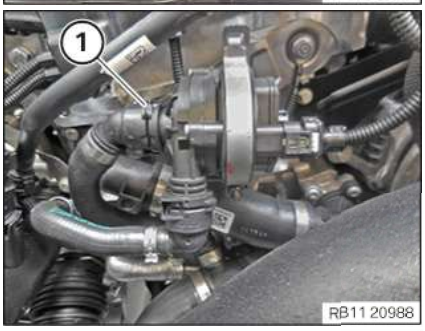
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TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

39 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

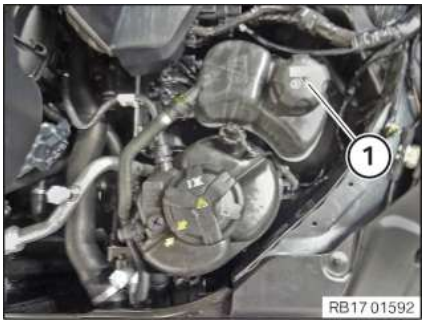
When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

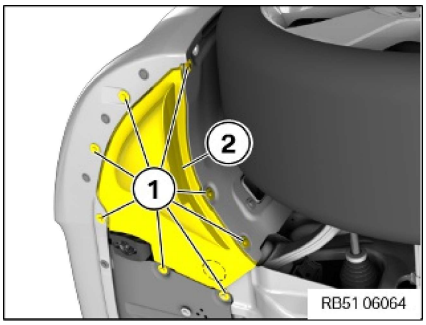
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

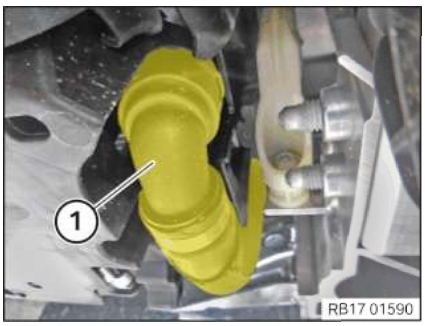
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- Loosen sealing cap (1).



- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

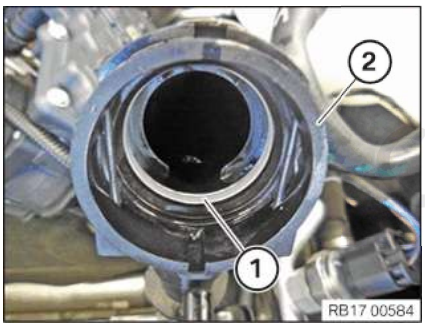


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

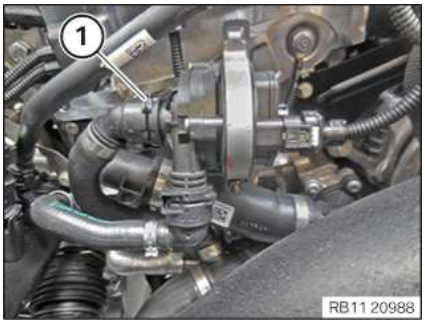
40 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

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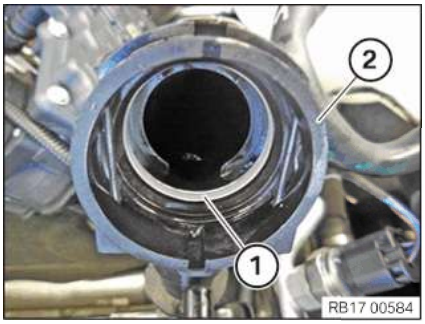


- Connect and lock coolant line (1).
  Coolant line (1) must audibly engage.

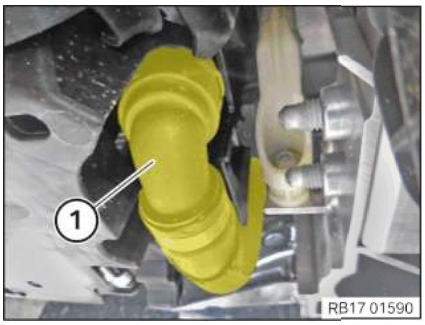
41 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

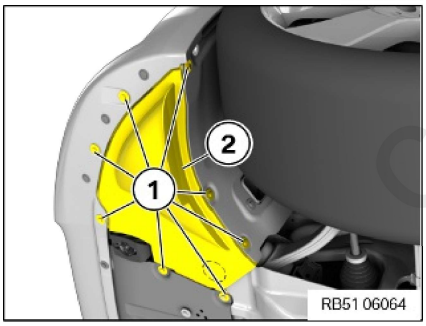
Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).
  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

42 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Heavy component.

Heavy components can lead to injury or damage.

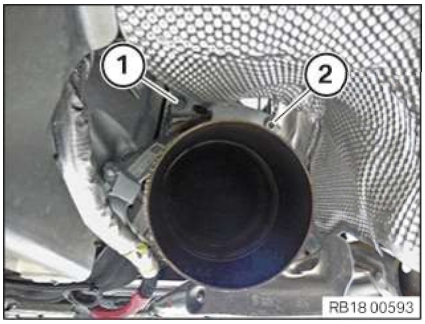
- Remove and install heavy components with the aid of another person/other persons.

CAUTION

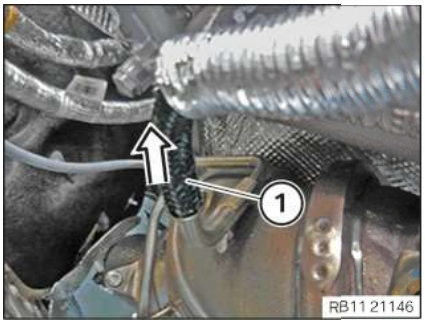
Component with heavy weight.

Danger of injury!

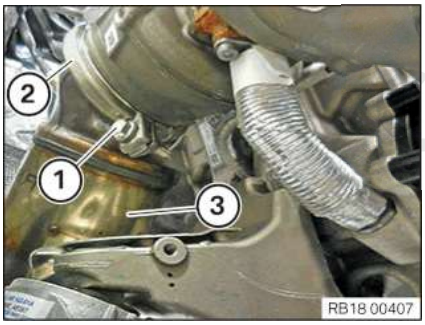
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.



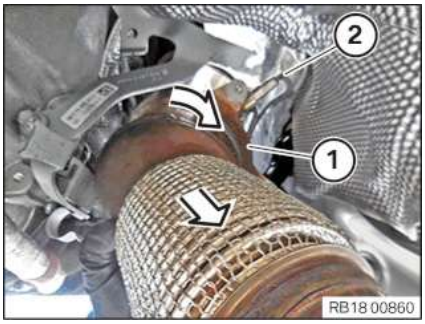
- Loosen screw (1).
- Loosen nut (2).



- Pull off pressure hose (1) in direction of arrow and set it aside.



- Loosen screw (1).
- Feed out V-clip (2) on catalytic converter (3) and remove.



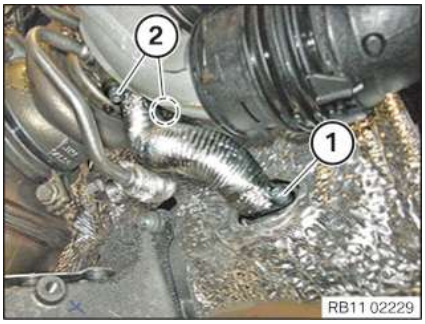
- Guide out catalytic converter (1) in direction of arrow and remove.
- Ensure that monitoring oxygen sensor (2) is**not** damaged.

43 – Removing the oil return line for the exhaust turbocharger

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TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

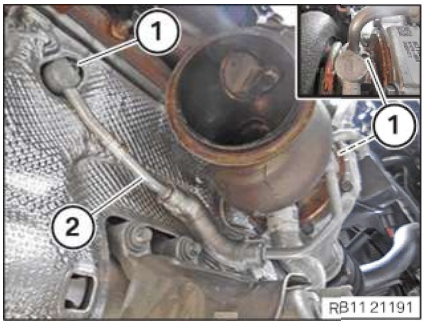


- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

44 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

45 – Remove the coolant return line for the exhaust turbocharger

WARNING

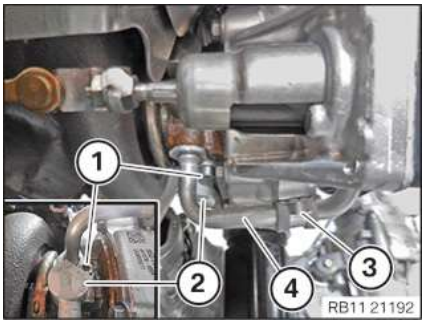
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

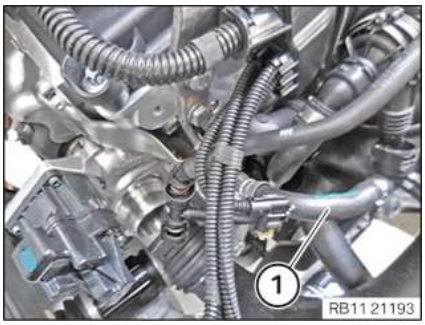


- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.

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- Unlock and release the coolant return line for the exhaust turbocharger (1).



- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

46 – Remove the coolant line between the coolant pump and the cylinder head

WARNING

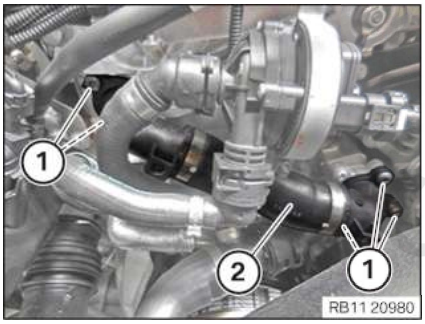
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Remove the coolant line (2).
- Catch and dispose of escaping coolant.

47 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

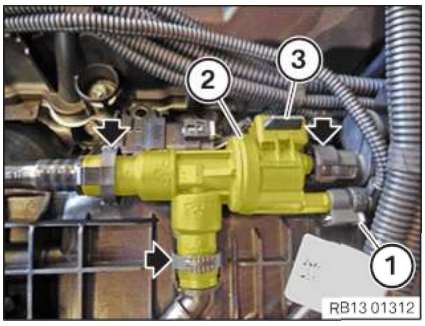
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

48 – Removing the intake plenum

RISK OF DAMAGE

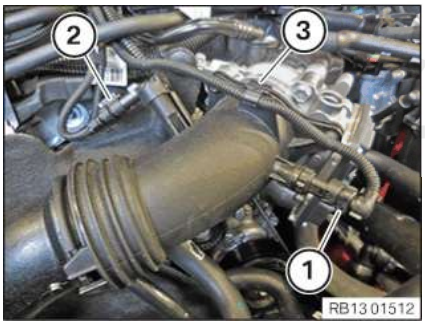
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

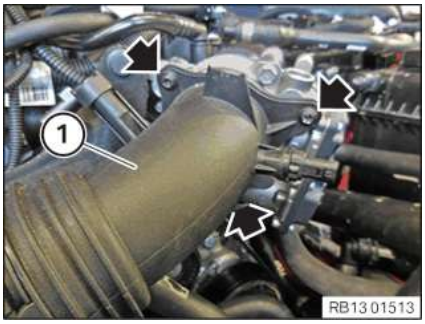
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

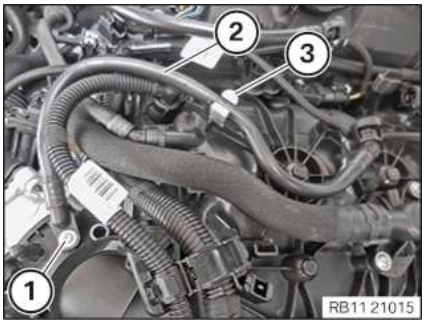


- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).

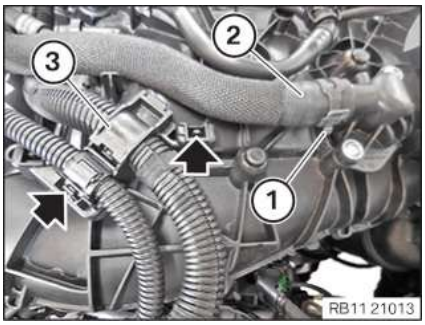


- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.

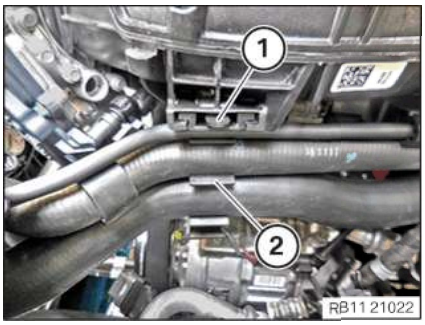
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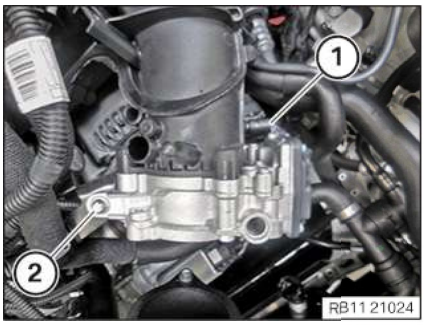
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



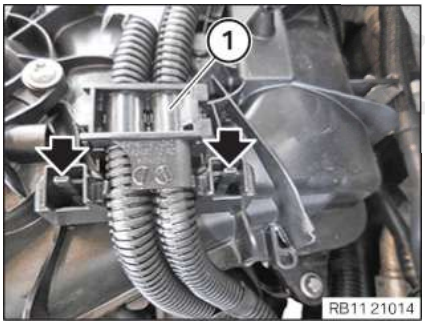
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



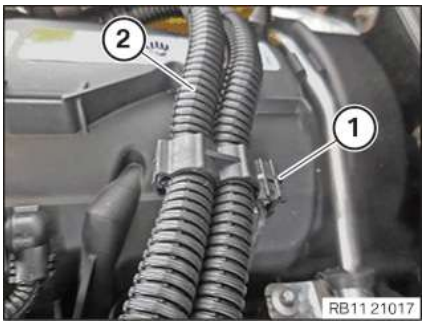
- Unlock the lock (1).
- Thread out holder (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

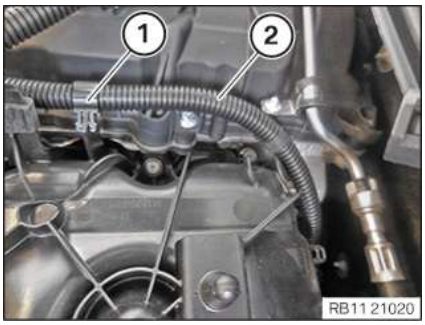


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.

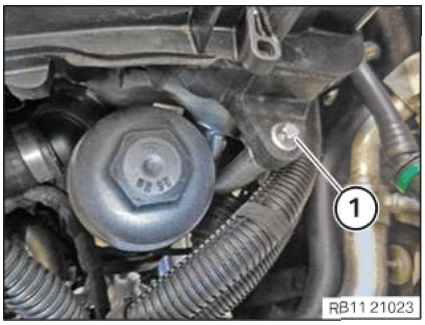
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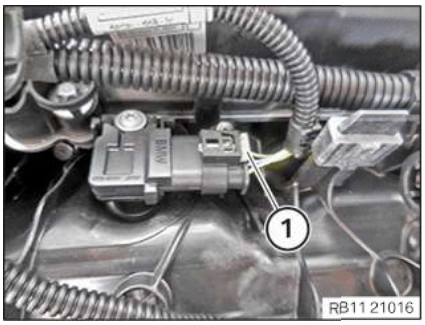
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



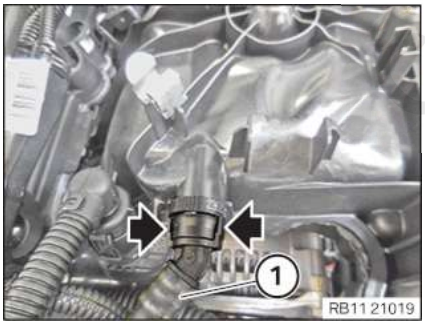
- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.



- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

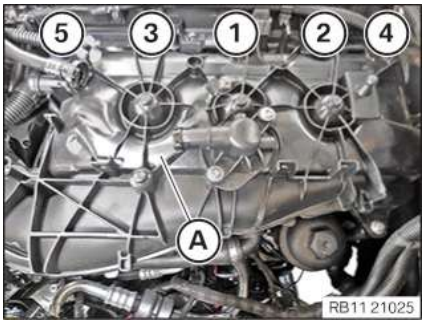


- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.

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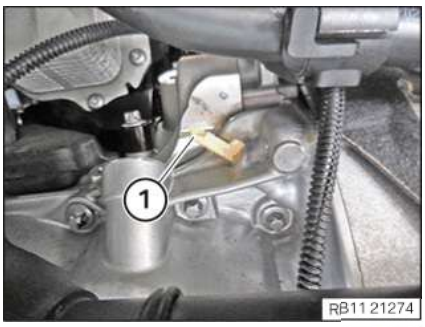


TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

49 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



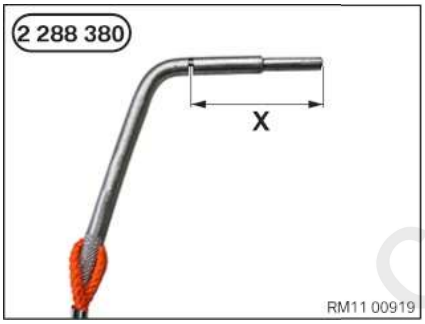
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

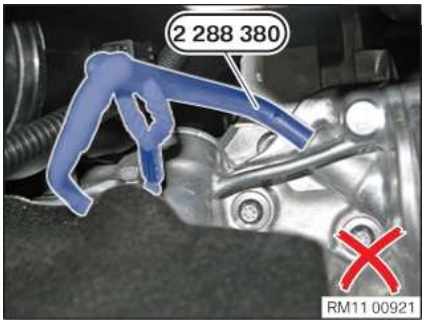
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

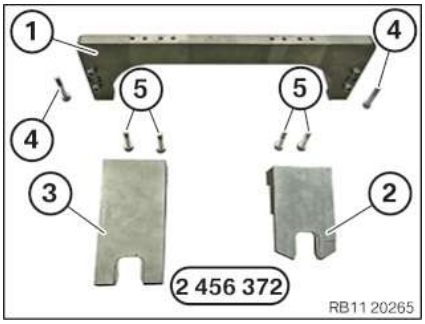


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

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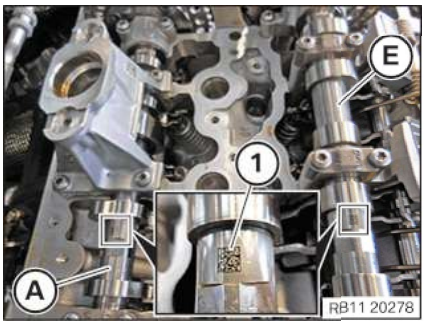
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

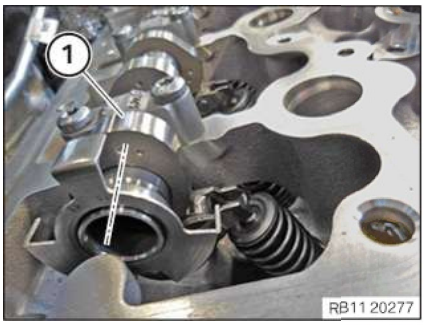


- Overview of the test gauges from the set of special tools 2 358 122:

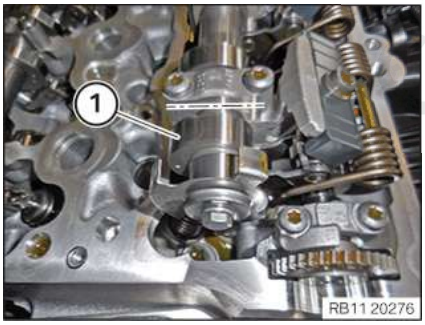
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



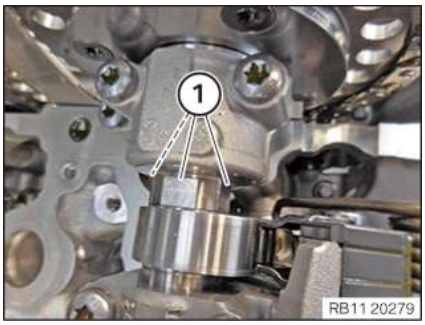
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

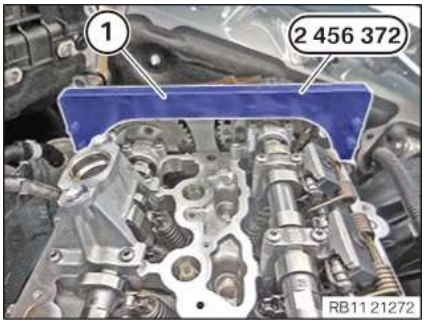


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

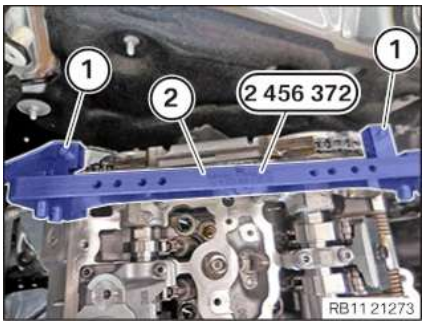


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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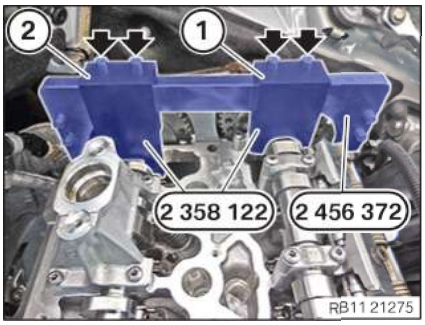
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

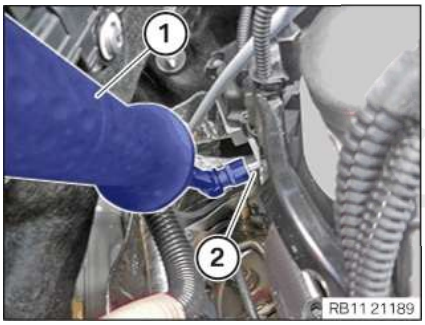
Test gauge to basic carrier

M6		Tightening torque	8 Nm

50 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

51 – Releasing the VANOS central valve of the intake adjuster

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- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

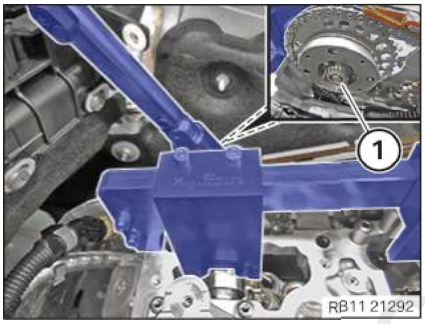
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

52 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

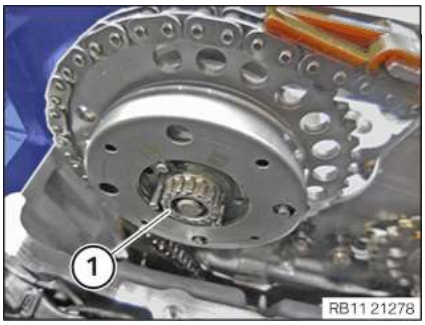


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

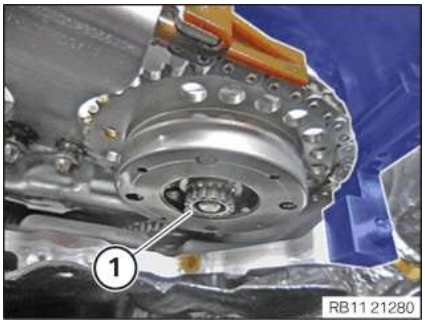
53 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

54 – Remove the VANOS central valve of the exhaust camshaft adjuster

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- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

55 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

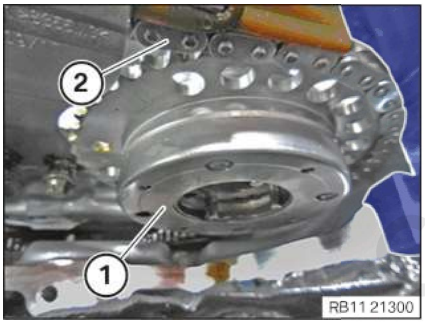


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

56 – Remove exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

57 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

MAIN WORK

58 – Remove cylinder head.

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CAUTION

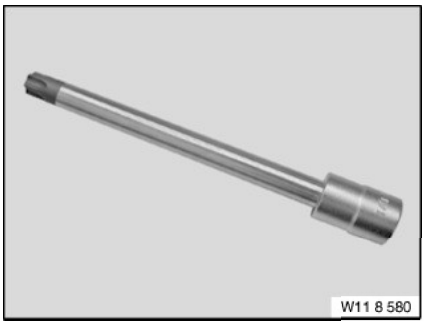
Heavy component.

Heavy components can lead to injury or damage.

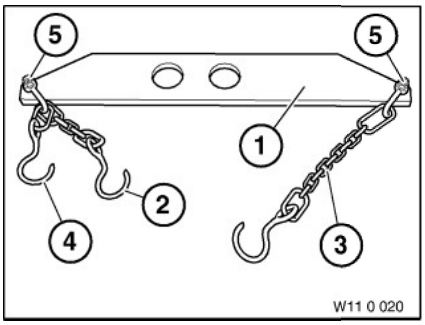
- Remove and install heavy components with the aid of another person/other persons.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



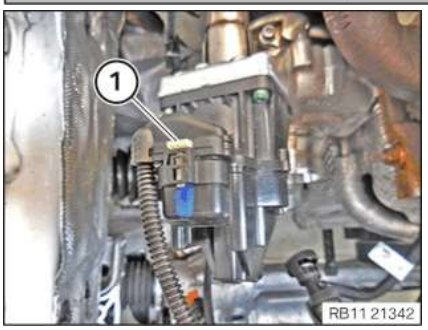
- Prepare special tool 0 495 747 (11 8 580).



- Prepare special tool .

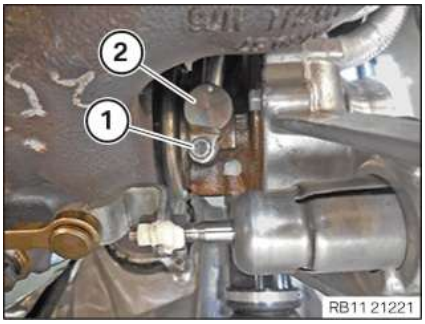


- Prepare the workshop crane 2 220 718.

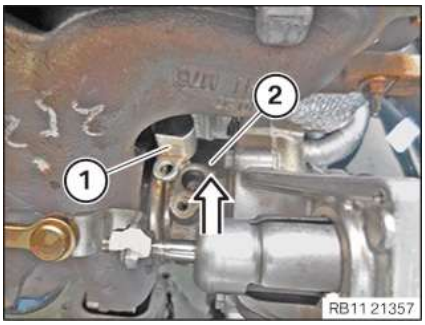


- Unlock plug connection (1) and disconnect.

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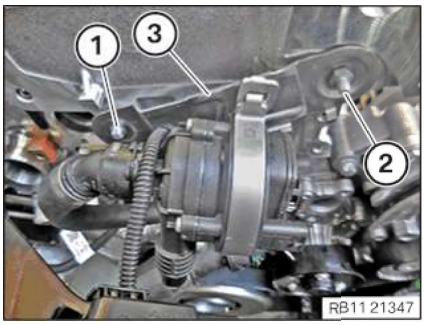
- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.



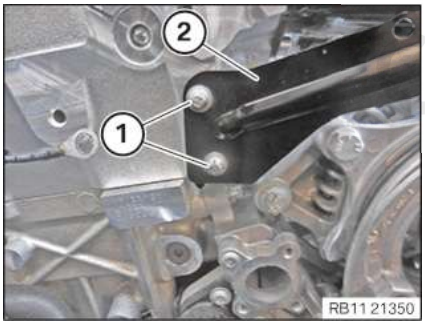
- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.

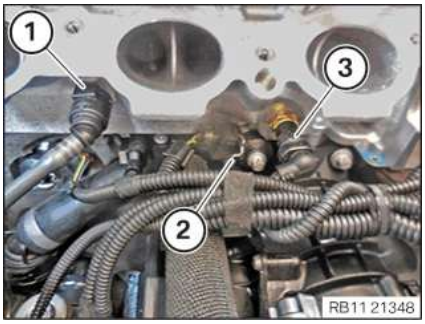


- Loosen screws (1).
- Thread out holder (2) and set aside.

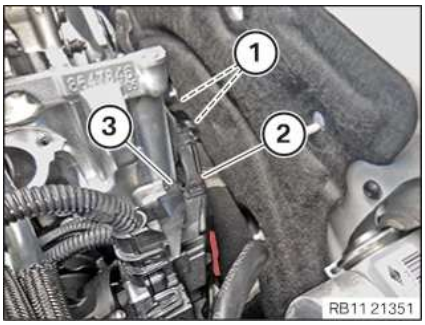


- Unlock plug connection (1) and disconnect.

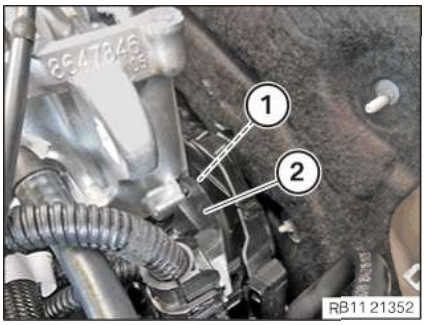
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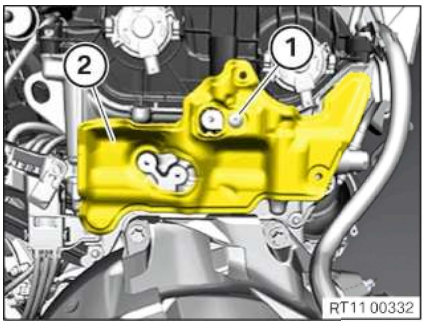
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



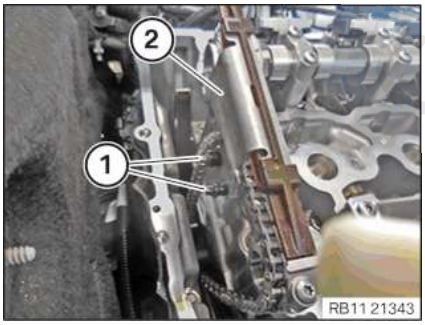
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



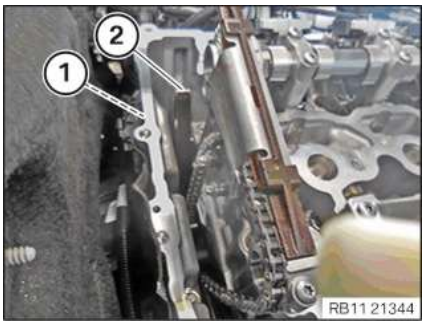
NOTICE

The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).



- Loosen screws (1).
- Guide out the slide rail (2) and remove.



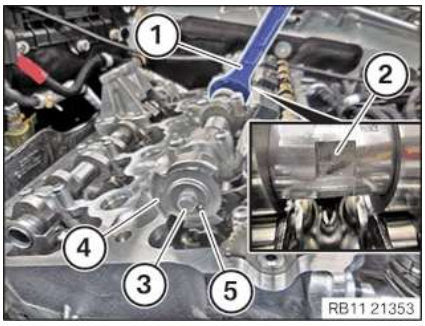
- Release the bearing journal (1) from the guide rail (2).



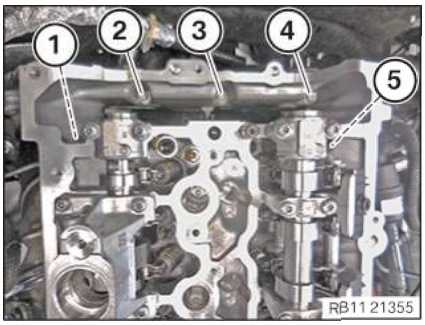
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

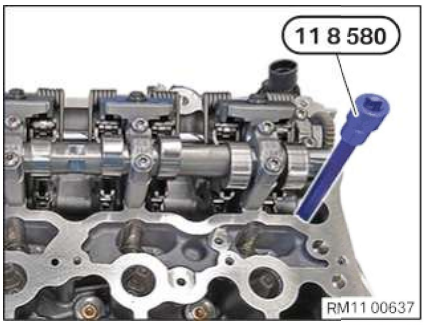
M8		Tightening torque	21,5 Nm



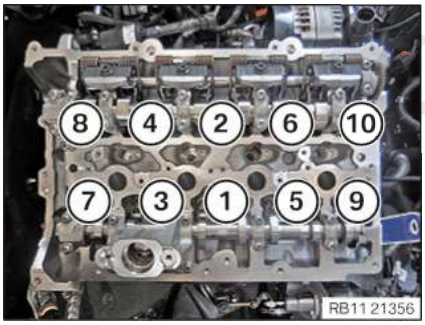
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.



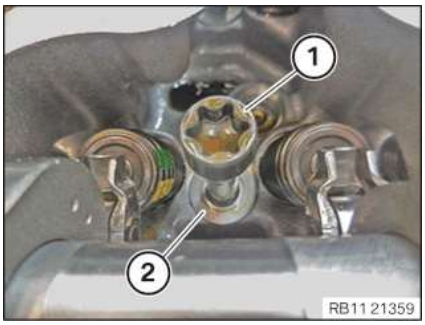
- Loosen the cylinder head bolts in the sequence from (5) to (1).



- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

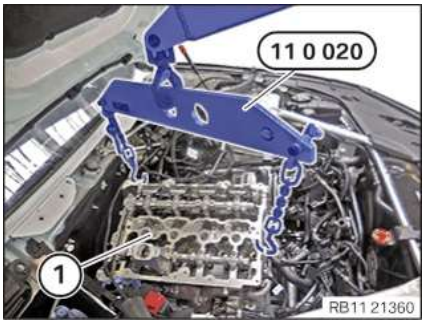


- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).

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CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

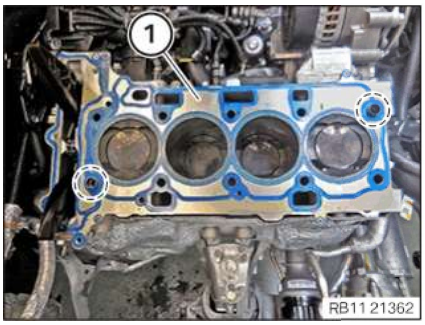
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

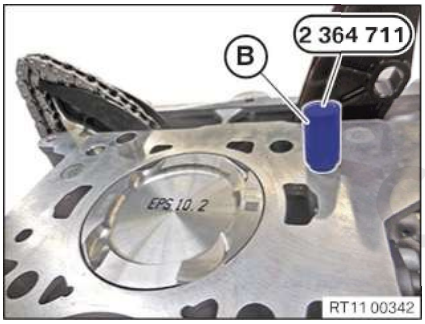
- Attach special tool to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an **auxiliary person**, the workshop crane and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

59 – Removing the cylinder head gasket



- Guide out and remove cylinder head gasket (1) in the **marked** area.

60 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

61 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

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- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.



CAUTION

Swirling dirt particles caused by compressed air.

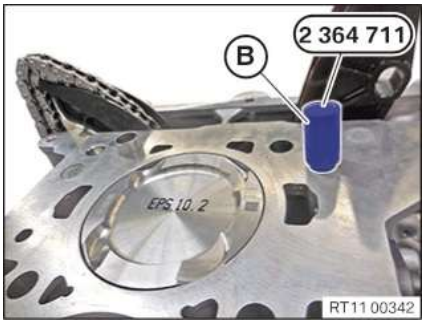
Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

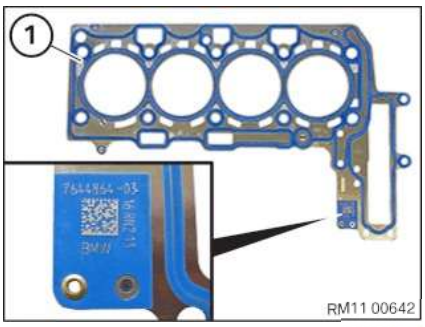
- Clean all the threaded holes in the **marked** area of the crankcase with compressed air.

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- Remove special tool (B) contained in the set of special tools 2 364 711.

62 – Renewing the cylinder head gasket

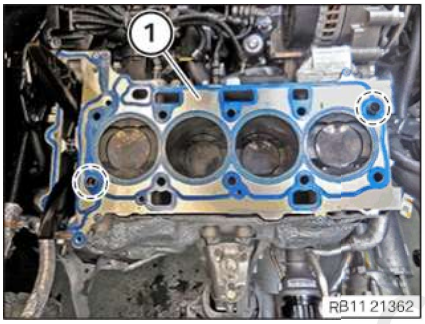


- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional thicker gasket 0.3 mm is available for service personnel.



- Check fitting sleeves (1) in the **marked** area for damage and, if necessary, renew them.



- Guide cylinder head gasket (1) into the **marked** area and install it.

63 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

- Dry threaded holes (e.g. using compressed air).

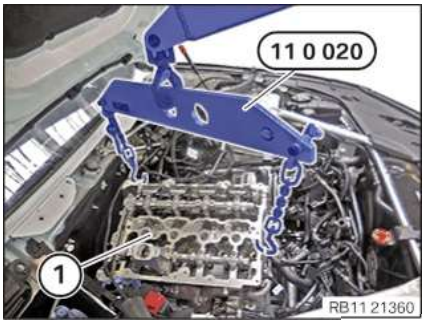
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TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



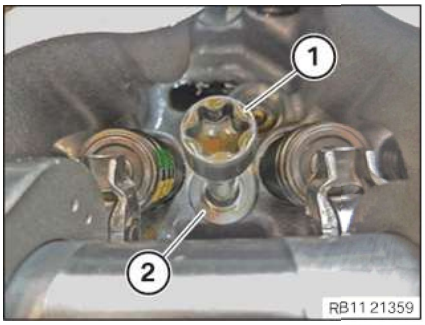
RISK OF DAMAGE

Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

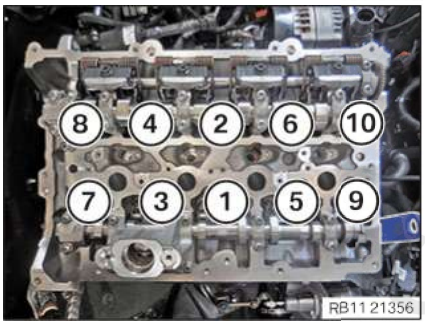
- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.



- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of engine block.
- Guide in and install cylinder head bolts (1).



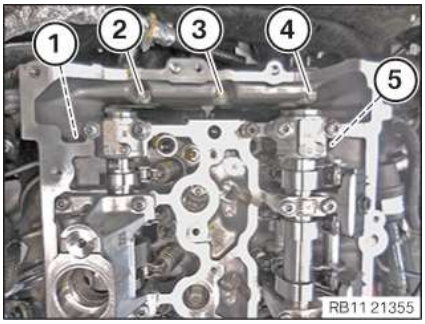
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °



- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

Cylinder head bolt to timing case cover

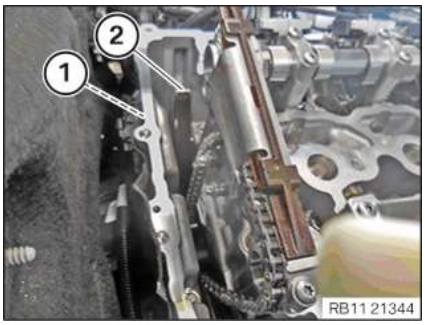
M8x40	Renew screws.	Tightening torque	19 Nm

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- Renew bearing journal (1).

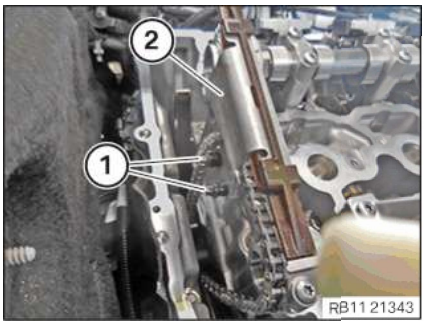
  Parts: Bearing journal



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

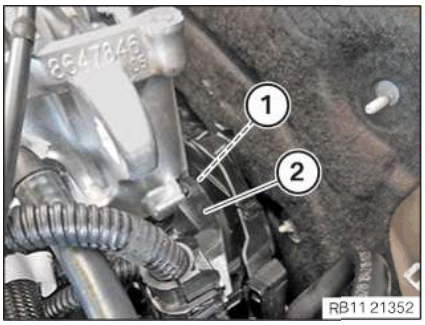
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

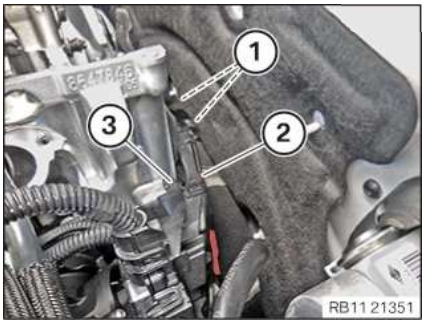
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

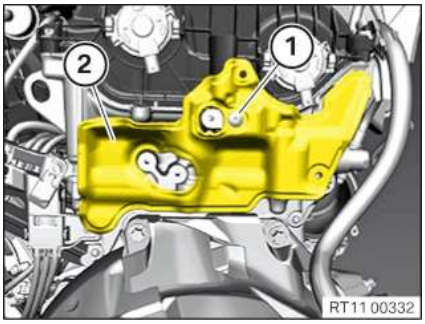
- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm

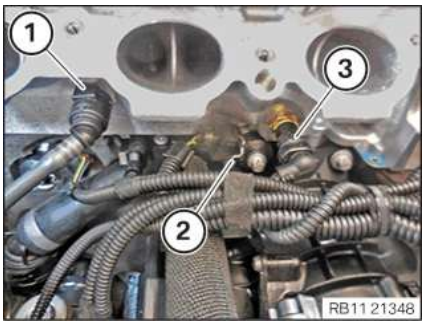
carofan.com



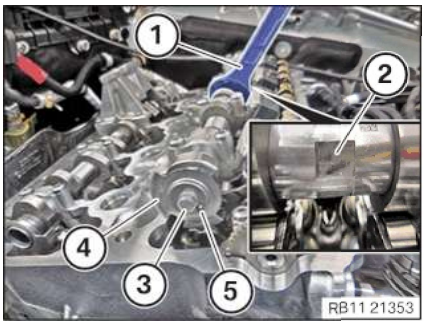
- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



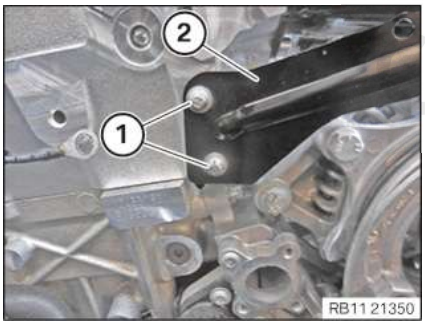
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm



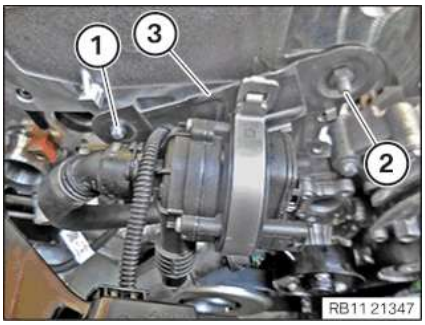
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

Holder for electrical auxiliary coolant pump on cylinder head

M6		Tightening torque	7 Nm

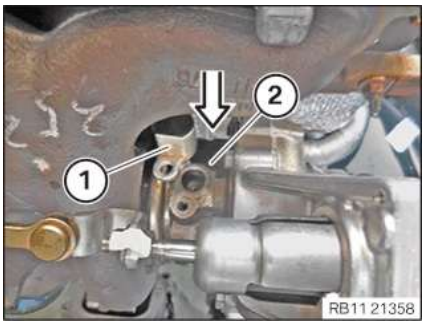
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- Thread in ground cable (2) and install.
- Tighten nut (1).

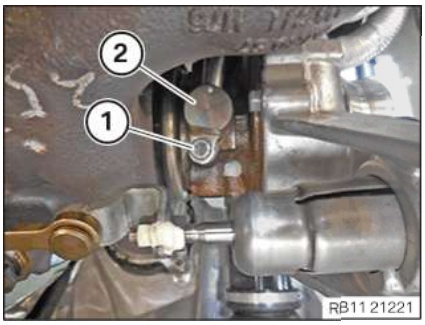
Standard screw connection M6

M6		8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

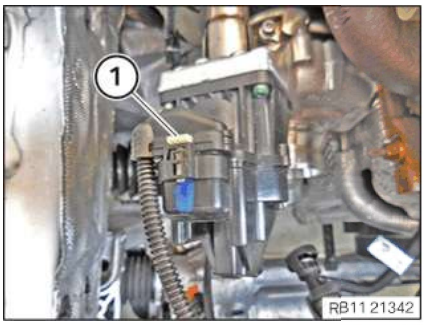
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm



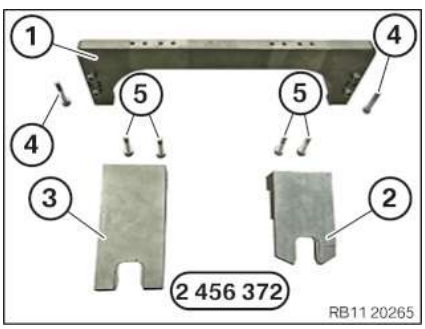
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

POSTPROCESSES

64 – Adjust the camshafts with the special tool



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

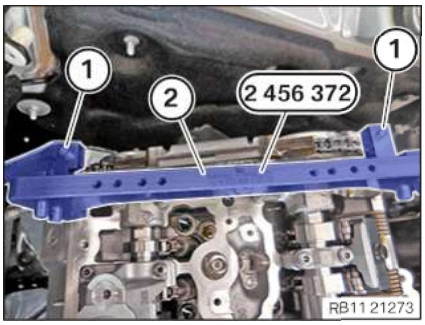
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- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



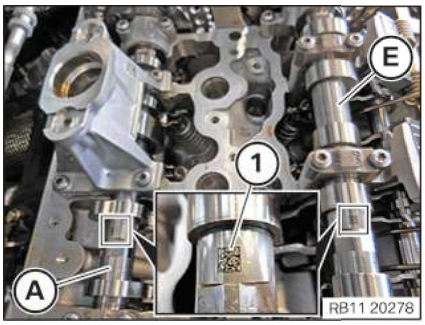
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



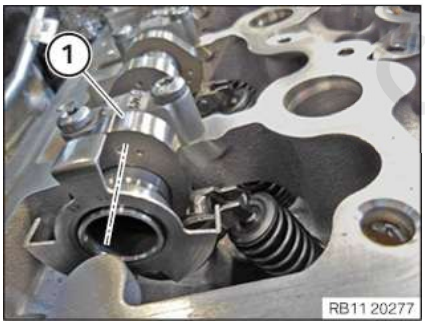
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

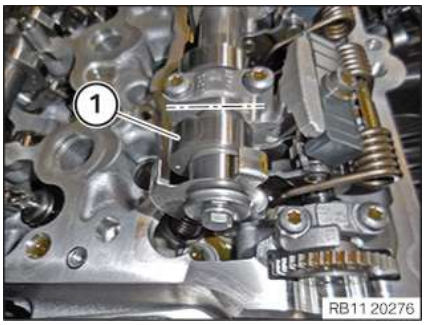
M6		Tightening torque	8 Nm



- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.

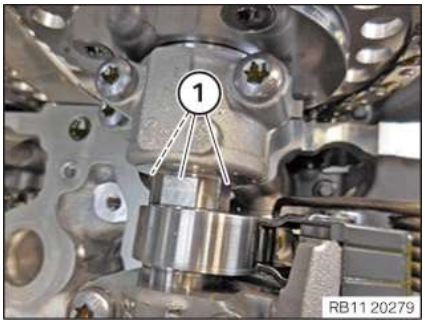


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

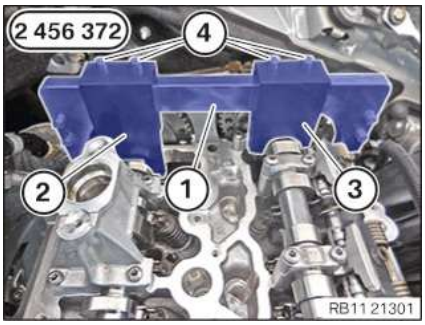


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

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- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

65 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

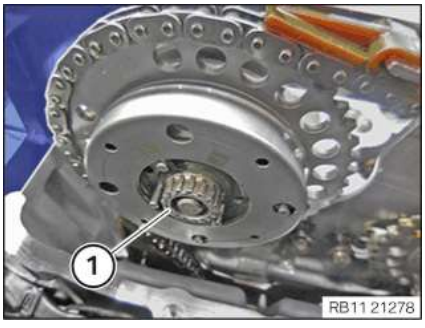


- Keep intake adjuster (1) marked IN ready.



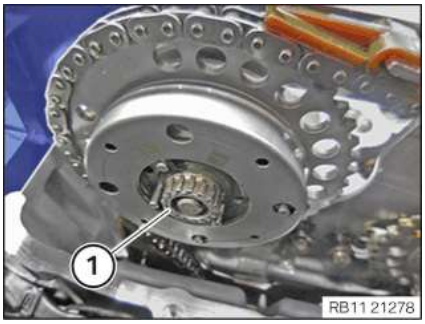
- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

66 – Install the VANOS central valve of the intake adjuster

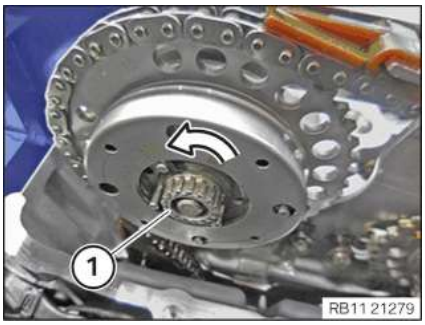


- Guide in the VANOS central valve (1) of the intake adjuster and install.

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- Hand-tighten the VANOS central valve (1) of the intake adjuster.



- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

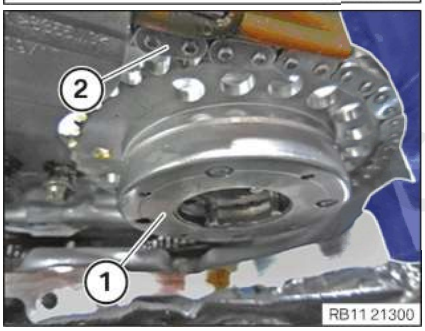
67 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

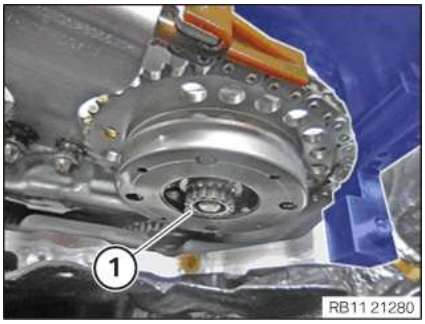


- Keep exhaust camshaft adjuster (1) marked EX ready.



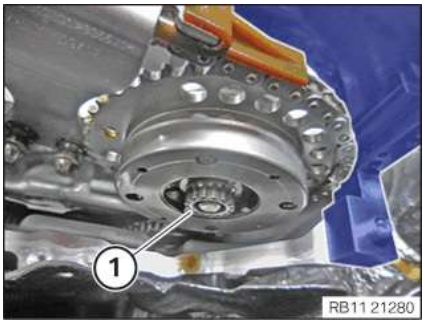
- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

68 – Installing the VANOS central valve of the exhaust camshaft adjuster

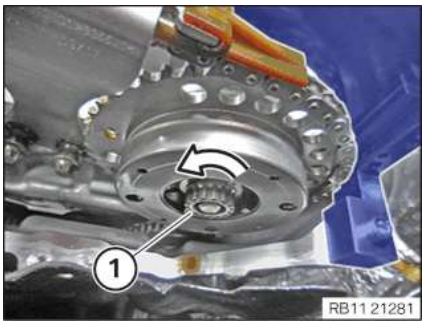


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.

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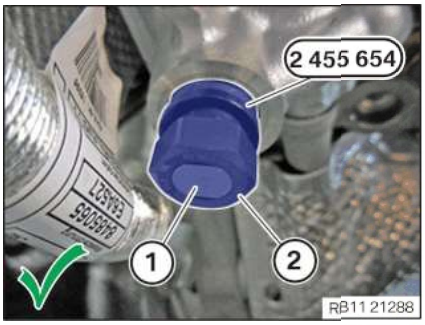


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



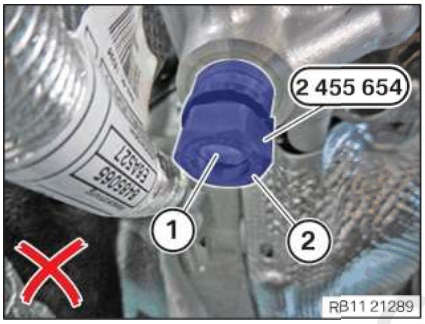
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

69 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

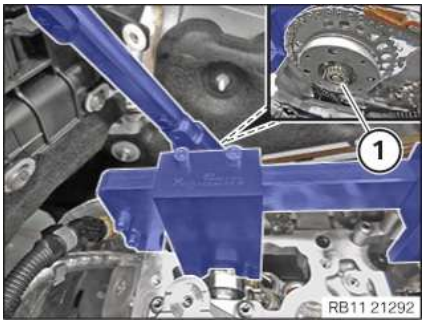
  The timing chain is **not correctly** pre-tensioned.

70 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

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- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

71 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

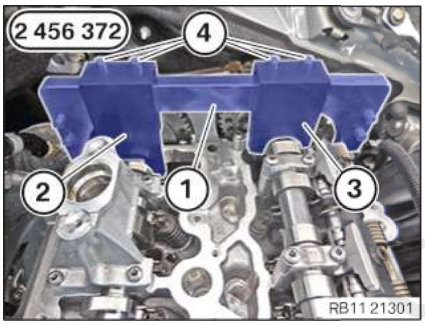


- Tighten the VANOS central valve (1) of the intake adjuster.

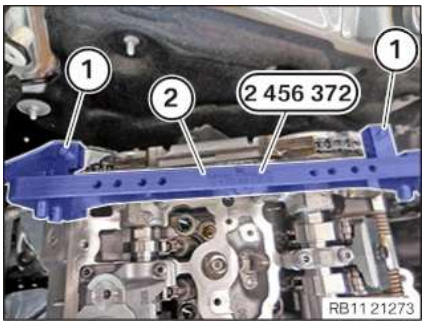
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

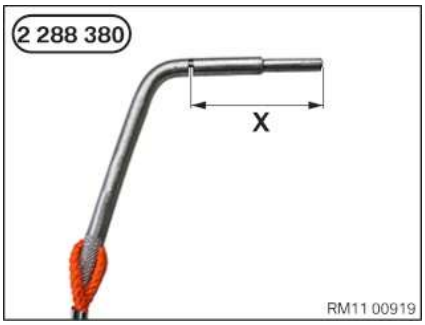
72 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.

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- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

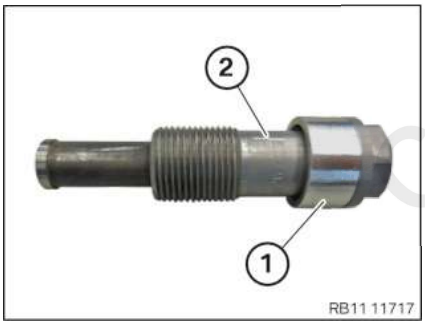
73 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



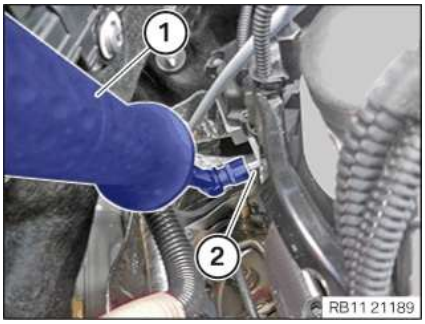
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

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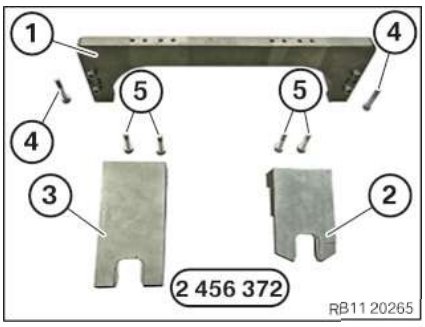


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

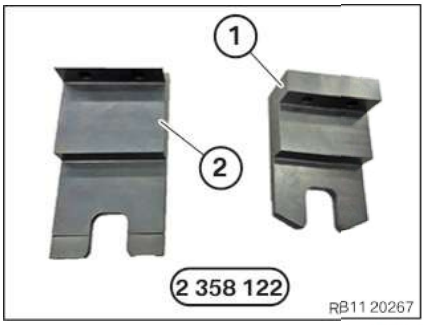
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

74 – Checking camshaft timing



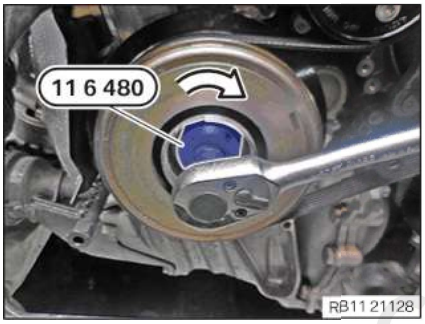
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



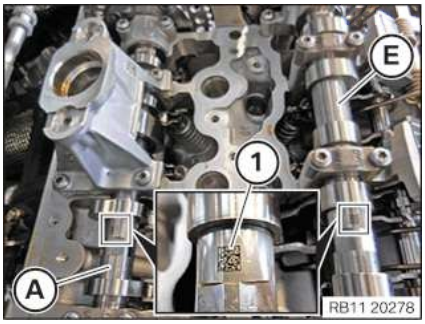
RISK OF DAMAGE

Damage to the engine.

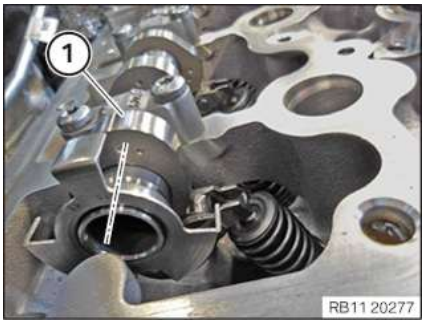
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

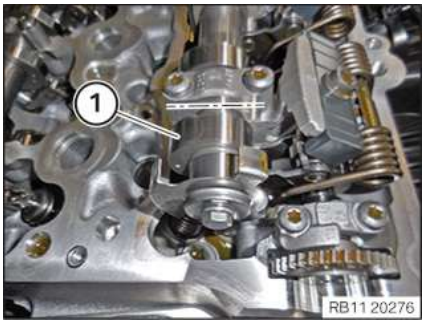


- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.

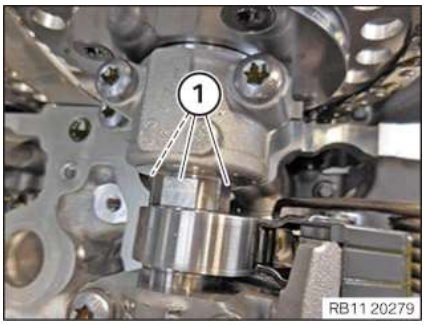


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

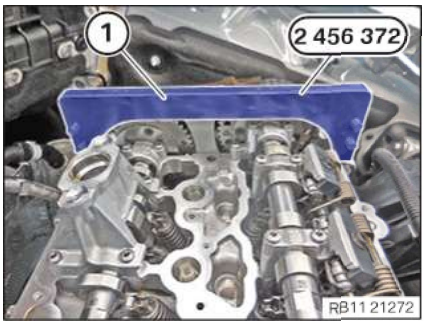
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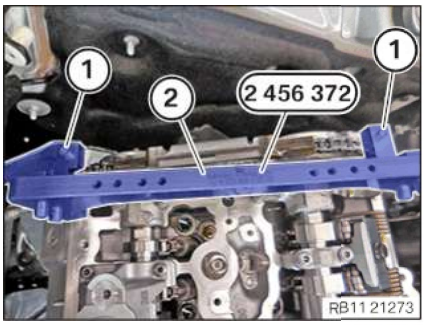
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



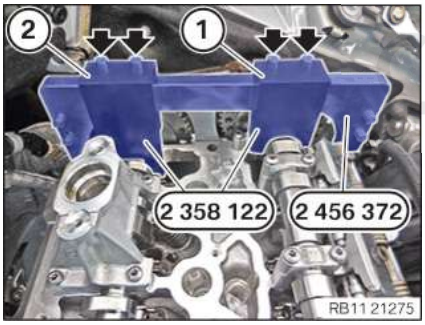
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

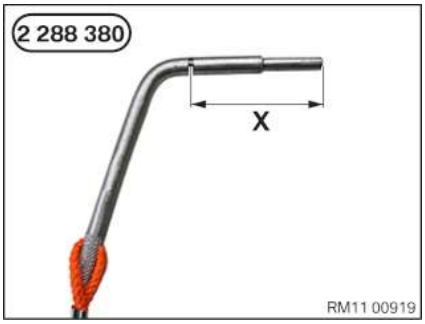
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

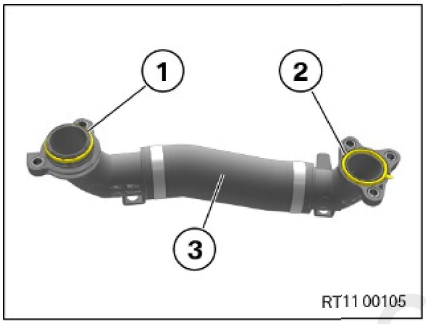


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

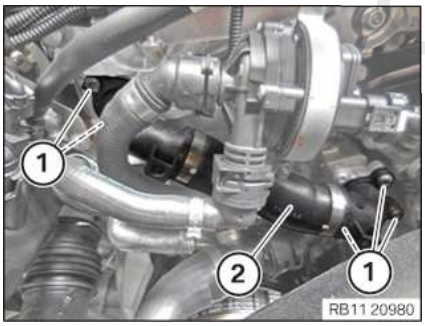
  The engine **is in the** TDC firing position of cylinder 1.

75 – Install the coolant line between the coolant pump and the cylinder head



- Check the sealing rings (1) and (2) for damage and if necessary, renew the coolant line (3).

  Parts: Sealing ring



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques. Non-observance of these requirements may result in leaks and damage.

- Feed in and install coolant line (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

Coolant line to coolant pump/cylinder head

M6x20		Tightening torque	8 Nm

76 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

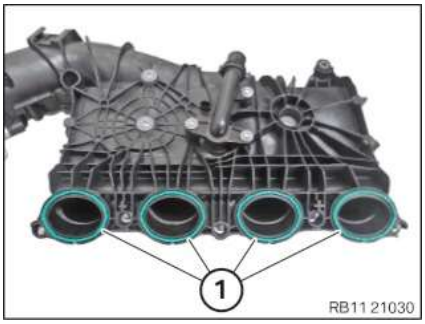
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

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TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

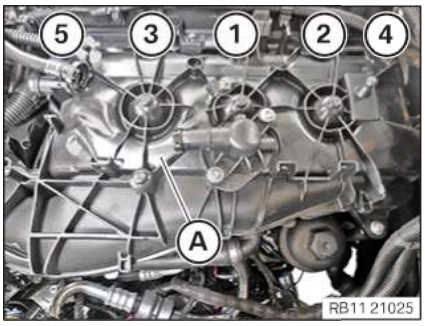


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

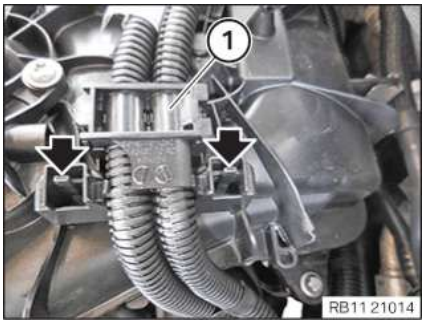


- Tighten down screw (1).

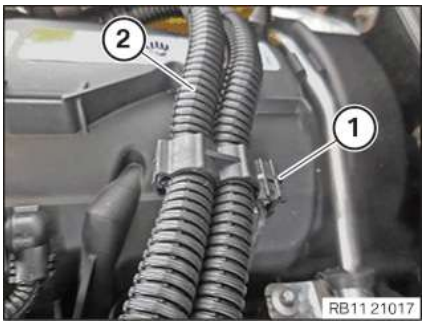
Intake plenum to support

M6X25		Tightening torque	8 Nm

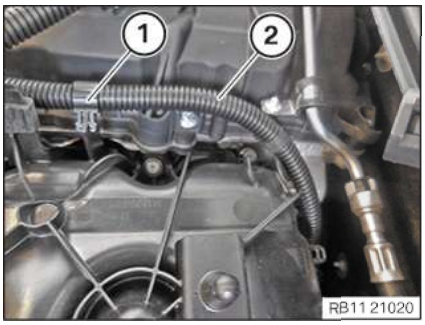
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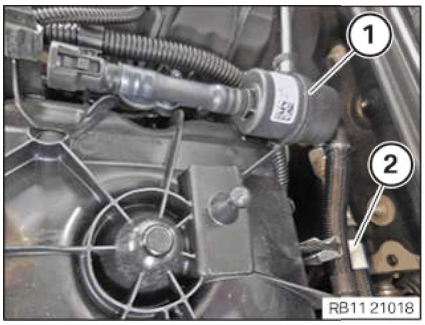
- Insert and install the wiring harness section (1) for the injectors and ignition coils.
  The locks (arrows) must engage audibly.



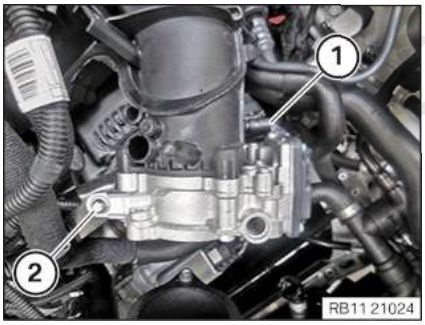
- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



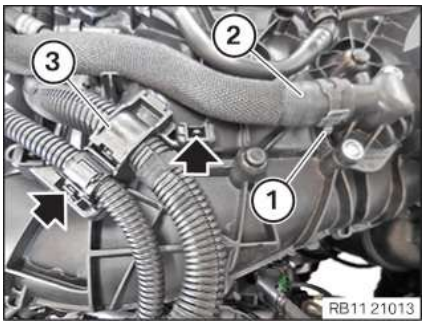
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

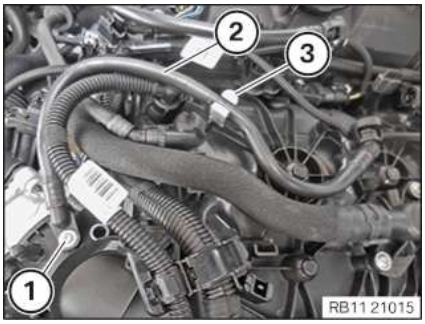
Throttle body to holder

M6X25		Tightening torque	8 Nm



- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

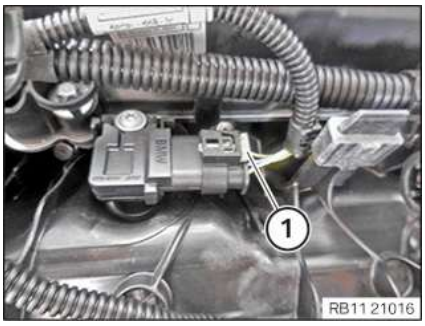
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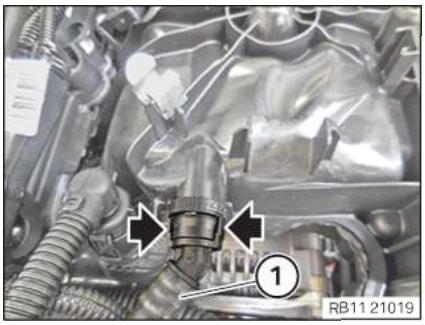
- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

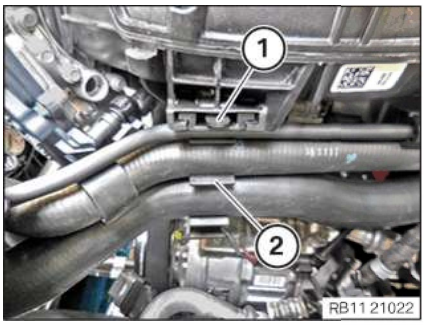
Oval-head screw		Tightening torque	3 Nm



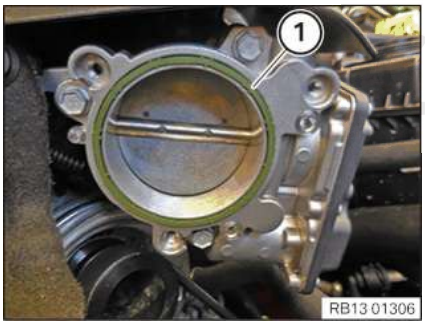
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.



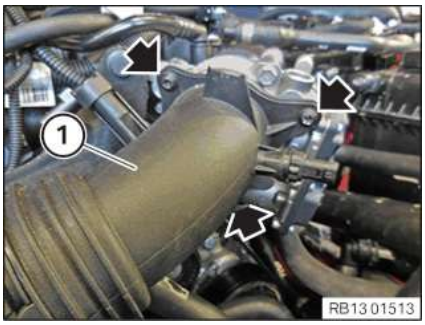
- Insert and install the tank ventilation line (1).
  The locks (arrows) must engage audibly.



- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).
  Parts: Gasket

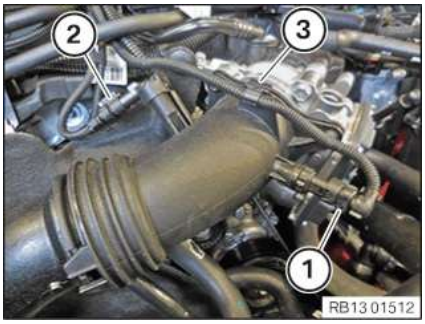


- Insert and install charge air line (1).
- Tighten screws (arrows).

Charge air line to throttle body

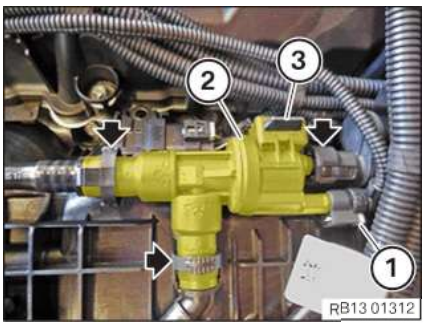
M6		Tightening torque	8 Nm

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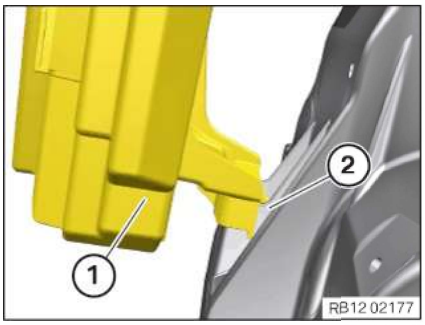
- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

77 – Installing the tank vent valve

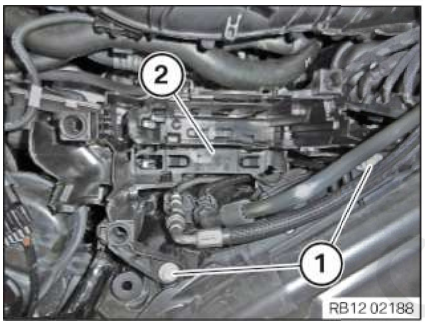


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).
  The connector (1) must engage audibly.

78 – Installing the control unit holder



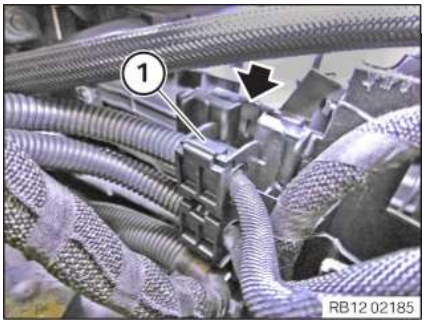
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



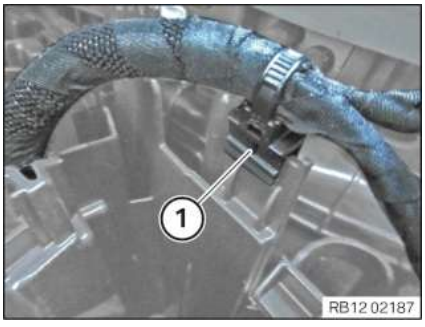
- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

Hexagon screw		Tightening torque	8 Nm

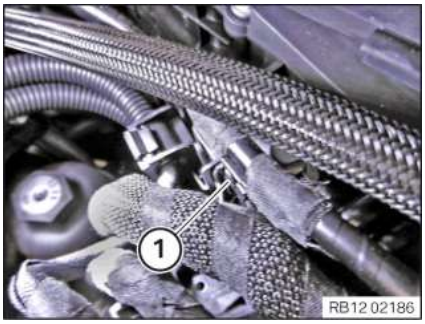


- Feed in and install the cable clip (1).
  Lock (arrow) must audibly engage.

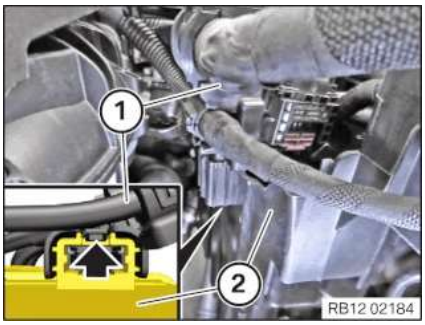


- Secure clamps (1).

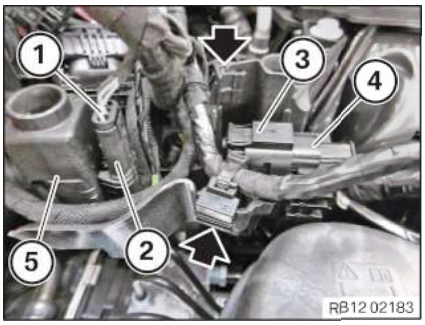
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- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

79 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

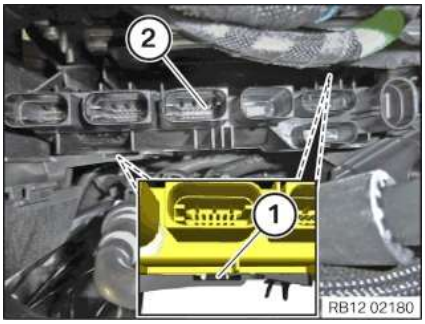
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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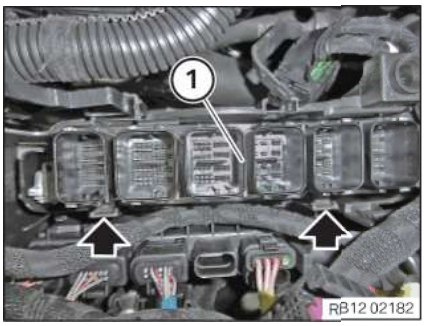


- Insert and install the integrated supply module (PDM) (2).
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).

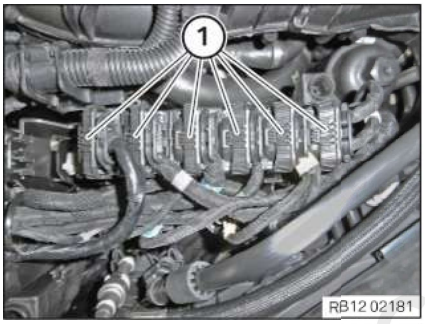


- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

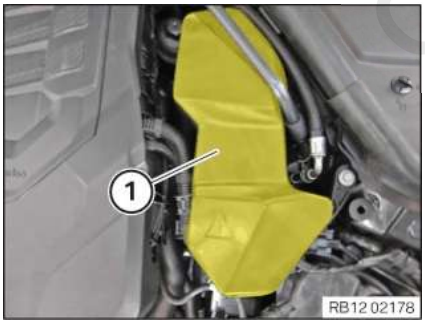
80 – Installing the DME control unit



- Feed in and install DME control unit (1).
  The locks (arrows) must engage audibly.

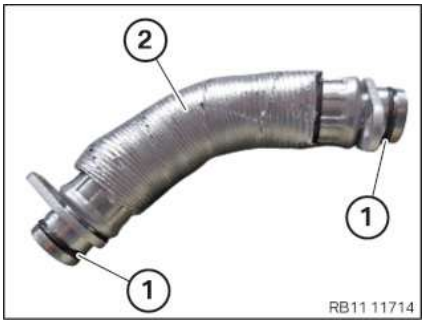


- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.



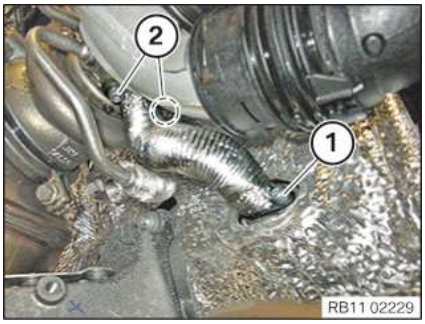
- Insert and install cover (1) into guides.

81 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).
  Parts: Sealing ring

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- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

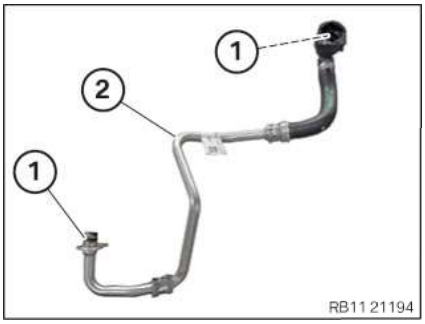
Oil return line to exhaust turbocharger/crankcase

M6x14		Tightening torque	8 Nm

82 – Install the coolant return line for the exhaust turbocharger

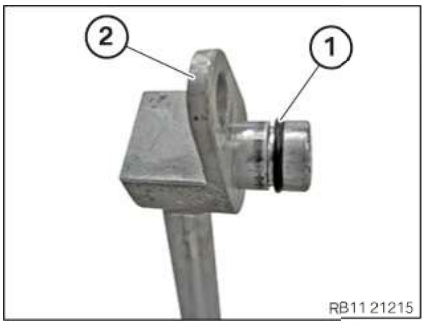
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



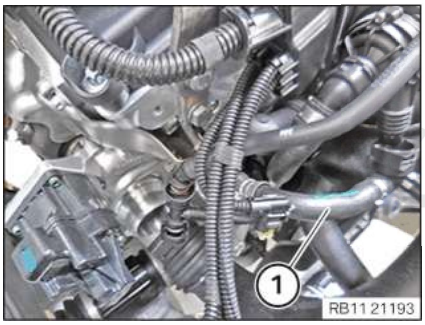
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-ring

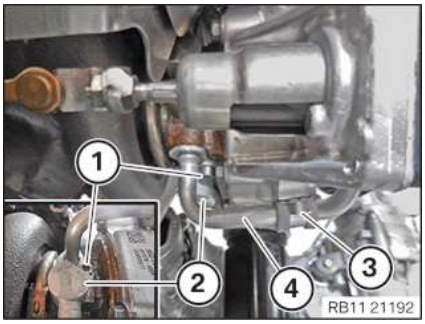


- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.

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- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

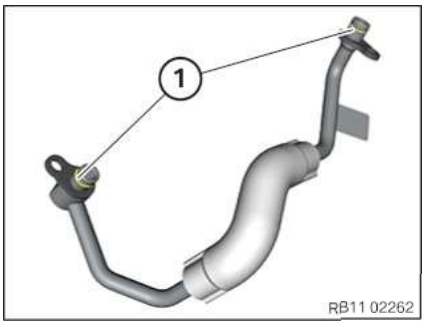
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

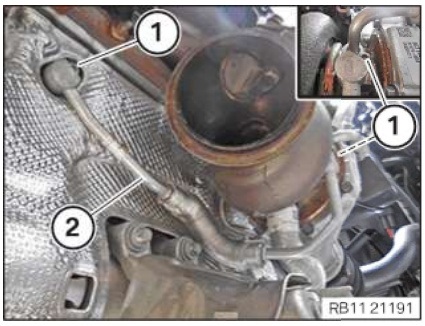
M6		Tightening torque	8 Nm

83 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

84 – Install catalytic converter



- Renew the V-clip (1).

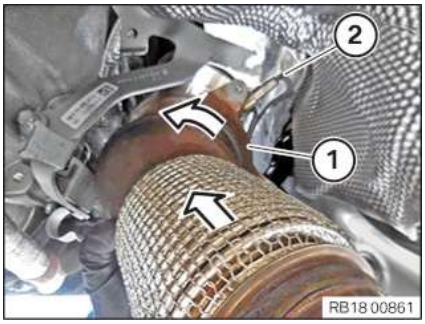
  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket

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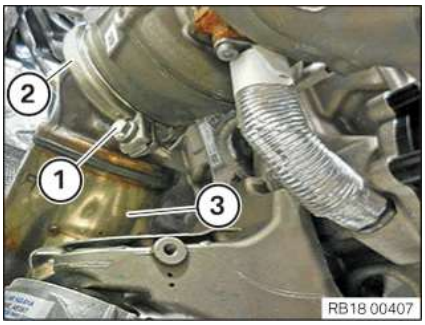
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

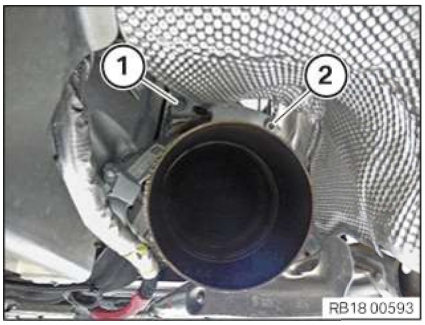
- Remove and install heavy components with the aid of another person/other persons.

- Guide in and install the catalytic converter (1) in the direction of arrow.
- Make sure that the monitoring oxygen sensor (2) **is not damaged.**



- Renew the V-clip (2).

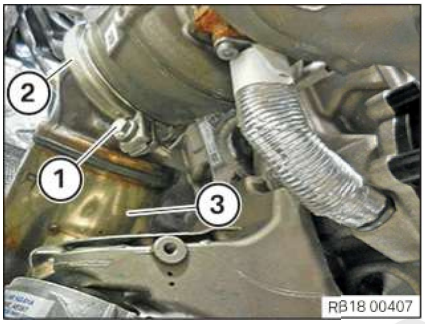
  Parts: V-band clamp
- Feed in and install V-clip (2) on the catalytic converter (3).
- Position the bolt (1).



- Renew the screw (1).

  Parts: Screw
- Position the bolt (1).
- Renew nut (2).

  Parts: Nut
- Position the nut (2).



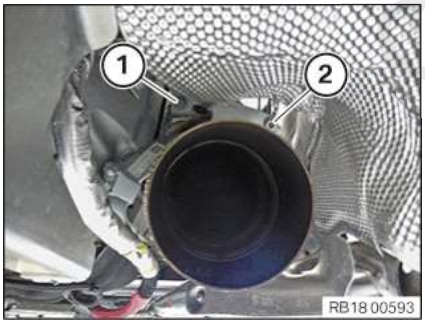
- Position the catalytic converter (3).
- Position V-clip (2).

Note: Ensure correct mounting orientation of the V-clip.

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm



- Tighten down screw (1).

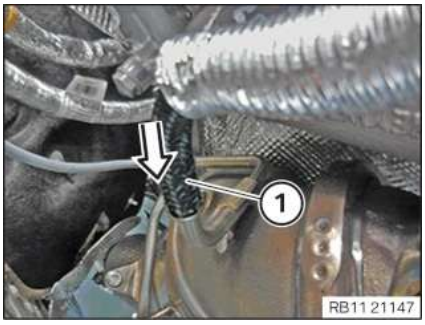
Catalytic converter to holder

M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm



- Check the pressure hose (1) for damage and renew hardened pressure hose (1) if necessary.
- Connect the pressure hose (1) in direction of arrow to the limit position.

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CAUTION

Component with heavy weight.

Danger of injury!

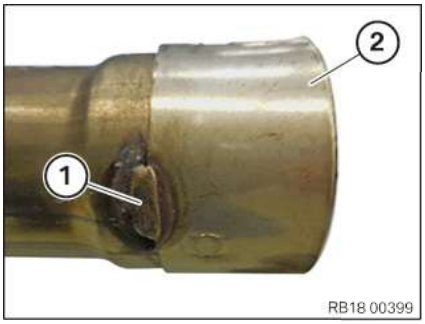
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



CAUTION

Swarf resulting from sawing or grinding components.

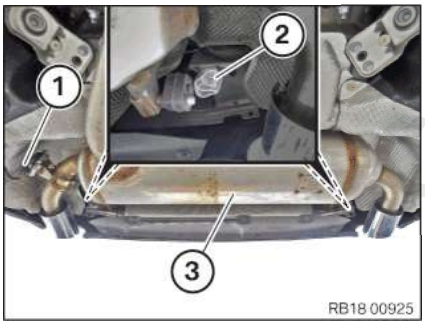
Danger of injury!

- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp



- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

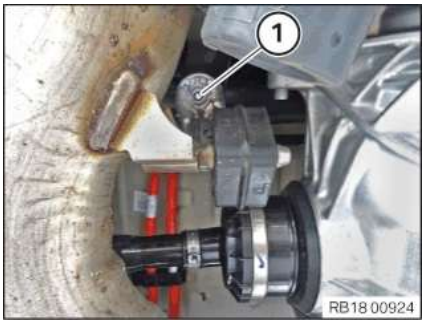
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm

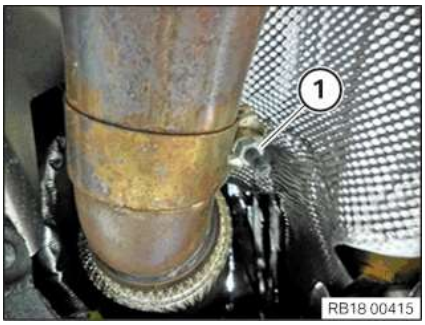


- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

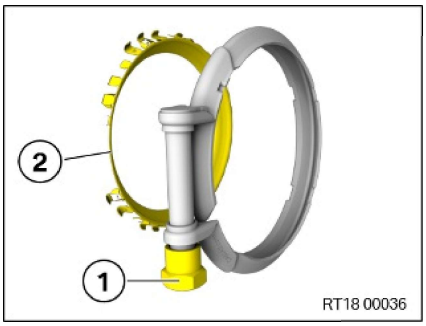
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

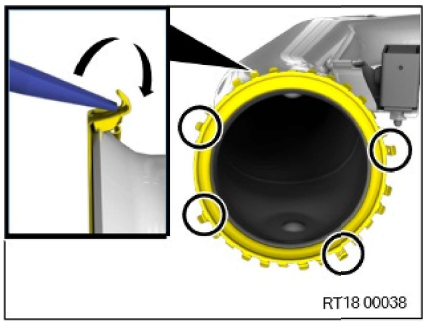


- **Equipment specification 2 (V-clips)**

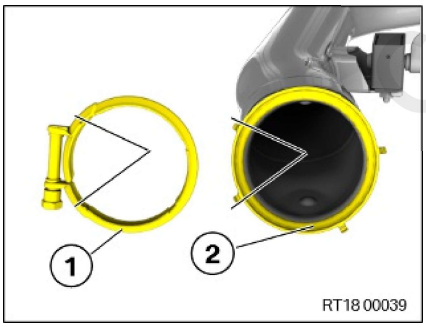
  Renew V-band clamp.

  Parts: V-band clamp

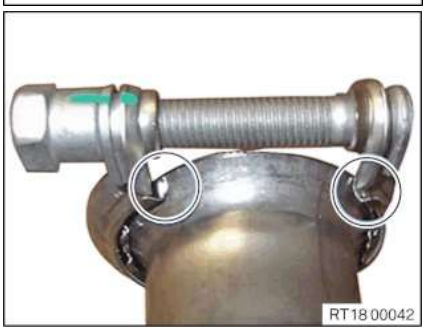
  Unscrew the nut (1) and remove the sealing ring (2).



- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.

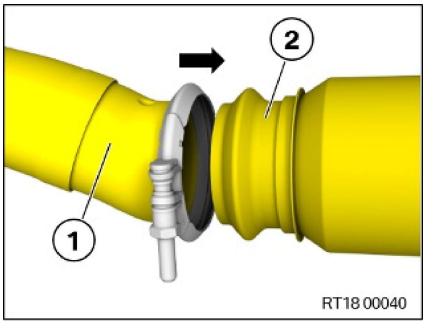


- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).

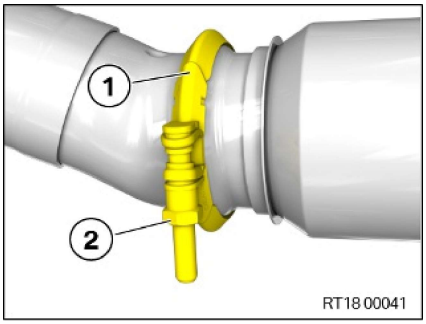


- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.

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- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).

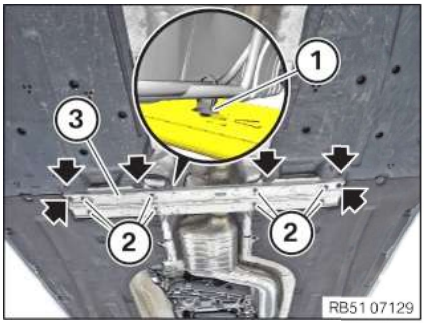


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

86 – Install the connecting supports on the tunnel



- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- Tighten screws (arrows).

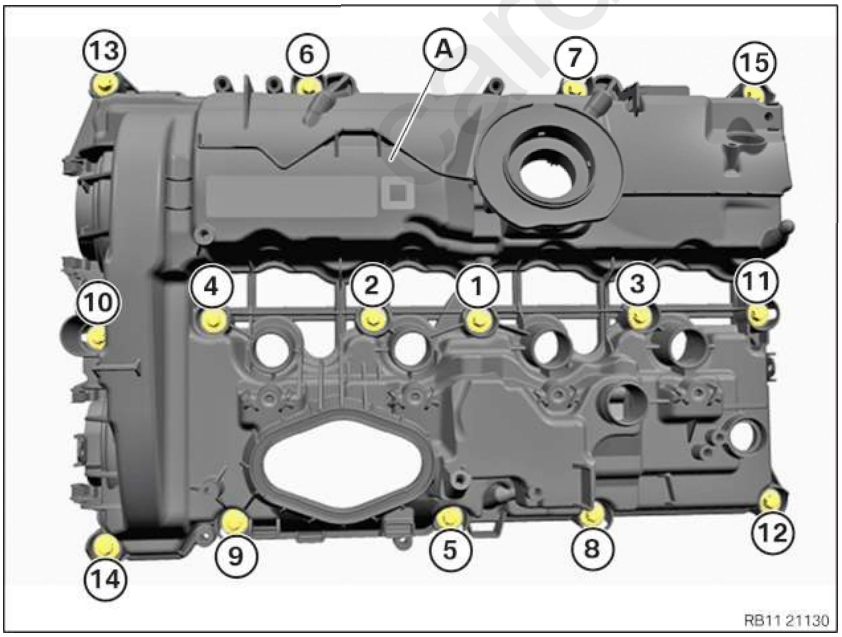
Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

87 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

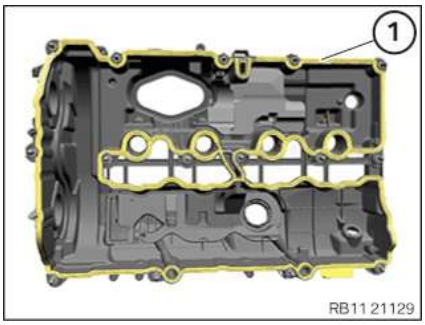
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RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

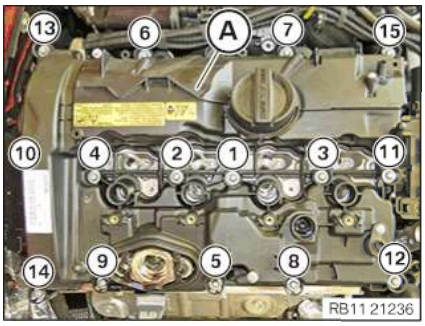
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques. Non-observance of these requirements may result in leaks and damage.

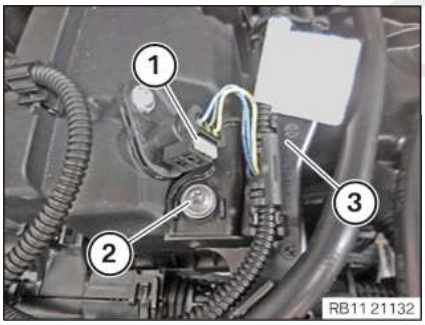
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

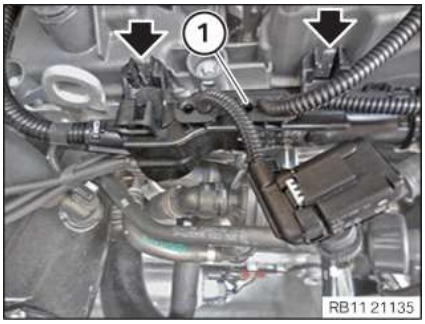
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

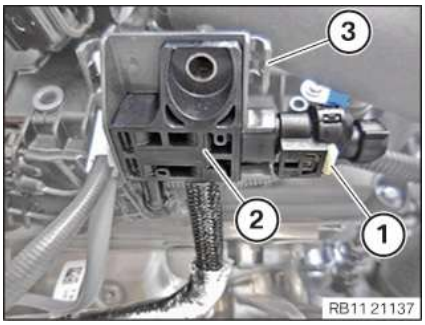


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

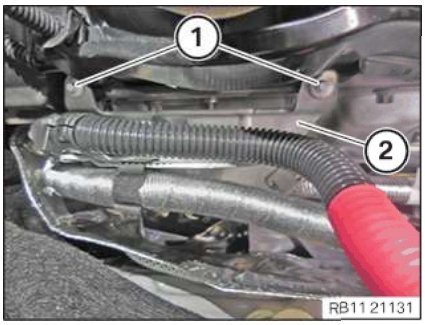
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- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

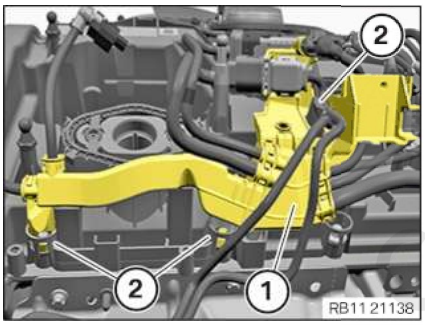
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

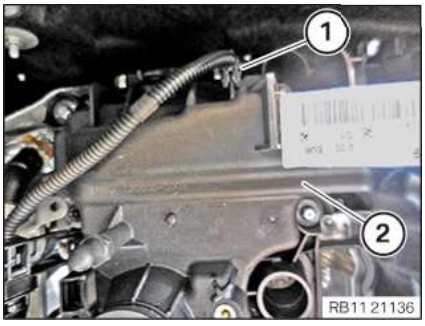
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

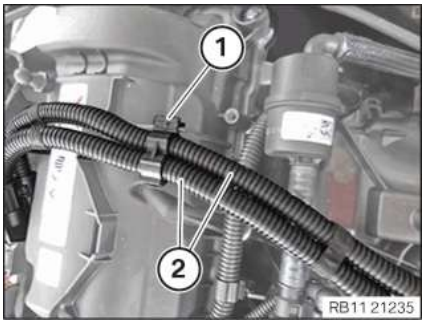
6X18	Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.



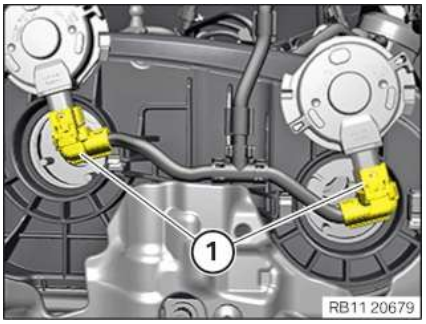
- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

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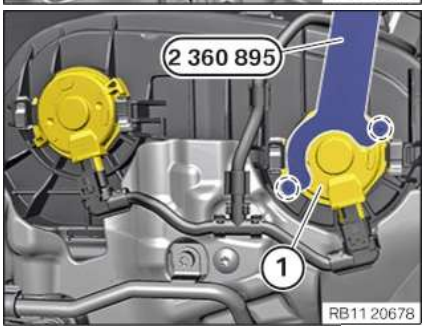
88 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

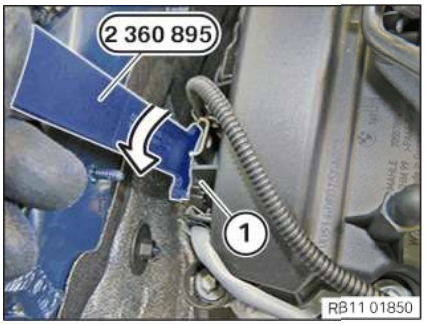
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



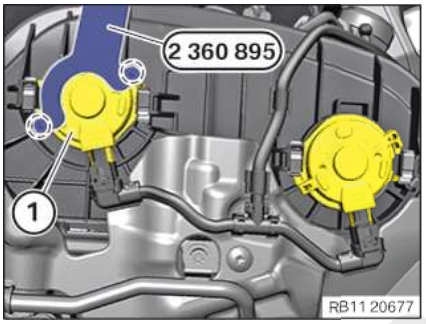
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



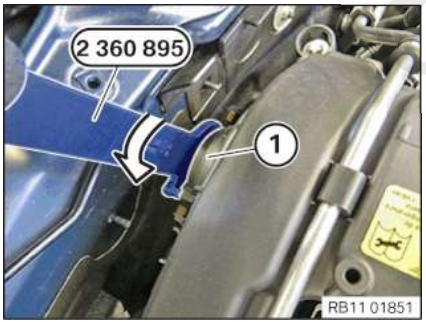
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

89 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

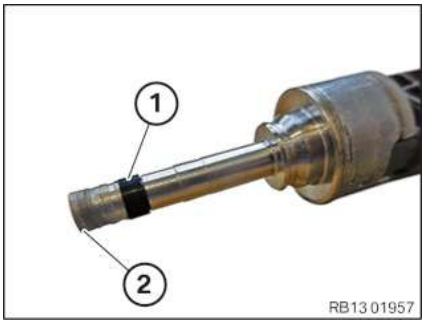
- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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TECHNICAL INFORMATION

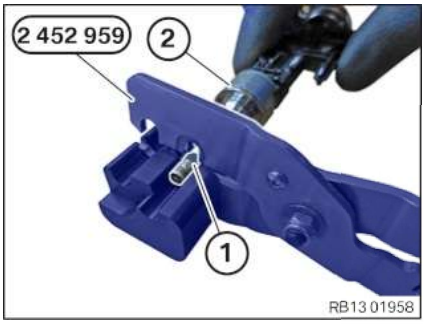
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

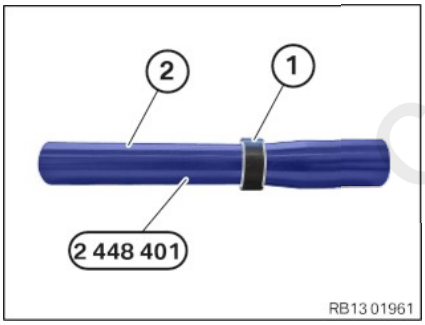


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

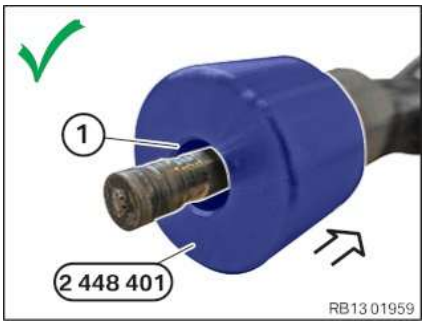
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



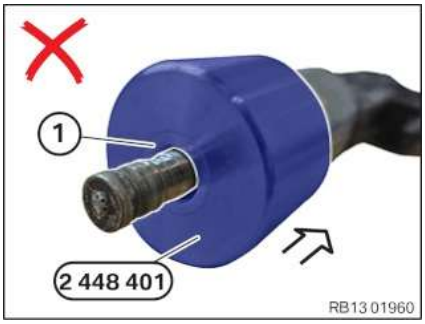
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

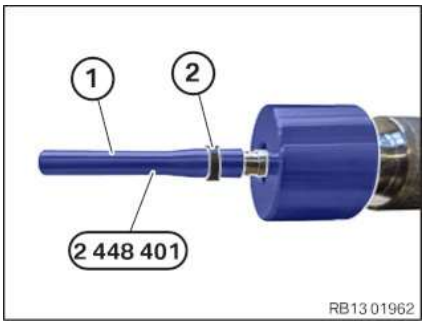
  The larger diameter of the assembly sleeve (1) must point to the injector tip.

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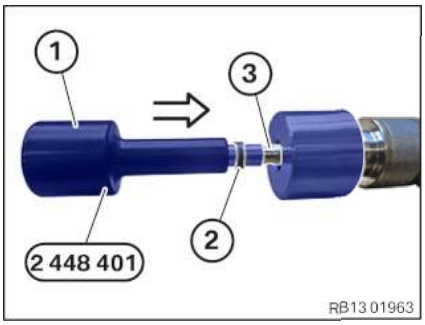


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

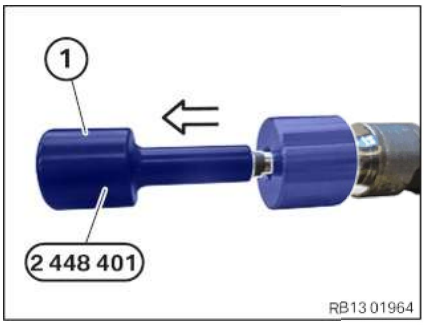
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



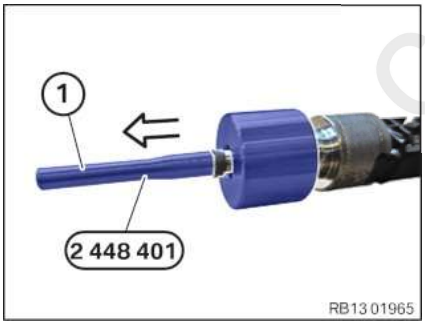
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



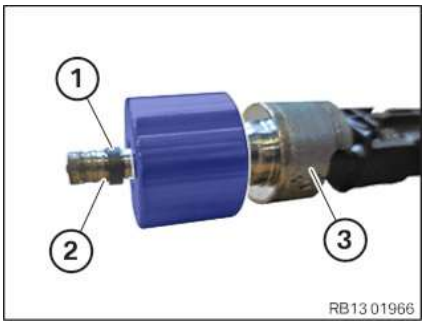
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

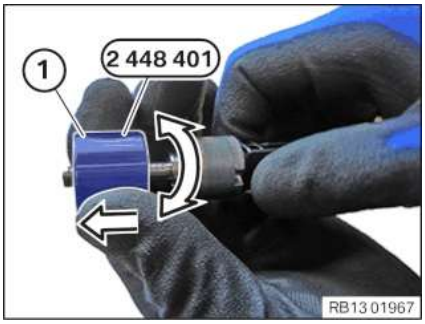


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



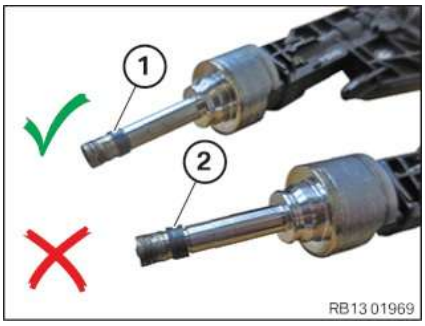
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

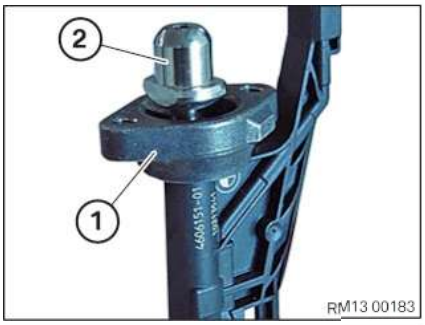


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

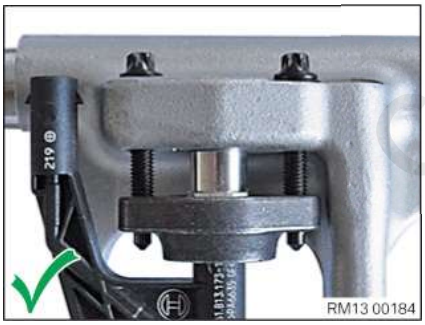
90 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

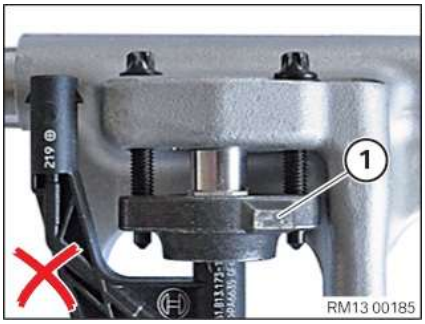


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

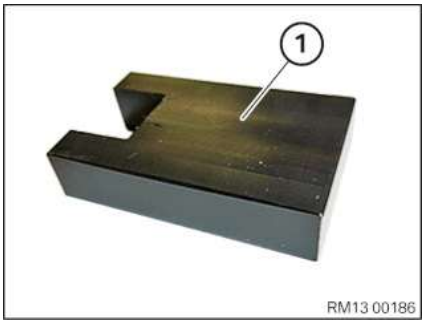
  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.

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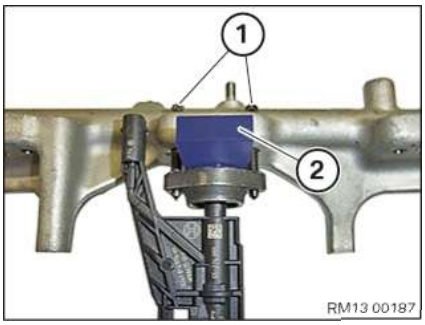
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



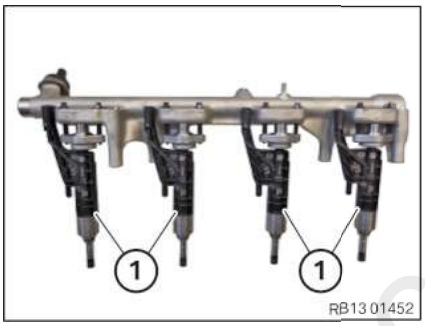
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



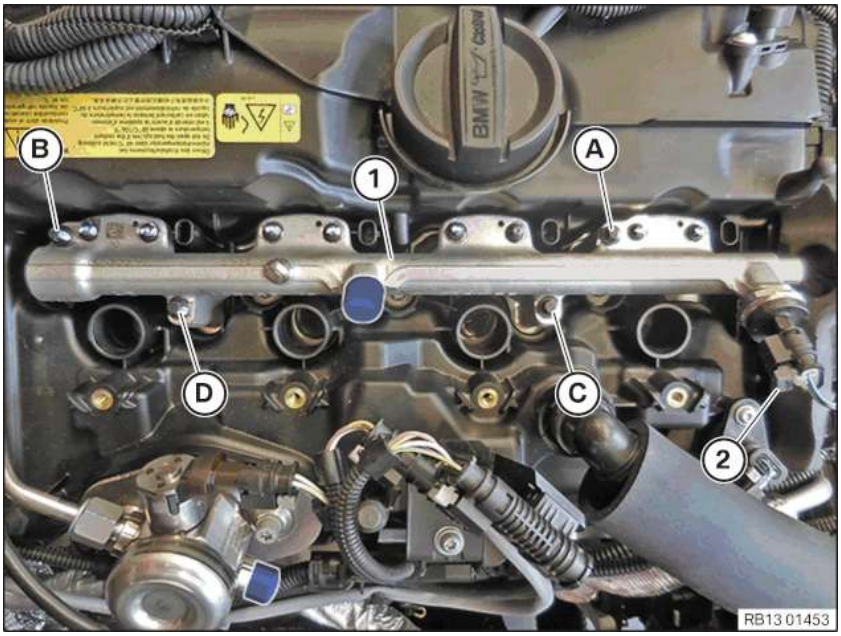
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

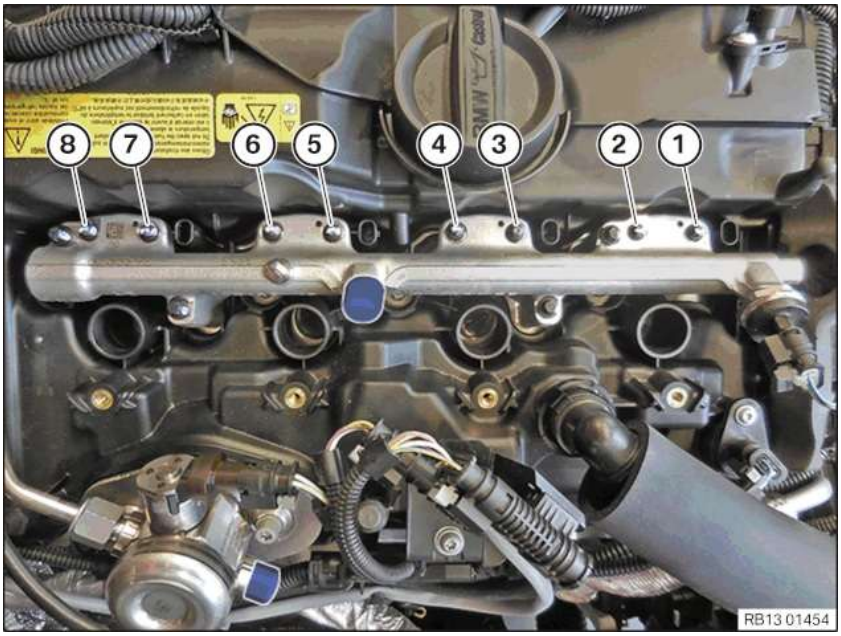
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

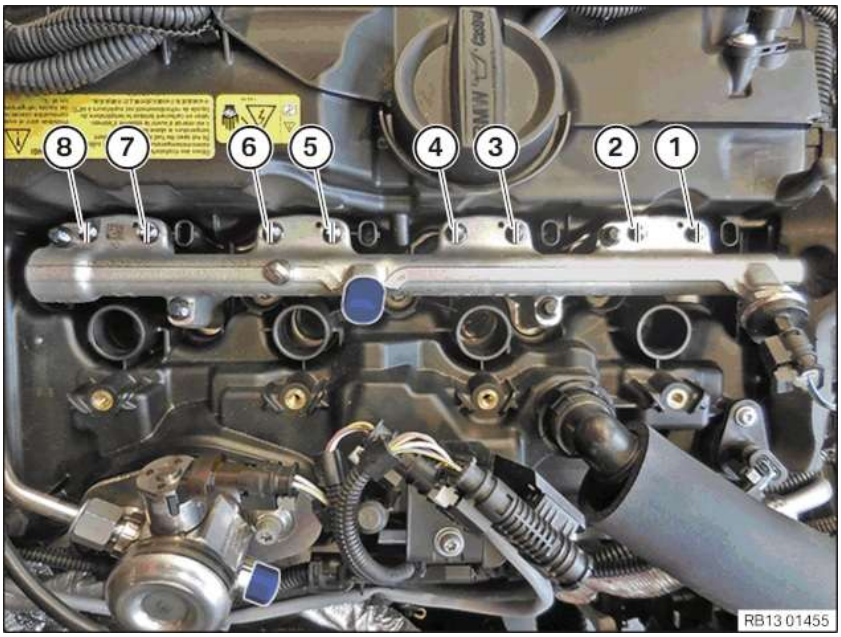
  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

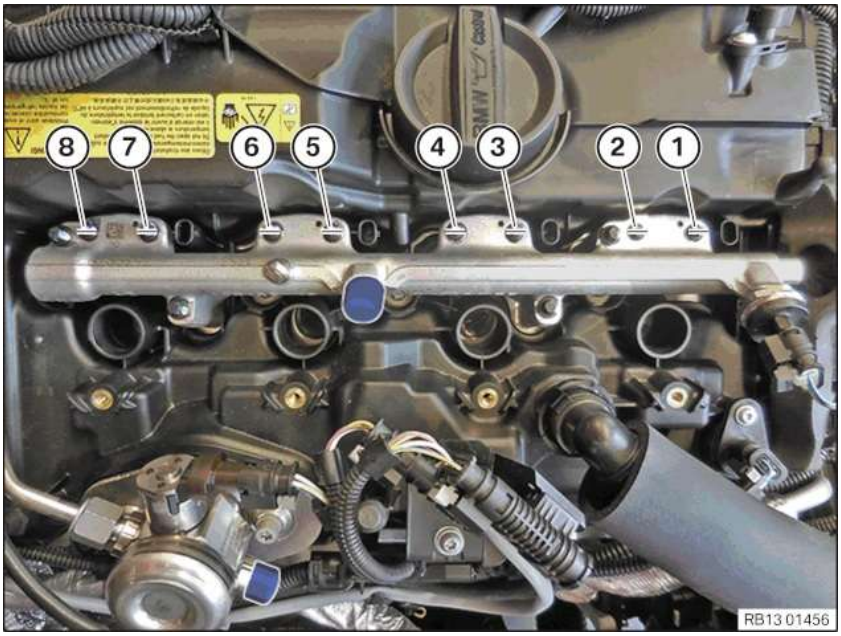
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.



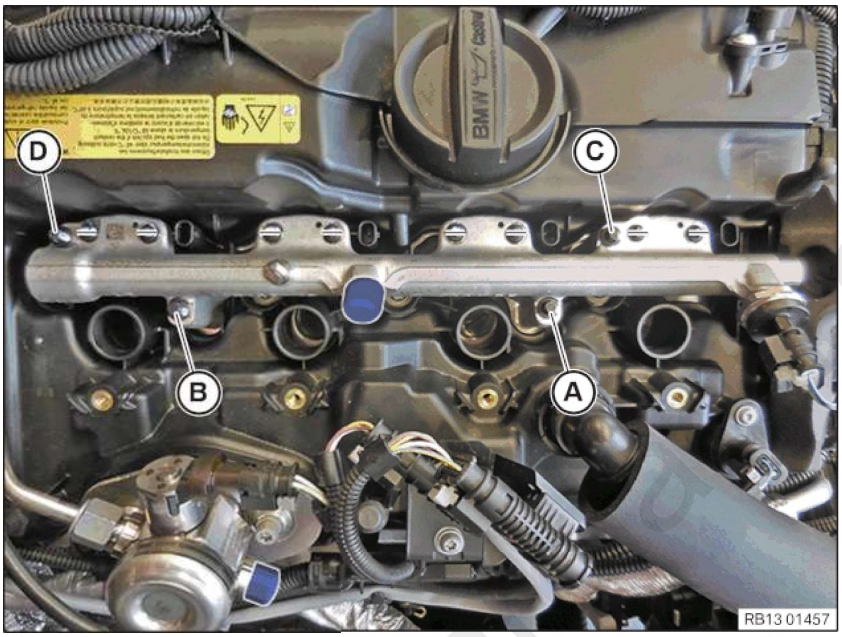
- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.

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- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

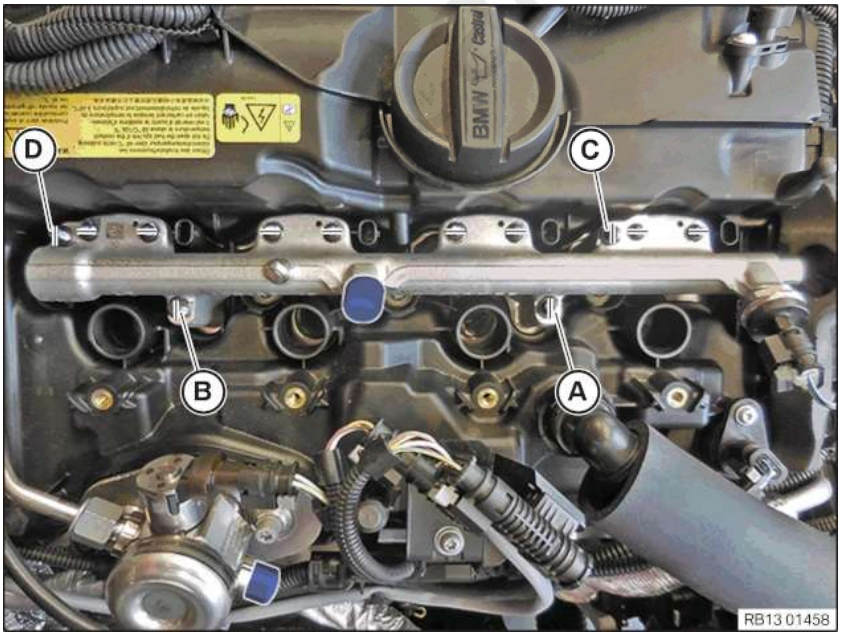
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

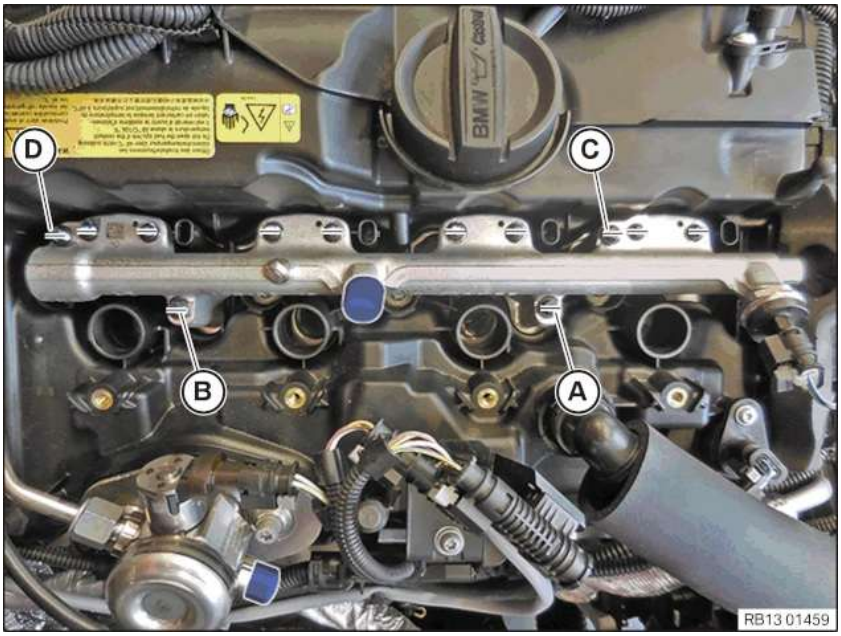
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

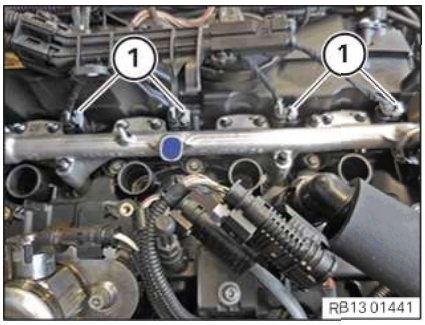


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



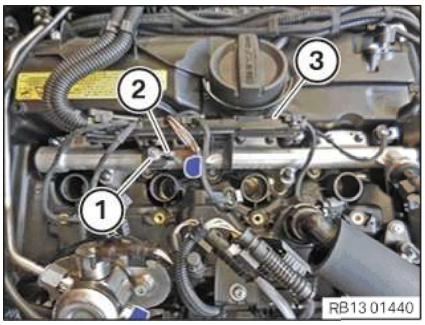
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6	Tightening torque	5 Nm

91 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

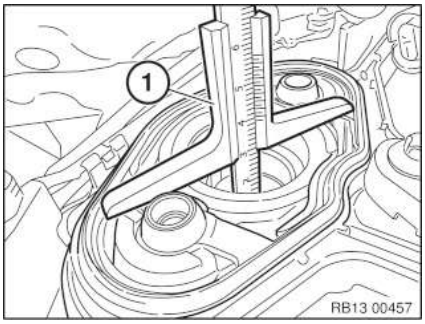
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

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- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

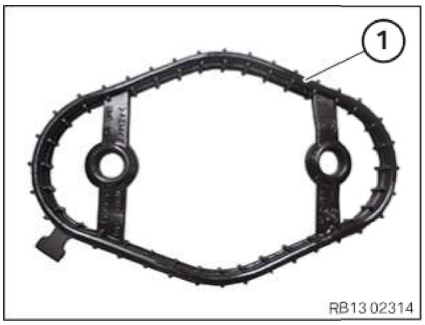
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

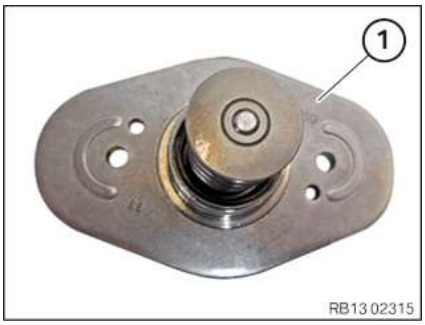
The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

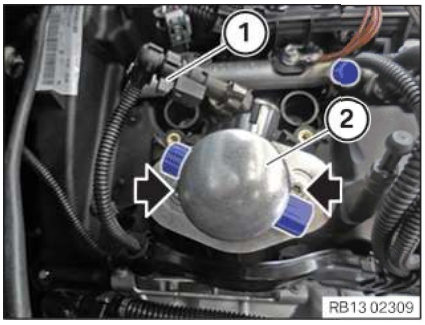
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

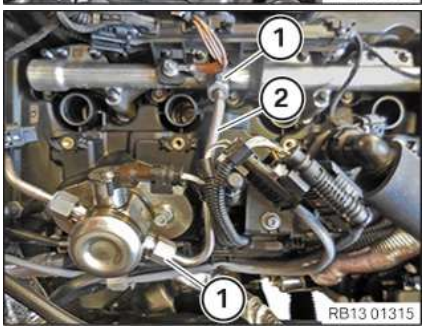
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

92 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

93 – Installing fuel delivery line

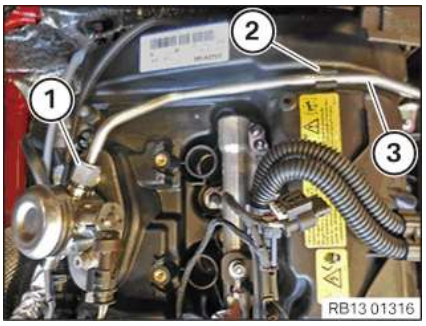
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RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

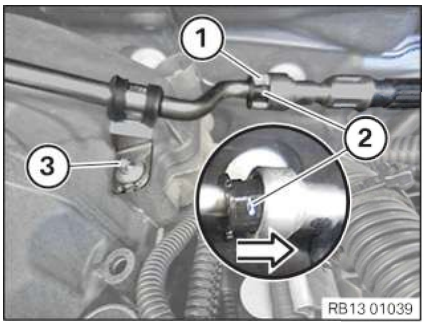
- Route all cables without abrasions, do not trap and crush.



- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

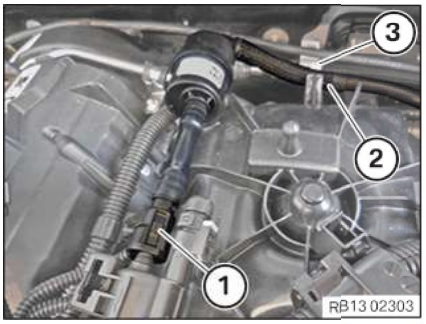
M14		Tightening torque	31 Nm



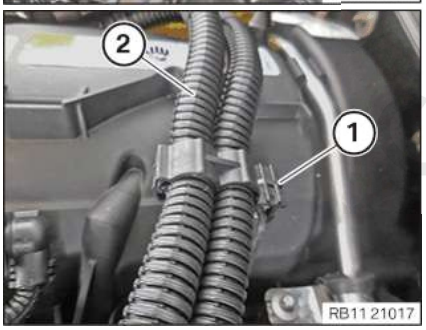
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

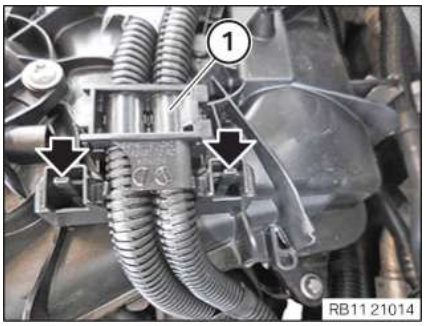
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).



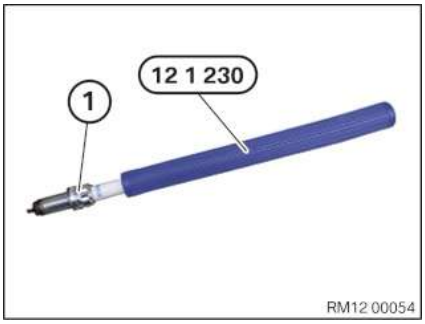
- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

94 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.

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- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

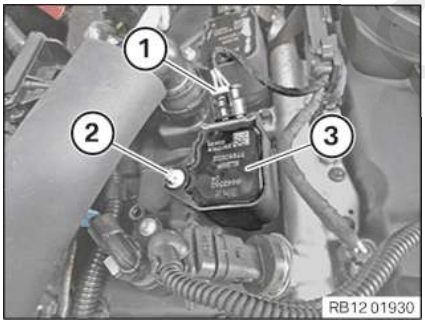
Spark plugs

M12x1.25		Tightening torque	23 Nm

95 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.



▸ **Install ignition coil.**

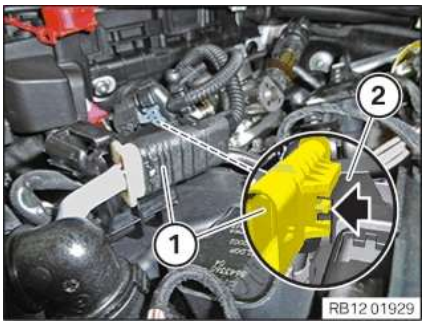
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

  The connector (1) must engage audibly.

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- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

96 – Install the control sensor

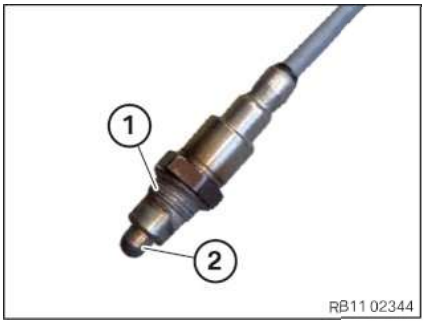
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

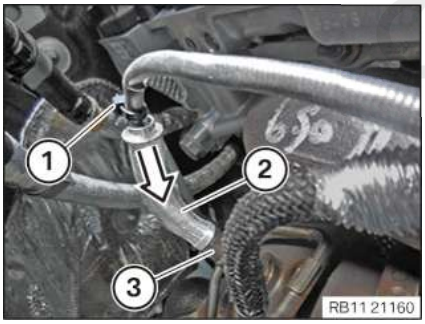
  (2) = Sensor ceramics



- Screw the control sensor (1) in and tighten it with the special tool 0 491 074 (11 7 020).

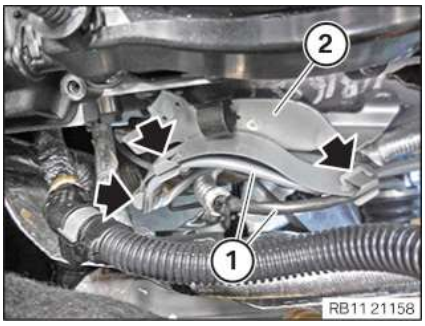
Control sensor

M18x1.5	Tightening torque	50 Nm



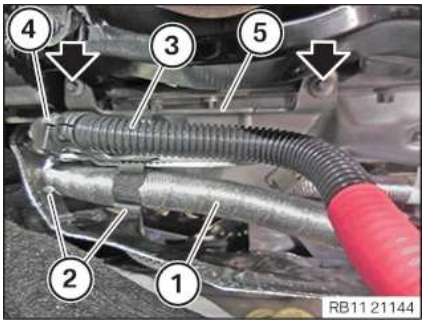
- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

  Parts: Cable strap
- Guide in and install the cable strap (1).



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).

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CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

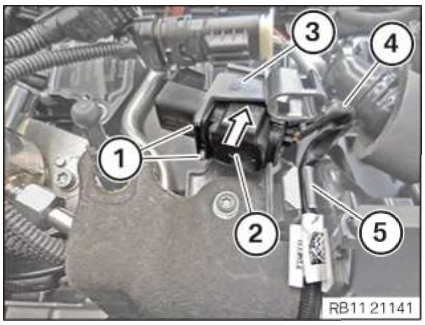
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

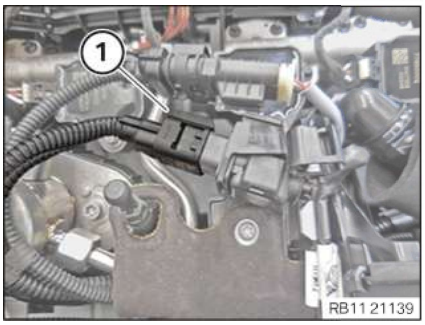
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).



- Guide in the connector (2) in the direction of arrow at the carrier plate (3) and install.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).

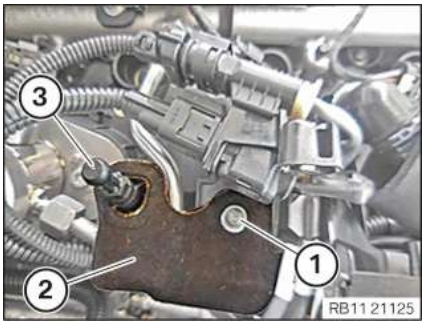


- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Connect and lock the connector (1).
- Guide the connector (1) into the carrier plate in the direction of arrow.
- Ensure the connector (1) audibly engages with the carrier plate.

97 – Install the cylinder head cover acoustic cover

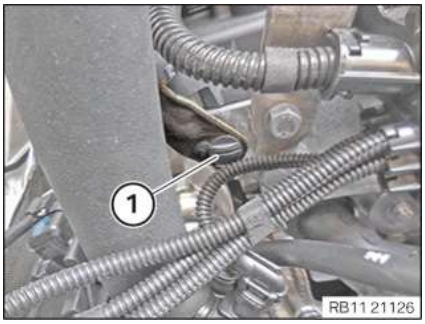


- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

Acoustic cover (side) to cylinder head cover

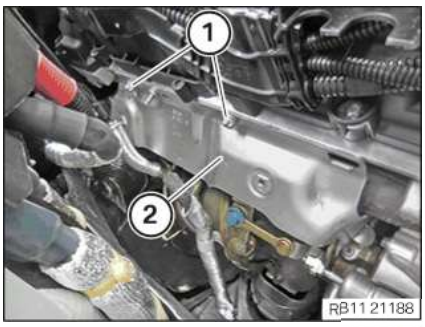
TS6 x 20			8 Nm

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- Secure the clip (1).

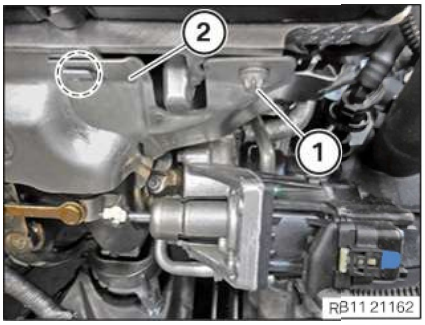
98 – Installing the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

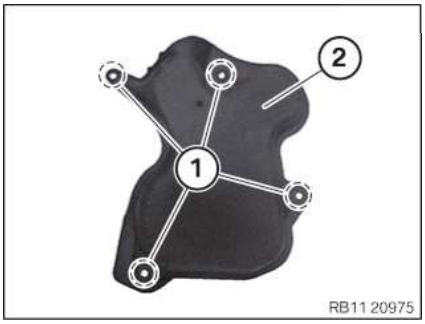


- Tighten down screw (1).

Heat shield to clamping strip

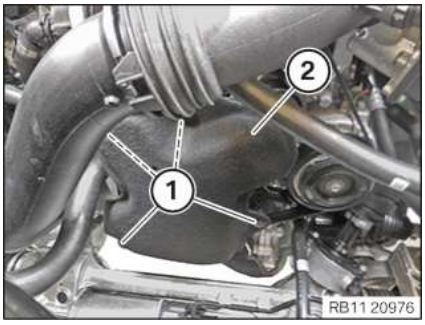
M6 x 12	Tightening torque	8 Nm

99 – Install the acoustic cover for the engine at the front



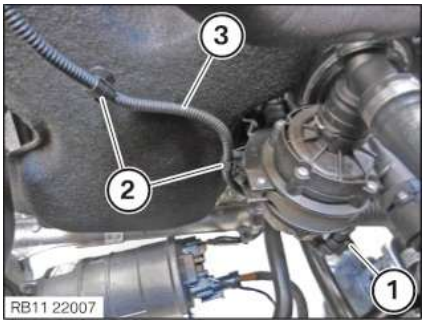
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



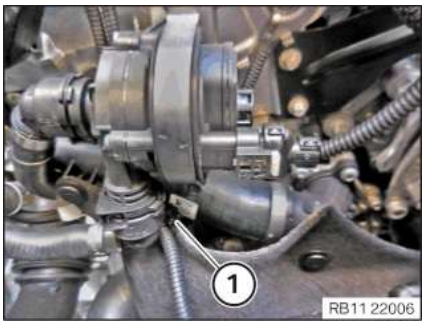
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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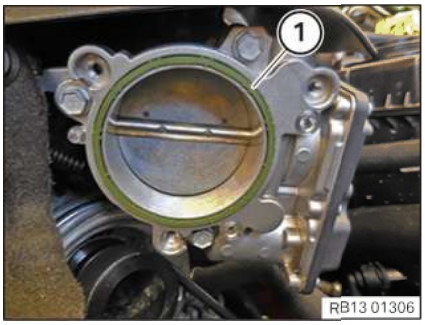
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



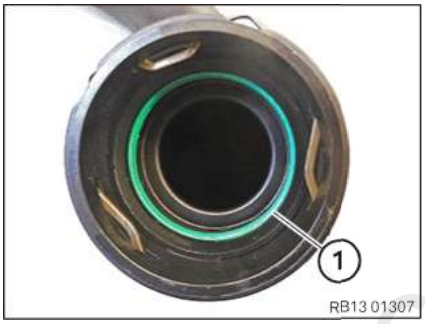
- Secure clamps (1).

100 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring

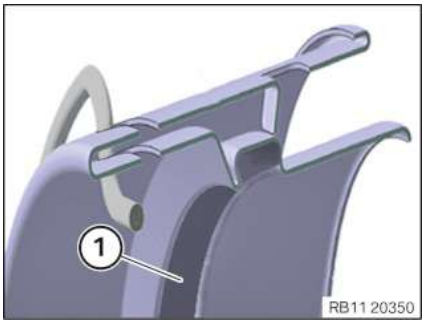


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

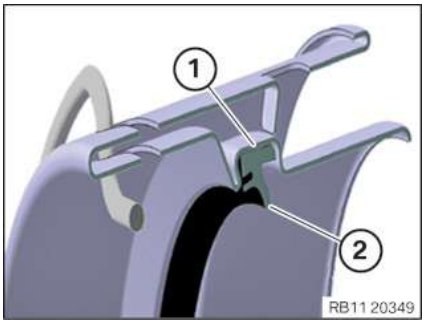
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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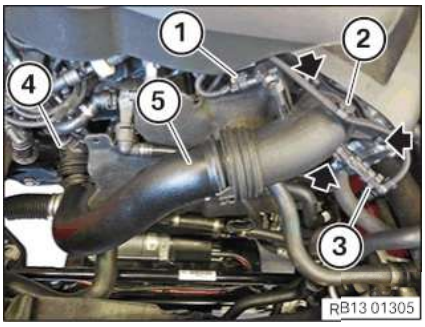
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

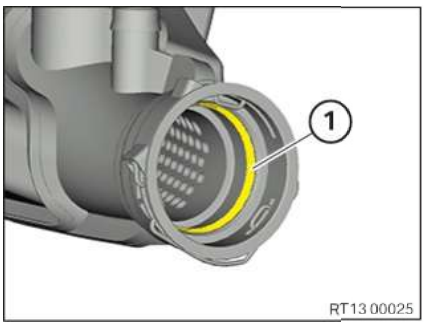
Charge air line to throttle body

M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

101 – Installing the clean air pipe with resonator

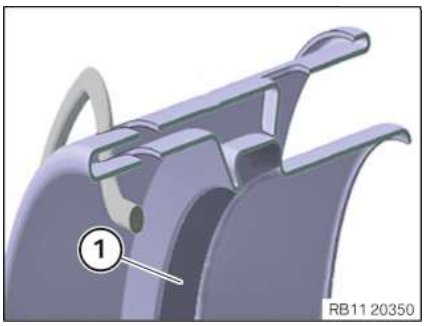


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

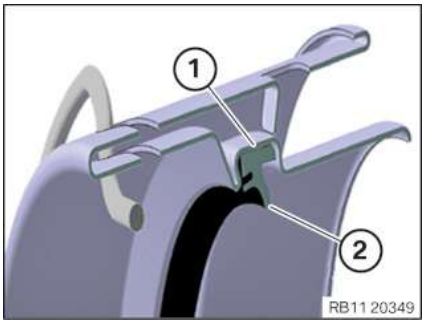
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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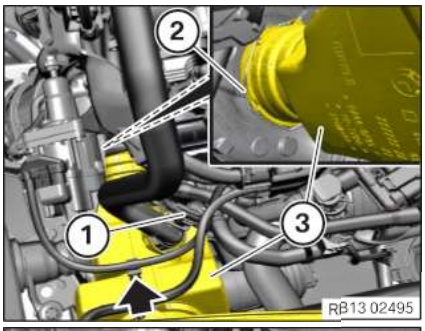
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

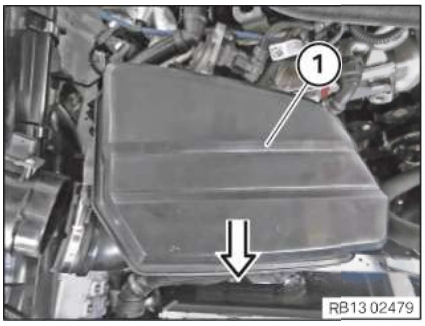
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



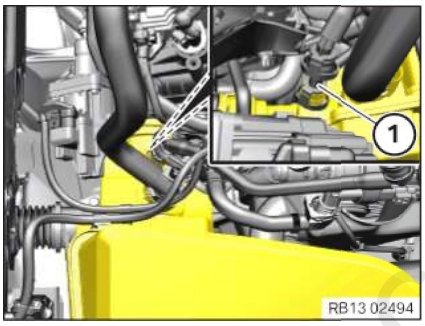
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

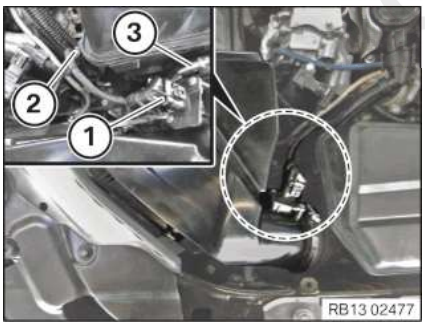
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

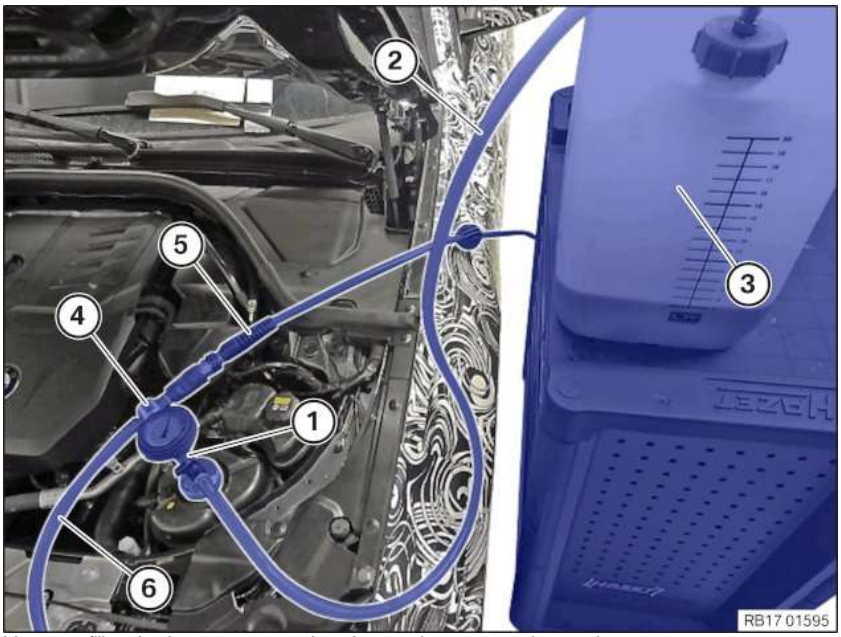
  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

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TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

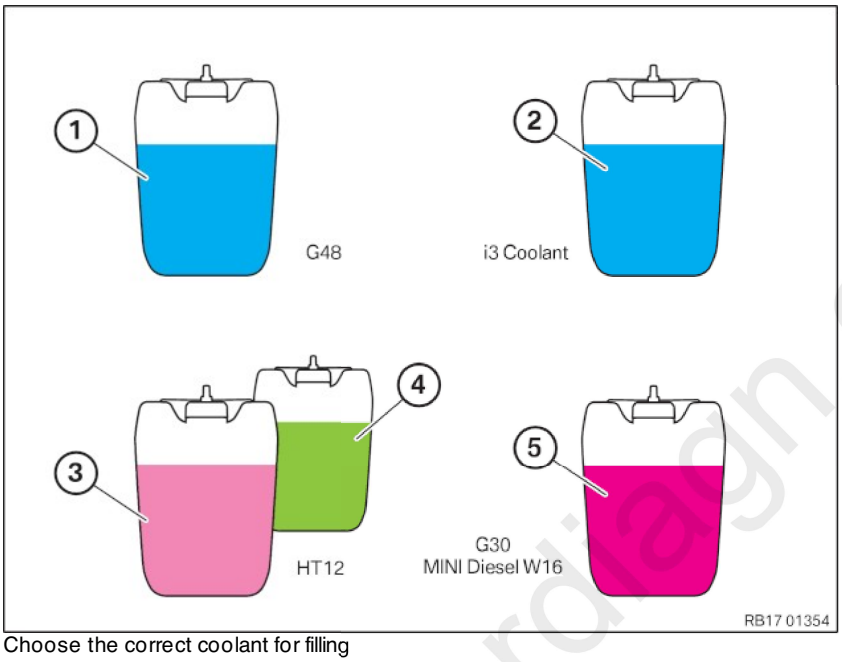
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. **G48 (Blue)** G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.
2. **i3 coolant (blue)** is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.
3. **HT12 (Pink)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
4. **HT12 (Green)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
5. **G30 (Pink)** must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

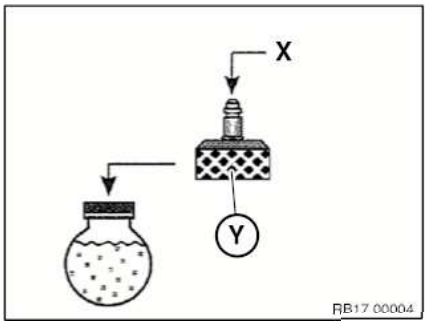
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

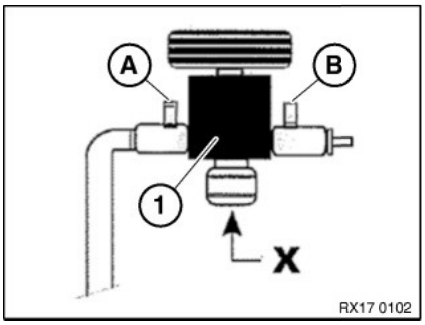
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

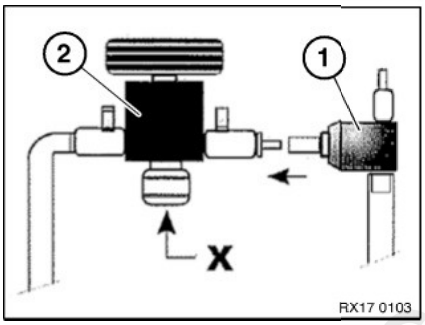
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



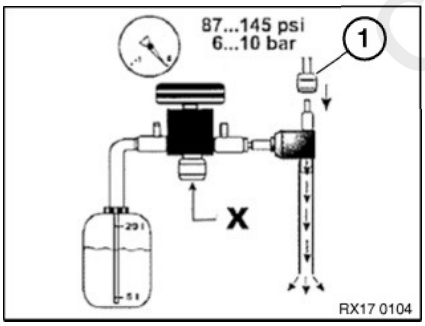
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



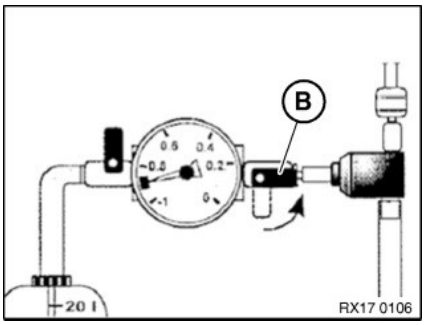
- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.

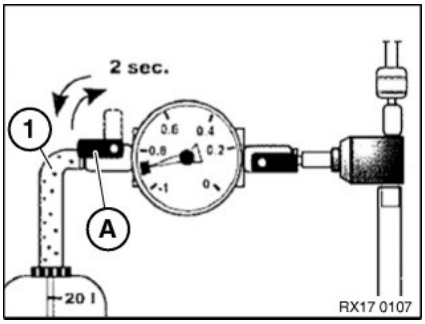


- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.



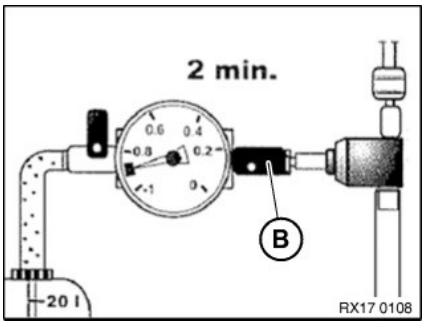
- Open shut-off valve (B).
  The venturi nozzle produces a flow noise.

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- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

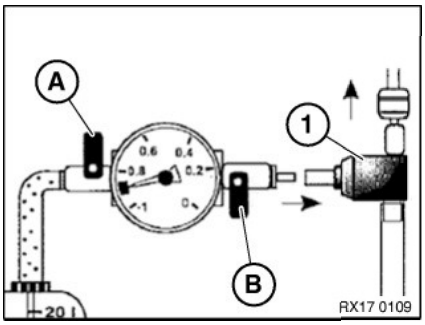


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

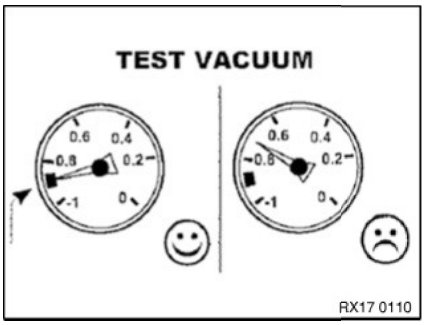
TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).



Check

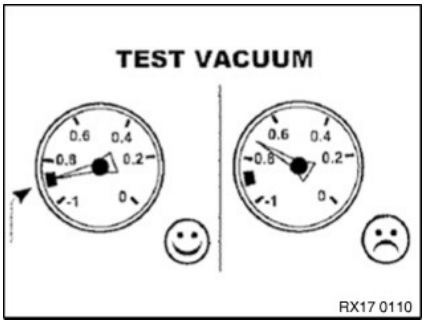
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.



Check

- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

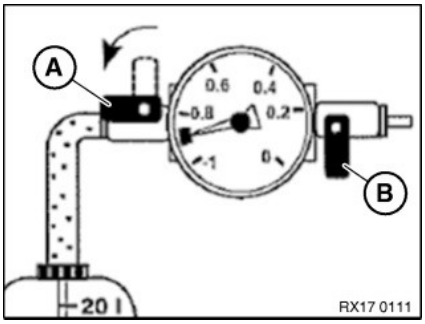
Result

» Vacuum remains constant.

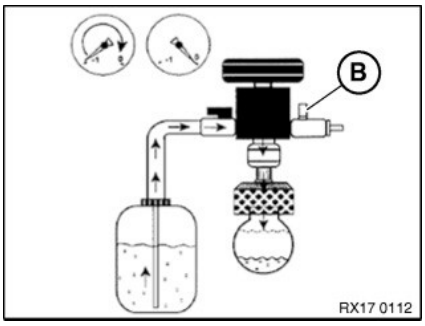
Measure

- Continue with filling.

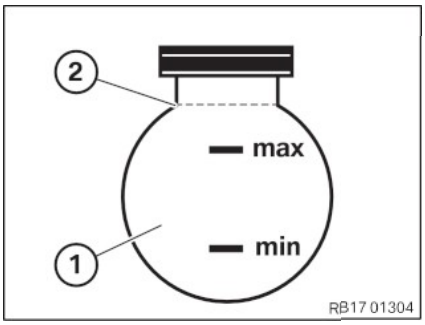
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- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



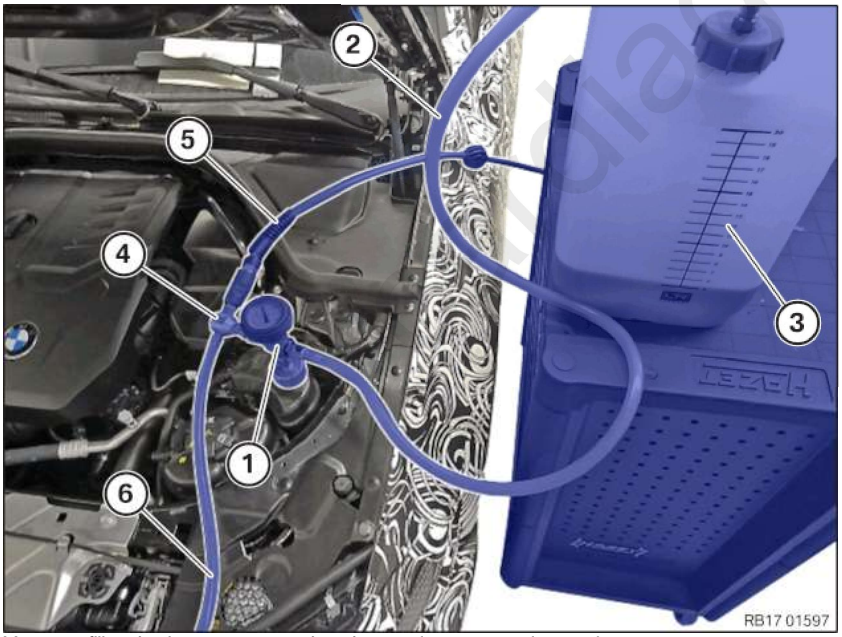
- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

103 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity

of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

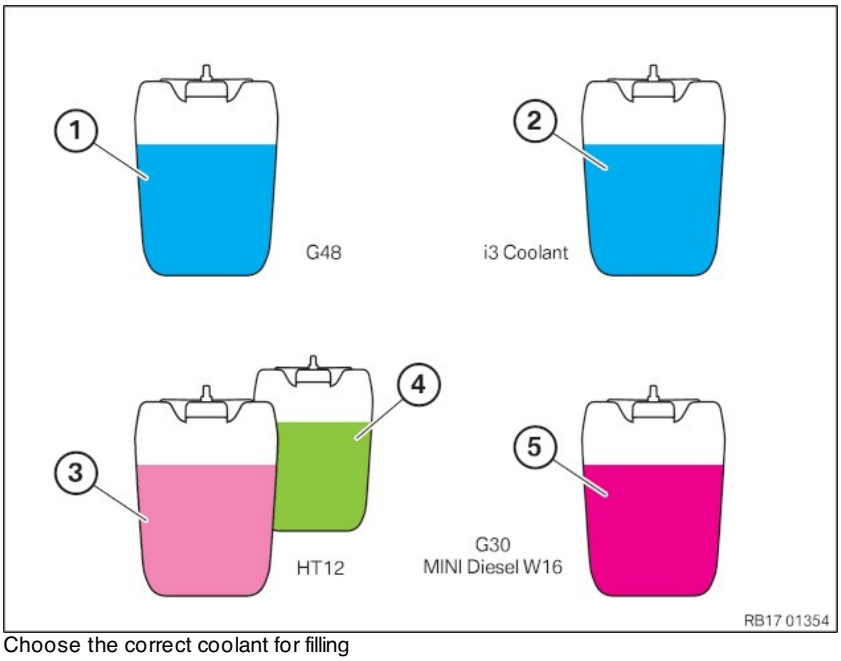
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. **G48 (Blue)** G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.
2. **i3 coolant (blue)** is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.
3. **HT12 (Pink)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
4. **HT12 (Green)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
5. **G30 (Pink)** must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

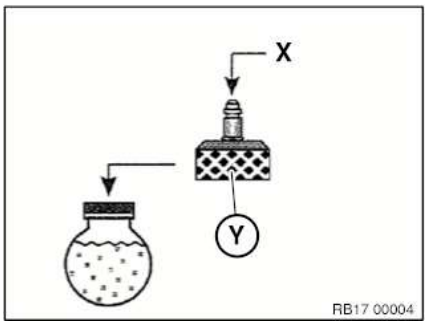
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

Capacity of low-temperature coolant circuit G20

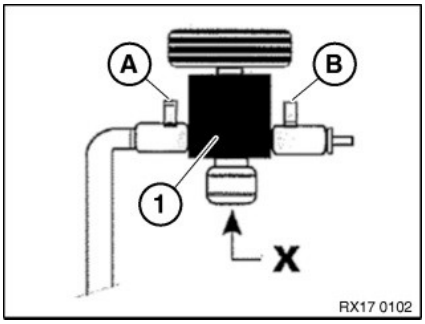
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

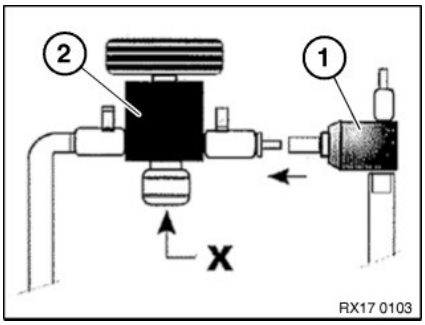


- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

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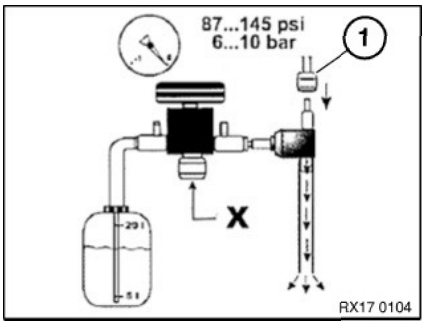


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



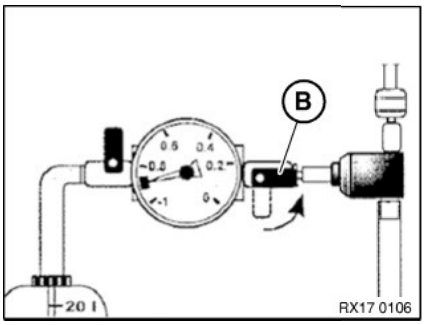
- Connect Venturi nozzle (1) to the vacuum filler device (2).

  (X)is the connection on the coolant expansion tank.



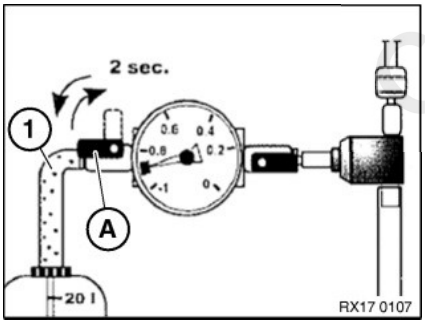
- Connect compressed air (1).

  (X)is the connection on the coolant expansion tank.



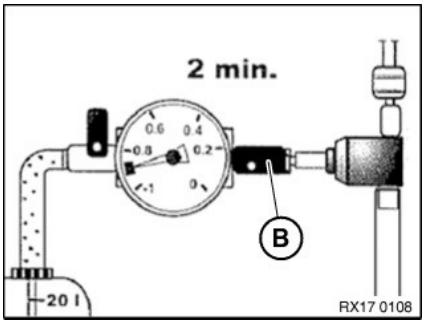
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.



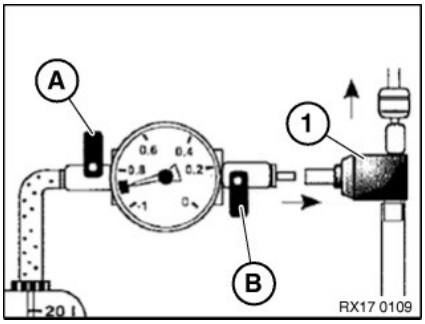
- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

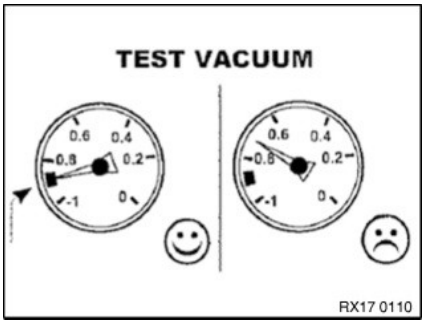
- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).

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- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

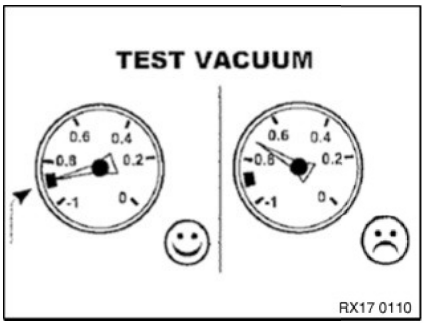
Result

» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



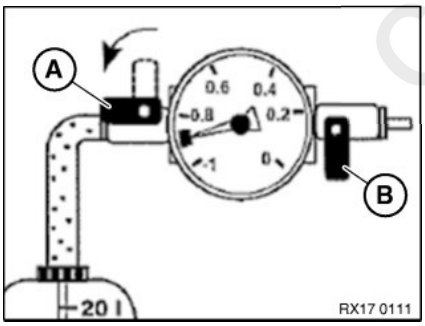
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

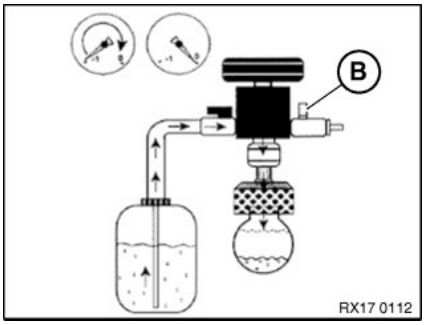
» Vacuum remains constant.

Measure

- Continue with filling.

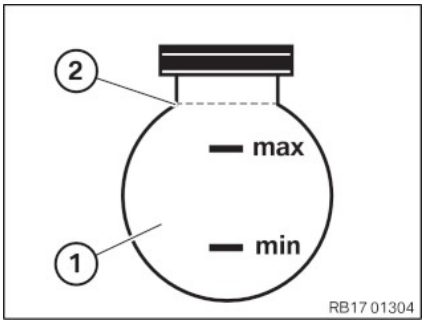


- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).

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- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

104 – Disconnecting all battery earth leads



- See additional information.

105 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

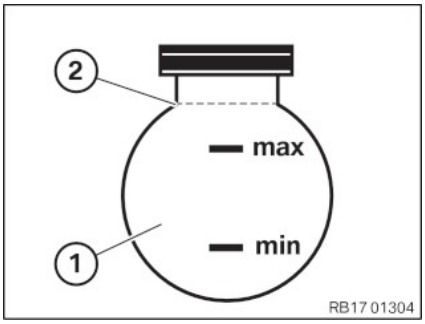
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

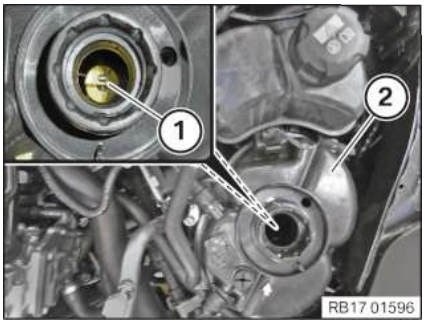
  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

  The engine speed **drops** to the idle speed.
- Observe the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

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106 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

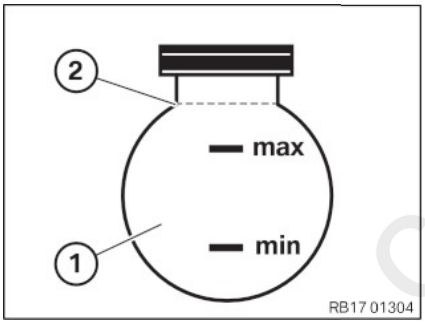
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

  The cooling system bleeding routine will start.

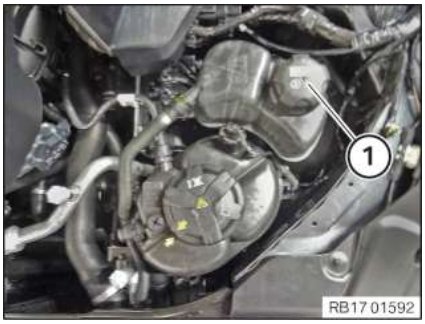
  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.

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- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

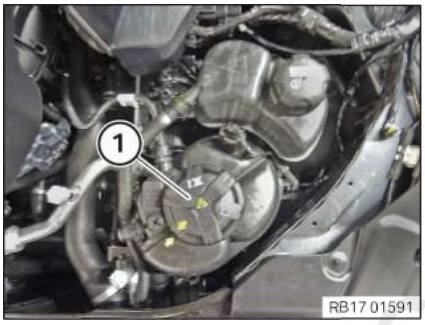
107 – Check the high-temperature cooling system for watertightness

WARNING

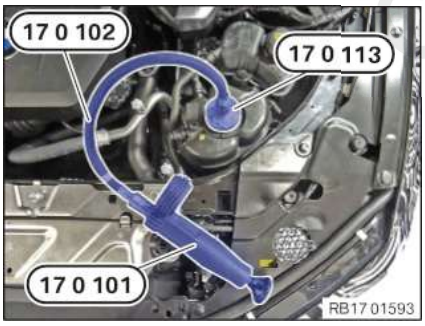
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Loosen sealing cap (1).



- Attach the special tool 0 494 418 (17 0 101) with special tools 0 494 419 (17 0 102) and 0 494 642 (17 0 113) from the set of special tools 0 494 417 (17 0 100).
- Build up excess pressure and wait for approximately 2 minutes.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

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TECHNICAL INFORMATION

If the described test step is not completed successfully: repeat test step twice. Only replace the sealing cap after three tests with an incorrect opening pressure.

When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has cooled down. These traces of coolant do not indicate whether the sealing cap is defective or not.

Escaping coolant vapours when the vehicle is at standstill may cause the pressure relief valve to stick to the sealing cap. This may cause an incorrect opening pressure.

- Screw on sealing cap (1) on special tool 0 494 643 (17 0 114) from the set of special tools 0 494 417 (17 0 100).
- Build up the pressure with special tools 0 494 418 (17 0 101) and 0 494 419 (17 0 102) from the set of special tools 0 494 417 (17 0 100).
- Observe on the pressure measuring device when the opening pressure has been reached.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

108 – Checking low-temperature cooling system for watertightness

WARNING

Hot surfaces.

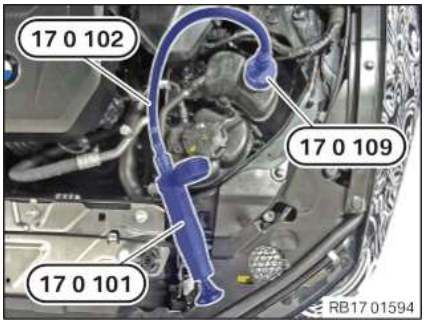
Risk of burning!

- Perform all work only on components that have cooled down.



- Loosen sealing cap (1).

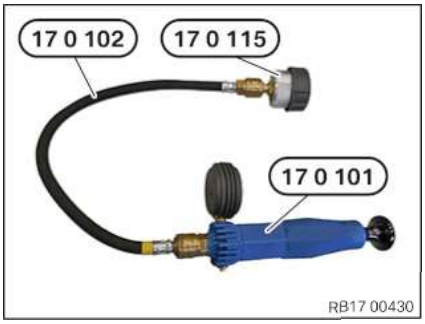
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- Attach the special tool 0 494 418 (17 0 101) with special tools 0 494 419 (17 0 102) and 0 494 426 (17 0 109) from the set of special tools 0 494 417 (17 0 100).
- Build up excess pressure and wait for approximately 2 minutes.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



TECHNICAL INFORMATION

If the described test step is not completed successfully: repeat test step twice. Only replace the sealing cap after three tests with an incorrect opening pressure.

When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has cooled down. These traces of coolant do not indicate whether the sealing cap is defective or not.

Escaping coolant vapours when the vehicle is at standstill may cause the pressure relief valve to stick to the sealing cap. This may cause an incorrect opening pressure.

- Screw on sealing cap (1) on special tool 0 495 889 (17 0 115) from the set of special tools 0 494 417 (17 0 100).
- Build up the pressure with special tools 0 494 418 (17 0 101) and 0 494 419 (17 0 102) from the set of special tools 0 494 417 (17 0 100).
- Observe on the pressure measuring device when the opening pressure has been reached.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

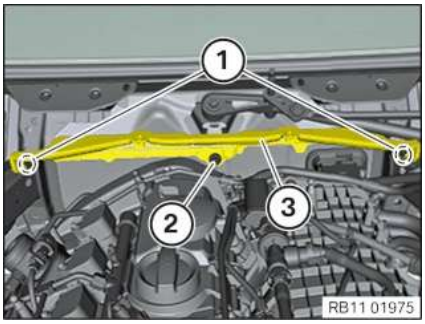


- Close sealing cap (1).

109 – Check engine oil level

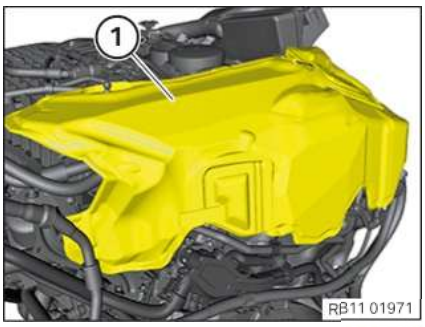
- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

110 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

111 – Installing acoustic cover at rear

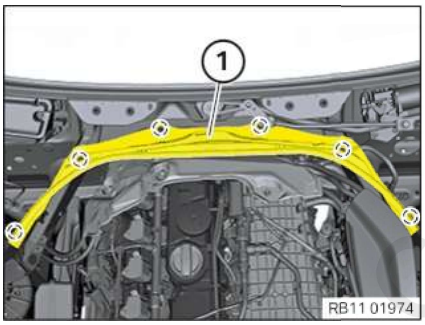


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

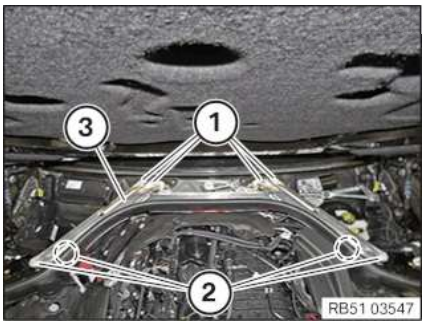
112 – Installing the centre bulkhead upper part



- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

113 – Installing cowl panel cover

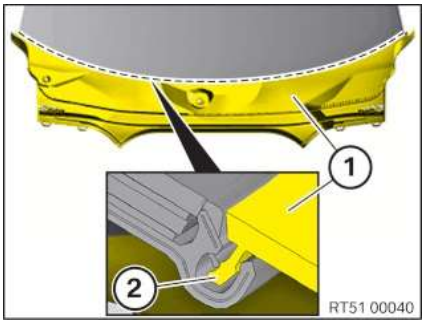
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RISK OF DAMAGE

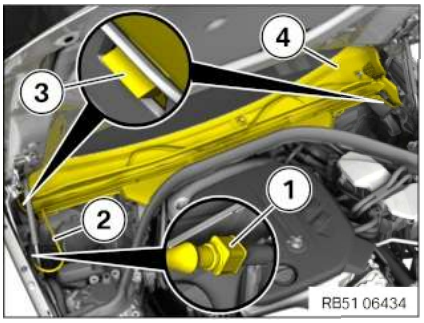
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

114 – Installing both wiper arms

NOTICE

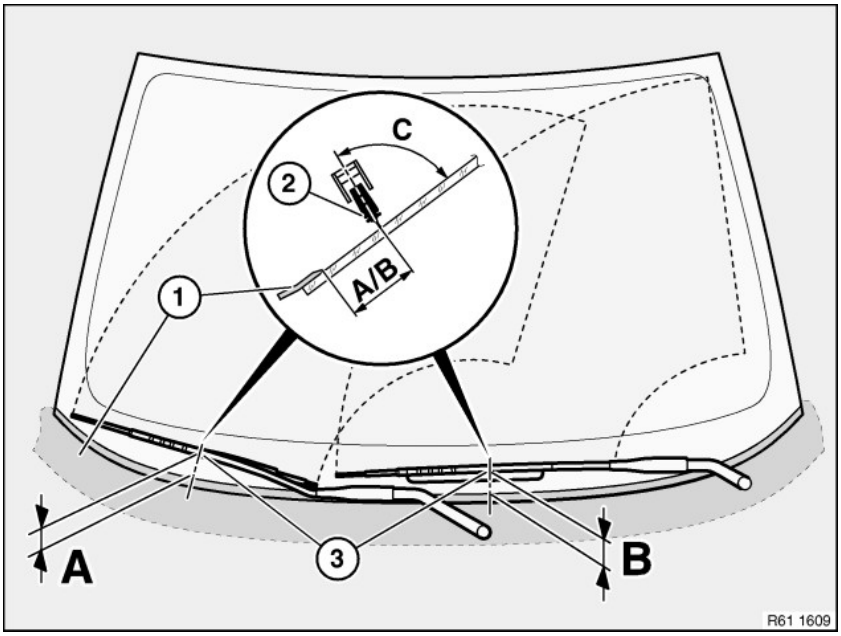
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.

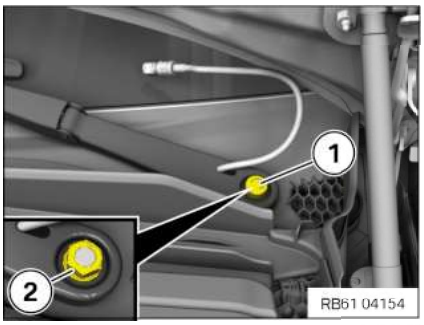
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

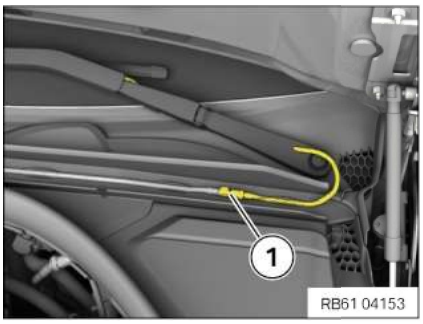


- Tighten nut (2).

Windscreen wiper arm

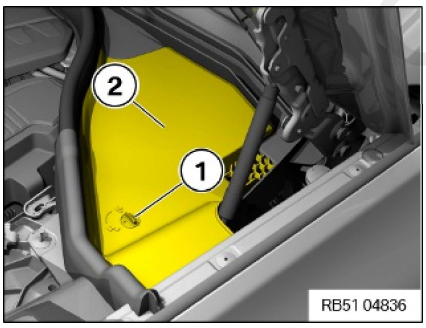
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



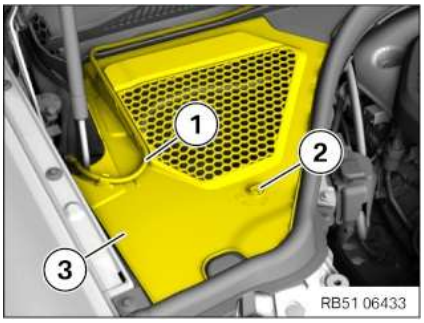
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

115 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

116 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

117 – Install the seal for the bonnet

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- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

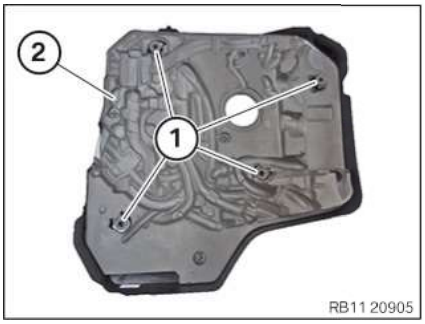
118 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

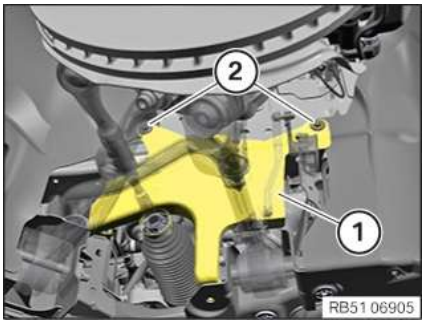


- Clip in the acoustic cover (1) into the holders in the **marked** areas.
  The acoustic cover (1) must audibly engage into place.

119 – Install the cover of the steering assembly

Prerequisite

The underbody protection of the steering gear is removed.



- Position the cover (1).
- Tighten the screws (2).

Cover, steering unit

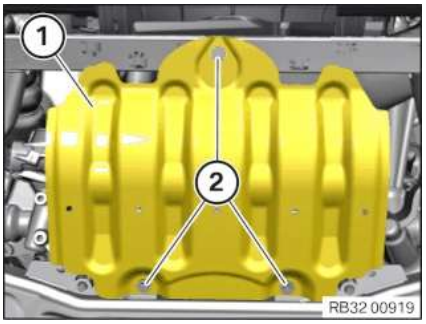
Screw		Tightening torque	3 Nm

120 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

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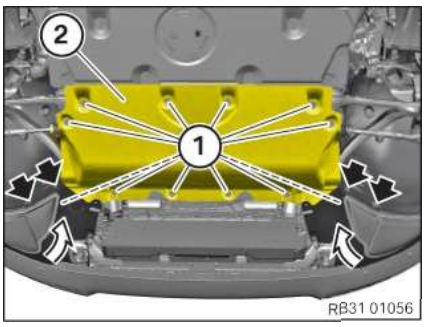


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

121 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

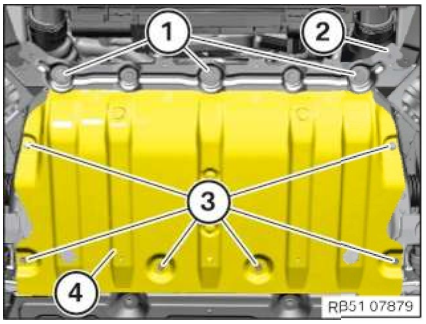
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

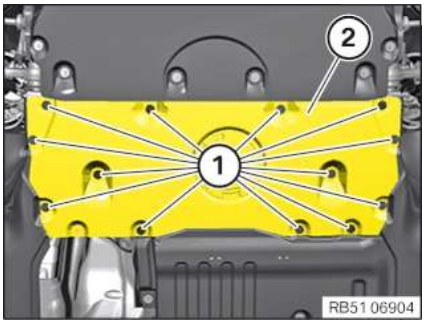
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

122 – Installing the centre underbody protection



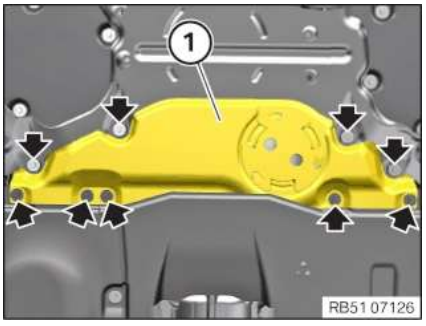
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

  Guide in and install the centre of underbody protection (1).

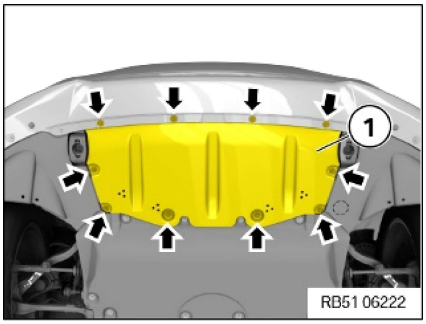
  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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123 – Installing the front underbody protection



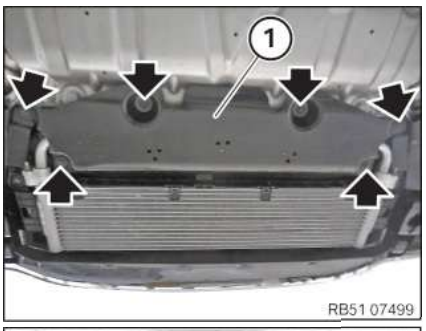
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



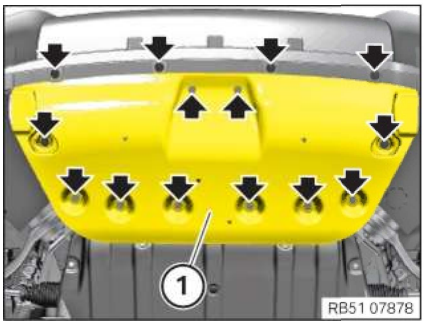
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

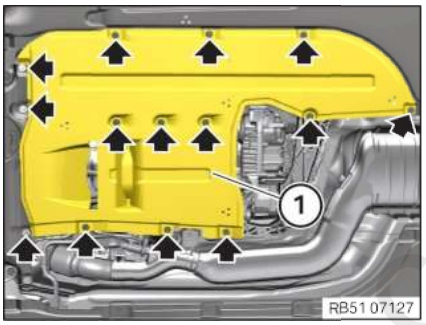
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

124 – Installing underbody protection at rear



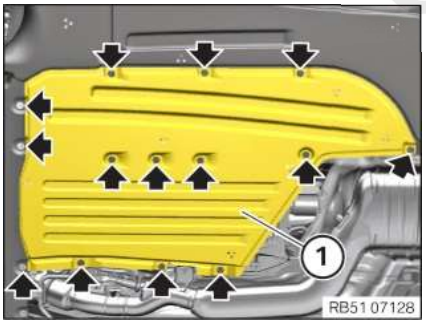
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

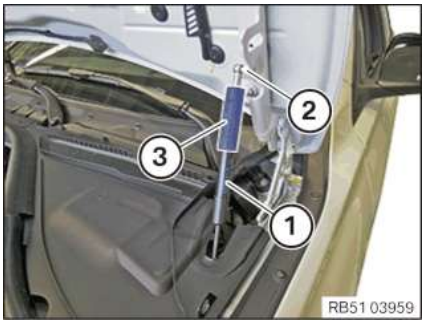
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

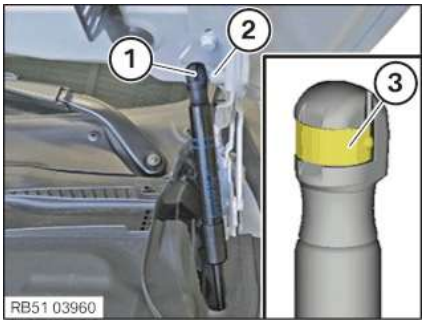
Hexagon screw		Tightening torque	3 Nm

125 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side			Used in step 41
Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head			Used in step 496474
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 496474
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 58
M8		Tightening torque	21,5 Nm

Cylinder head to crankcase			Used in step 63
M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °

Cylinder head bolt to timing case cover			Used in step 63
M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head			Used in step 63
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head			Used in step 63
M6x16			8 Nm

Cable routing to cylinder head, rear			Used in step 63
M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head			Used in step 63
M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft			Used in step 63
M6x16		Tightening torque	8 Nm

Manifold support for intake air to cylinder head			Used in step 63
M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head			Used in step 63
M6		Tightening torque	7 Nm

Standard screw connection M6			Used in step 63
M6			8 Nm

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Oil feed line to exhaust turbocharger/crankcase — Used in step 63

M6x12		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 7071

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 73

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Coolant line to coolant pump/cylinder head — Used in step 75

M6x20		Tightening torque	8 Nm

Intake plenum to cylinder head — Used in step 76

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 76

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 76

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 76

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 76100

M6		Tightening torque	8 Nm

Control unit holder on spring strut dome — Used in step 78

Hexagon screw		Tightening torque	8 Nm

Oil return line to exhaust turbocharger/crankcase — Used in step 81

M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger — Used in step 8283

M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger — Used in step 82

M6		Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 83

M6 x 12		Tightening torque	8 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger — Used in step 84

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Catalytic converter to holder — Used in step 84

M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder — Used in step 84

M8	Renew nut.	Tightening torque	19 Nm

Rear silencer to body / bumper support — Used in step 85

M8	Replace nuts.	Tightening torque	19 Nm

Exhaust system to rear axle carrier — Used in step 85

Nut M8	Renew nut.	Tightening torque	19 Nm

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Front silencer / petrol particulate filter on transmission bracket — Used in step 85

M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter — Used in step 85

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter — Used in step 85

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

Connecting support to tunnel — Used in step 86

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Cylinder head cover to cylinder head — Used in step 87

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 87

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 8796

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 90

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 91

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 92

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 93

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 93

M6 screw		Tightening torque	6,5 Nm

Spark plugs — Used in step 94

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 95

Screw		Tightening torque	8 Nm

Control sensor — Used in step 96

M18x1.5		Tightening torque	50 Nm

Acoustic cover (side) to cylinder head cover — Used in step 97

TS6 x 20			8 Nm

Heat shield to cylinder head — Used in step 98

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 98

M6 x 12		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 101

Clamp		Tightening torque	3 Nm

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Bulkhead upper part to bottom bulkhead			Used in step 112
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 112
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 112
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 114
Combination hexagon nut		Tightening torque	35 Nm

Cover, steering unit			Used in step 119
Screw		Tightening torque	3 Nm

Bumper buffer device steering on front axle support			Used in step 120
M10		Tightening torque	56 Nm

Underbody protection of the steering gear			Used in step 121
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 121
Thermoplastic hexagon screw		Tightening torque	3 Nm

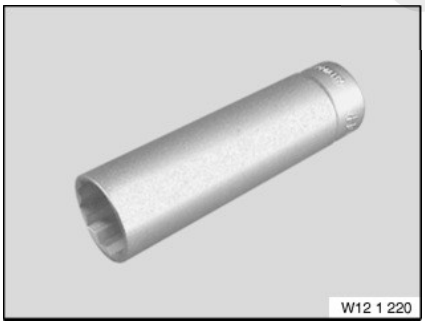
Holder underride guard to front axle support			Used in step 121
M10		Tightening torque	56 Nm

Underbody protection			Used in step 122124
Hexagon screw		Tightening torque	3 Nm

Underbody protection front			Used in step 123
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

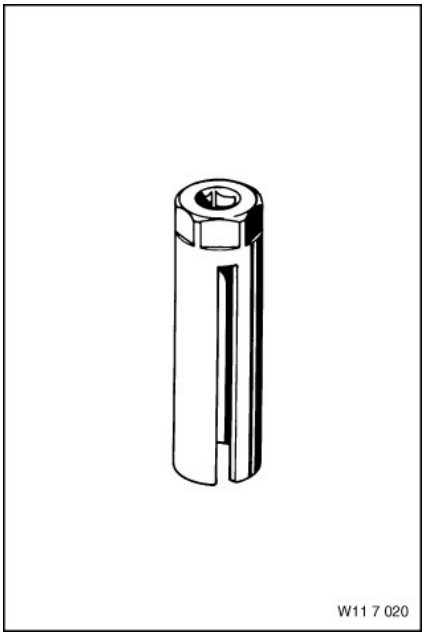
0 495 560 (12 1 220) Socket



Common		Used in step 2094
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

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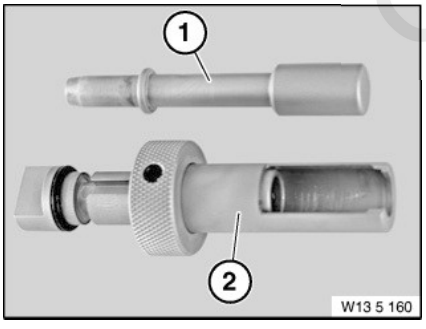
0 491 074 (11 7 020) Socket wrench insert



Common	Used in step 2396
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

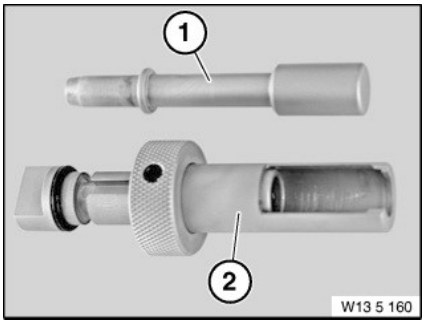
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0 496 567 (13 5 161) Fastener



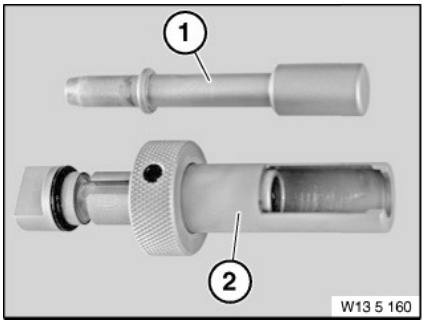
Common	Used in step 25
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 568 (13 5 162) Fastener



Common	Used in step 25
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener

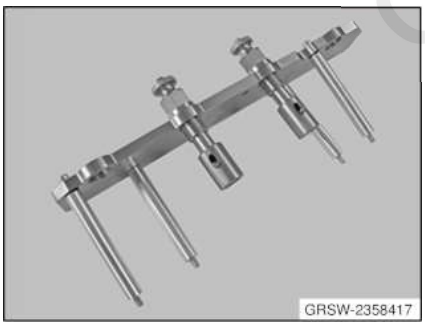


Common	Used in step 25
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

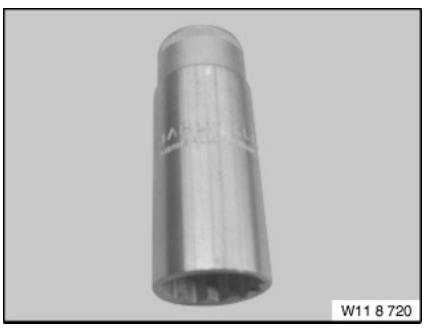
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

2 358 417 Device



Common	Used in step 26
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 26
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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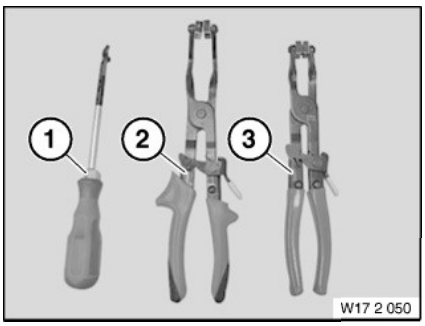
2 360 895 Pin wrench



Common Used in step 2888

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 794 (17 2 050) Pliers



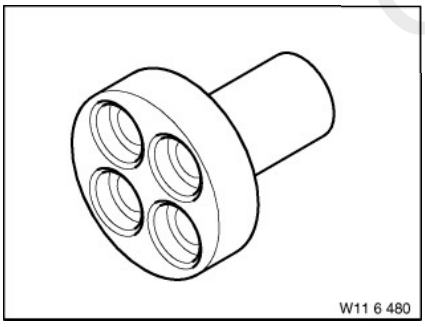
Common Used in step 4876

Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

0 493 380 (11 6 480) Connector



Common Used in step 49727491

Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud

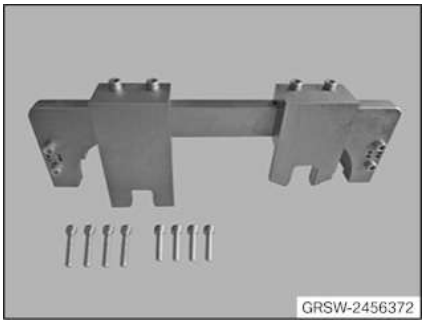


Common Used in step 497274

Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

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2 456 372 Gauge



Common	Used in step 4957647274
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 495774
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



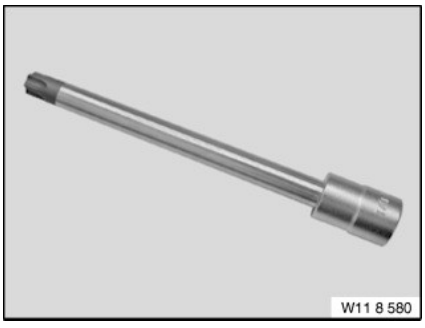
Common	Used in step 51527071
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 51527071
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

0 495 747 (11 8 580) Socket wrench



Common	Used in step 5863
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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2 220 718 Workshop crane



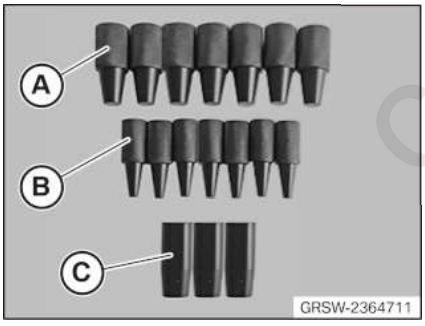
Common	Used in step 58
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

2 459 012 Holder



Common	Used in step 5863
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 364 711 Plug



Common	Used in step 6061
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

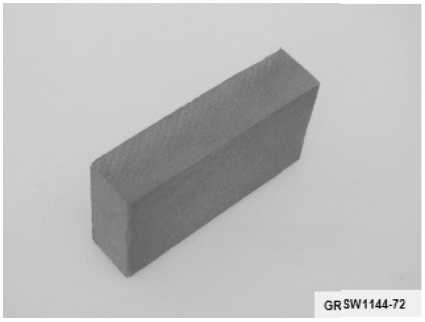
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0 495 103 (11 4 471) Scraper



Common	Used in step 61
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

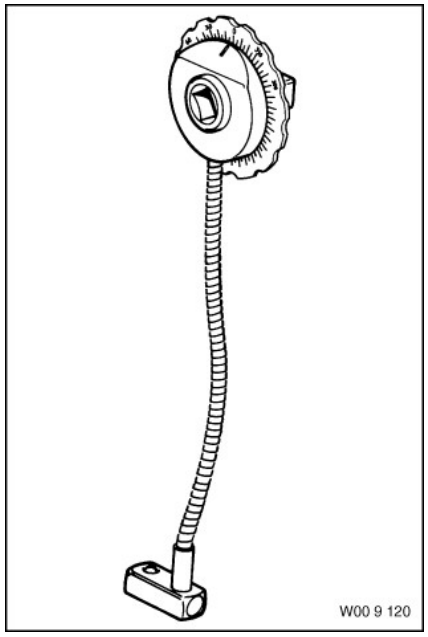
0 495 104 (11 4 472) Extractor



Common	Used in step 61
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

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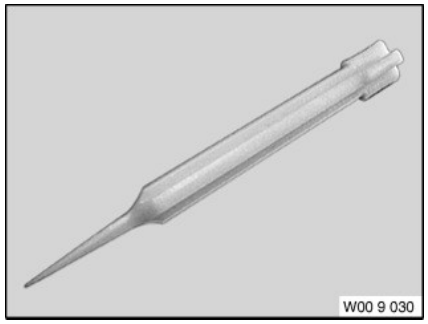
0 490 504 (00 9 120) Torque angle measuring dial



Common	Used in step 63
Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

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0 496 714 (00 9 030) Wedge



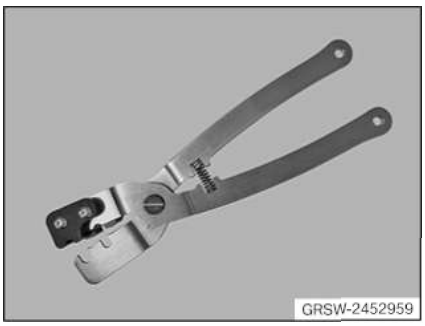
Common	Used in step 638283
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

2 455 654 Tensioning tool



Common	Used in step 6972
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 89
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



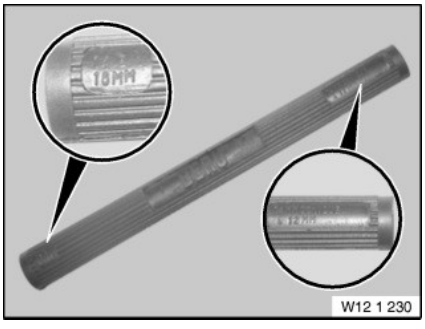
Common	Used in step 89
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 90
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

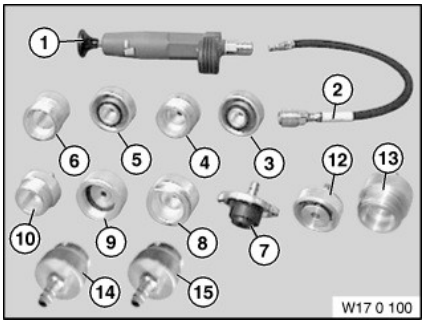
0 496 065 (12 1 230) Fitting aid



Common	Used in step 94
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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0 494 417 (17 0 100) Tester



Common		Used in step	102103107108
Usage	For checking engine cooling system on watertightness. For checking radiator cap.		
Included in the tool or work			
Storage location	Individual		
Replaced by			
In connection with			
SI-Number	01 07 02 (884)		

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

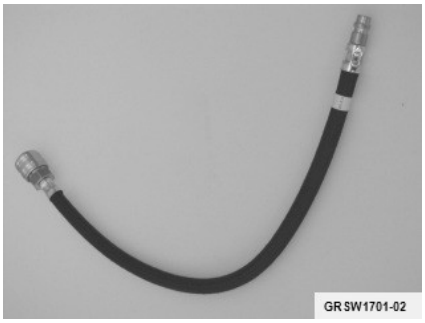
0 494 418 (17 0 101) Pump



Common		Used in step	107108
Usage			
Included in the tool or work	0 494 417		
Storage location			
Replaced by			
In connection with			
SI-Number			

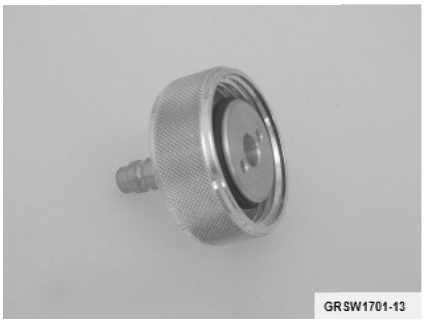
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0 494 419 (17 0 102) Hose



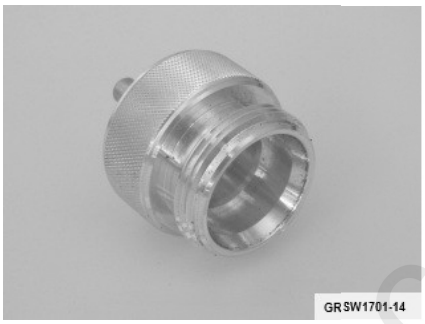
Common	Used in step 107108
Usage	(hose with quick-release coupling)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 642 (17 0 113) Adapter



Common	Used in step 107
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 643 (17 0 114) Adapter



Common	Used in step 107
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

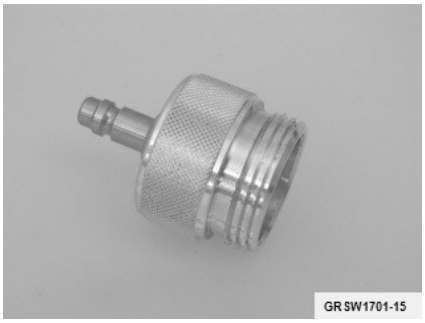
0 494 426 (17 0 109) Adapter



Common	Used in step 108
Usage	For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 495 889 (17 0 115) Adapter



Common		Used in step 108
Usage	For radiator cap Model series: N12, N14	
Included in the tool or work	0 494 417	
Storage location		
Replaced by		
In connection with		
SI-Number	01 26 06 (321)	

Overview Technical Data

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system	Used in step 107108
Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

Distance from window pane edge to wiper blade	Used in step 114
Wiper arm right (A)	57,5 ±5 mm
Wiper arm left (B)	63,3 ±4 mm

Capacity of high-temperature coolant circuit G20	Used in step 102
B48B20O1/B46B20O1	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Capacity of low-temperature coolant circuit G20	Used in step 103
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

Repair instructions (PRE)	Used in step
Repair notes on renewing the cylinder head	

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	1580
11 00 ... Overview of consumables (Electronic Parts Catalogue)	96

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1104
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1104
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	1104

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61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
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61 20 900 Disconnecting and connecting battery earth lead	1104
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61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
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61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 35 ... Notes on ESD protection (Electro Static Discharge)	15161926284779
13 53 ... Clean the cylinder head around the injectors due to grit / dust	26
61 13 ... Unlocking and disconnecting different plug connections	262987
61 35 ... Notes on ESD protection (Electro Static Discharge)	2847
61 00 730 Encode/program control unit(s) (after vehicle test)	80
17 00 ... Notes for working on cooling system.	102103

Operating materials	**Used in step**
Main group 17	102103

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11 12 000 Removing and installing/sealing cylinder head cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

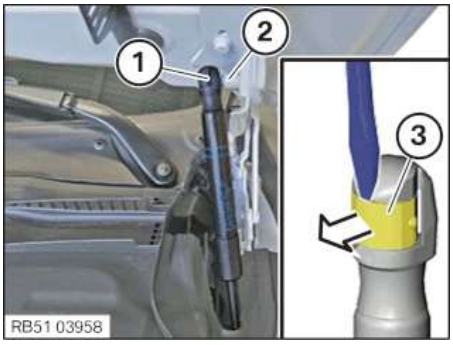
Engine compartment lid is open.

CAUTION

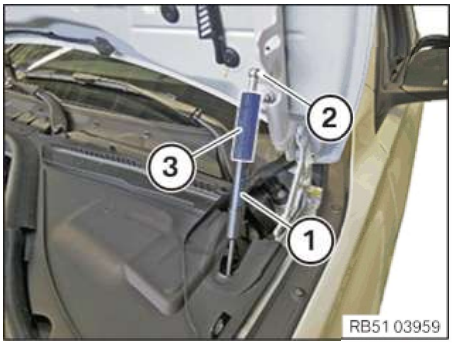
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

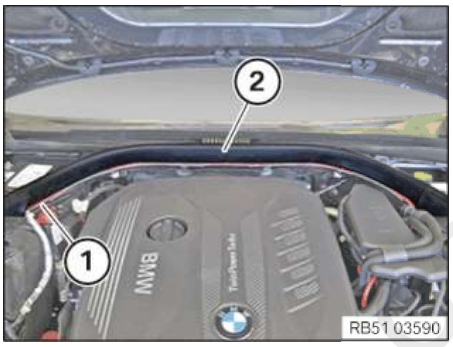


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

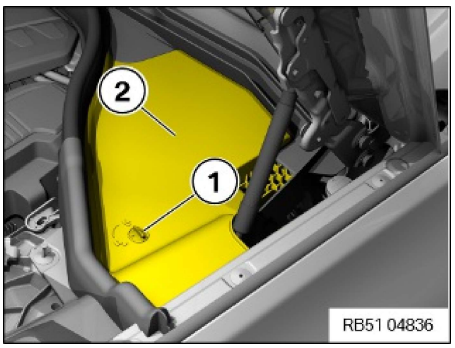
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

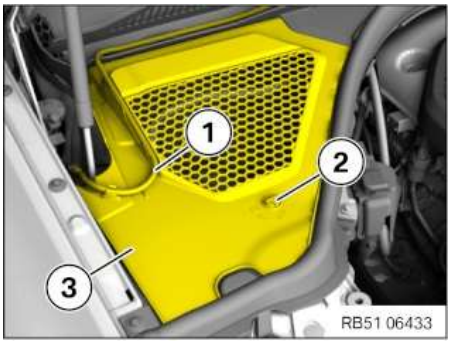
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

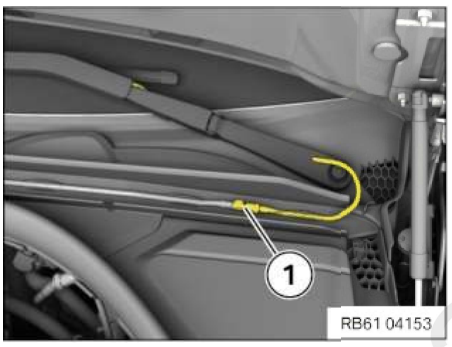
▶ **Remove the wiper arm**

RISK OF DAMAGE

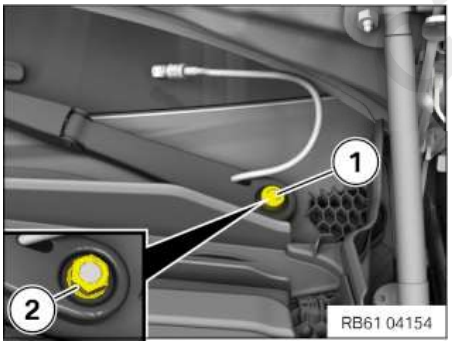
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

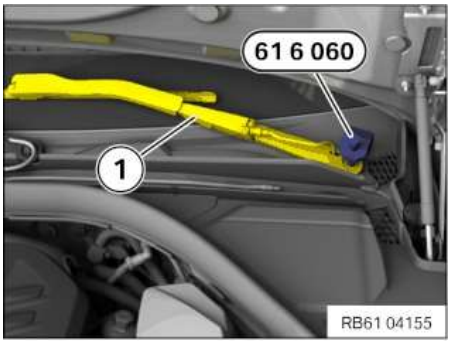
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



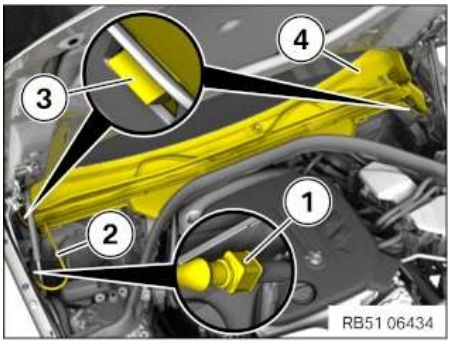
- Remove the protective cap (1).
- Loosen nut (2).



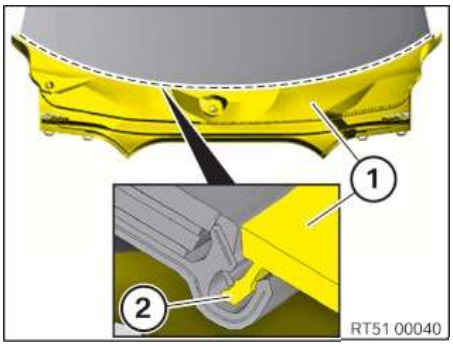
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

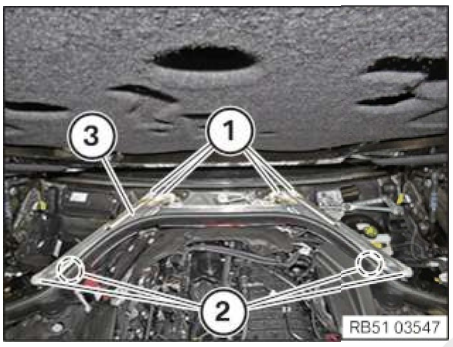


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

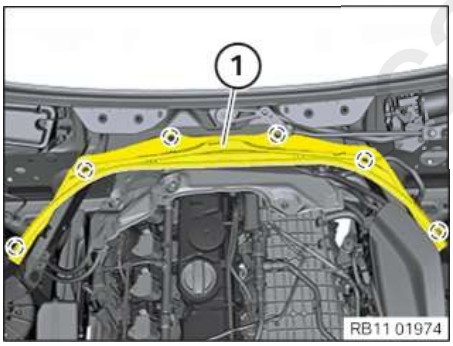
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

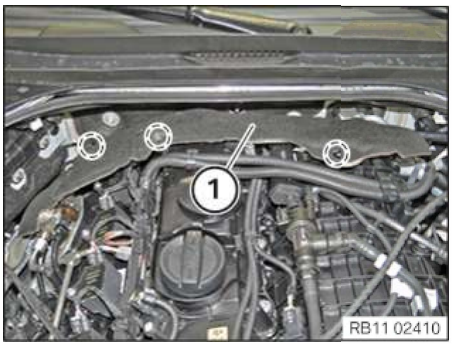
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



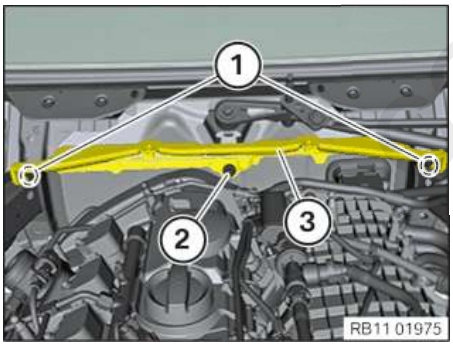
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

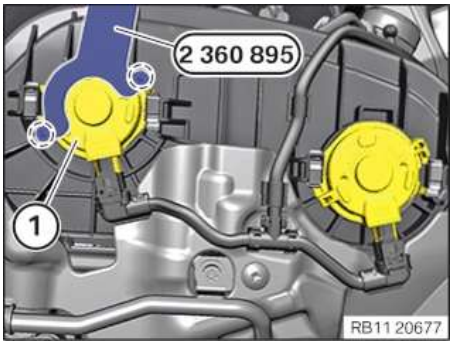
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

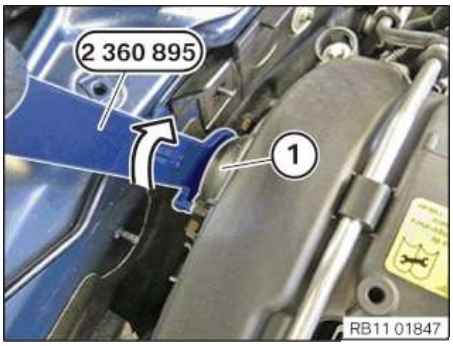
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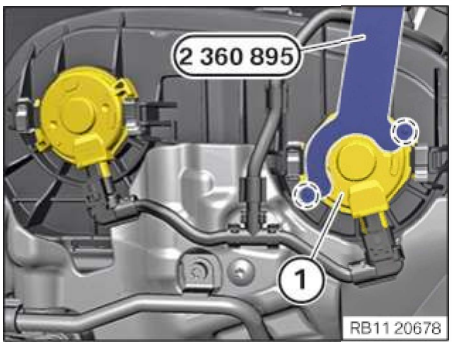
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



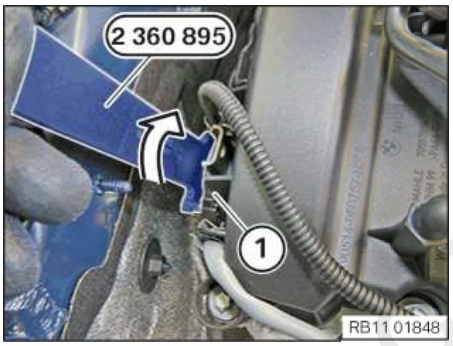
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



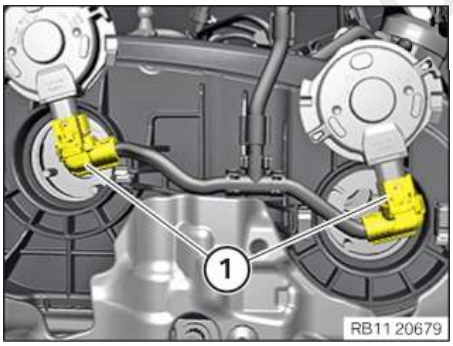
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

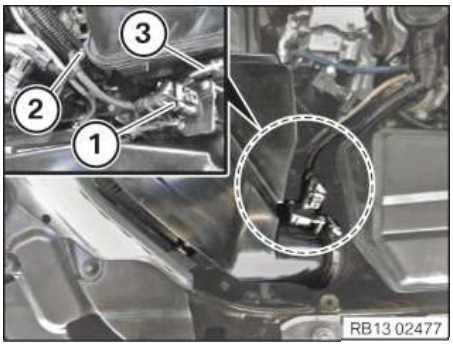
Risk of burning!

- Perform all work only on components that have cooled down.

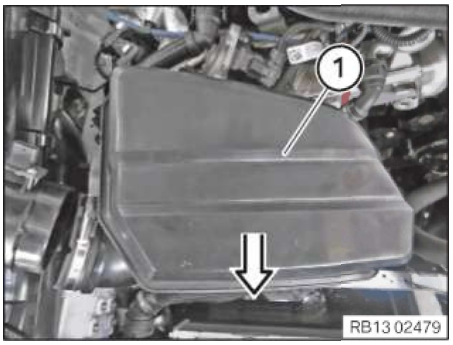
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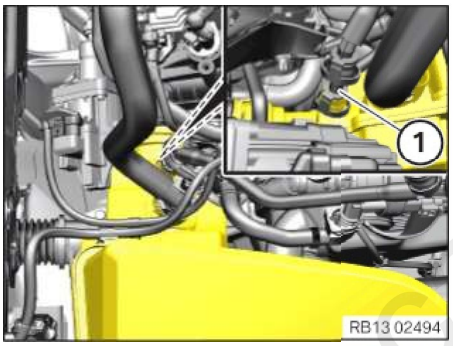
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



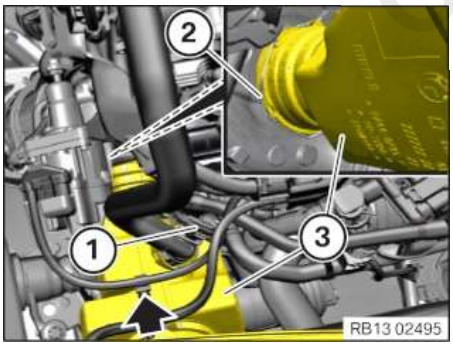
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



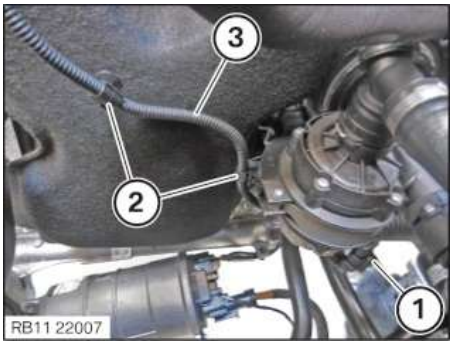
- Unlock and disconnect the tank ventilation line (1).



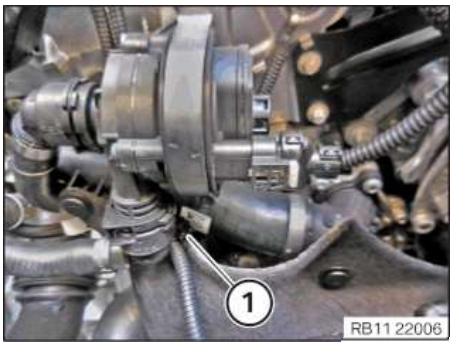
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

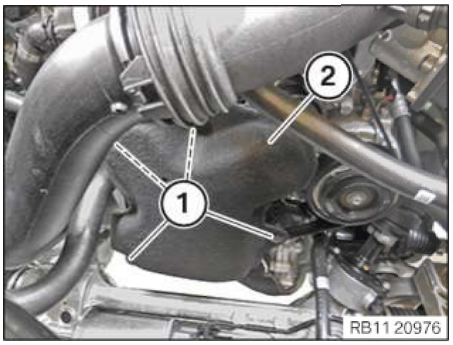
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

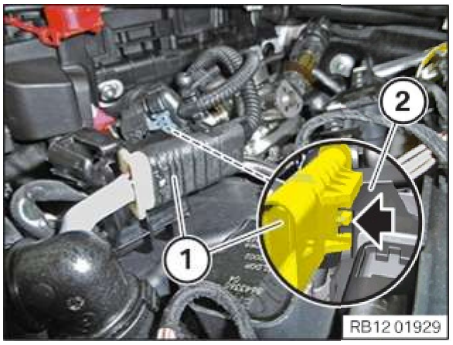
Electrostatic discharge.

Damage to or destruction of electrical components.

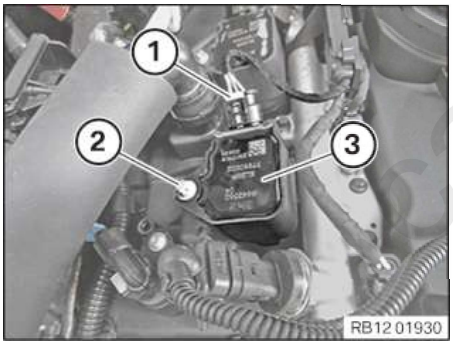
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.

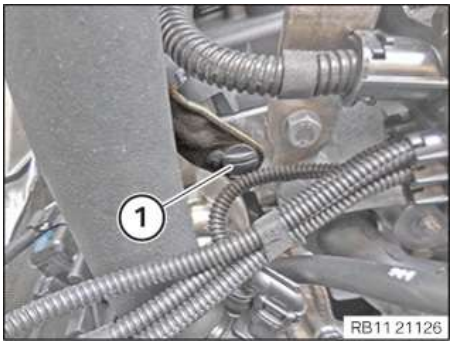


- Unlock connector (1) (arrow) and disconnect it from holder (2).



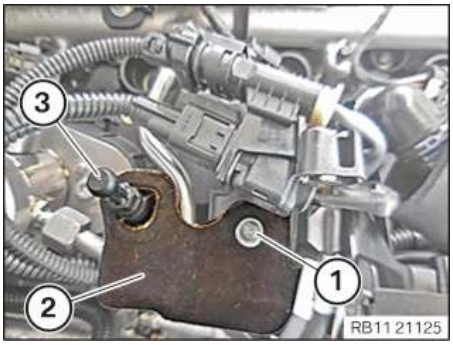
- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).

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- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

17 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

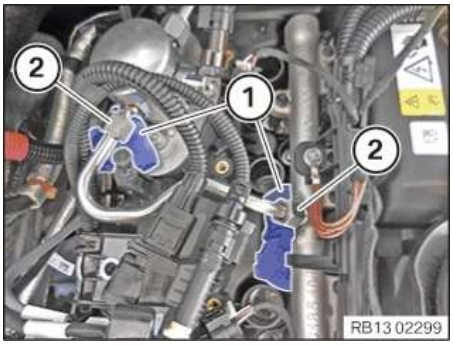
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

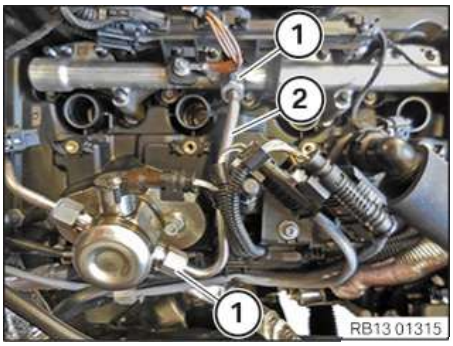


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

18 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

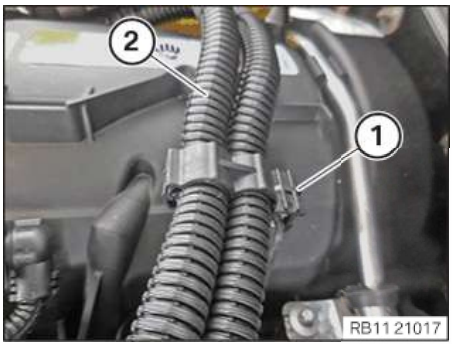
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

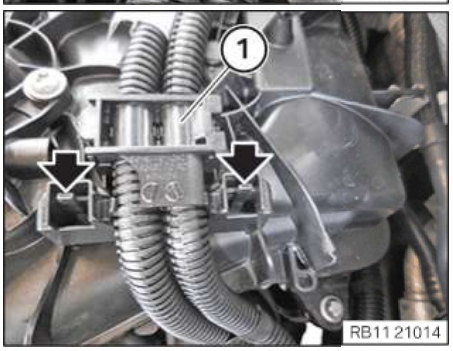
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

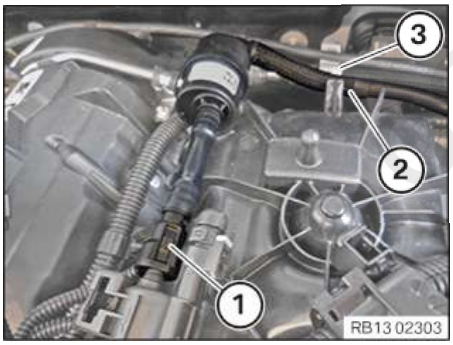
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



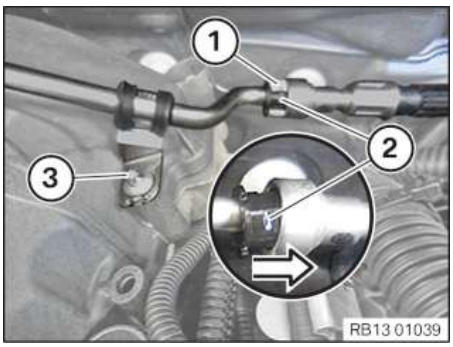
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

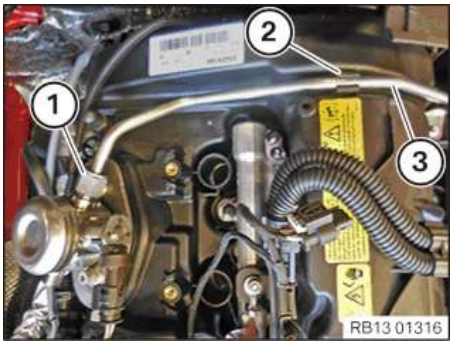


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

19 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

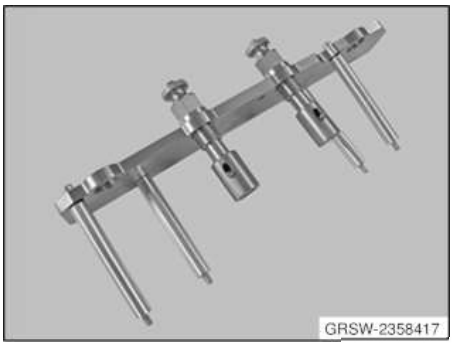
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



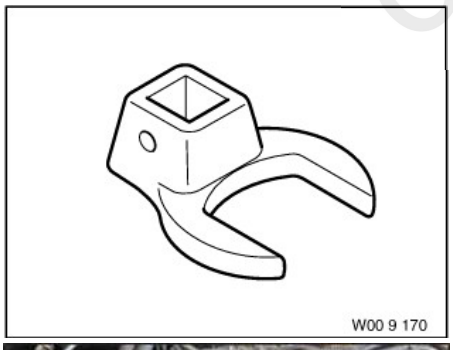
- Prepare special tool 2 358 417.



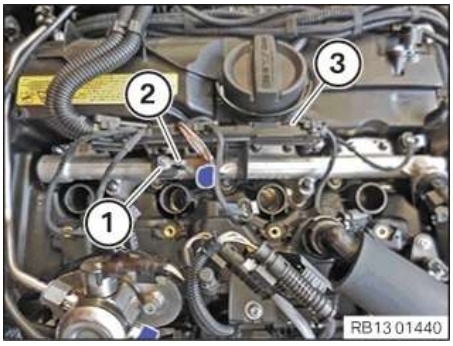
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

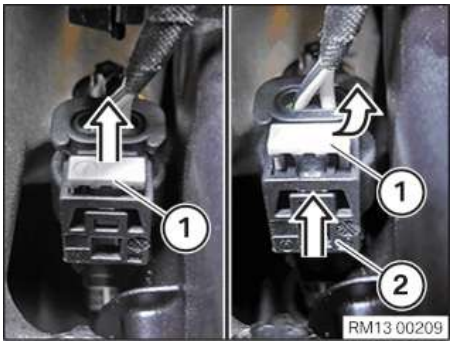


- Prepare special tool .

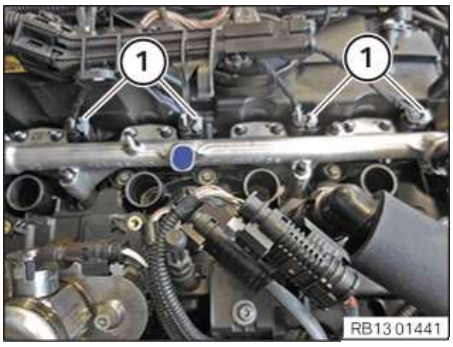


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



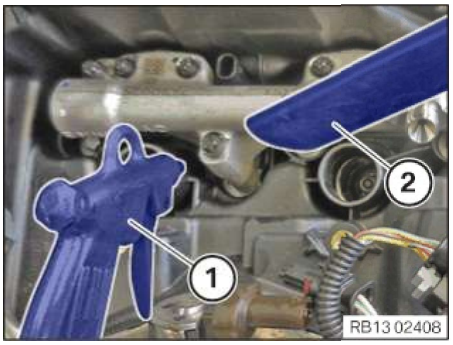
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

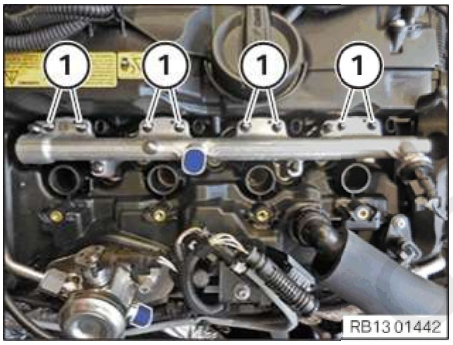


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

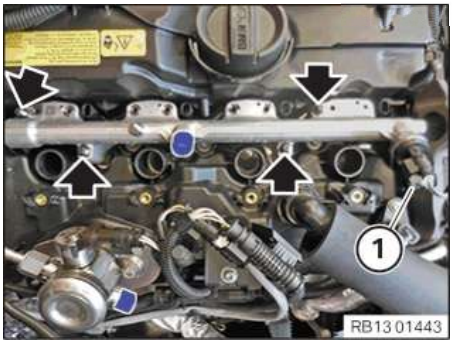
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



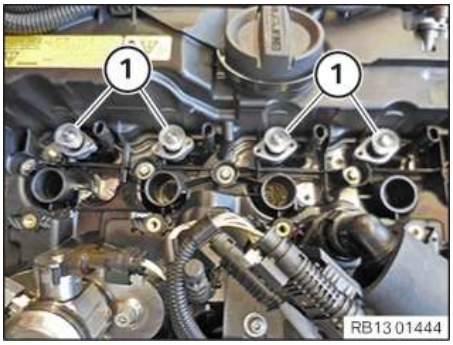
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

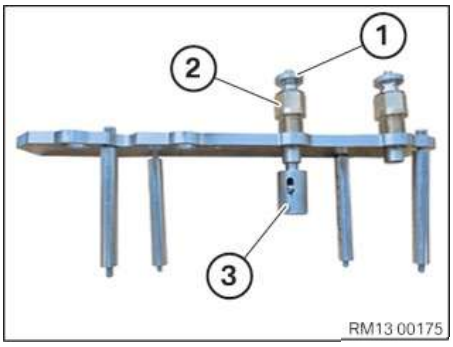
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

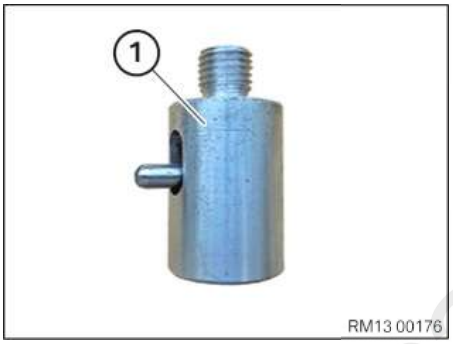
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

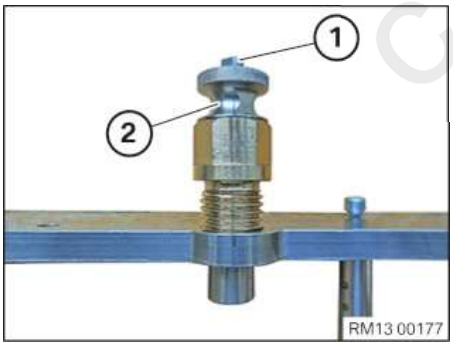
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

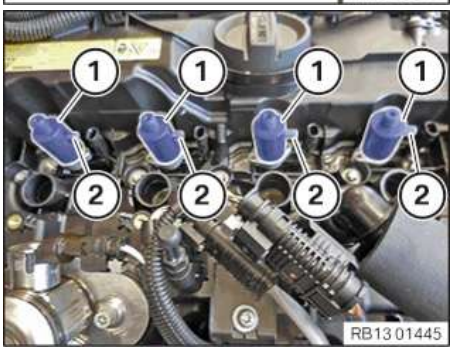
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



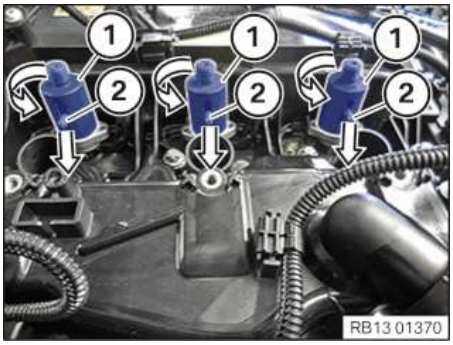
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



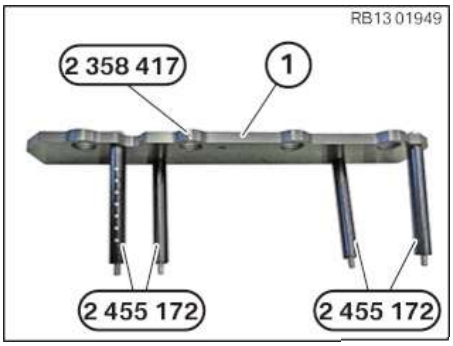
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

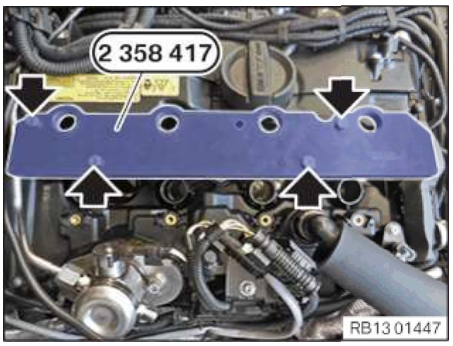
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



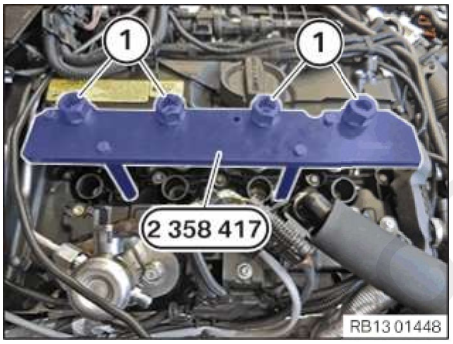
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

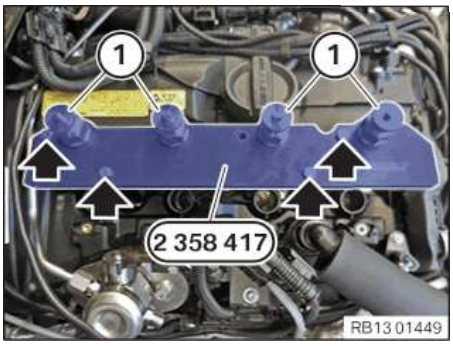
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

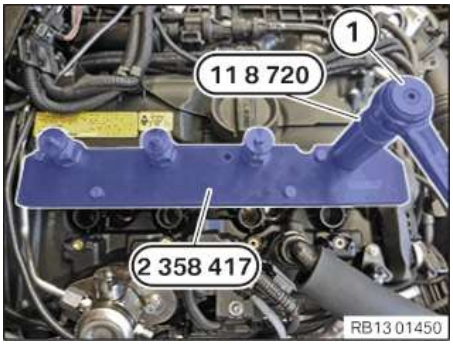
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

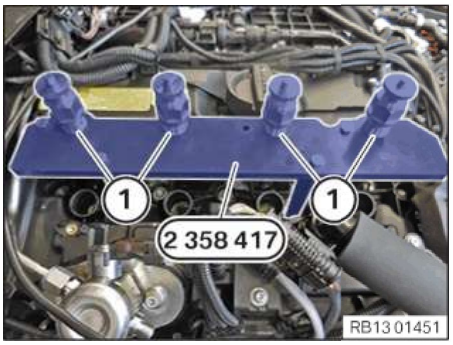


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

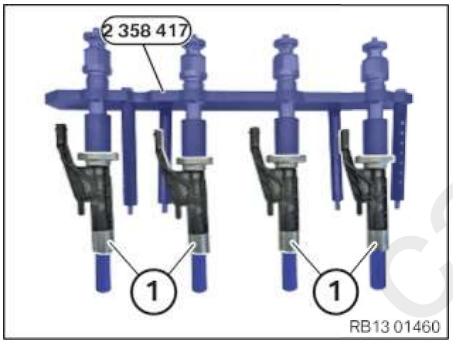
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

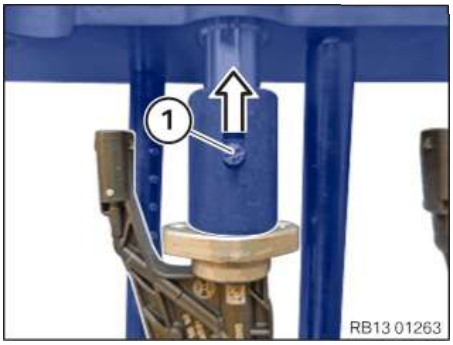


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

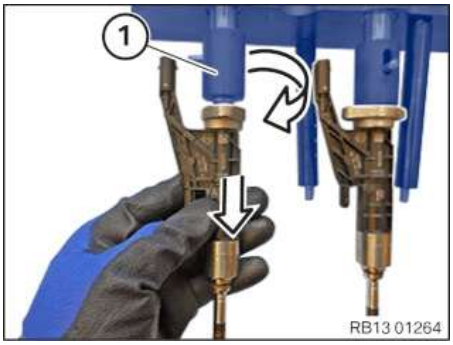


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

20 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

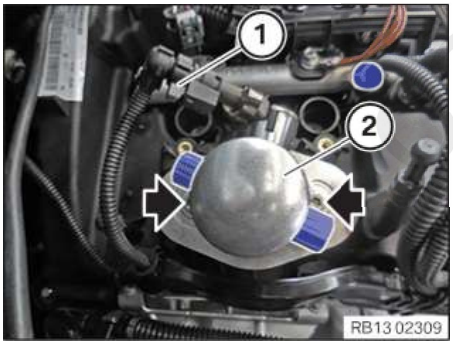
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

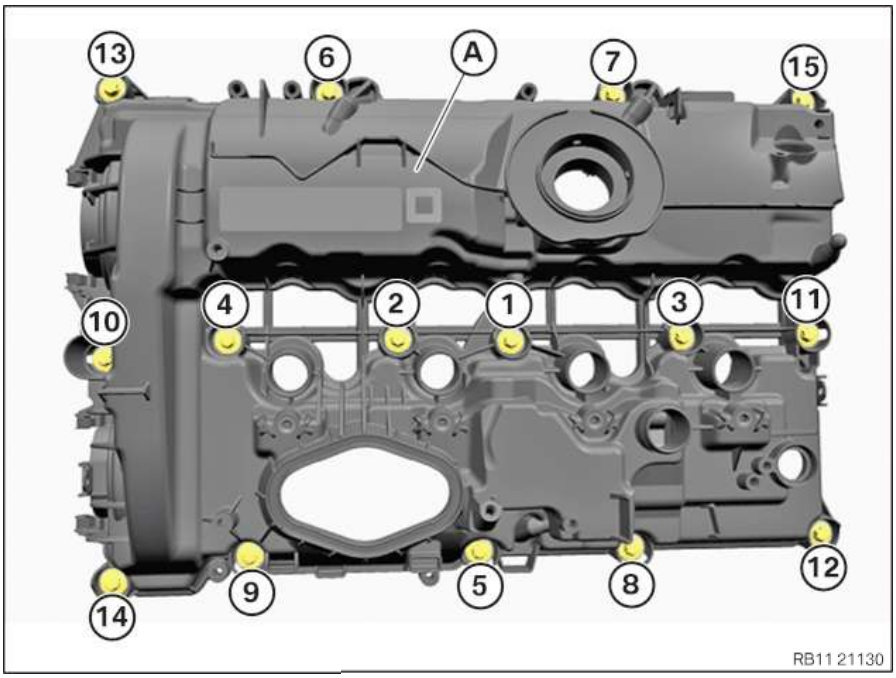


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

MAIN WORK

21 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

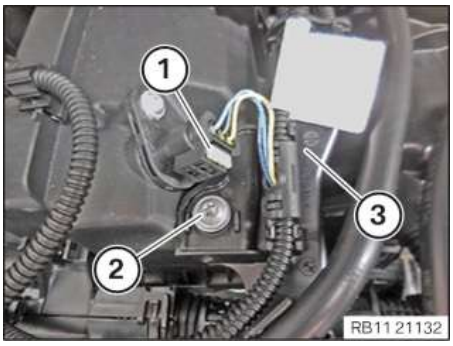
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

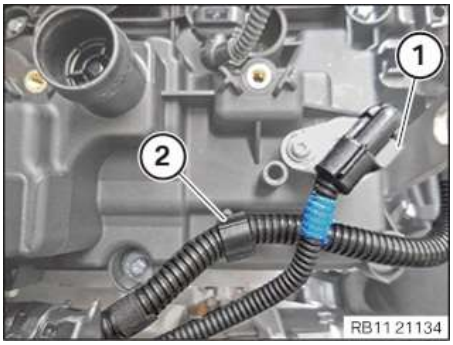
- Do not pull on the wires when disconnecting connectors and plug connections.



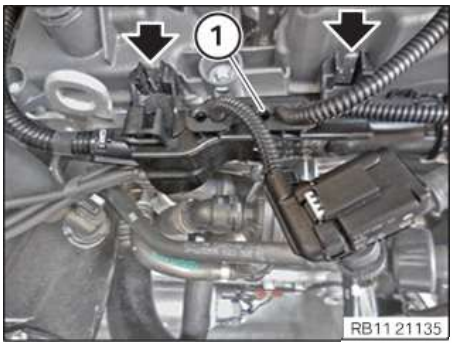
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



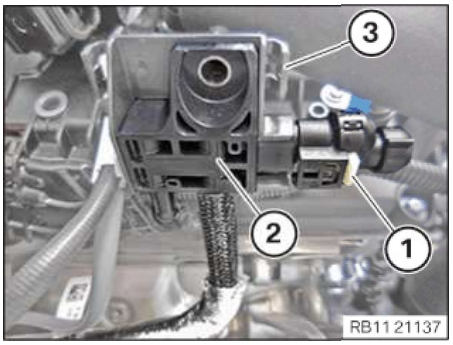
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



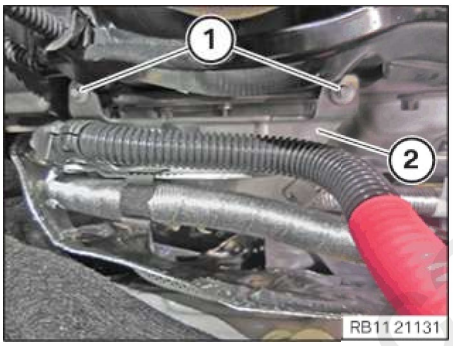
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



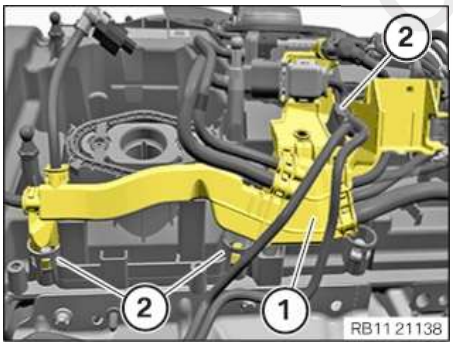
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



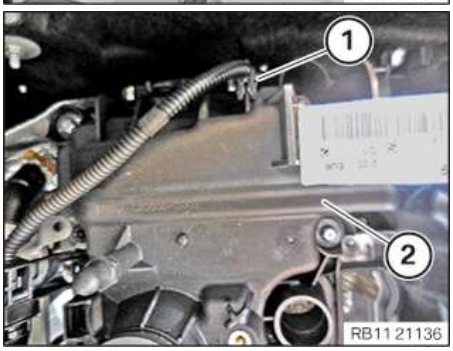
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

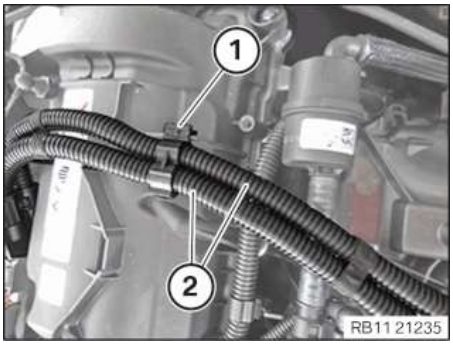


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

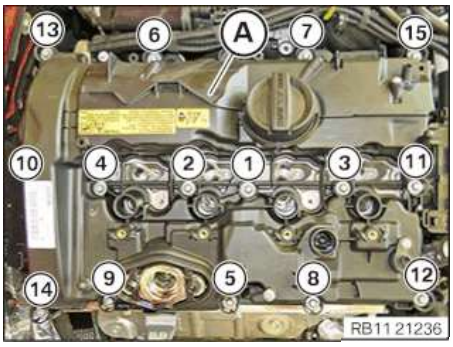


- Loosen clamp (1).

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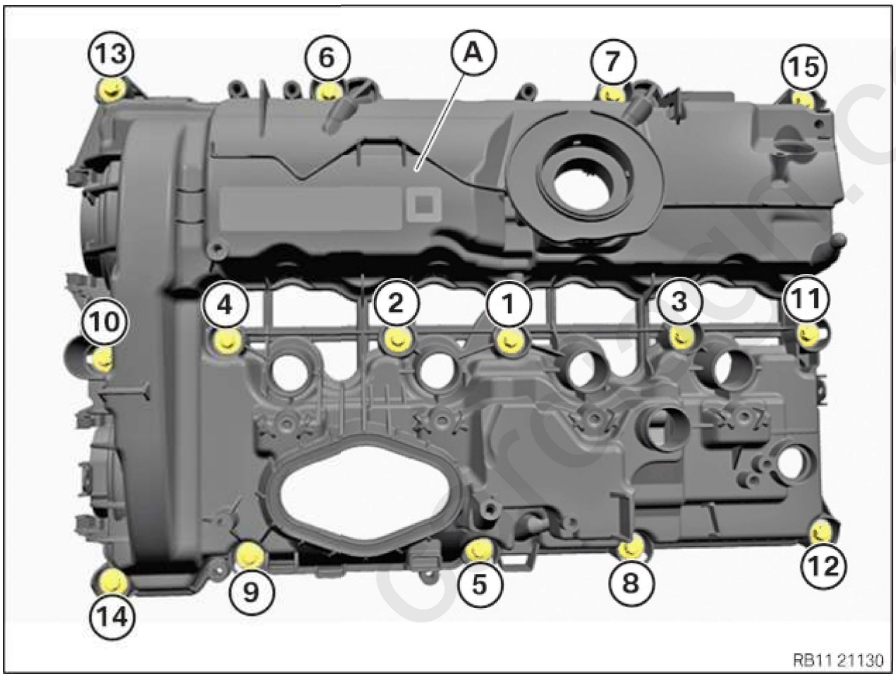
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

22 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

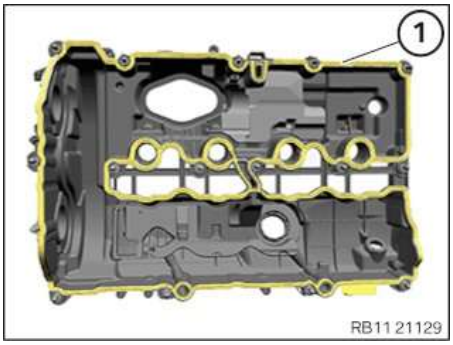
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

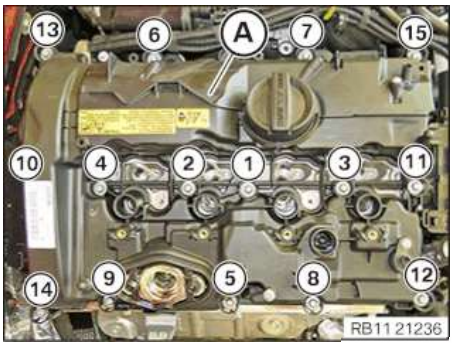
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

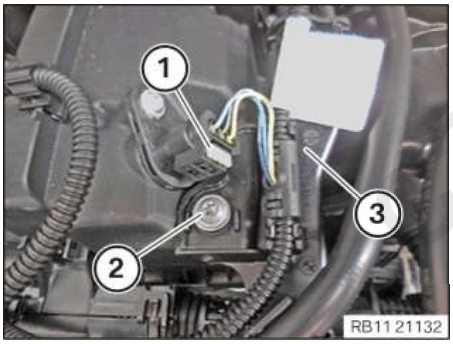
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

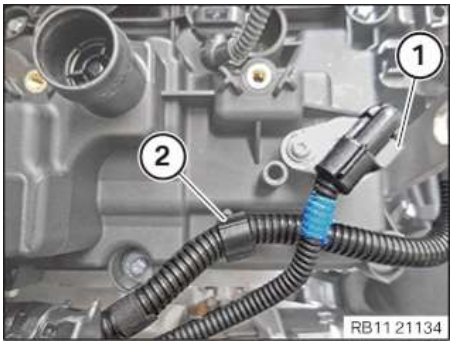


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

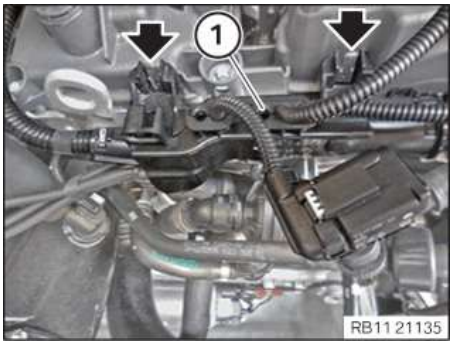
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

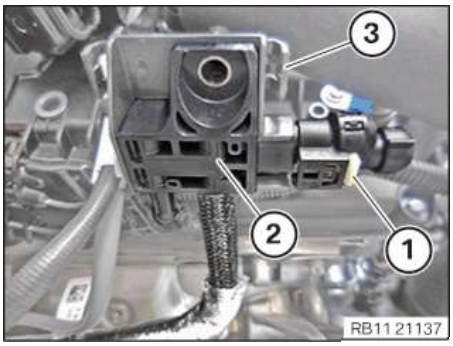


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

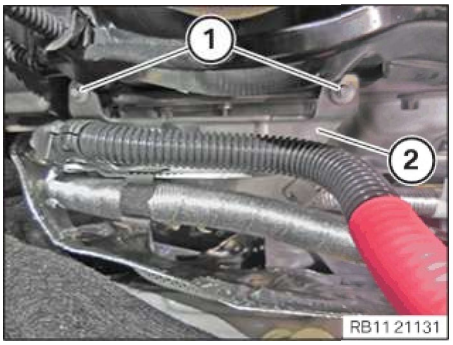
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- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

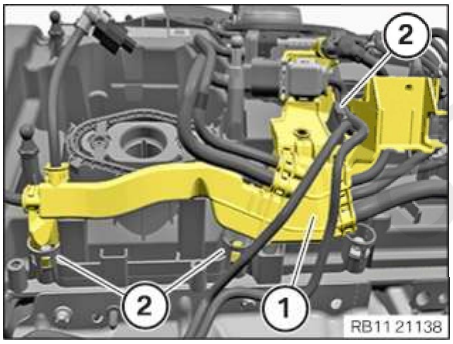
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

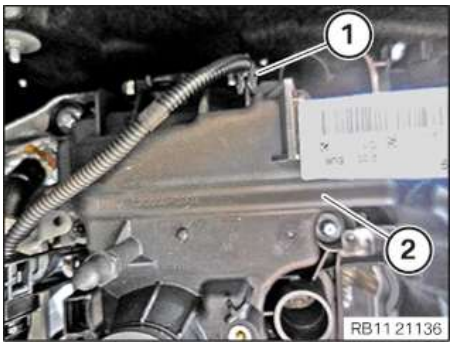
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

6X18	Tightening torque	6 Nm

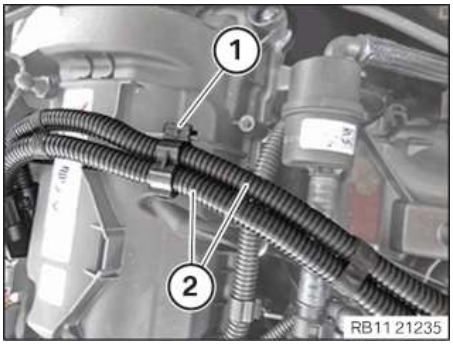


- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.



- Secure clamps (1).

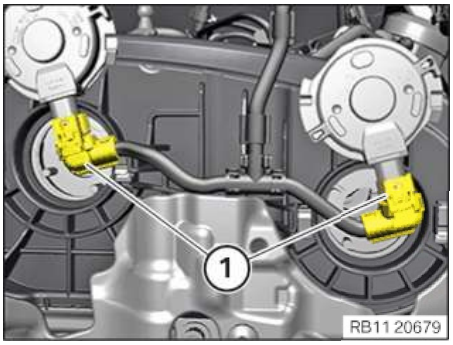
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- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

POSTPROCESSES

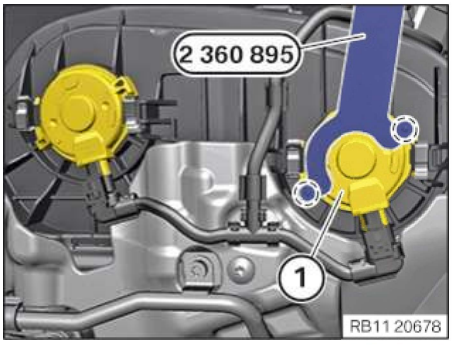
23 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

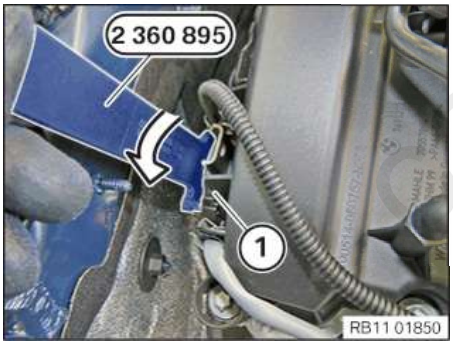
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



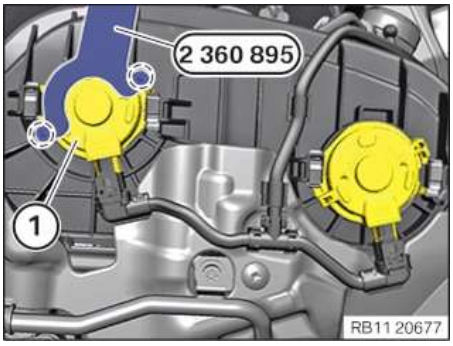
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



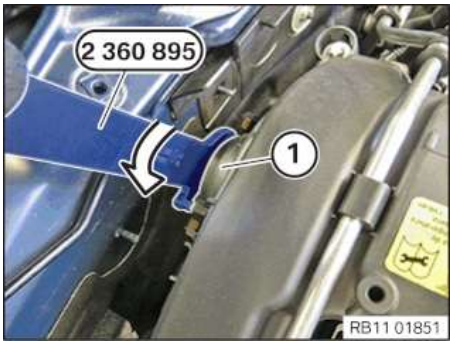
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

24 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

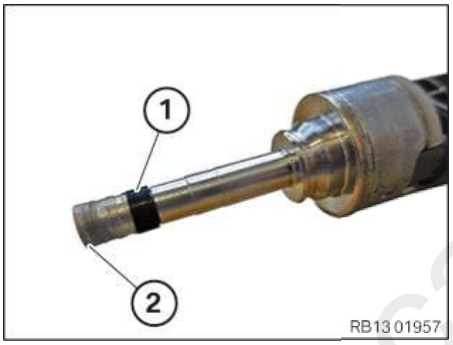
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

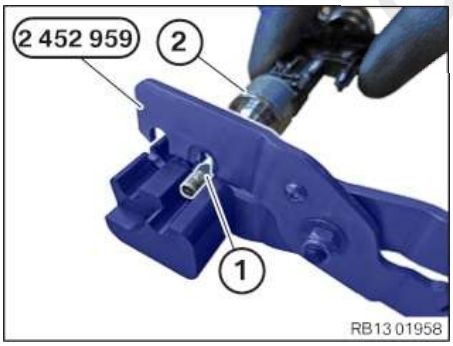
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.



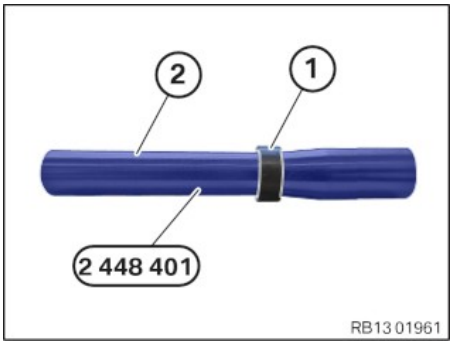
- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

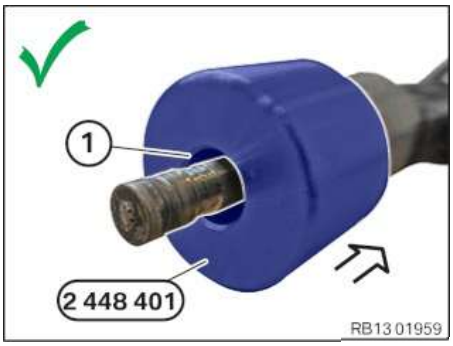
  (2) Sliding sleeve

  (3) Assembly sleeve

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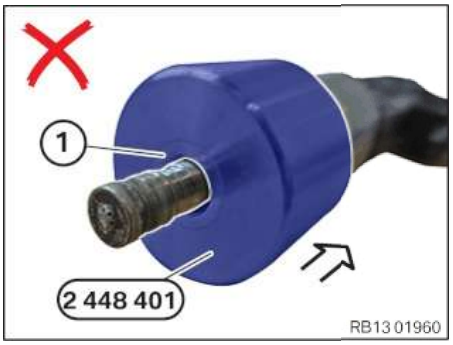


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



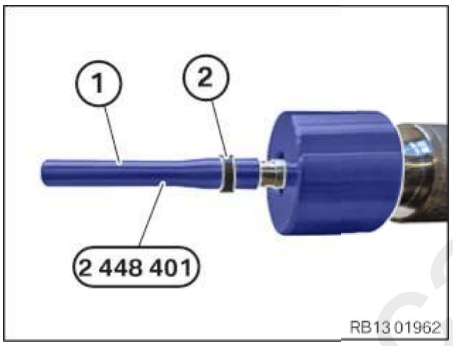
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

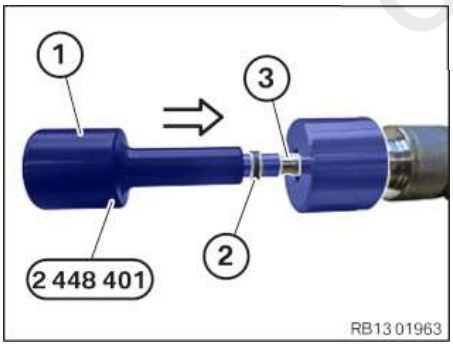


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

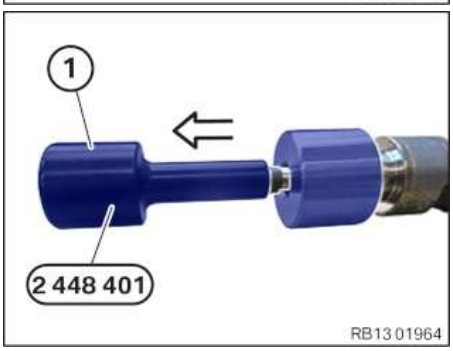
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

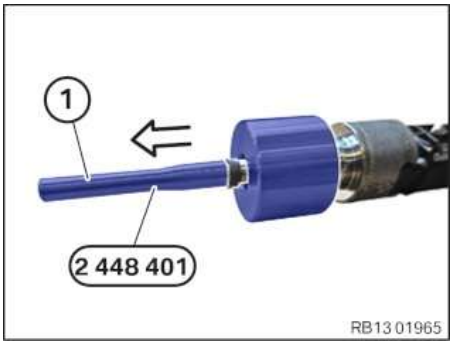


- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

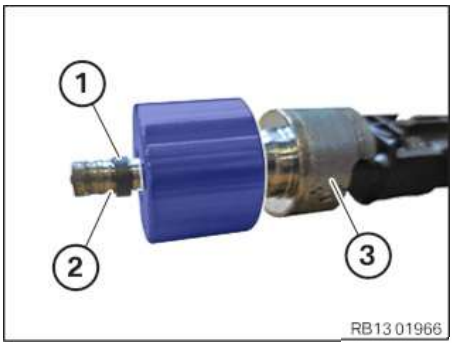


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

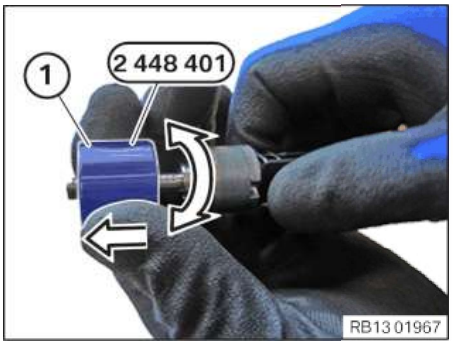
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- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

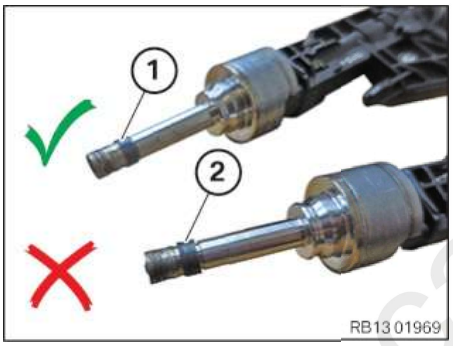


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

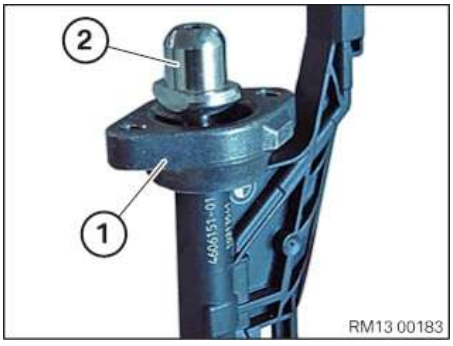


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

25 – Installing the rail with injectors

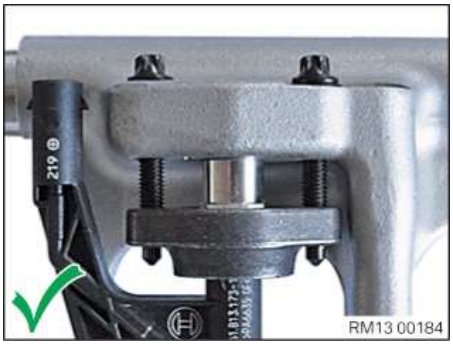
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



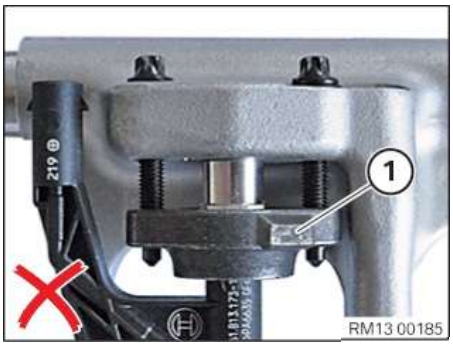
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.

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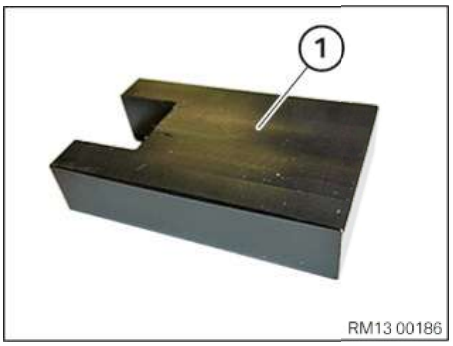
- If applicable, note the position of the cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



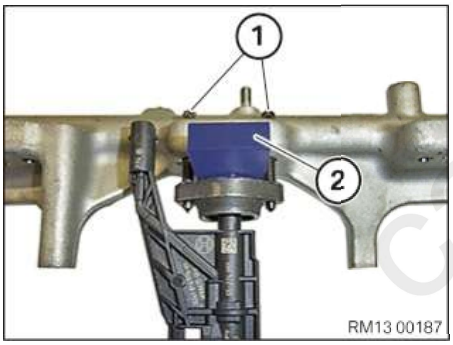
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

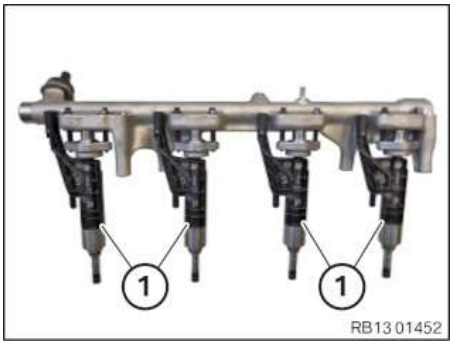
  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



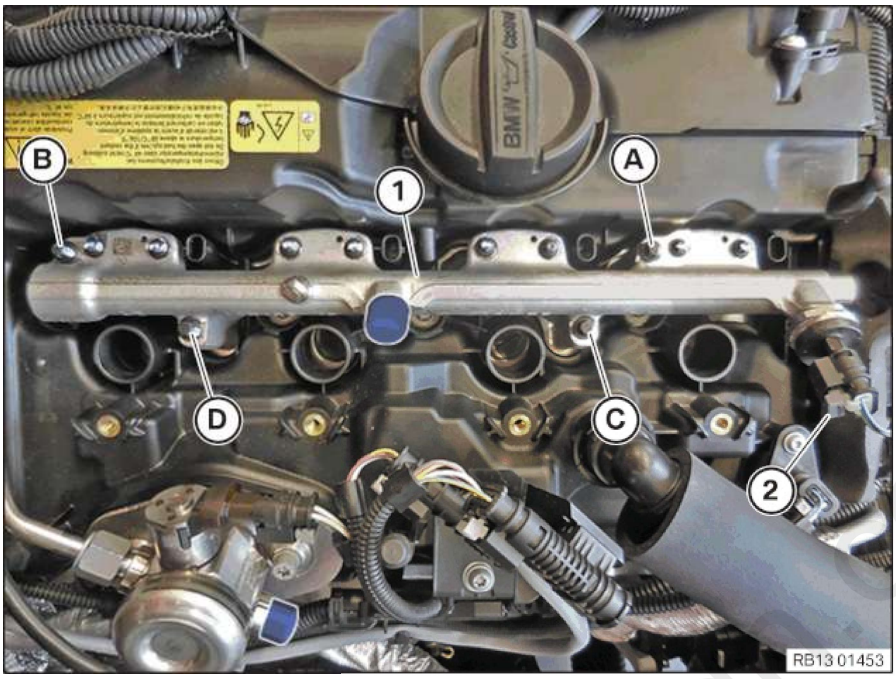
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

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- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.



- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

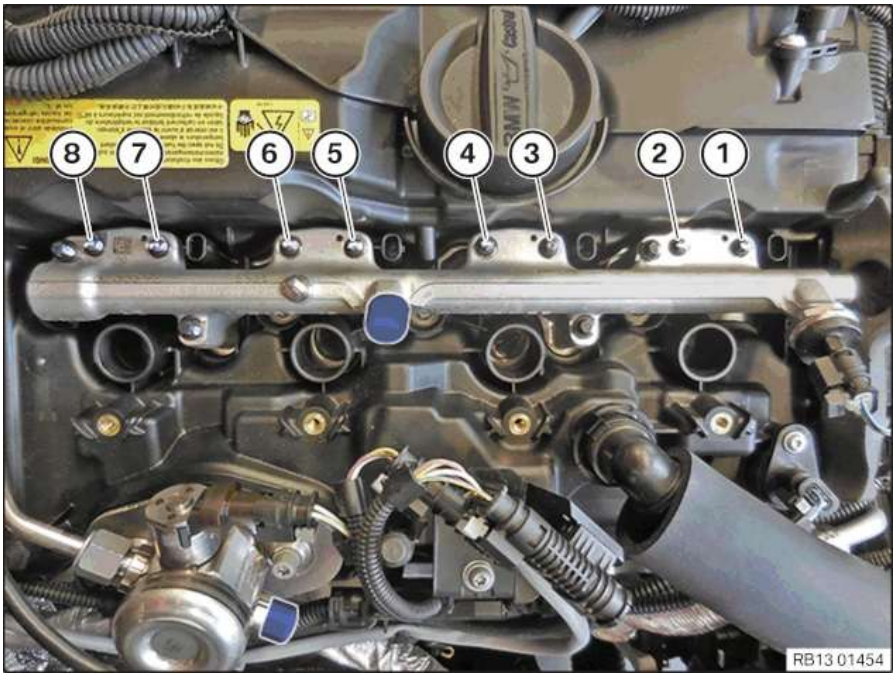
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

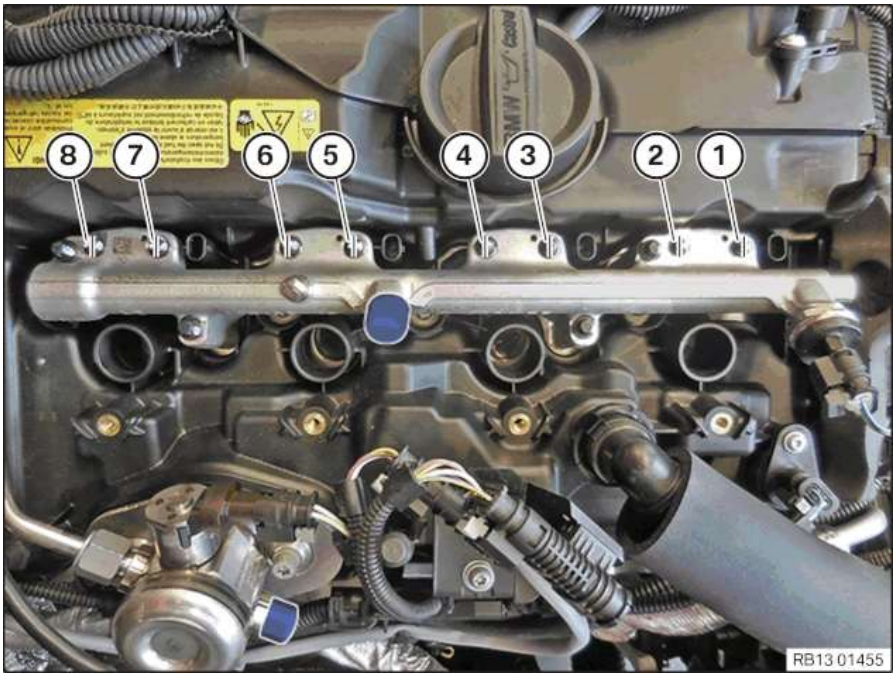
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

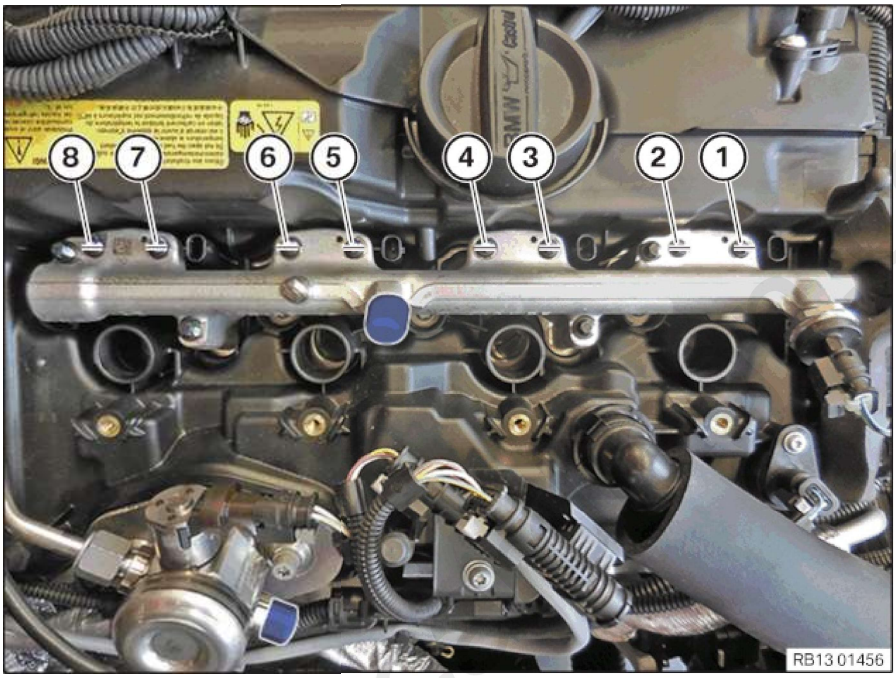
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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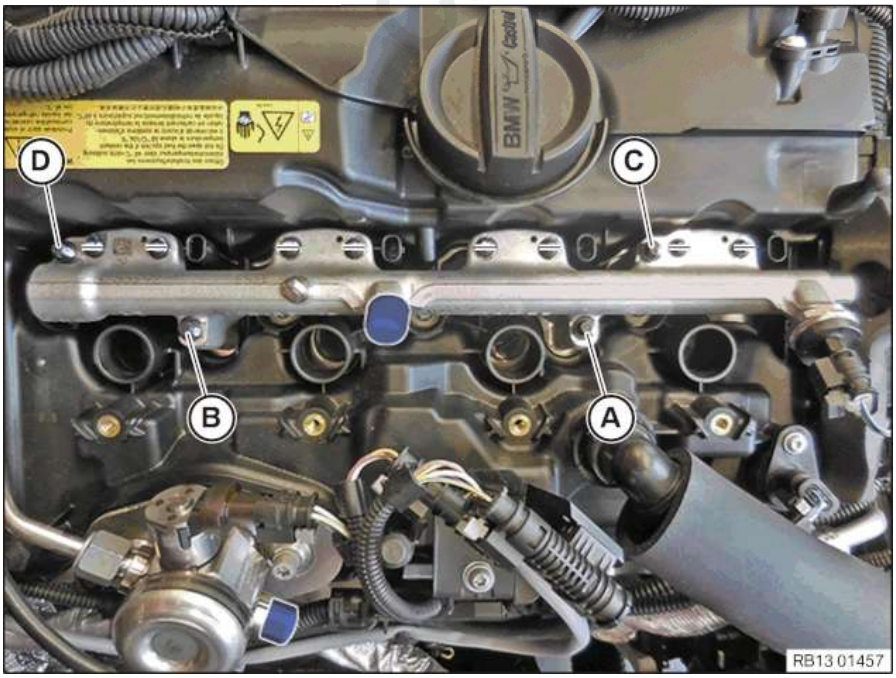


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

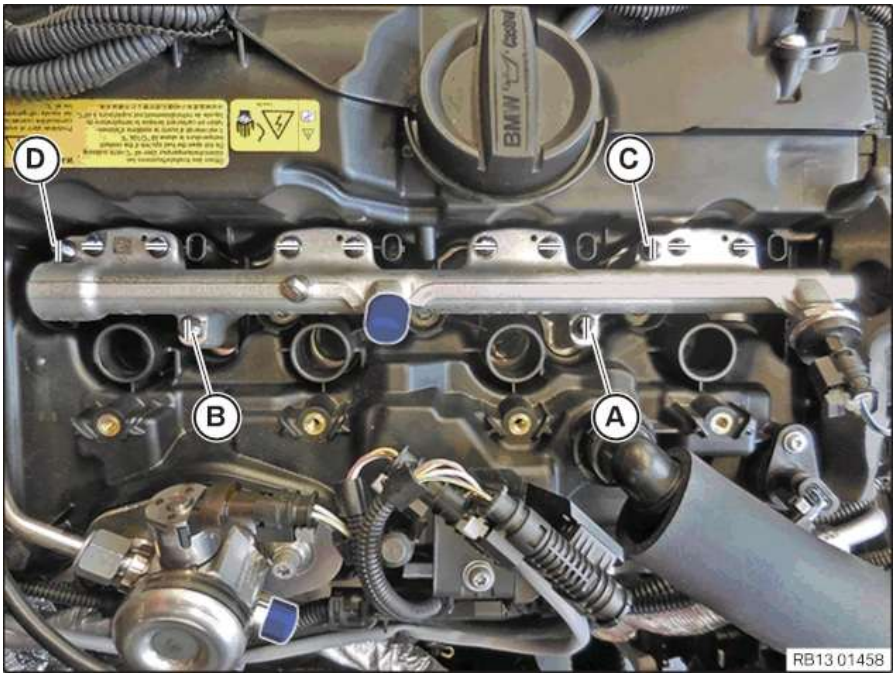
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

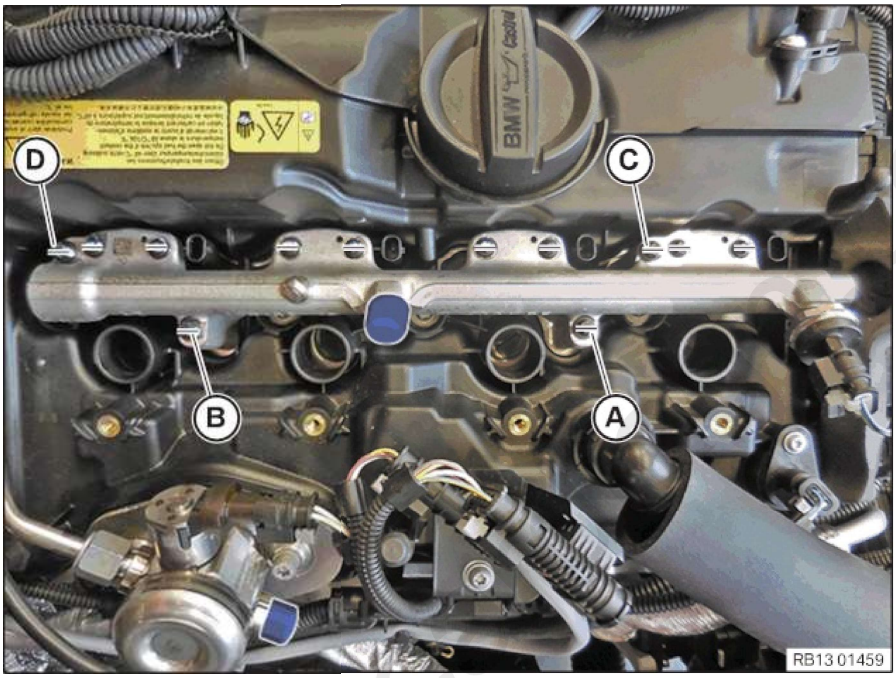
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

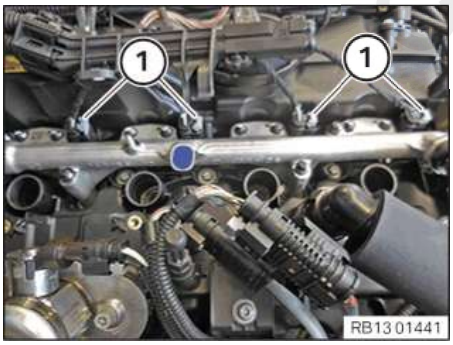


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



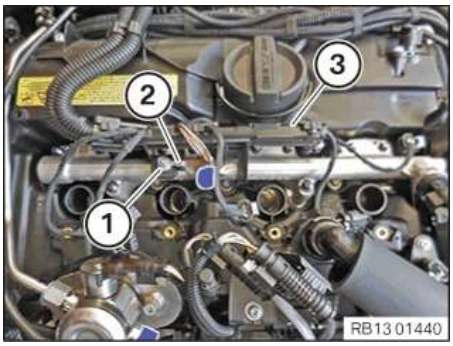
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

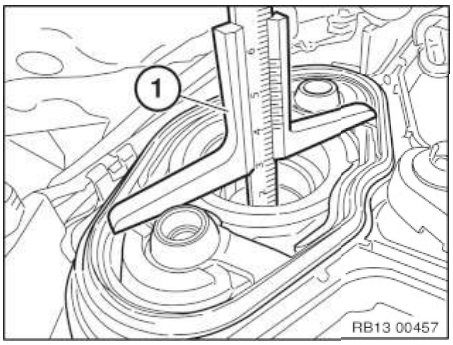
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

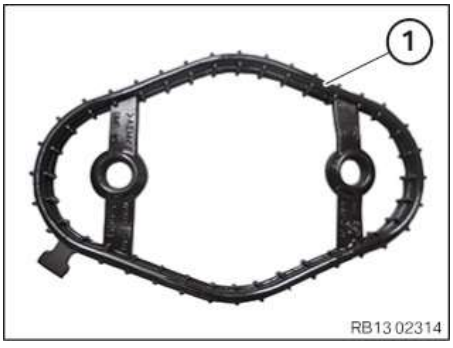
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

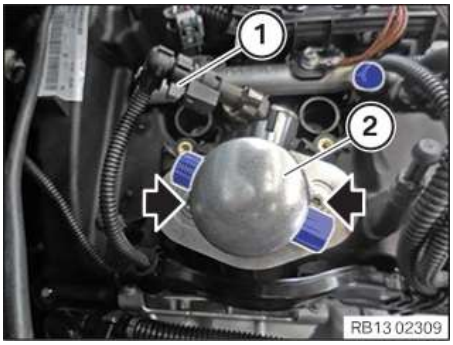
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

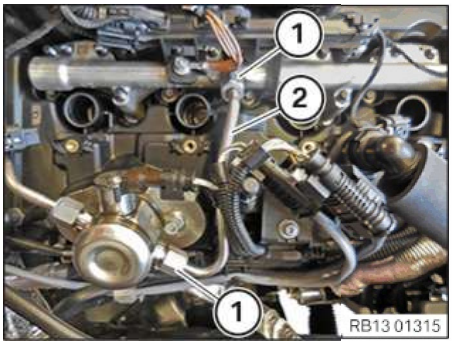
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

27 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

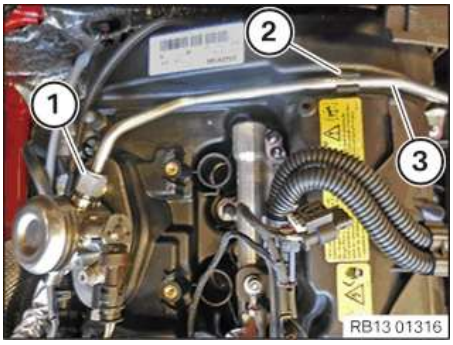
28 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

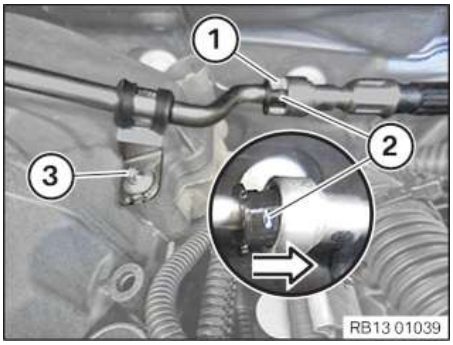


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

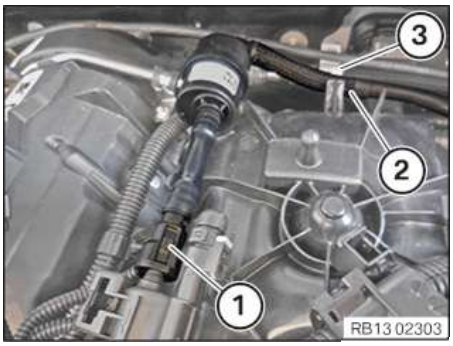
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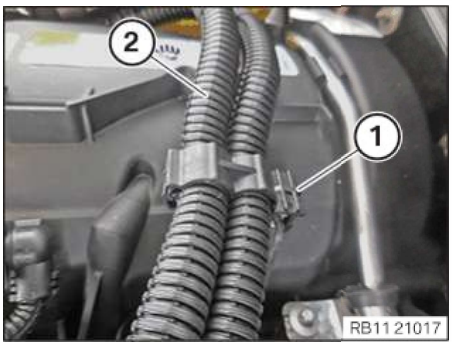
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

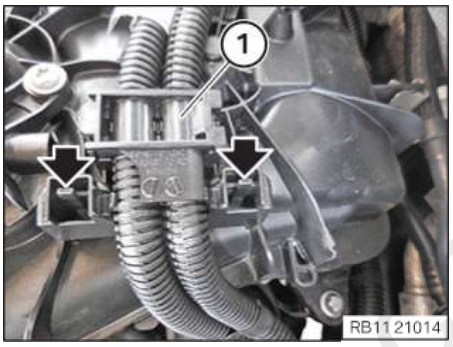
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).



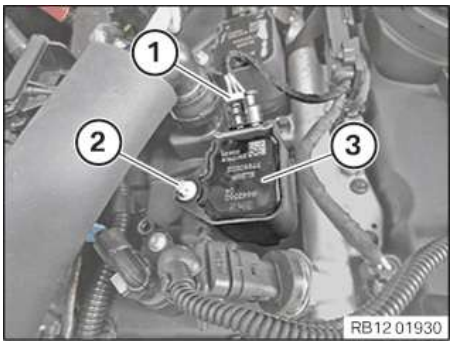
- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

29 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



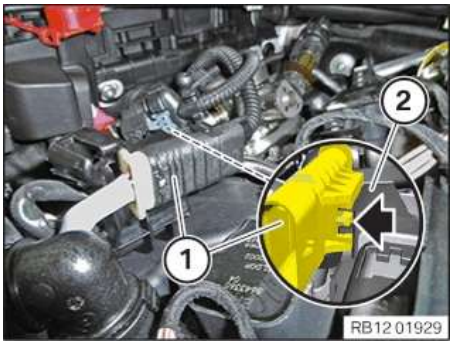
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.
  The connector (1) must engage audibly.

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- Connect and lock connector (1) with holder (2) (arrow).

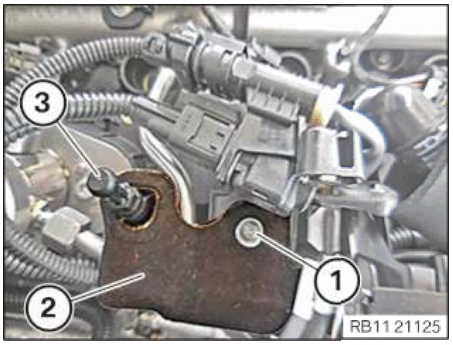
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

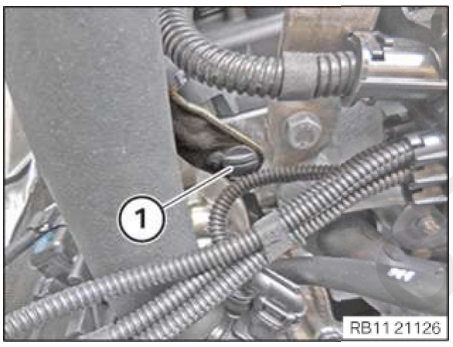
  The connector (1) must engage audibly.

30 – Install the cylinder head cover acoustic cover



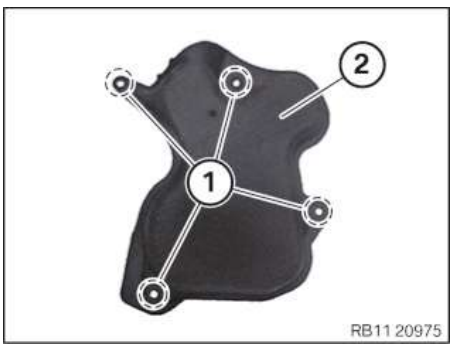
- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

Acoustic cover (side) to cylinder head cover		
TS6 x 20		8 Nm



- Secure the clip (1).

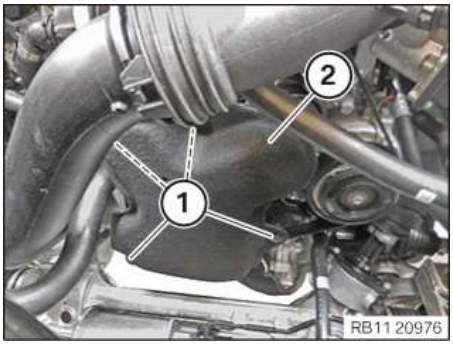
31 – Install the acoustic cover for the engine at the front



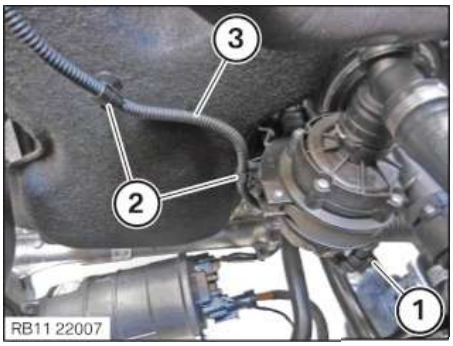
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

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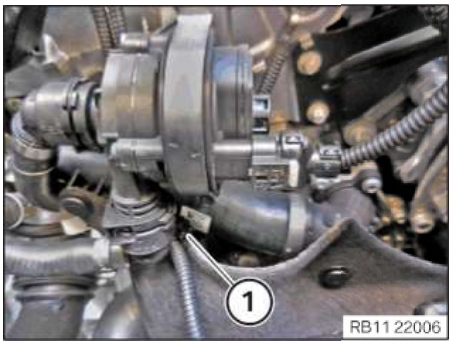


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

32 – Installing the clean air pipe with resonator

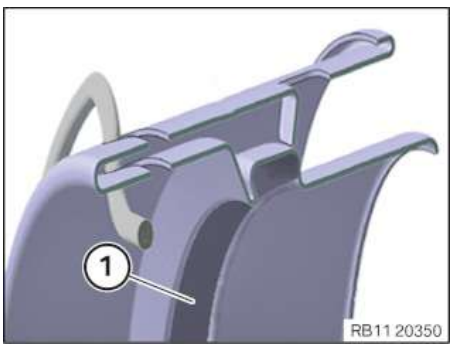


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

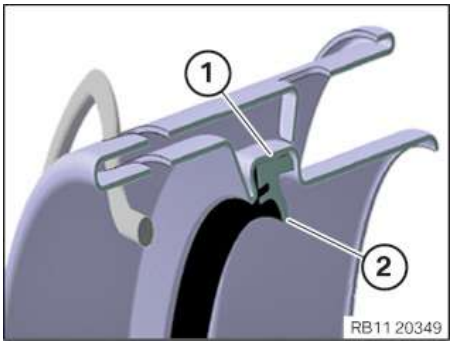
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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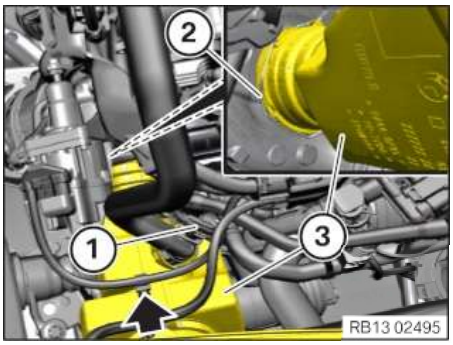
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

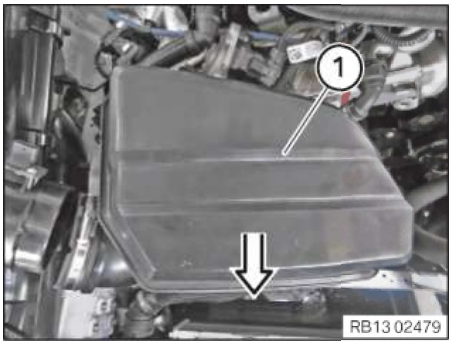
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



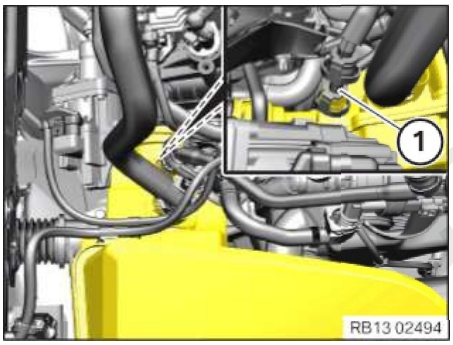
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

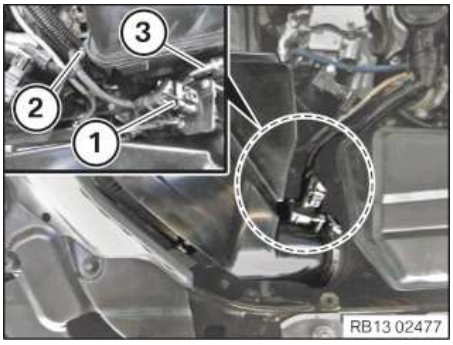
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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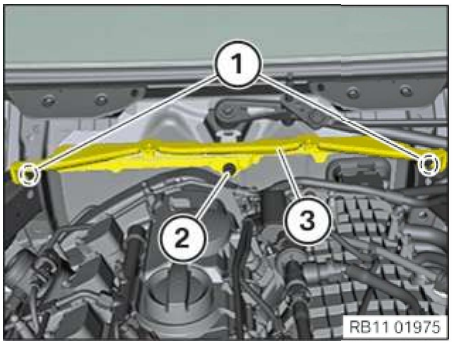
- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

33 – Disconnecting all battery earth leads



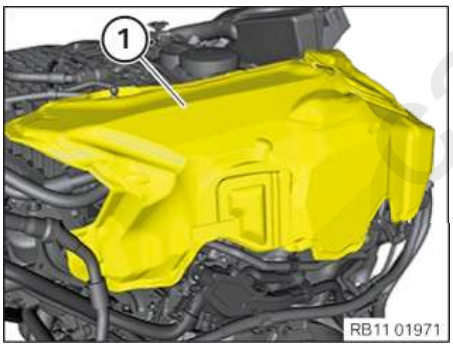
- See additional information.

34 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

35 – Installing acoustic cover at rear



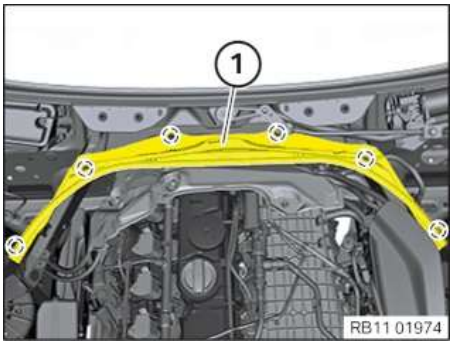
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

36 – Installing the centre bulkhead upper part

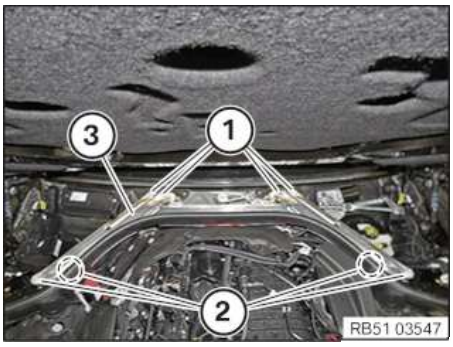
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- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

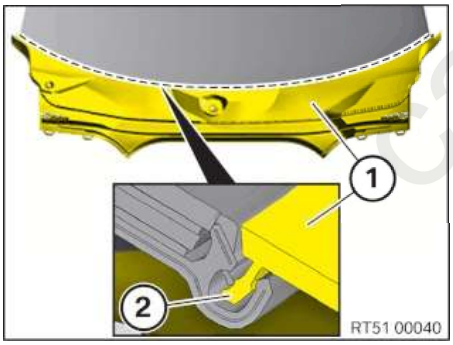
37 – Installing cowl panel cover

RISK OF DAMAGE

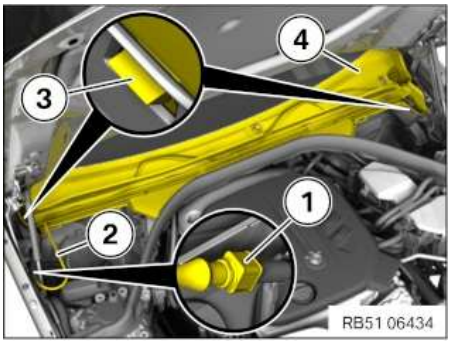
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

38 – Installing both wiper arms

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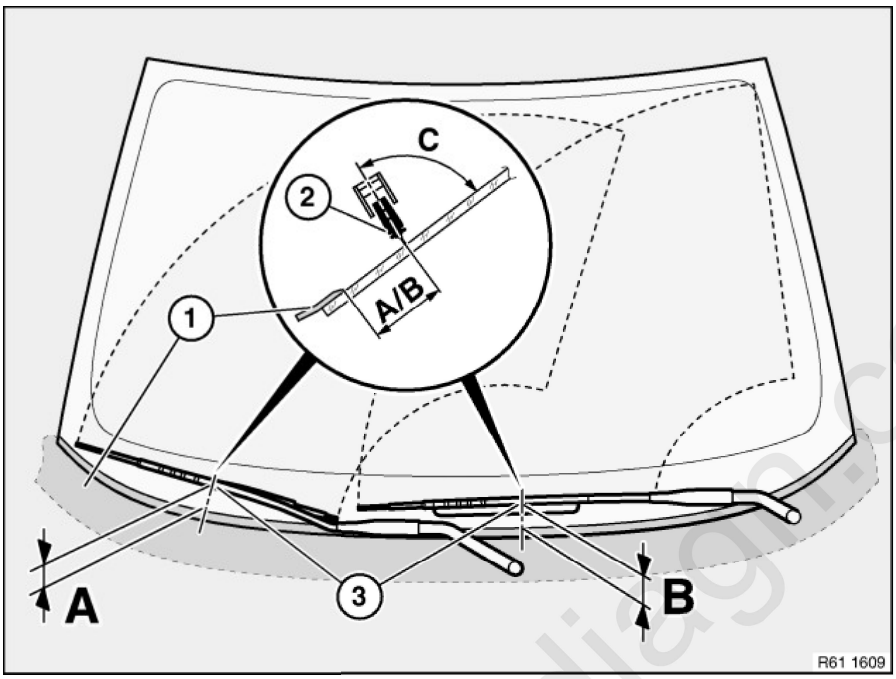
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

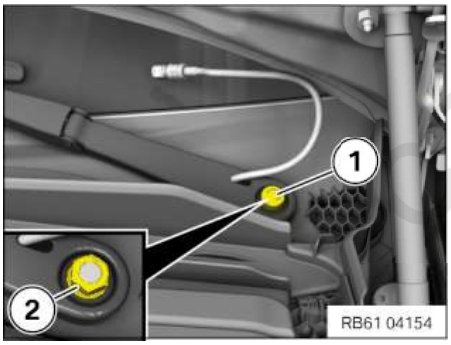
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

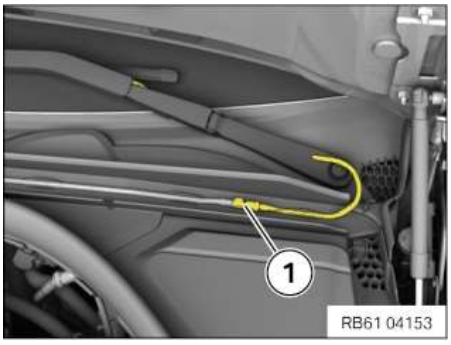


- Tighten nut (2).

Windscreen wiper arm

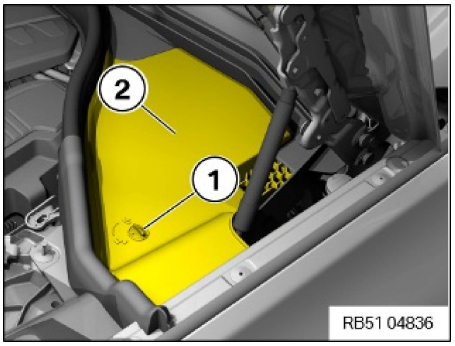
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



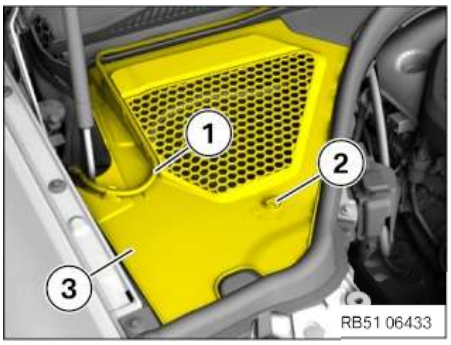
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

39 – Install the cover of the engine compartment on the rear left



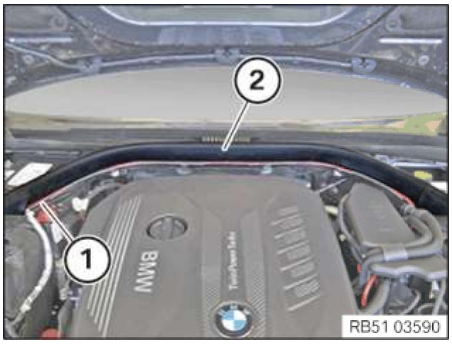
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

40 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

41 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

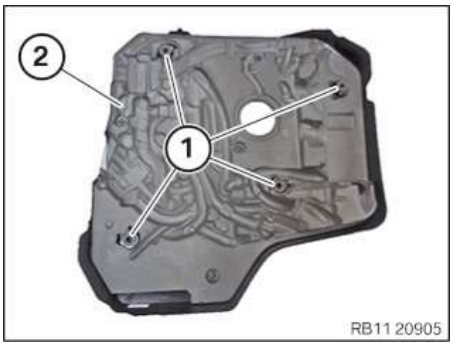
42 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

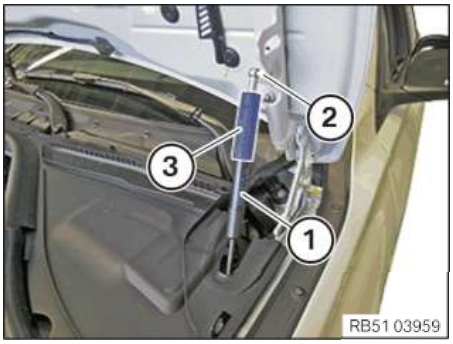
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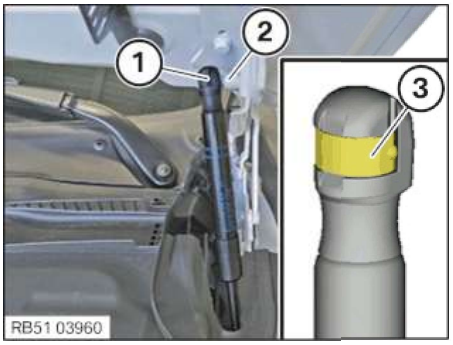
- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

43 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cylinder head cover to cylinder head — Used in step 22

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 22

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 22

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 25

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 26

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 27

M14		Tightening torque	33 Nm

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Fuel delivery line to high pressure pump			Used in step 28
M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover			Used in step 28
M6 screw		Tightening torque	6,5 Nm

Ignition coil			Used in step 29
Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover			Used in step 30
TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 32
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 36
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 36
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 36
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 38
Combination hexagon nut		Tightening torque	35 Nm

Overview of Special Tools

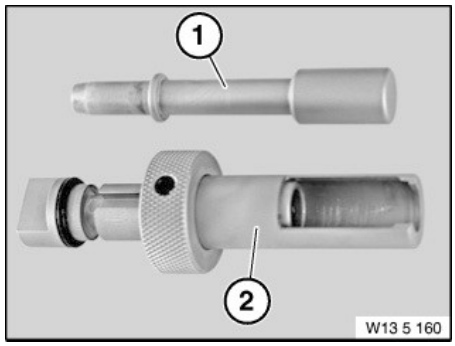
2 360 895 Pin wrench



Common		Used in step 1223
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).	
Included in the tool or work		
Storage location	A56	
Replaced by		
In connection with		
SI-Number	01 13 14 (098)	

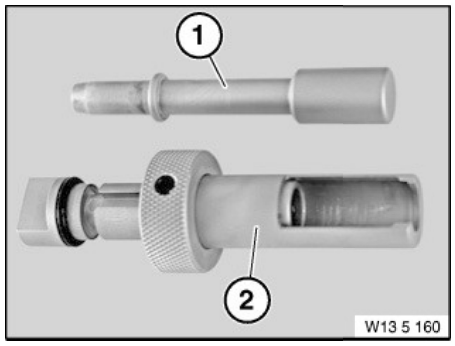
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0 496 567 (13 5 161) Fastener



Common	Used in step 18
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

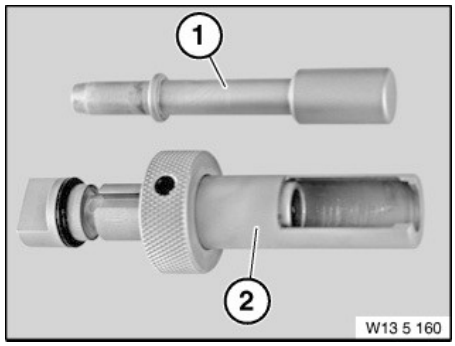
0 496 568 (13 5 162) Fastener



Common	Used in step 18
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 565 (13 5 160) Fastener



Common Used in step 18

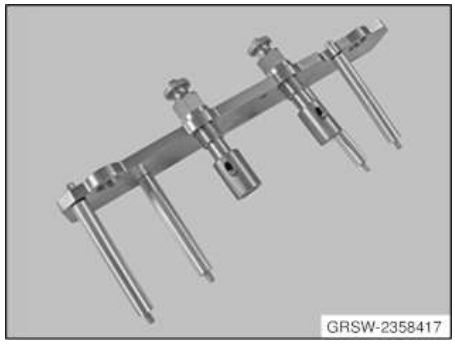
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

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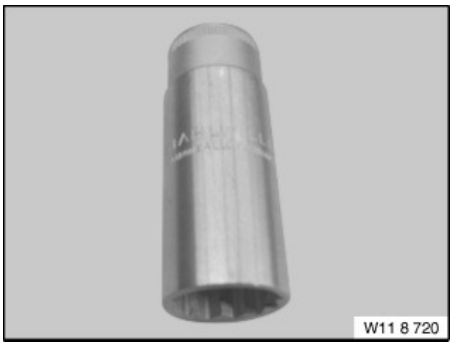
2 358 417 Device



Common Used in step 19

Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 19
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 452 959 Pliers



Common	Used in step 24
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 24
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

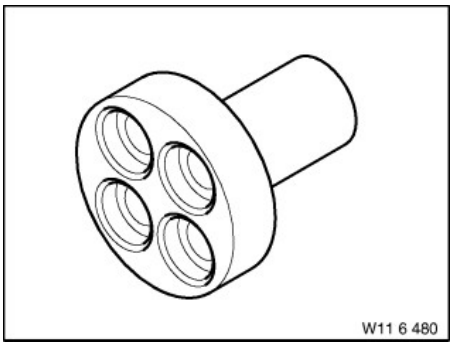
2 358 022 Gauge



Common	Used in step 25
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 493 380 (11 6 480) Connector



Common	Used in step 26
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 38
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	133
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	133
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
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61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133

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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 20 900 Disconnecting and connecting battery earth lead	133
61 35 ... Notes on ESD protection (Electro Static Discharge)	12
61 35 ... Notes on ESD protection (Electro Static Discharge)	121519
13 53 ... Clean the cylinder head around the injectors due to grit / dust	19
61 13 ... Unlocking and disconnecting different plug connections	192122

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11 12 161 replace cylinder head

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

RISK OF DAMAGE

Engine damage due to lack of engine oil.

Lack of engine oil after the cylinder head or the engine has been renewed may cause damage to the valve gear.

- Do not start the engine after renewing the cylinder head or the engine without following the repair notes.
- The repair notes on renewing the cylinder head or the engine must be followed.
- For additional information, see: Repair notes on renewing the cylinder head or the engine

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

Engine compartment lid is open.

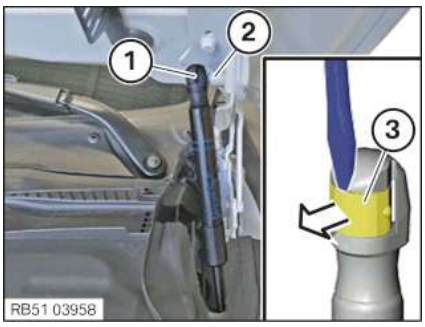
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CAUTION

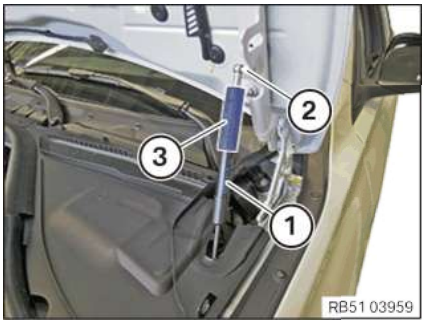
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

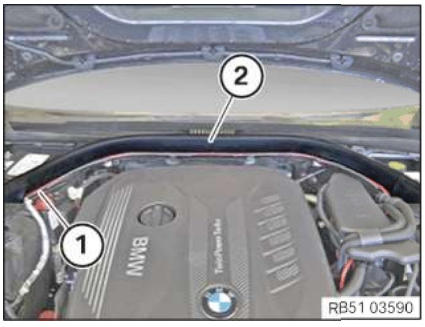


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

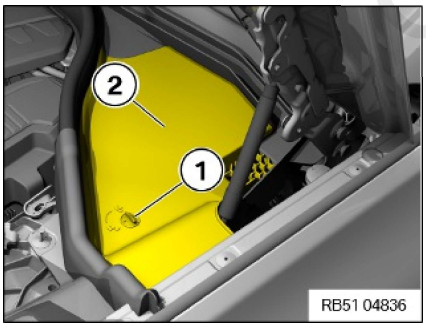
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



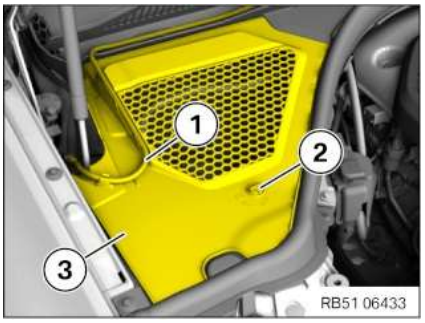
- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment



- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

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6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

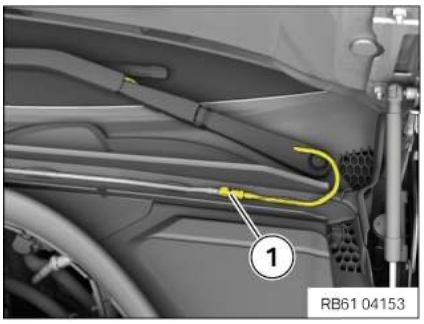
▸ **Remove the wiper arm**

RISK OF DAMAGE

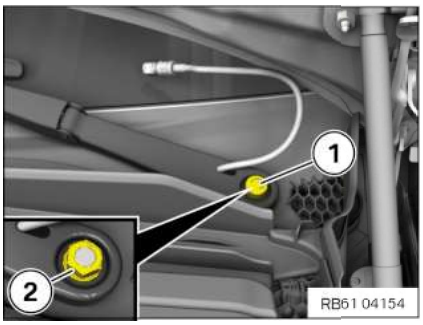
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

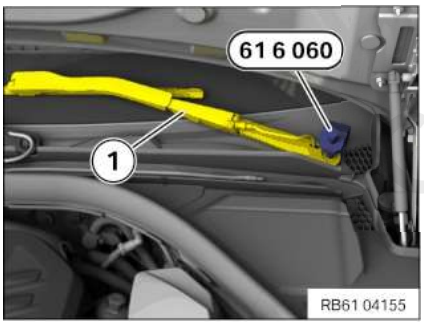
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.

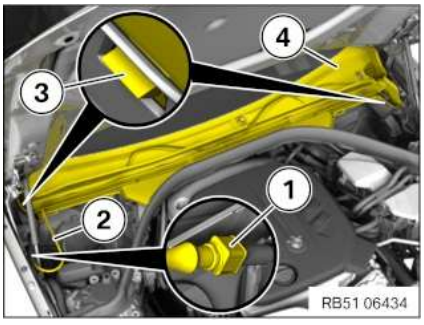


- Remove the protective cap (1).
- Loosen nut (2).



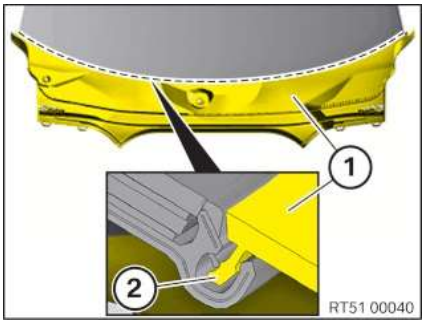
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover



- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

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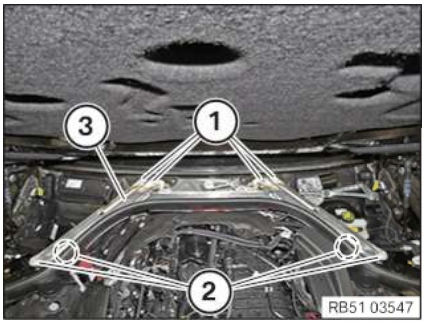


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

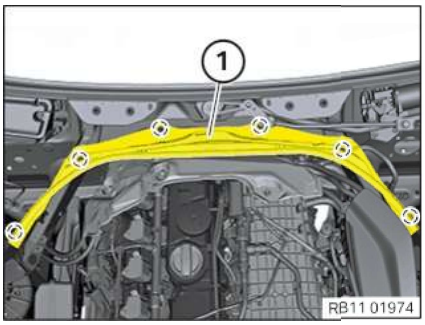
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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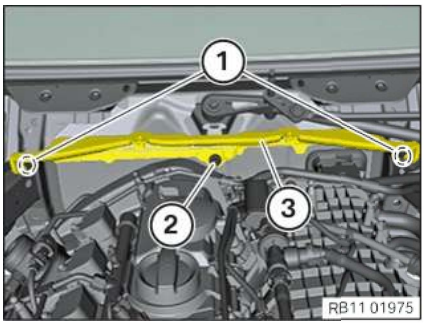
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing the clean air pipe with the resonator

WARNING

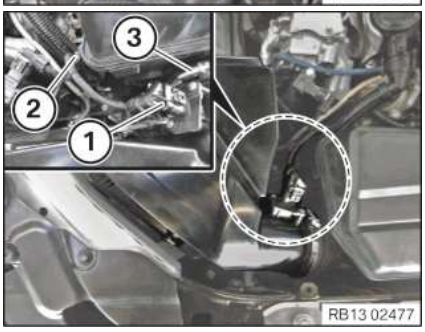
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

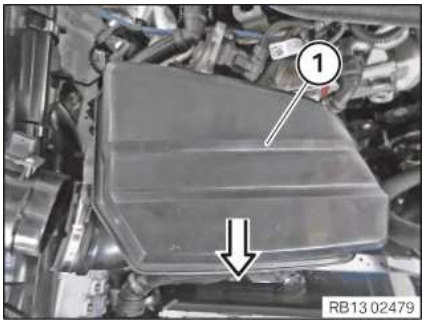


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

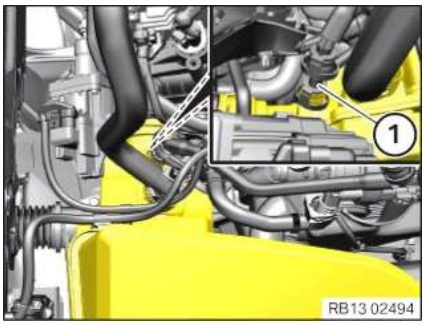


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

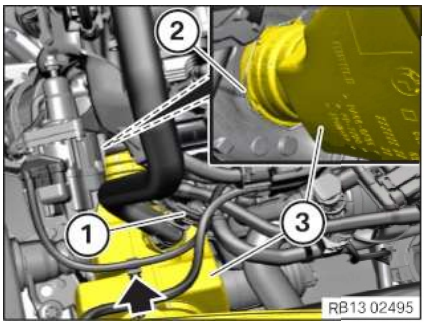
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- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

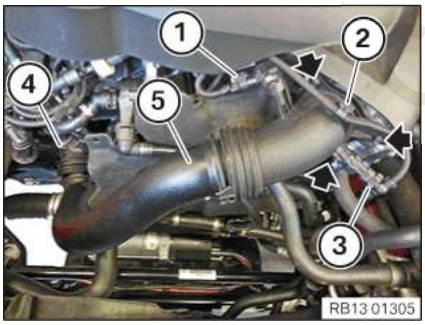
13 – Remove charge air line

WARNING

Hot surfaces.

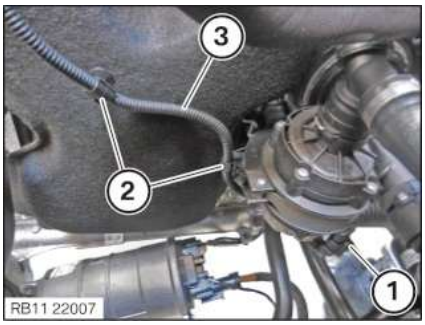
Risk of burning!

- Perform all work only on components that have cooled down.



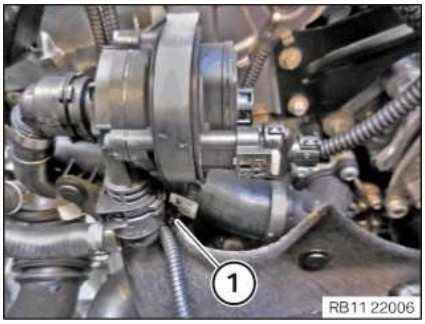
- Unlock and loosen the connector (1) on the charging pressure sensor.
- Unlock and loosen clamp (2).
- Unlock and disconnect the connector (3) from the charge-air temperature sensor.
- Remove screws (arrows).
- Unlock and loosen the clamp (4) on the exhaust turbocharger.
- Guide out and remove charge air line (5).

14 – Removing the acoustic cover for the engine at the front

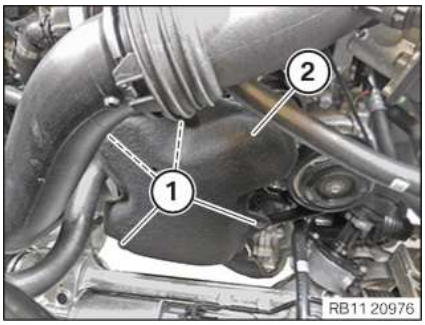


- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

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- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.
For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

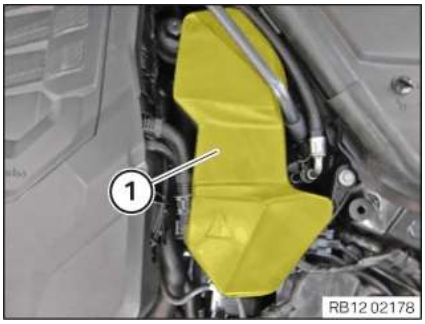
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.
For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

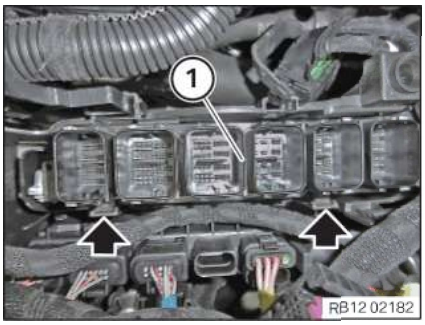
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- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

16 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

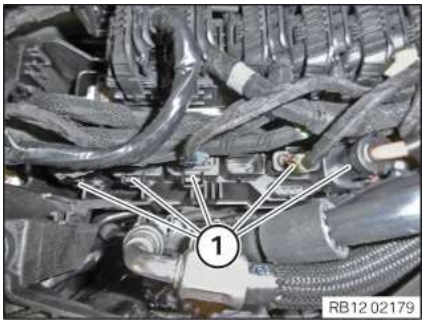
RISK OF DAMAGE

Electrostatic discharge.

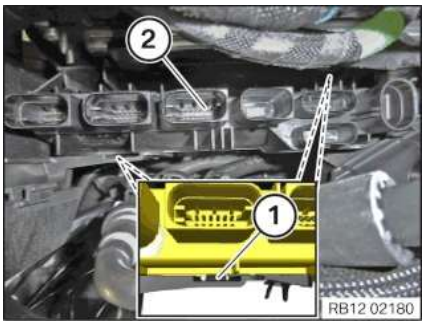
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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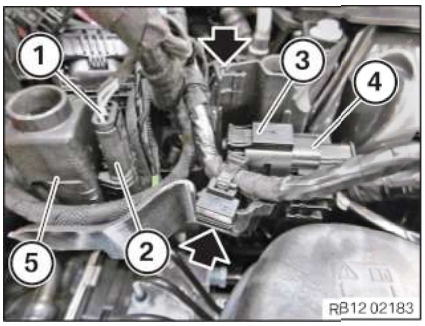


- Unlock and disconnect plug connections (1).

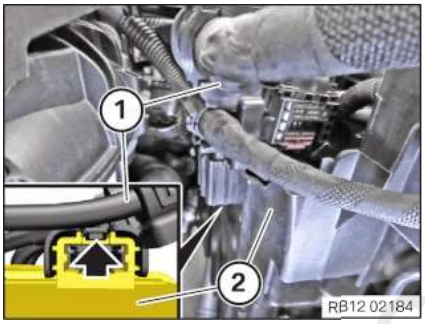


- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

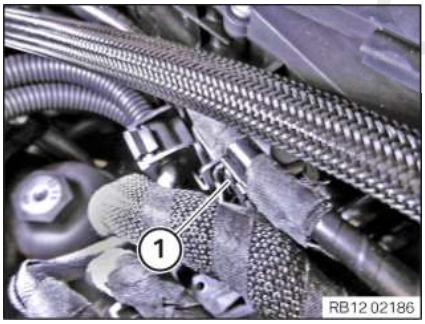
17 – Removing the control unit holder



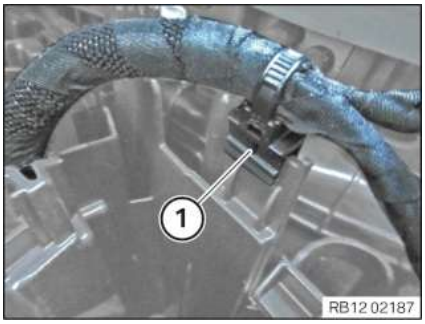
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).



- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).

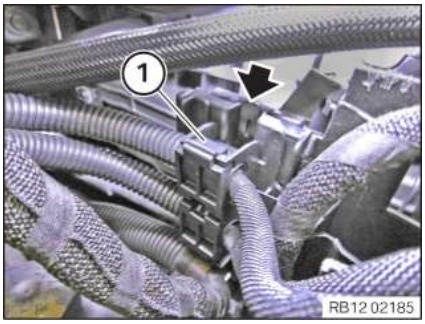


- Loosen clamp (1).

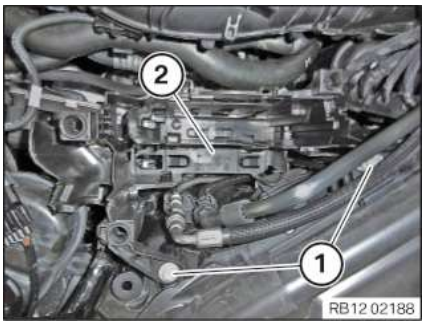


- Loosen clamp (1).

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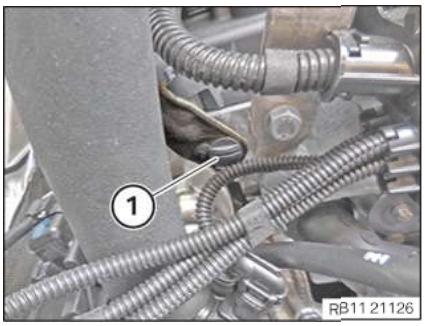


- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.

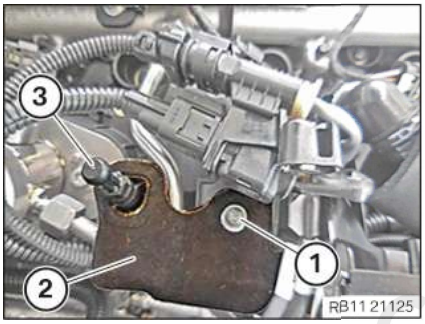


- Loosen screws (1).
- Guide out and remove the control unit holder (2).

18 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

19 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

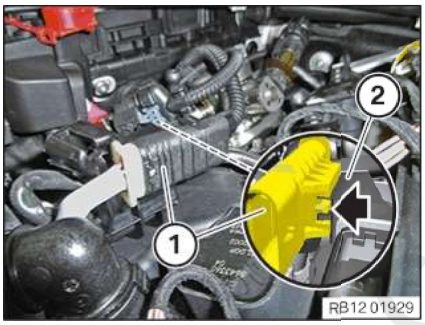
Electrostatic discharge.

Damage to or destruction of electrical components.

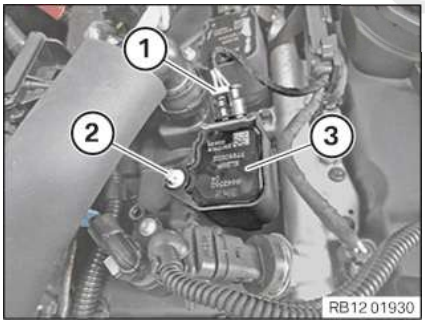
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

20 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

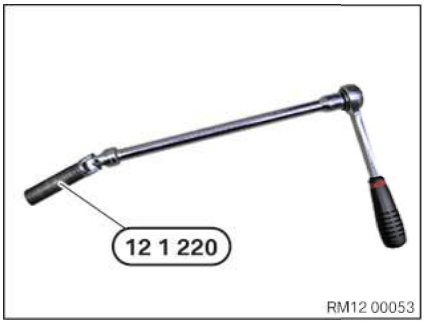
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

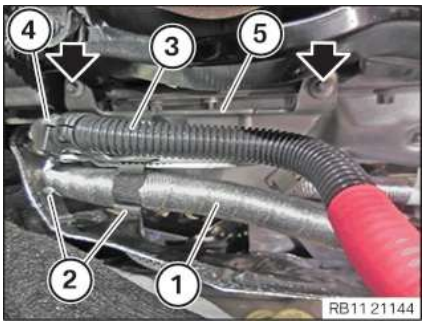
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.



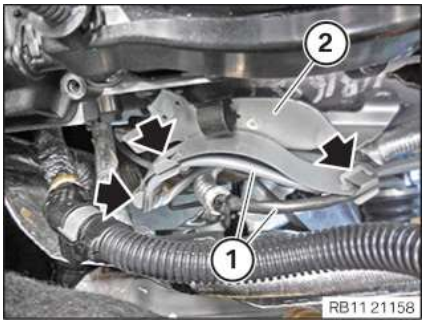
- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

21 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.

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- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

22 – Remove the heat shield on the cylinder head

WARNING

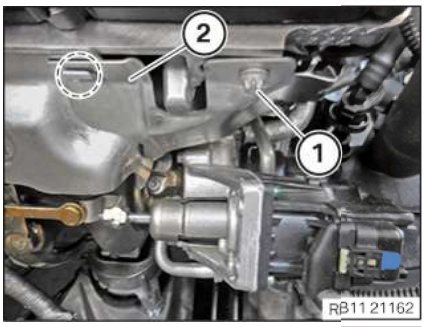
Hot surfaces.

Risk of burning!

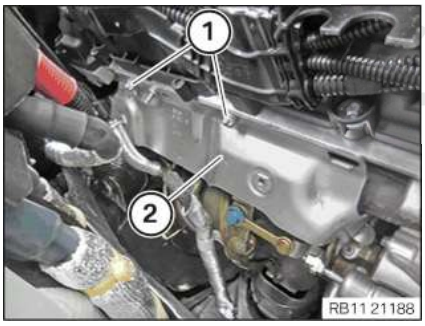
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.



- Loosen screws (1).
- Feed out and remove the heat shield (2).

23 – Remove the control sensor

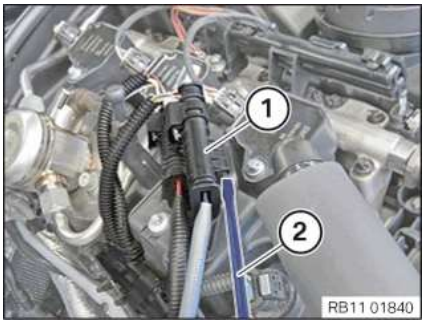
WARNING

Hot surfaces.

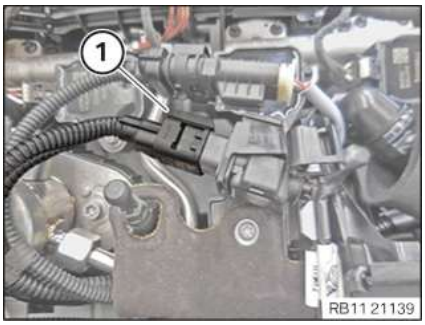
Risk of burning!

- Perform all work only on components that have cooled down.

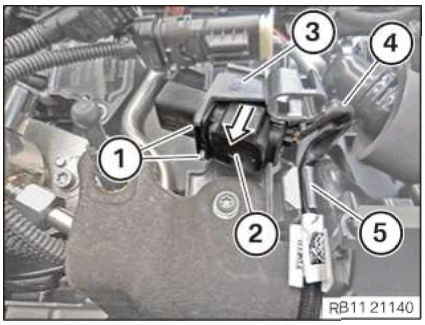
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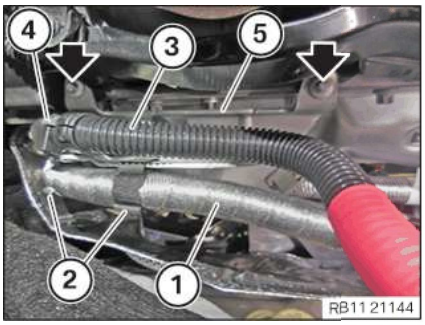
- Unlock connector (1) with screwdriver (2) and remove from the carrier plate.
- Unlock and loosen connector (1).



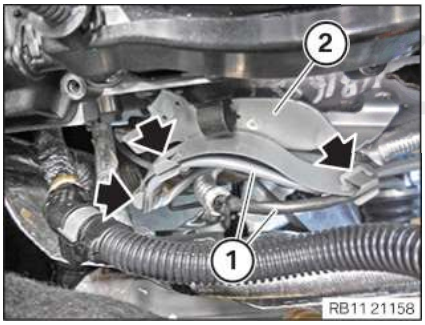
- Unlock and loosen connector (1).



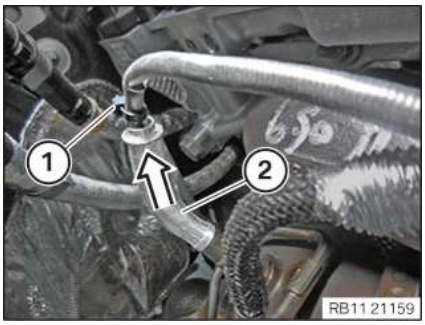
- Unlock the locks (1).
- Guide the connector (2) out of the bracket (3)in the **direction of the arrow** and set it aside.
- Release the cable (4) from the clamp (5).



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.



- Unfasten cable strap (1).
- Feed out the heat shield (2) **in direction of arrow** and set it aside.

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- Release and remove the control sensor (1) with the special tool 0 491 074 (11 7 020).

24 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

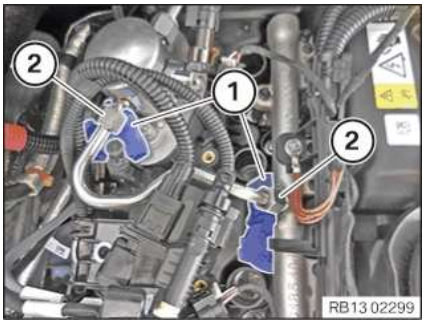
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

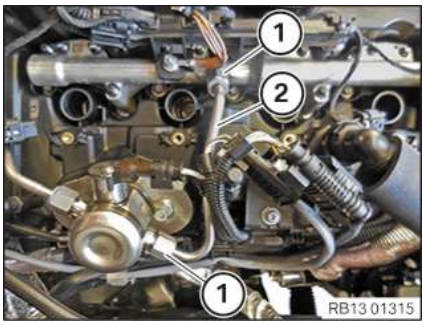


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

25 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

RISK OF DAMAGE

Contaminant or foreign body.

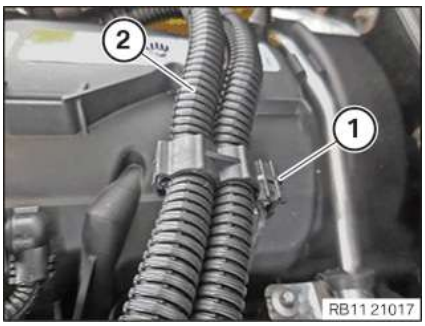
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

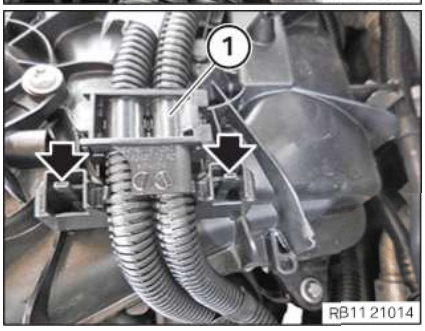
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TECHNICAL INFORMATION

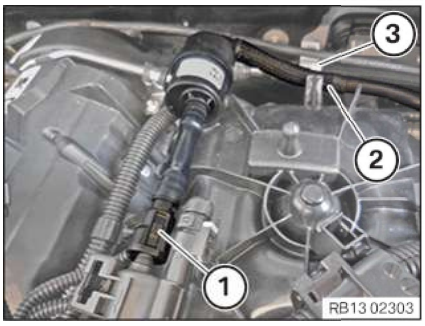
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



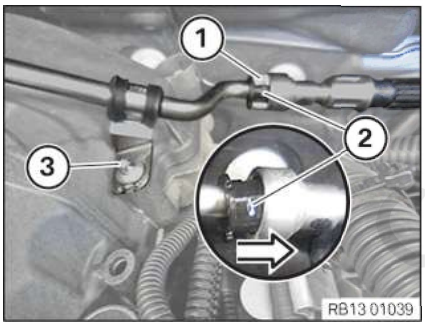
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



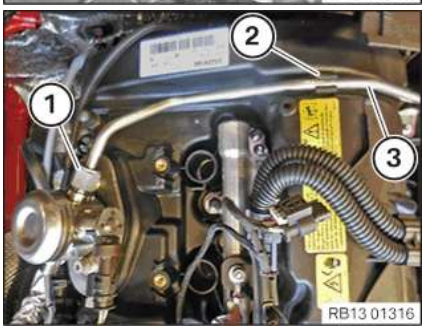
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).



- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

26 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

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RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

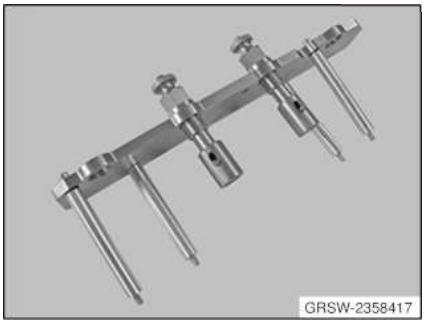
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Prepare special tool .

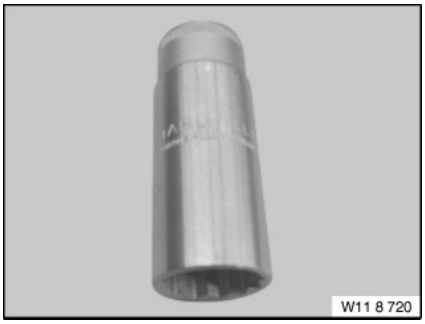


- Prepare special tool 2 358 417.

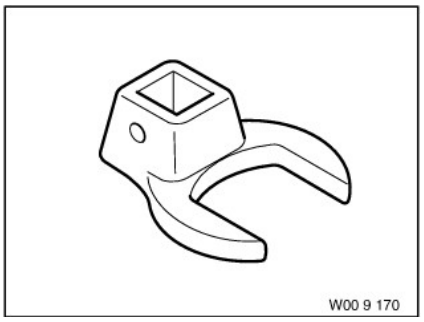


- Prepare special tool .

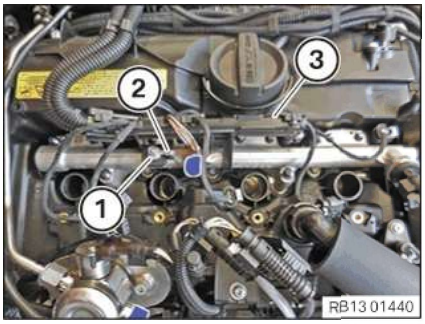
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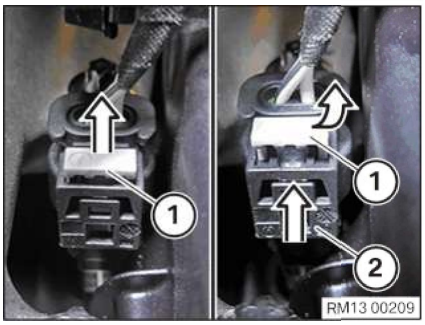
- Prepare special tool 0 496 106 (11 8 720).



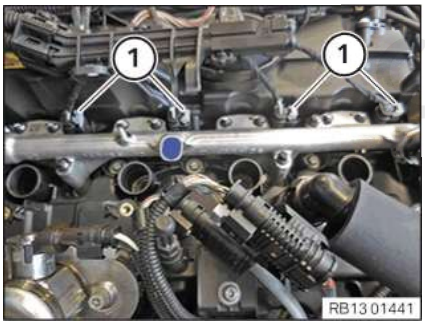
- Prepare special tool .



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.



- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



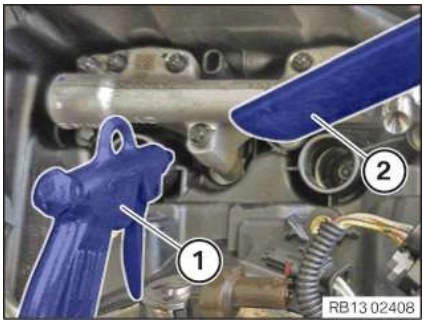
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.



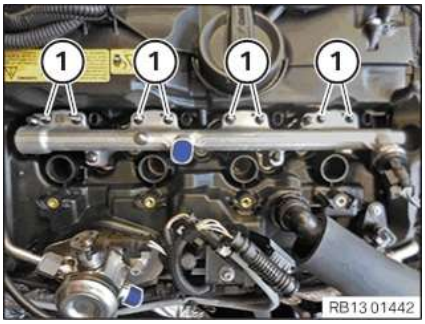
TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.

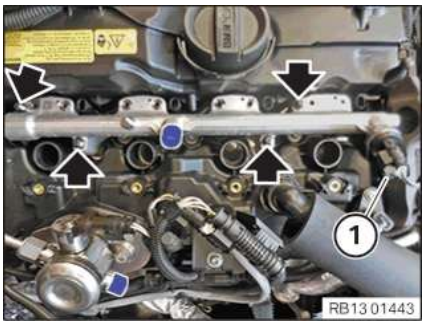
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- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

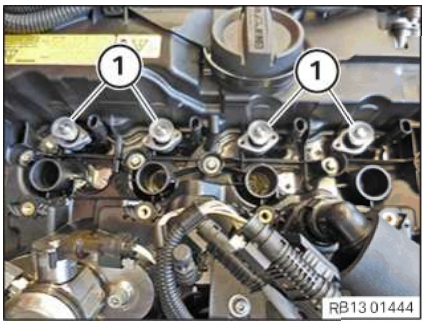


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

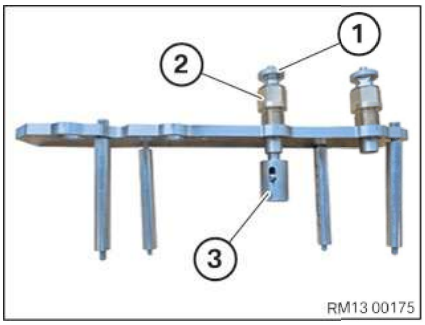
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

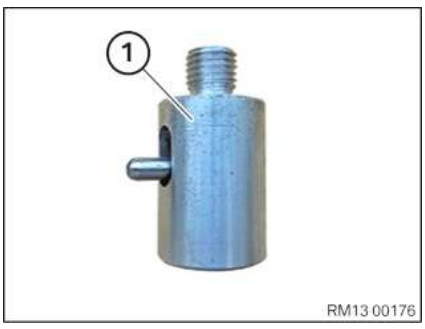
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

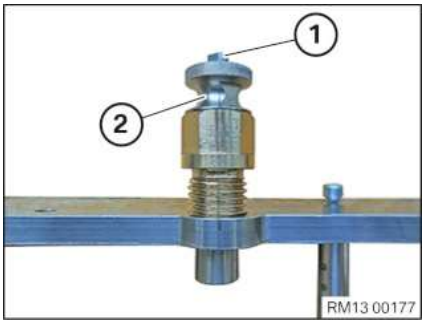
  The special tool 2 358 417 consists of:

  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector

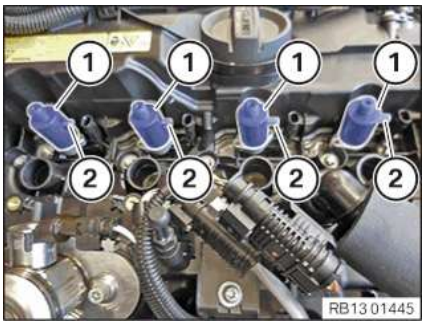


- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

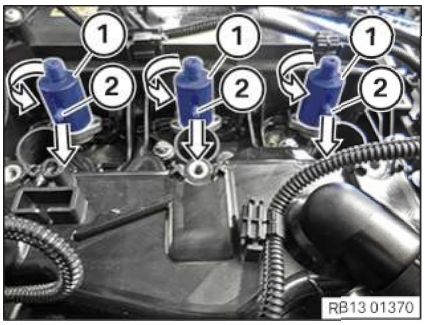
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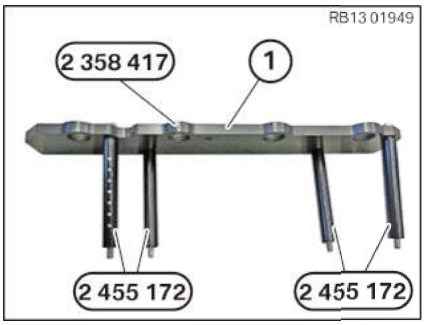
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



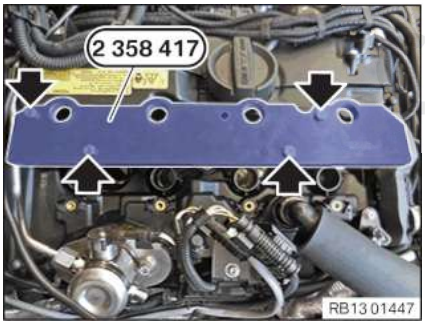
- Install all fixtures (1) for the injectors.
  The fixtures (1) are not locked when the levers (2) are up.



- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



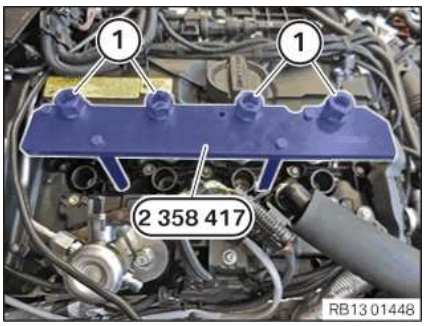
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).

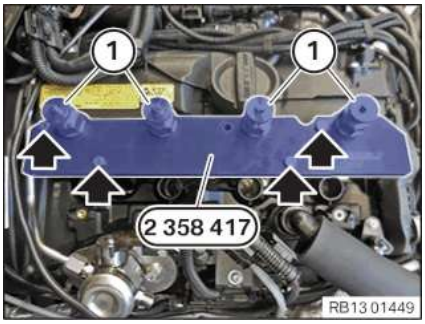


TECHNICAL INFORMATION

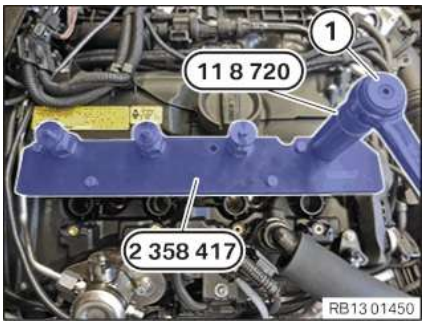
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.

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- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.



- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

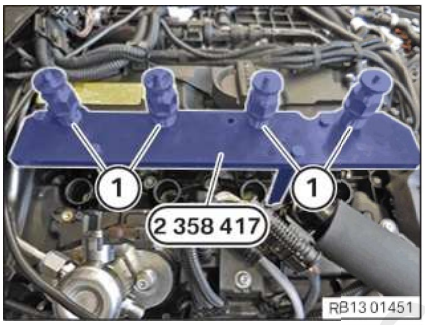


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

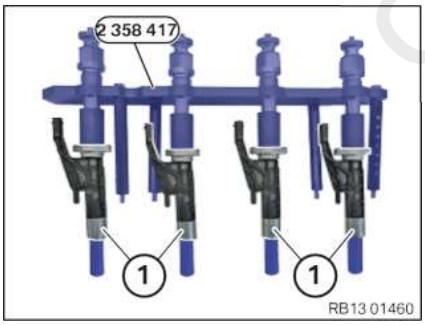
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

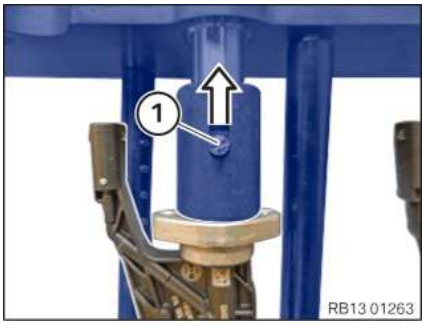


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

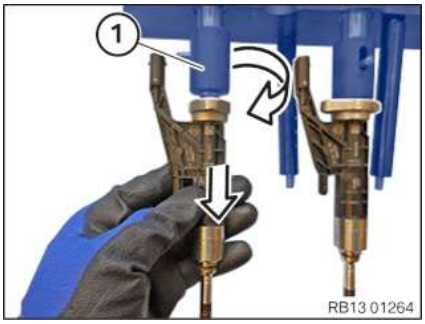


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

27 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

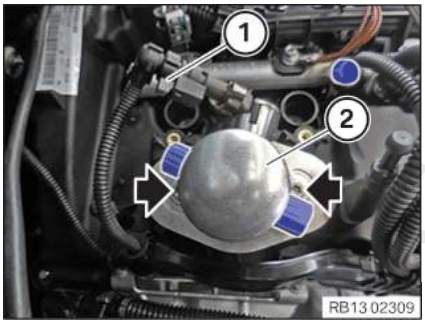
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

28 – Removing both actuators

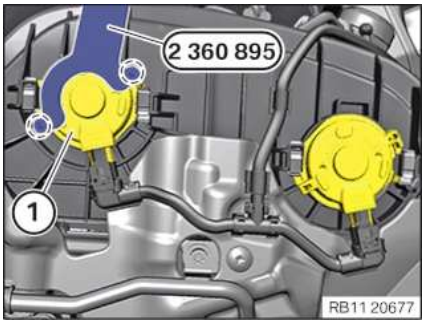
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

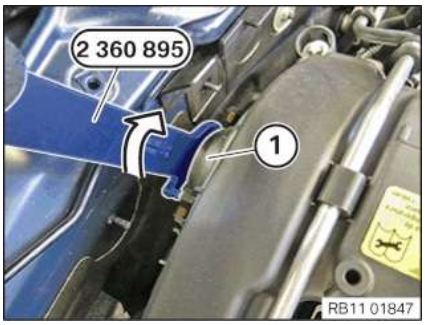
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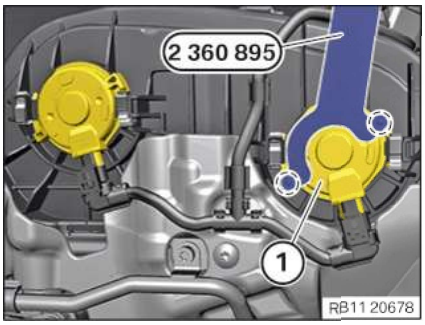
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



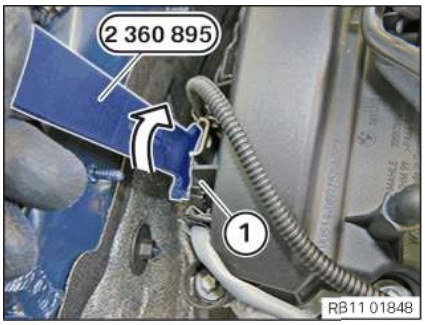
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



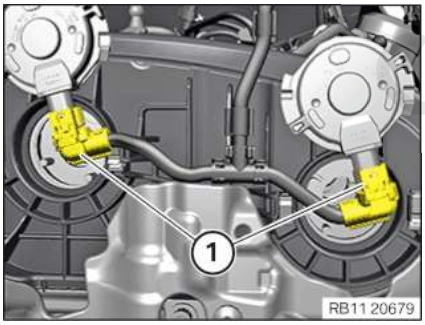
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

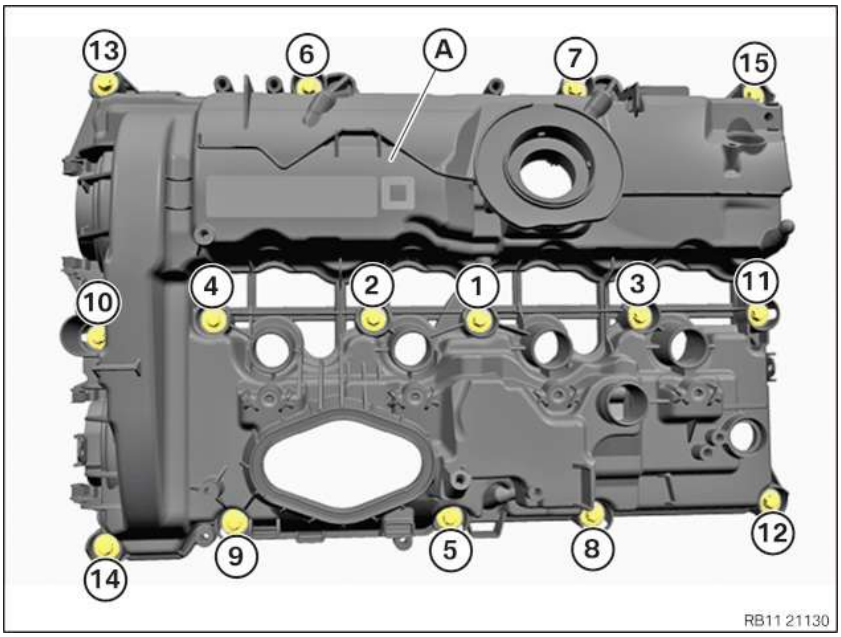
The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

29 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

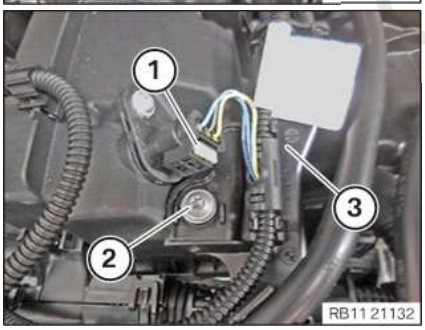
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

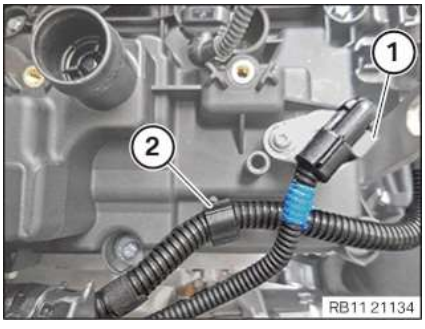
- Do not pull on the wires when disconnecting connectors and plug connections.



- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

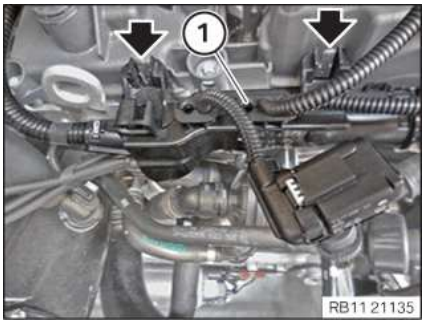


- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.

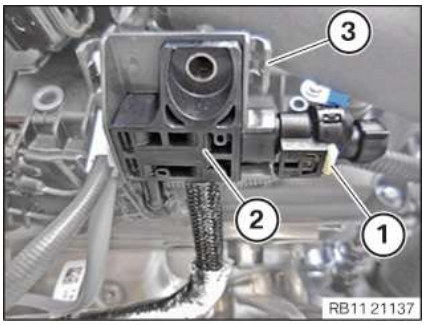


- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).

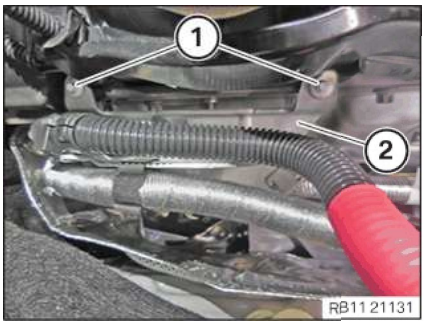
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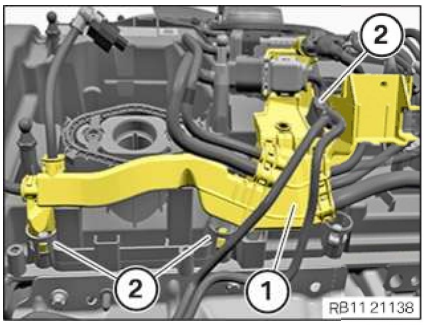
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



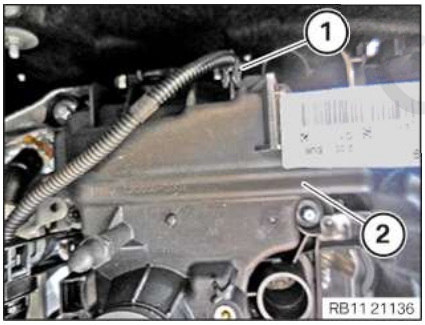
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



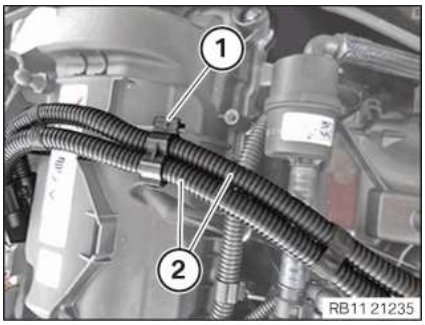
- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.



- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

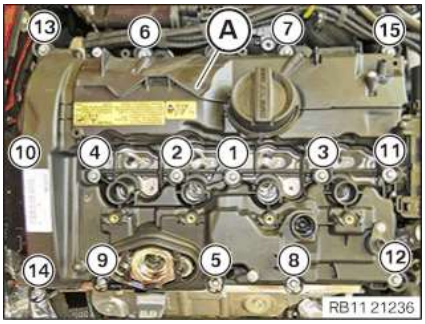


- Loosen clamp (1).



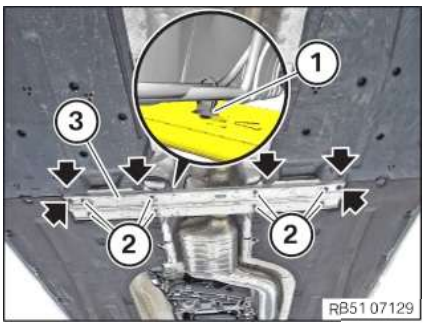
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.

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- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

30 – Remove the connecting support from the tunnel



- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

31 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

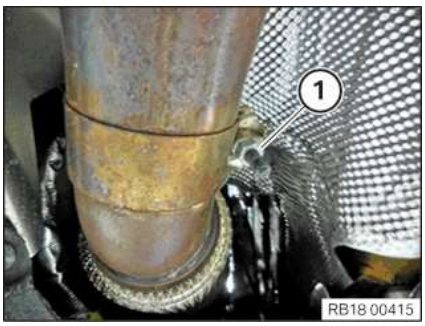
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

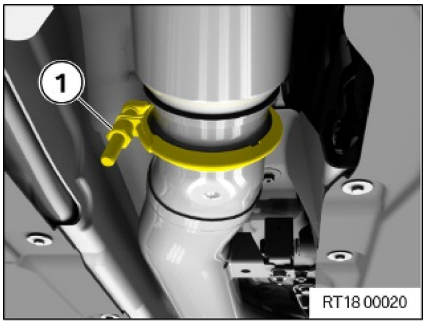
- Remove and install heavy components with the aid of another person/other persons.



- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).

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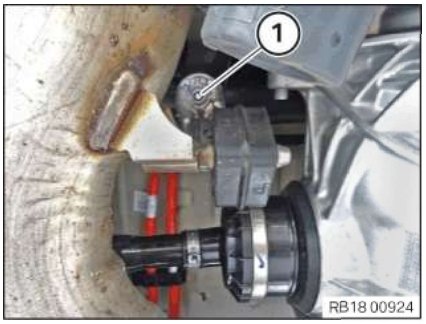


- **Equipment specification 2 (V-clips)**

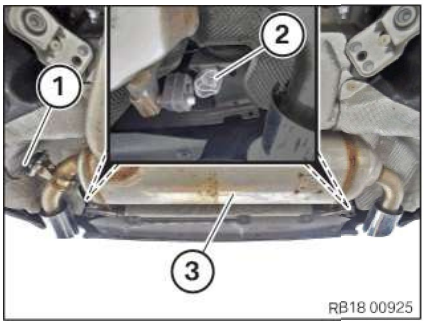
  Unfasten clamp (1).



- Loosen nut (1).

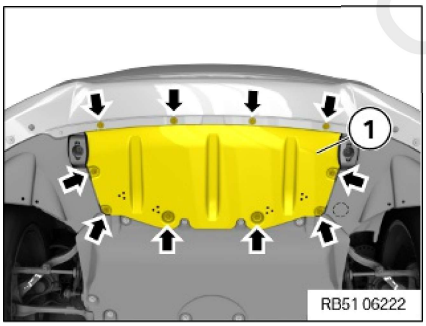


- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

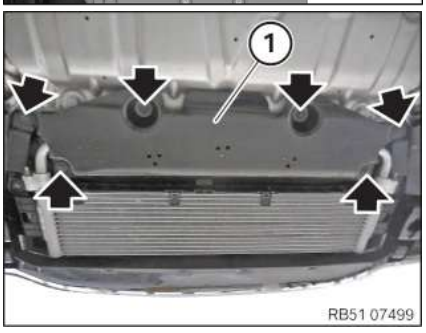
32 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed front underbody protection (1) backwards out of the bumper panel.

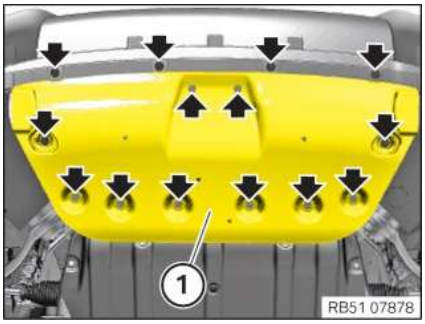


- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

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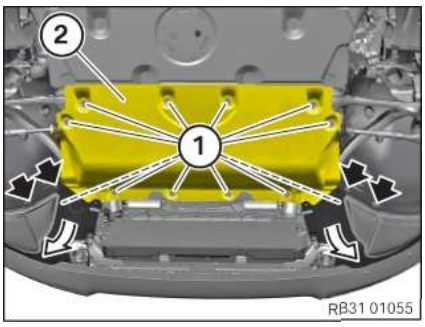


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

33 – Remove the underbody protection of the steering gear



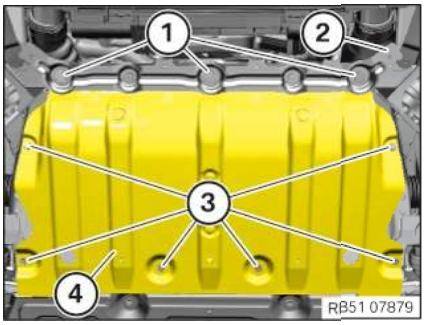
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

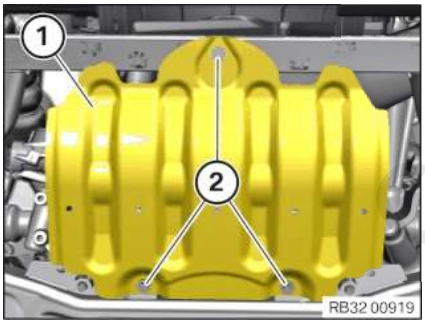
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

34 – If installed: Removing the steering start protection

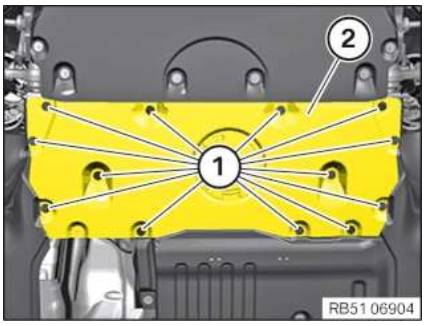
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

35 – Removing the centre underbody protection

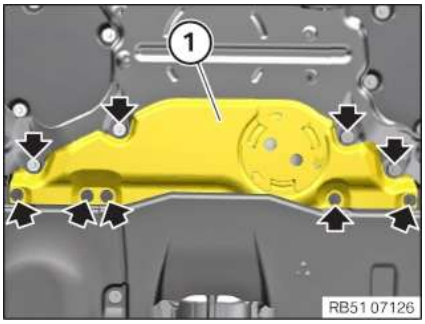


- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

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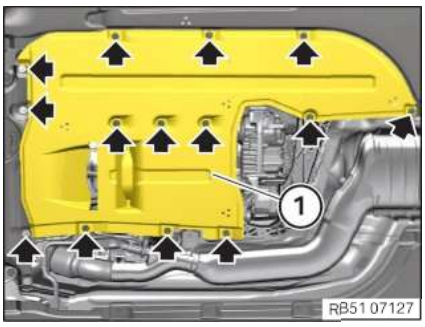


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

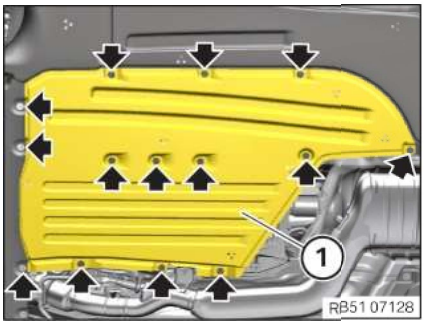
36 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

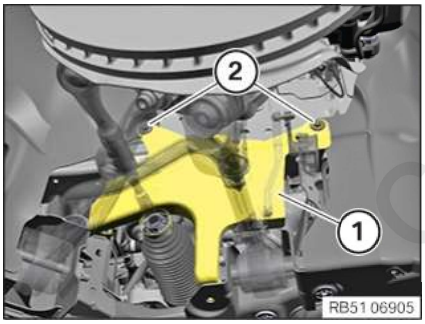
  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

37 – Remove the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.



- Loosen screws (2).
- Remove the cover (1).

38 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

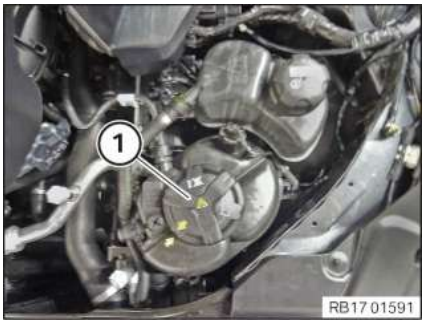
When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

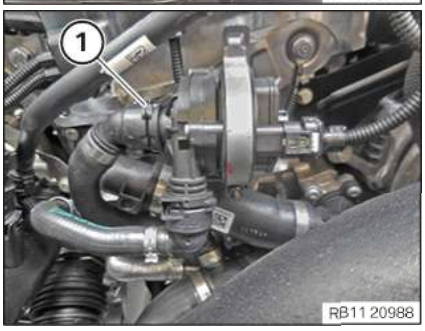
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TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

39 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

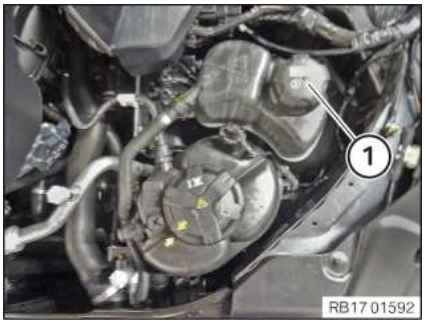
When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

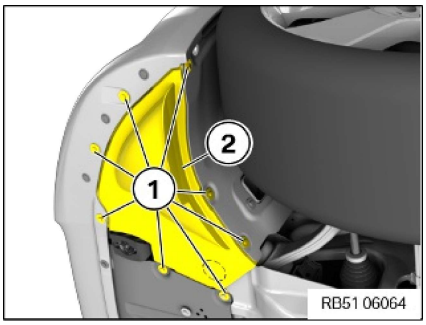
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

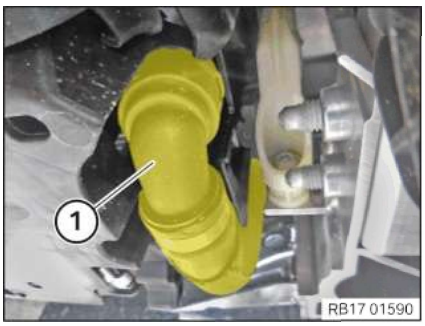
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- Loosen sealing cap (1).



- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

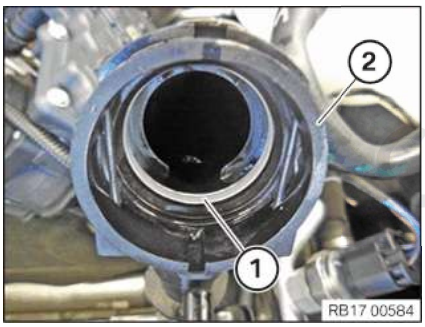


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

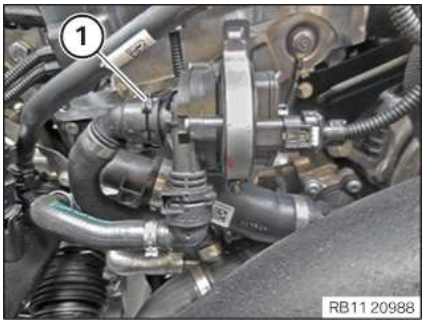
40 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

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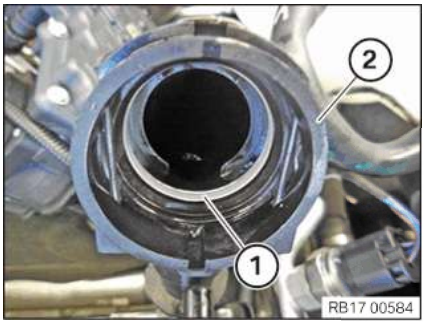


- Connect and lock coolant line (1).
  Coolant line (1) must audibly engage.

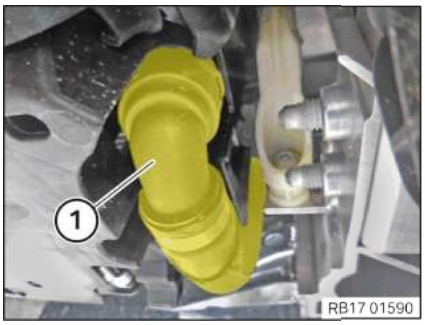
41 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

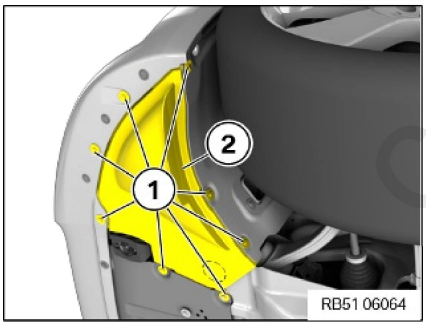
Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).
  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

42 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Heavy component.

Heavy components can lead to injury or damage.

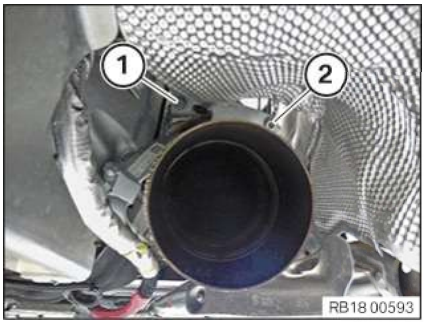
- Remove and install heavy components with the aid of another person/other persons.

CAUTION

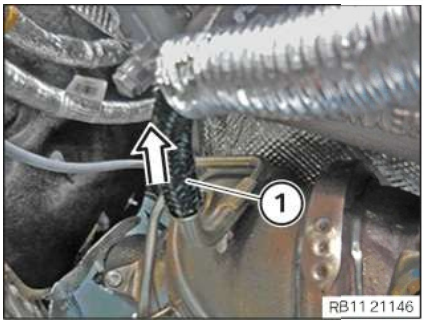
Component with heavy weight.

Danger of injury!

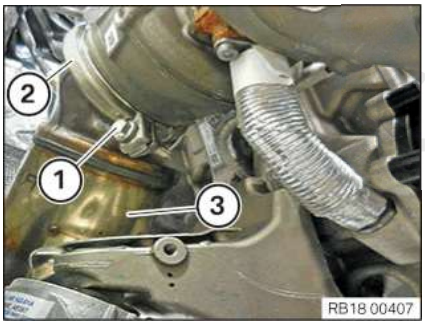
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.



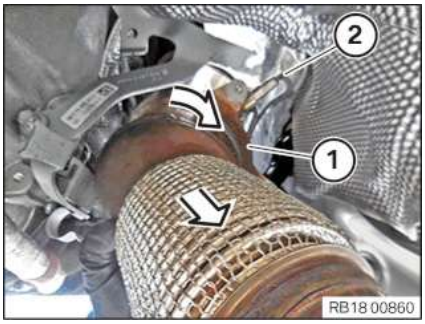
- Loosen screw (1).
- Loosen nut (2).



- Pull off pressure hose (1) in direction of arrow and set it aside.



- Loosen screw (1).
- Feed out V-clip (2) on catalytic converter (3) and remove.



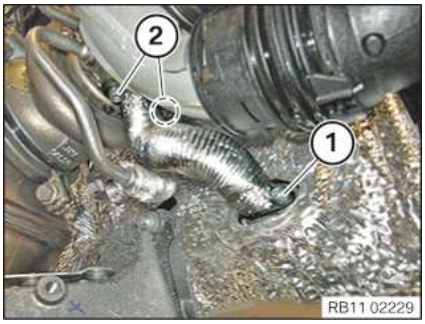
- Guide out catalytic converter (1) in direction of arrow and remove.
- Ensure that monitoring oxygen sensor (2) is**not** damaged.

43 – Removing the oil return line for the exhaust turbocharger

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TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

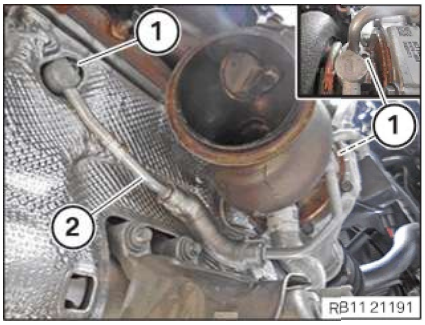


- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

44 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

45 – Remove the coolant return line for the exhaust turbocharger

WARNING

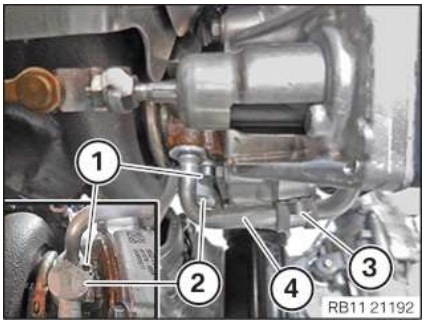
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

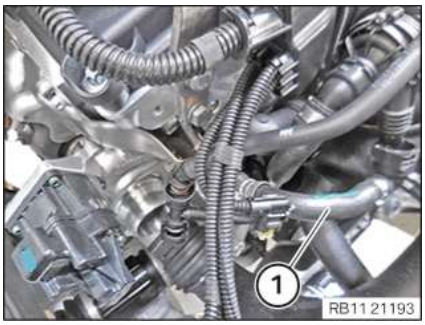


- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.

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- Unlock and release the coolant return line for the exhaust turbocharger (1).



- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

46 – Remove the coolant line between the coolant pump and the cylinder head

WARNING

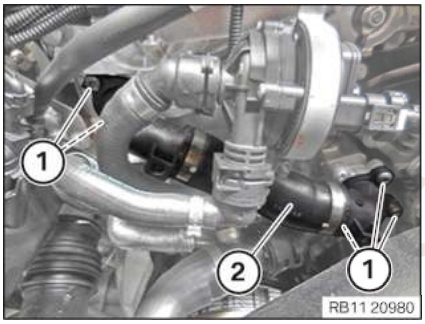
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Remove the coolant line (2).
- Catch and dispose of escaping coolant.

47 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

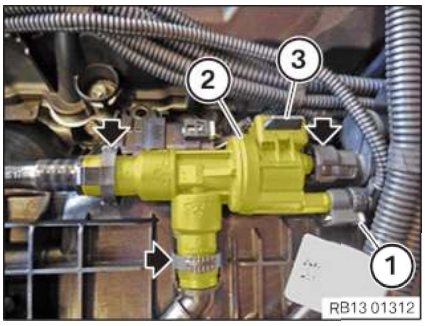
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

48 – Removing the intake plenum

RISK OF DAMAGE

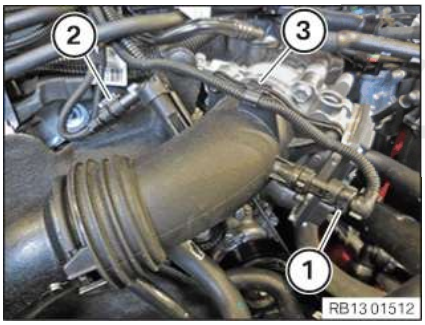
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

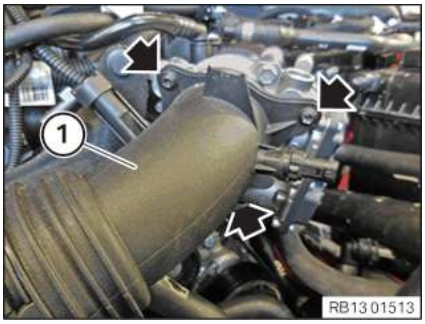
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

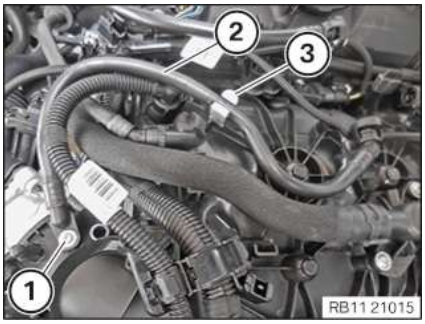


- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).

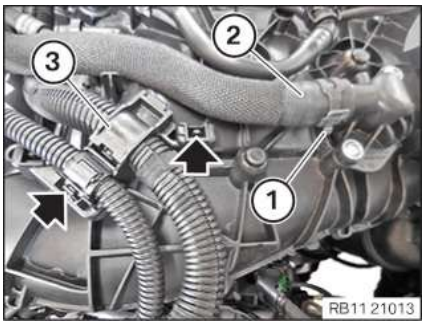


- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.

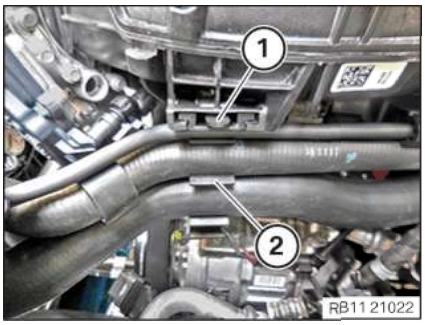
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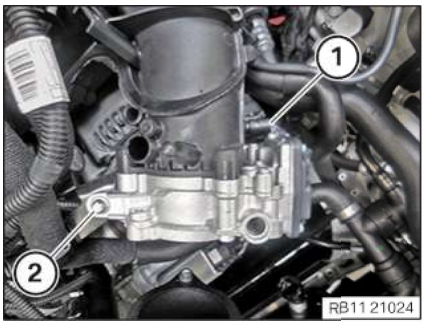
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



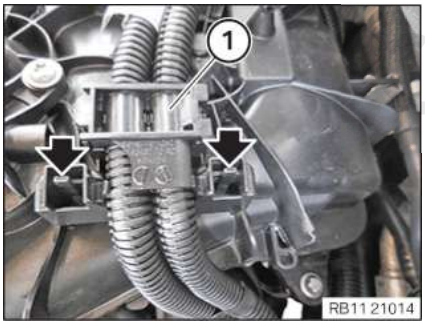
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



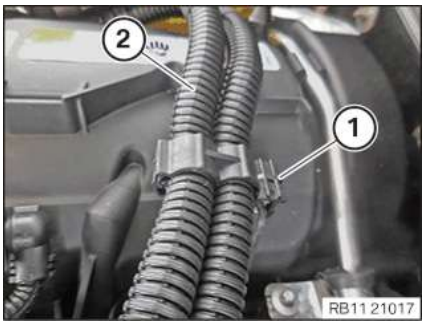
- Unlock the lock (1).
- Thread out holder (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

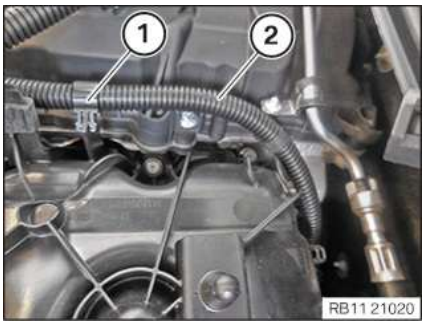


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.

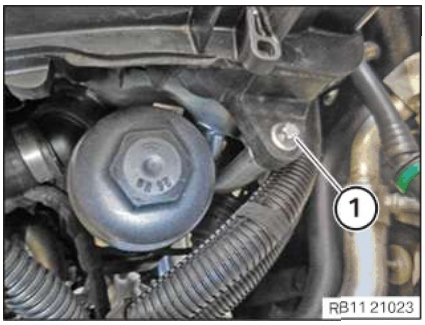
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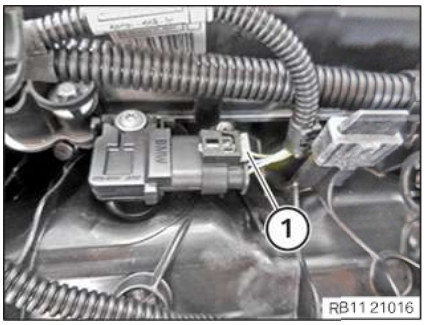
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



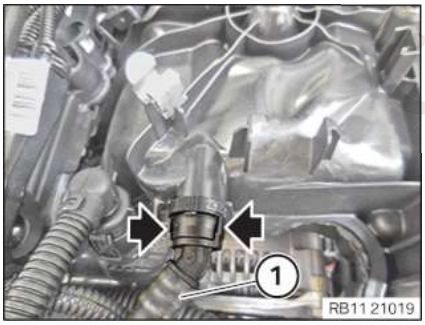
- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.



- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

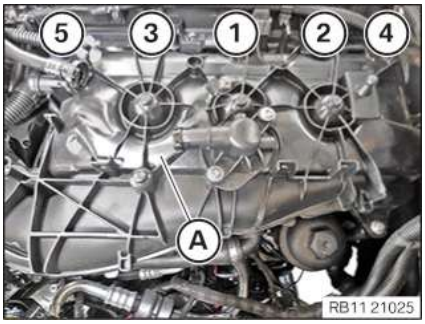


- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.

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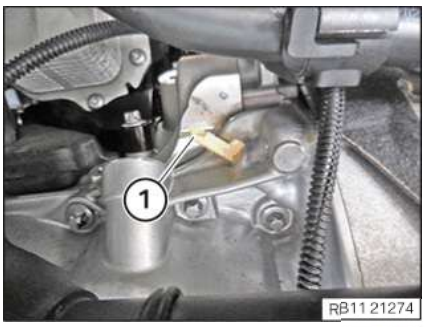


TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

49 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



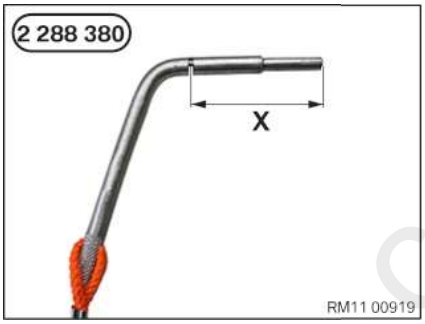
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

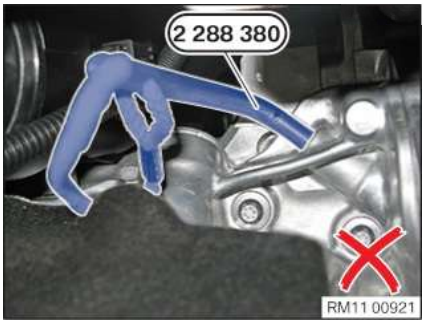
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

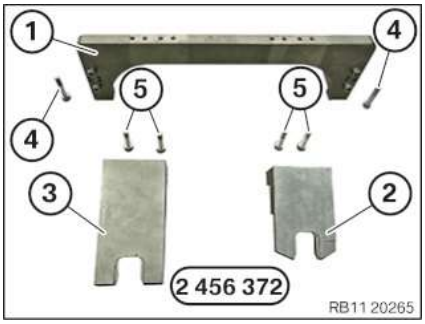


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

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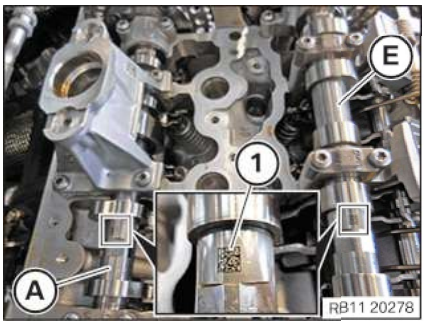
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

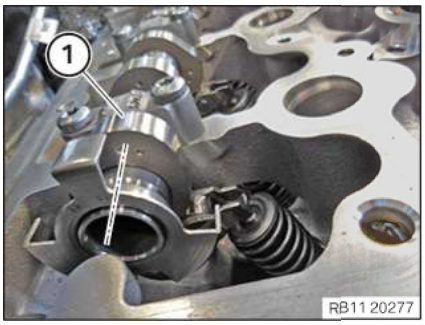


- Overview of the test gauges from the set of special tools 2 358 122:

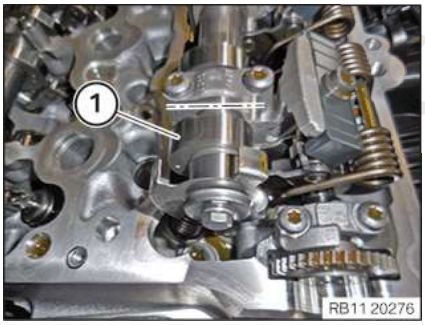
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



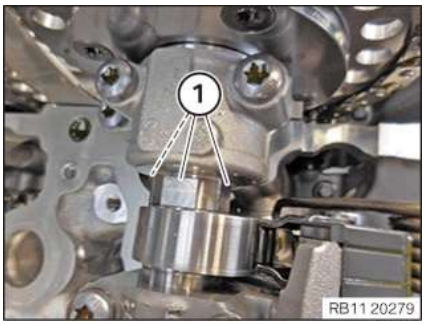
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

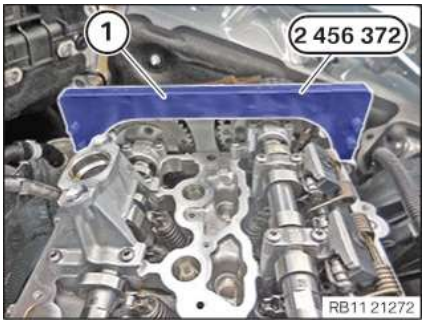


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

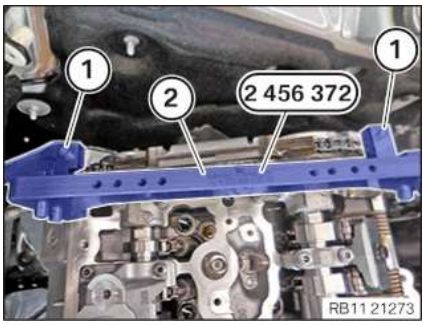


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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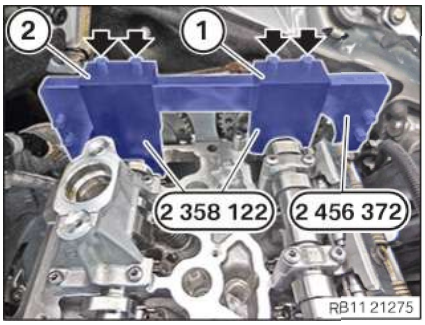
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

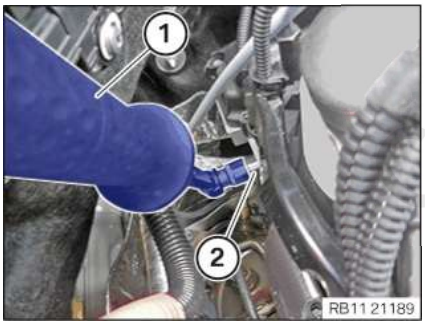
Test gauge to basic carrier

M6		Tightening torque	8 Nm

50 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

51 – Releasing the VANOS central valve of the intake adjuster

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- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

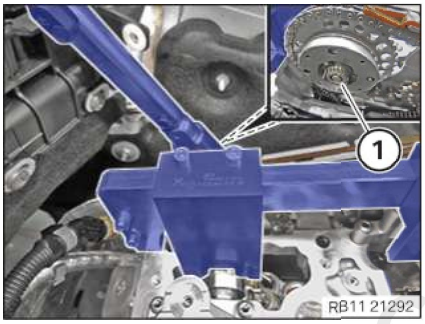
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

52 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

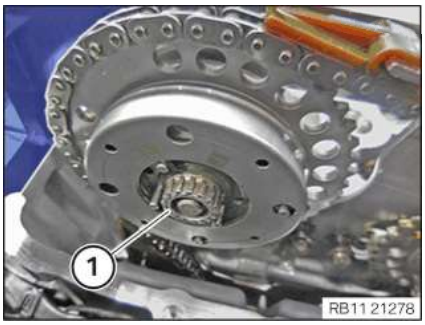


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

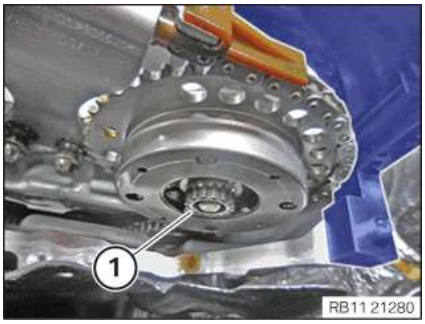
53 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

54 – Remove the VANOS central valve of the exhaust camshaft adjuster

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- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

55 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

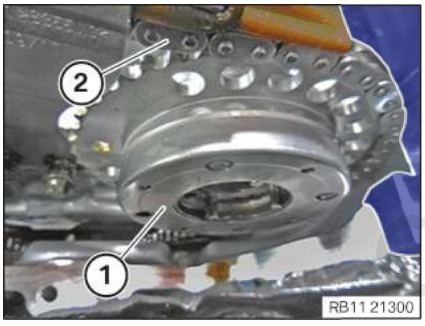


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

56 – Remove exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

57 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

58 – Remove cylinder head.

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CAUTION

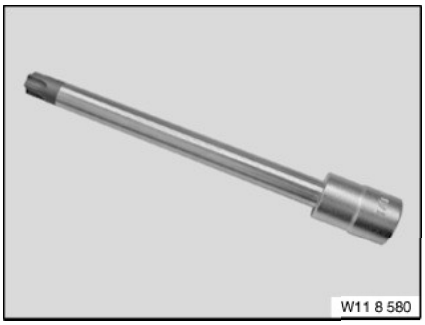
Heavy component.

Heavy components can lead to injury or damage.

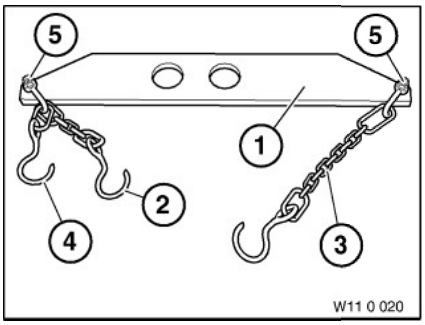
- Remove and install heavy components with the aid of another person/other persons.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



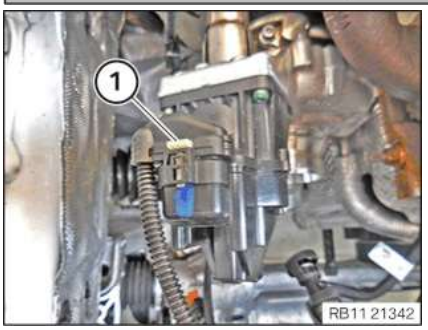
- Prepare special tool 0 495 747 (11 8 580).



- Prepare special tool .

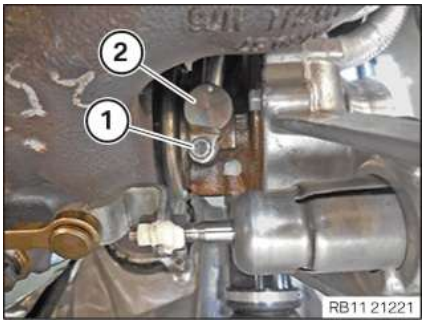


- Prepare the workshop crane 2 220 718.

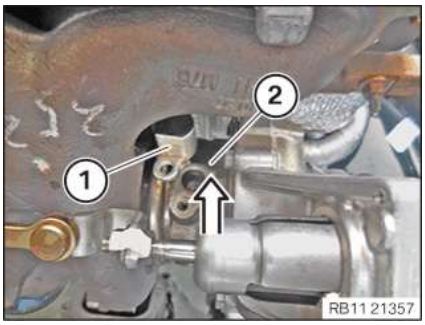


- Unlock plug connection (1) and disconnect.

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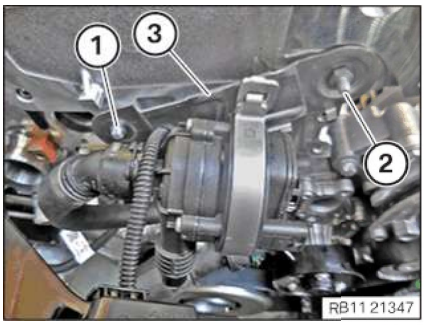
- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.



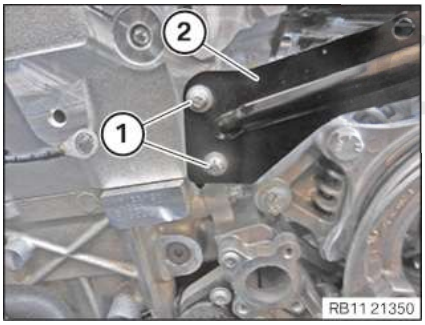
- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.

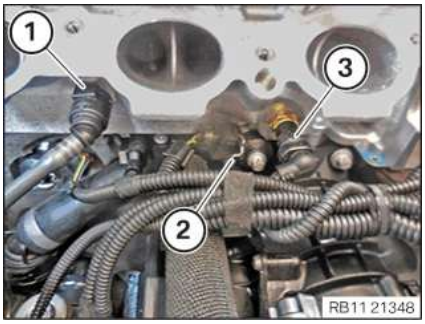


- Loosen screws (1).
- Thread out holder (2) and set aside.

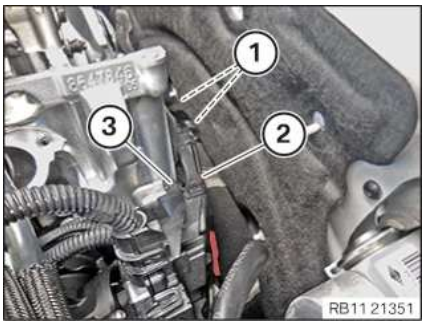


- Unlock plug connection (1) and disconnect.

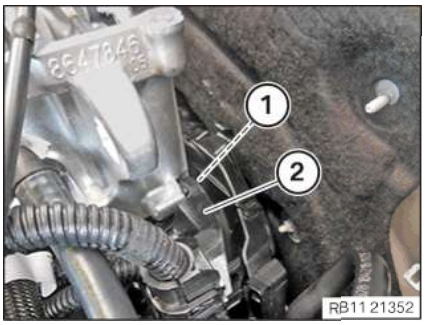
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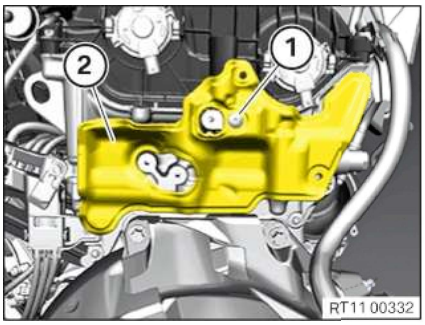
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



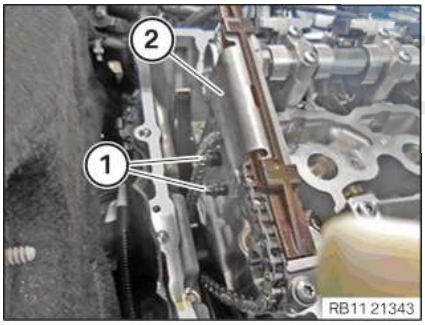
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



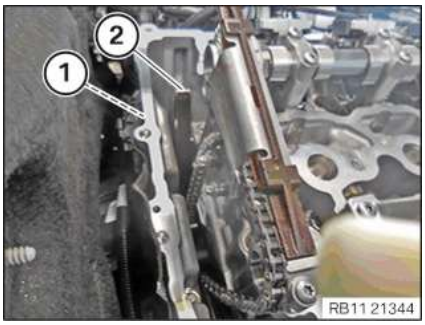
NOTICE

The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).



- Loosen screws (1).
- Guide out the slide rail (2) and remove.



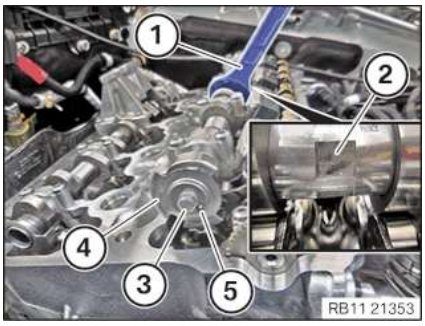
- Release the bearing journal (1) from the guide rail (2).



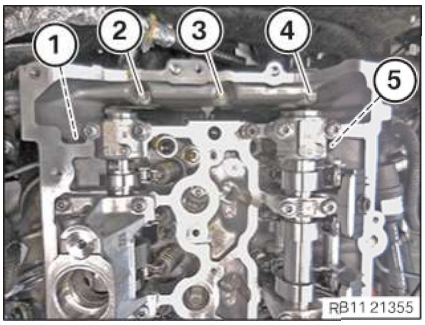
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

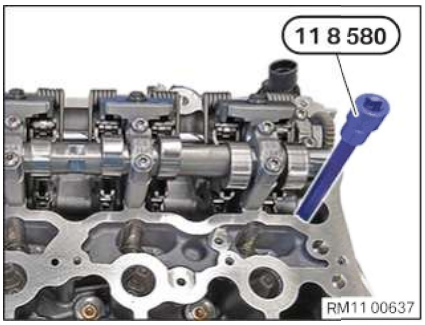
M8		Tightening torque	21,5 Nm



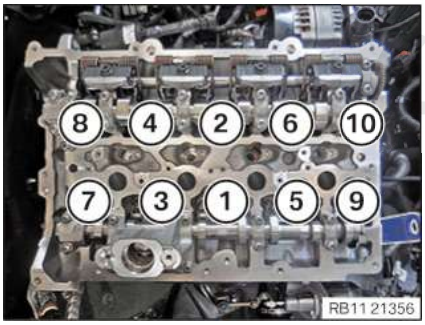
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.



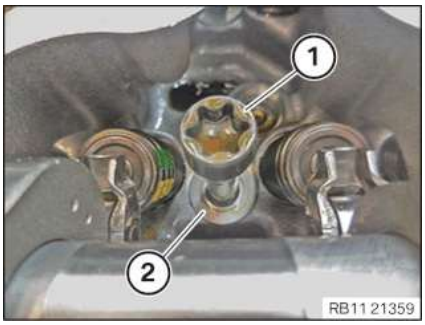
- Loosen the cylinder head bolts in the sequence from (5) to (1).



- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

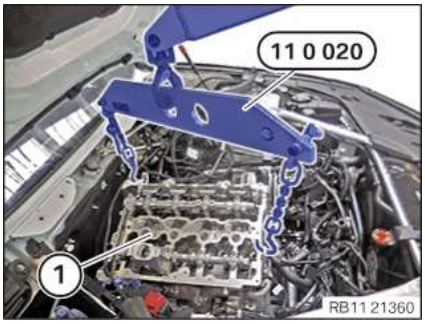


- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).

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CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to the guide rails.

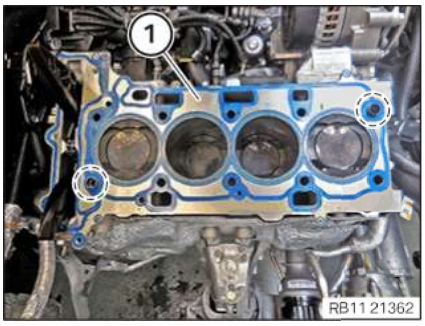
Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Attach special tool to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an **auxiliary person**, the workshop crane and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

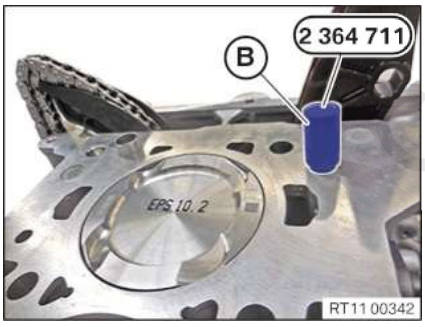
MAIN WORK

59 – Removing the cylinder head gasket



- Guide out and remove cylinder head gasket (1) in the **marked** area.

60 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

61 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

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- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.



CAUTION

Swirling dirt particles caused by compressed air.

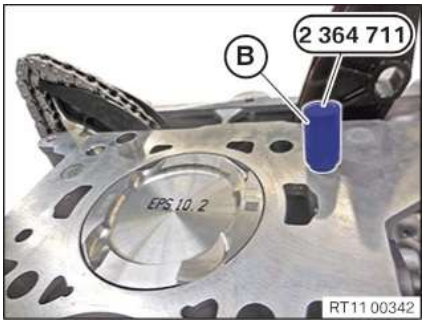
Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

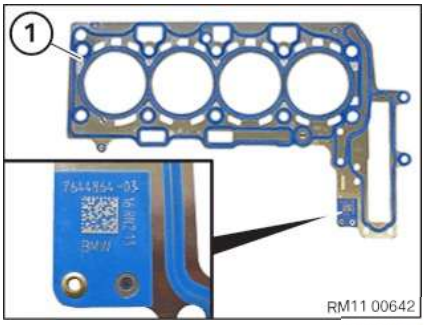
- Clean all the threaded holes in the **marked** area of the crankcase with compressed air.

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- Remove special tool (B) contained in the set of special tools 2 364 711.

62 – Renewing the cylinder head gasket

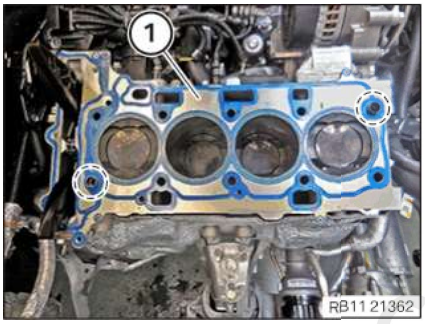


- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional thicker gasket 0.3 mm is available for service personnel.

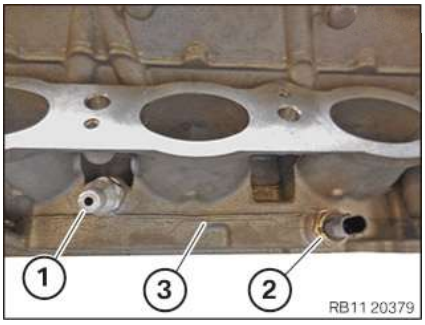


- Check fitting sleeves (1) in the **marked** area for damage and, if necessary, renew them.

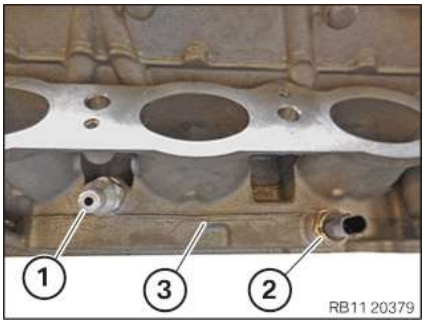


- Guide cylinder head gasket (1) into the **marked** area and install it.

63 – Renewing the cylinder head (remounting components)



- Detach ventilation connection (1) on cylinder head (3).
- Detach coolant temperature sensor (2) on cylinder head (3).



- Tighten ventilation connection (1) on new cylinder head (3).

Ventilation connection/special tool to cylinder head

M10		18 Nm

- Tighten coolant temperature sensor (2) on new cylinder head (3).

Coolant temperature sensor at cylinder head

Sensor		Tightening torque	13,5 Nm

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64 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

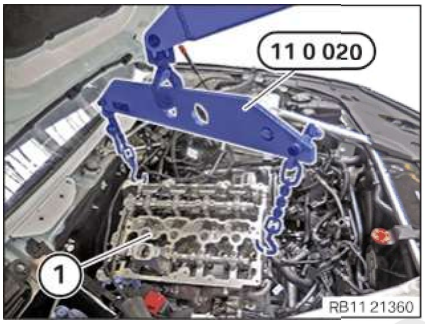
- Dry threaded holes (e.g. using compressed air).

TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



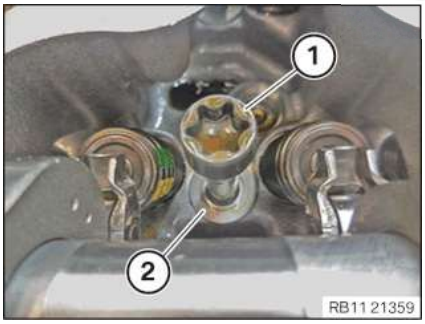
RISK OF DAMAGE

Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

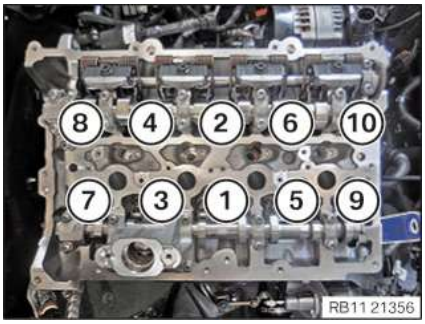


- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of engine block.
- Guide in and install cylinder head bolts (1).

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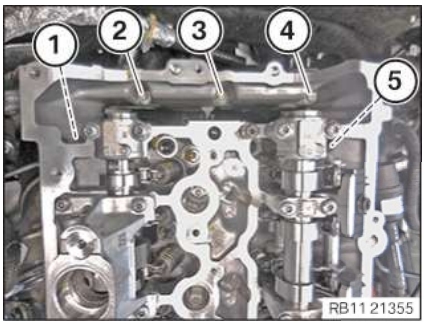
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °



- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

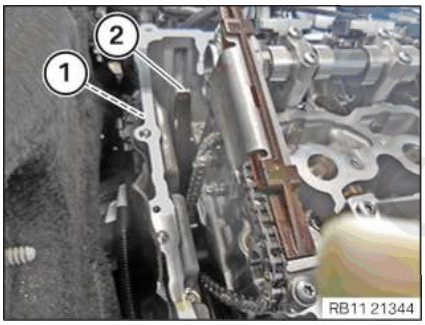
Cylinder head bolt to timing case cover

M8x40	Renew screws.	Tightening torque	19 Nm



- Renew bearing journal (1).

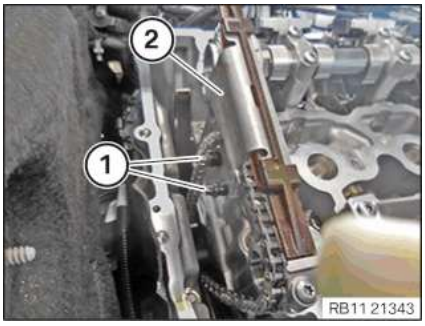
  Parts: Bearing journal



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

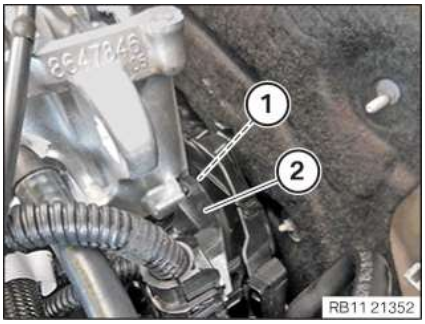


- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm

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RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

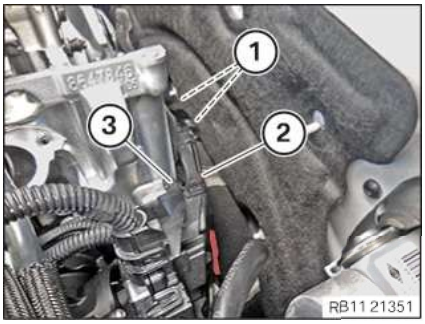
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

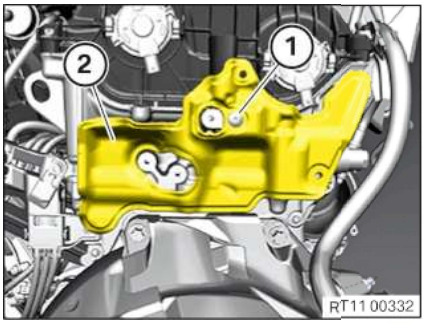
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

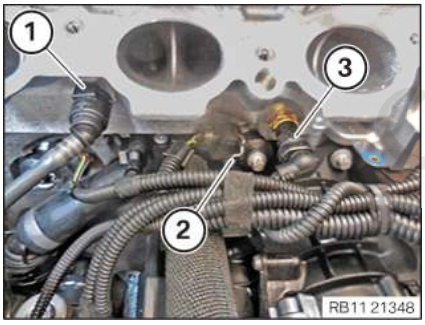
M6 x 20		Tightening torque	8 Nm



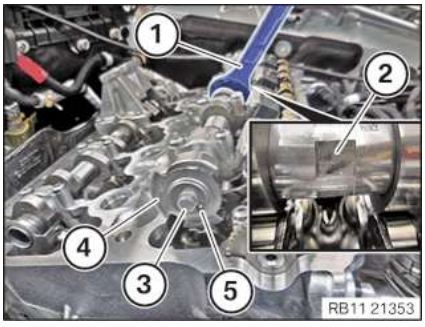
- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

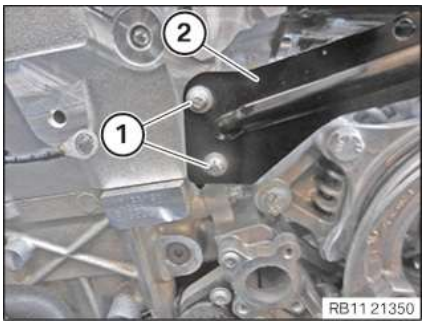
Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm

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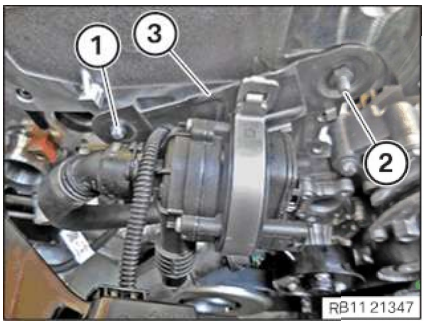
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

Holder for electrical auxiliary coolant pump on cylinder head

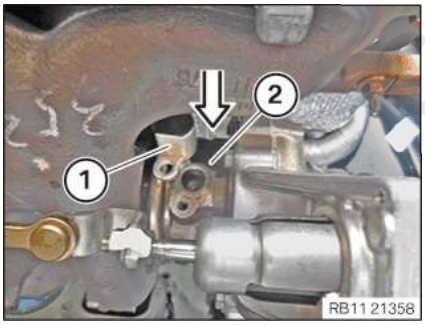
M6		Tightening torque	7 Nm



- Thread in ground cable (2) and install.
- Tighten nut (1).

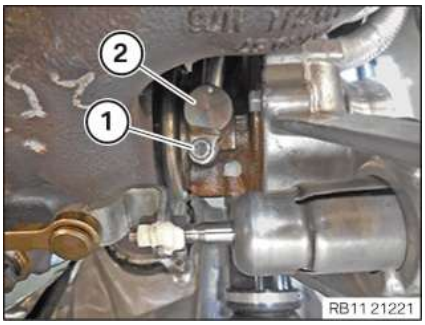
Standard screw connection M6

M6	8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).

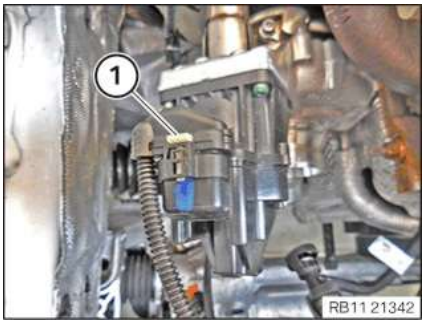


- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm

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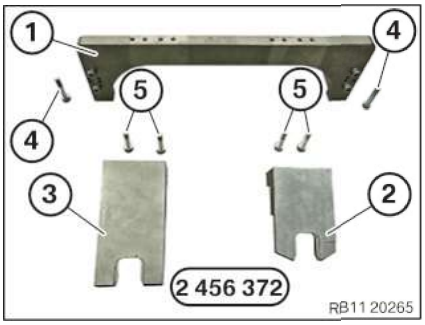


- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

65 – Adjust the camshafts with the special tool

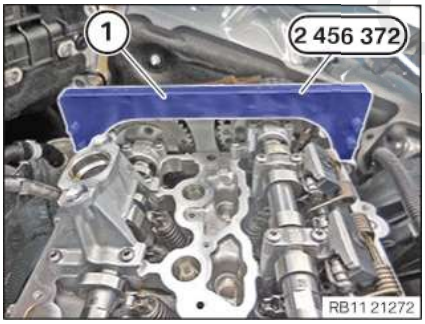


- Overview of the set of special tools 2 456 372:

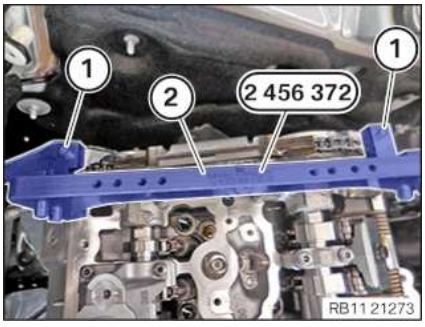
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

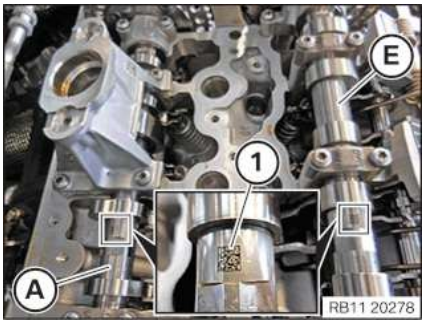


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

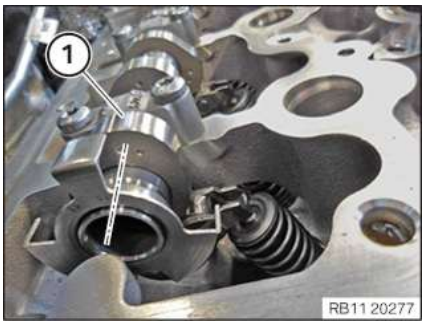
Basic carrier to cylinder head

M6		Tightening torque	8 Nm

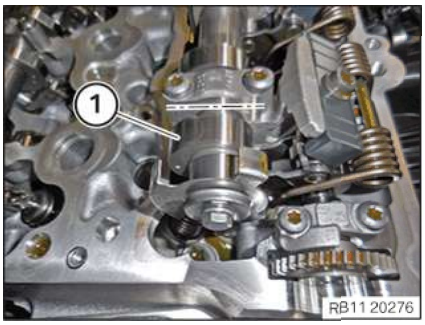
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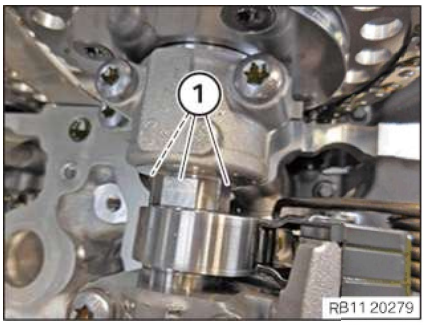
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



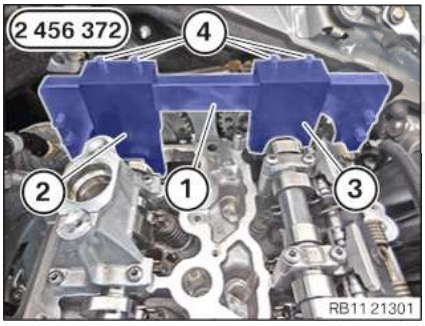
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

66 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

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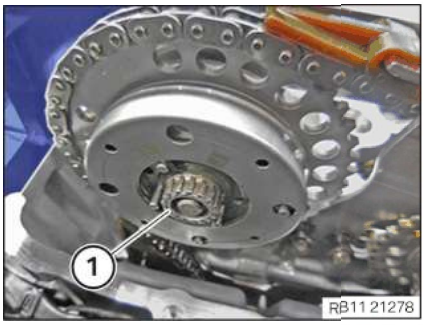


- Keep intake adjuster (1) marked IN ready.

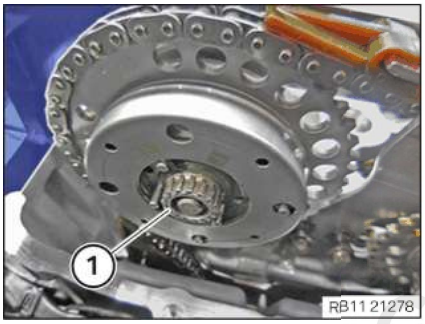


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

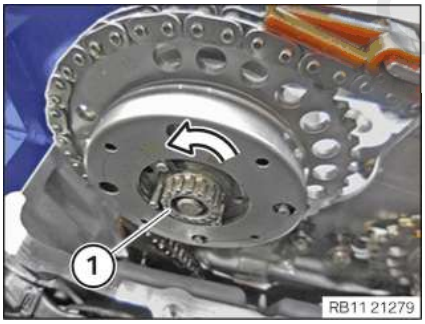
67 – Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.



- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

68 – Install exhaust camshaft adjuster

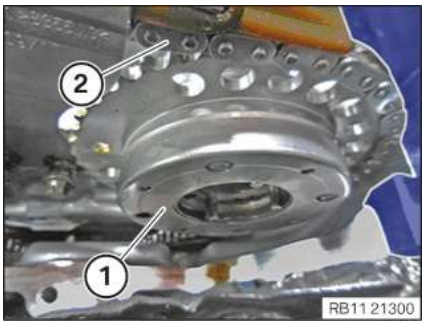
NOTICE

The figure shows the rear side of the engine.

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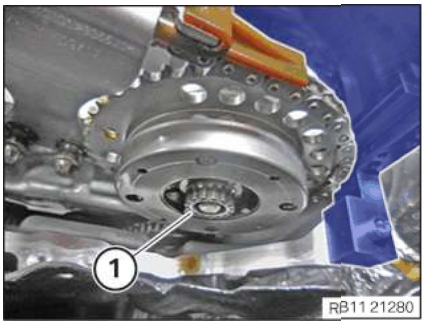


- Keep exhaust camshaft adjuster (1) marked EX ready.

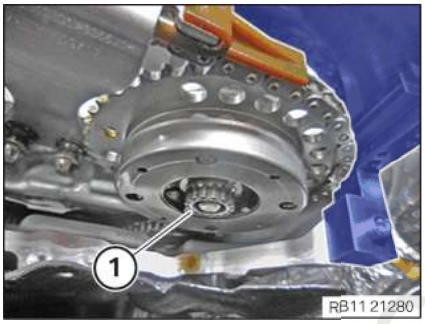


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

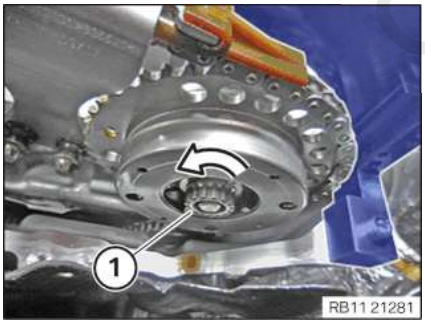
69 – Installing the VANOS central valve of the exhaust camshaft adjuster



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.

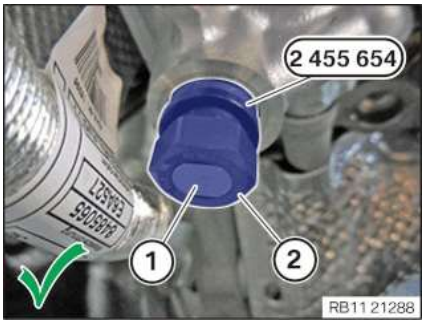


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

70 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

  The pin (1) must align **precisely** with housing (2).

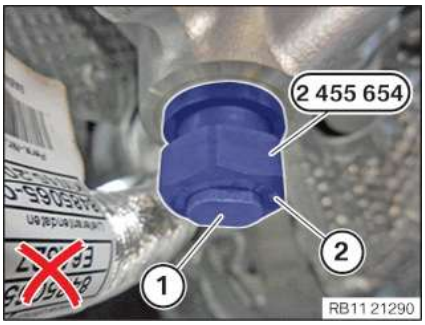
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- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

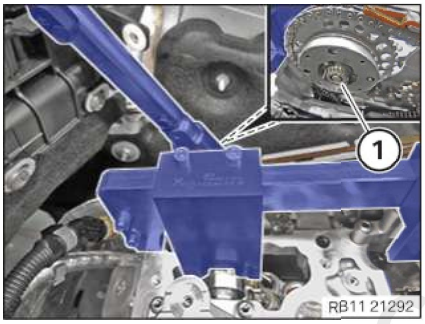
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

71 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

72 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



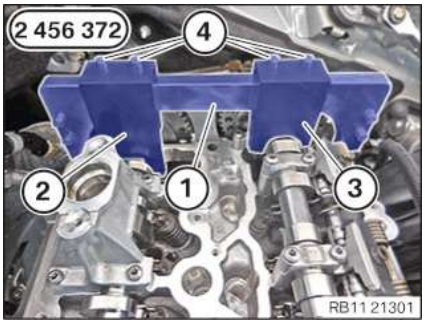
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

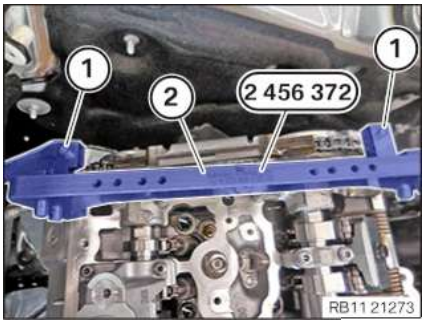
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

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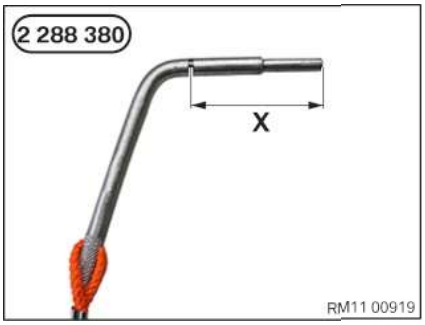
73 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



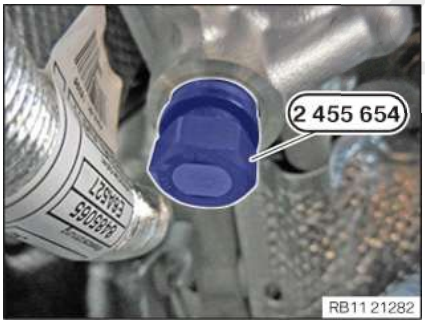
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

74 – Install chain tensioner

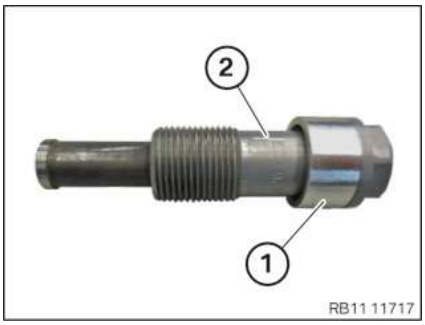
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

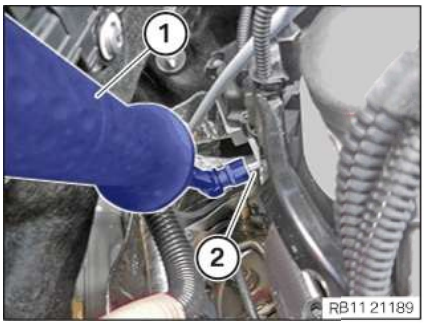


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

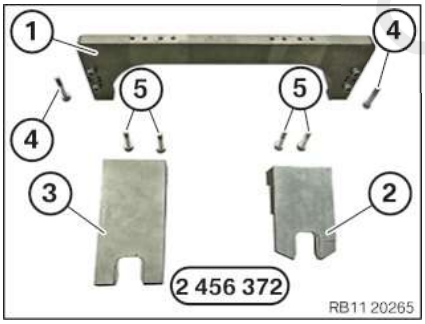


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner	Tightening torque	20 Nm
	Angle of rotation	40 °

75 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft

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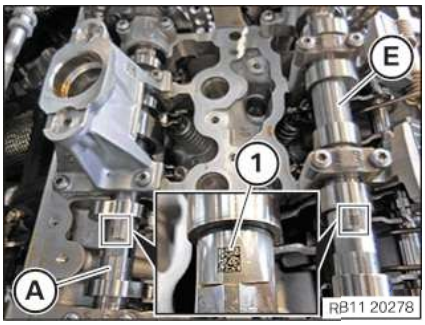
RISK OF DAMAGE

Damage to the engine.

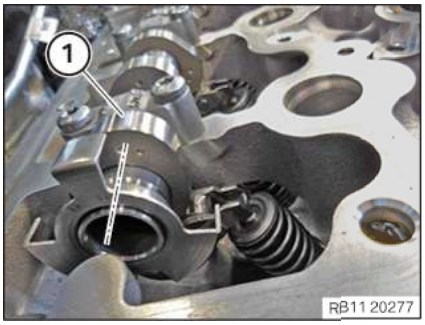
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

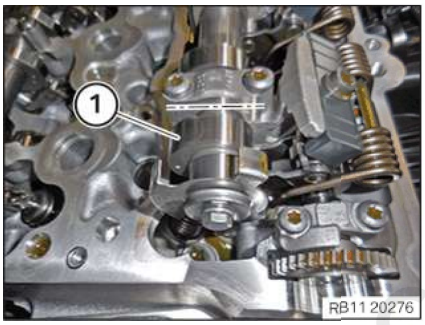
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



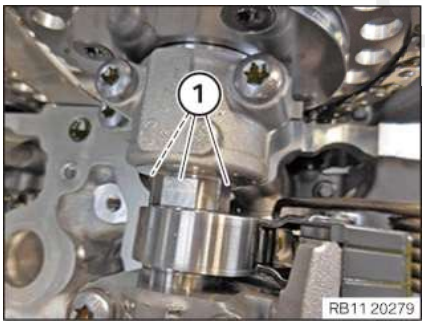
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

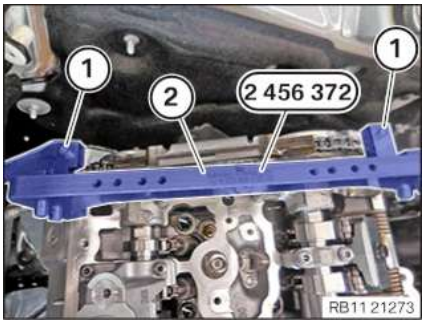


- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

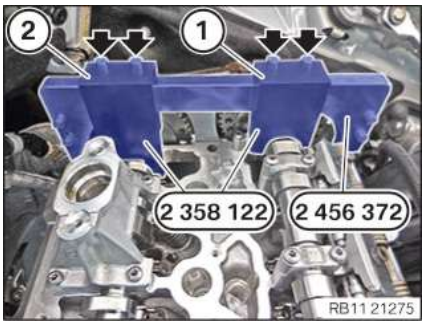
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- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



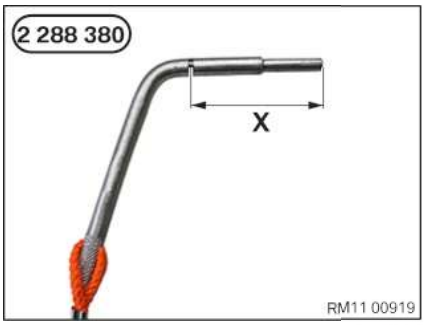
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



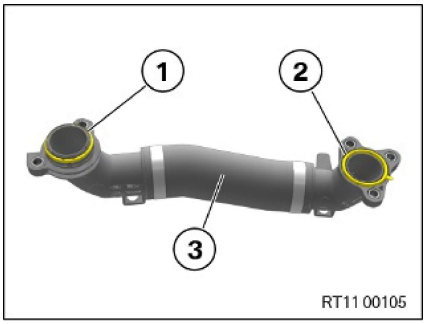
- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

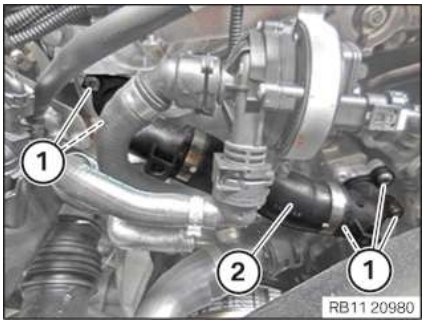
76 – Install the coolant line between the coolant pump and the cylinder head

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- Check the sealing rings (1) and (2) for damage and if necessary, renew the coolant line (3).

  Parts: Sealing ring



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques. Non-observance of these requirements may result in leaks and damage.

- Feed in and install coolant line (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

Coolant line to coolant pump/cylinder head

M6x20		Tightening torque	8 Nm

77 – Installing the intake plenum

RISK OF DAMAGE

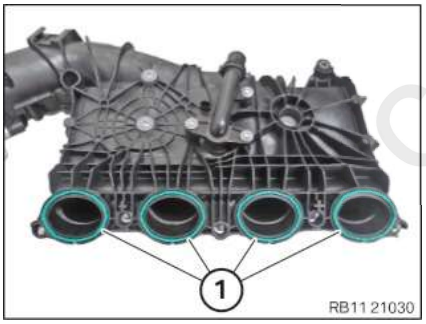
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

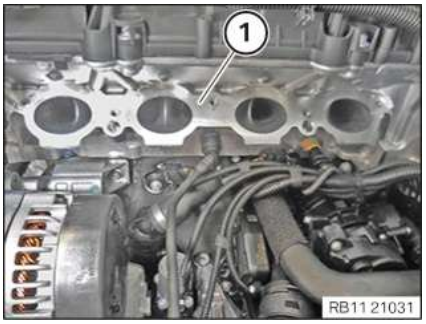
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



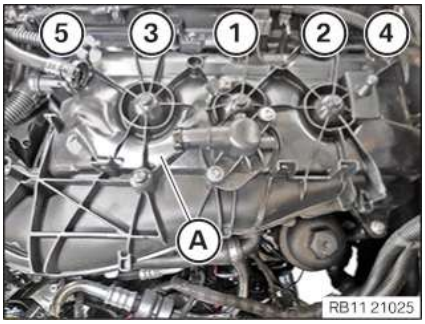
- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).

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TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

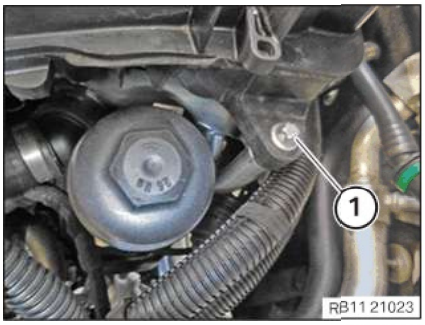
Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



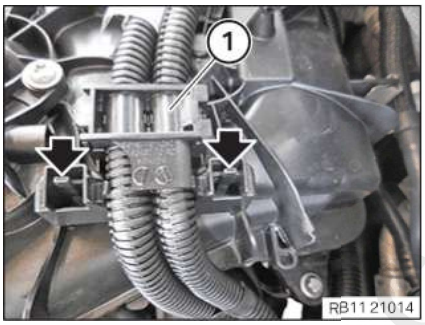
- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.



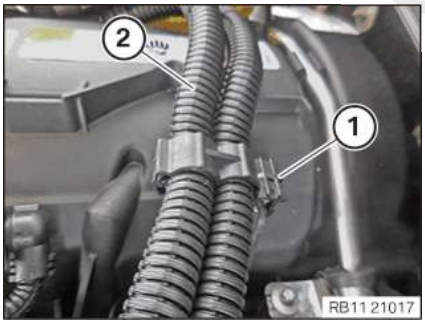
- Tighten down screw (1).

Intake plenum to support

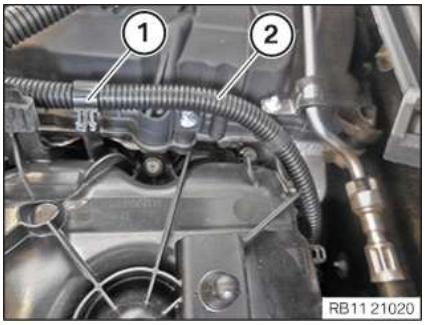
M6X25		Tightening torque	8 Nm



- Insert and install the wiring harness section (1) for the injectors and ignition coils.
  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

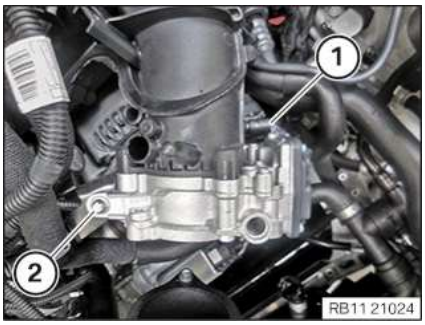


- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).

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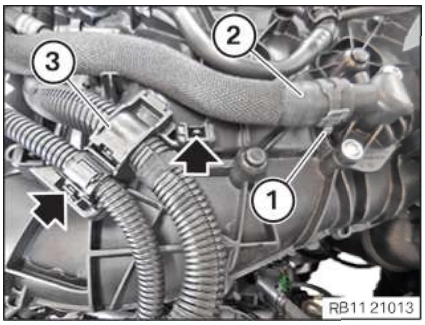
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



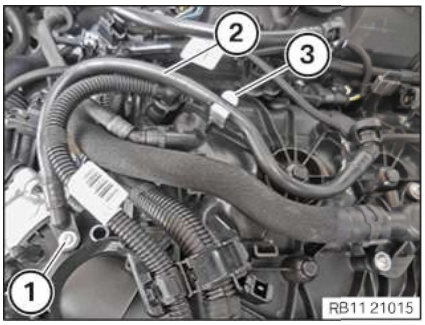
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



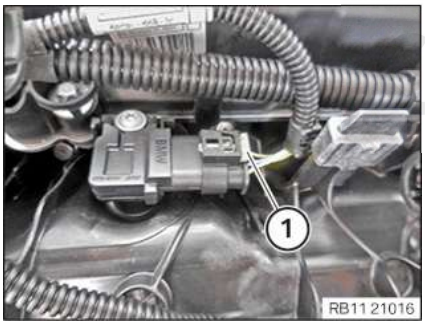
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

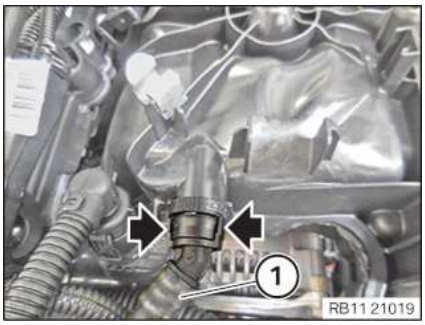
Tank ventilation line to intake plenum

Oval-head screw	Tightening torque	3 Nm



- Connect connectors (1) and lock.

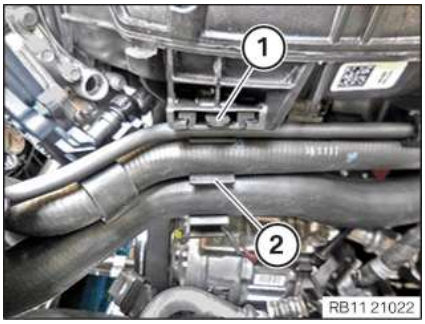
  The connector (1) must engage audibly.



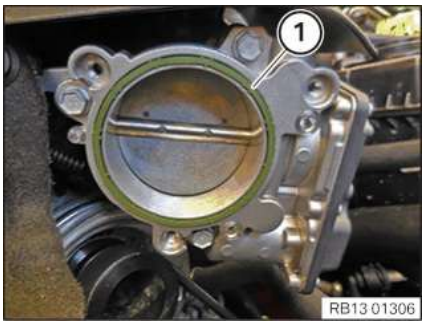
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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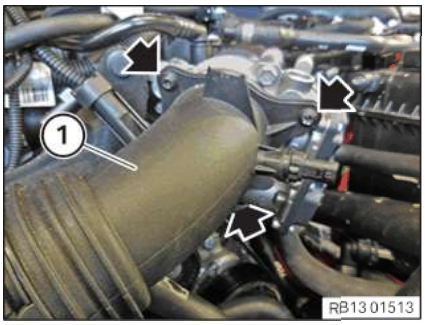


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

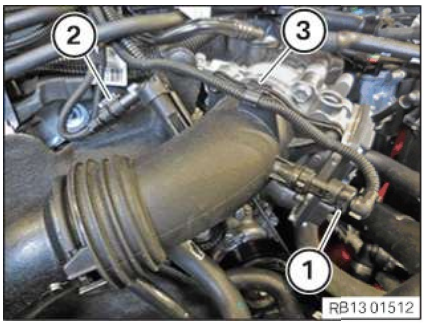
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

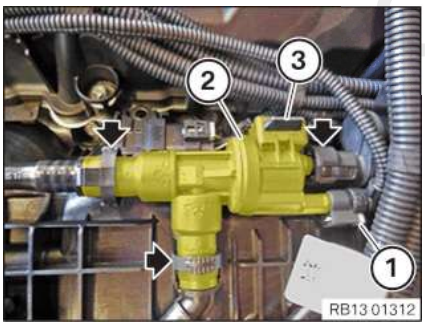
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

78 – Installing the tank vent valve

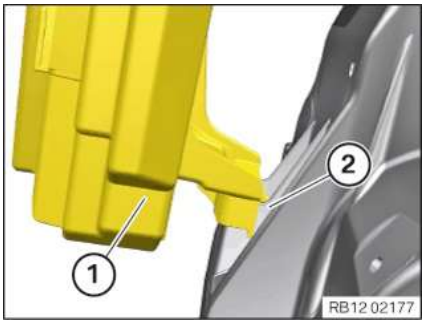


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

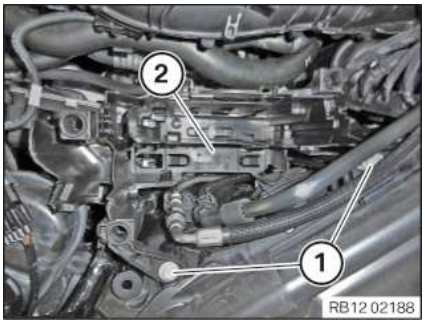
  The connector (1) must engage audibly.

79 – Installing the control unit holder



- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).

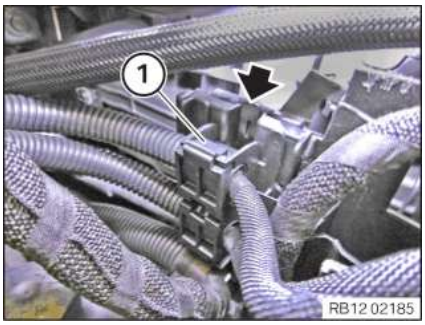
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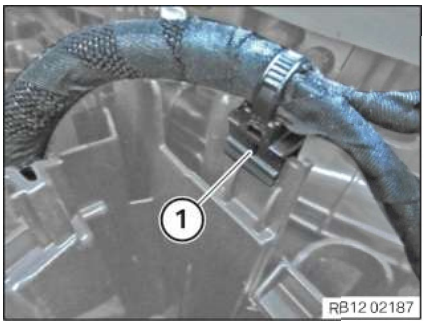
- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

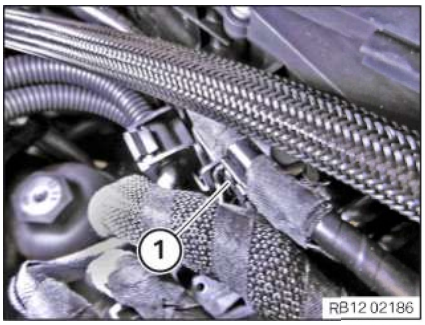
Hexagon screw		Tightening torque	8 Nm



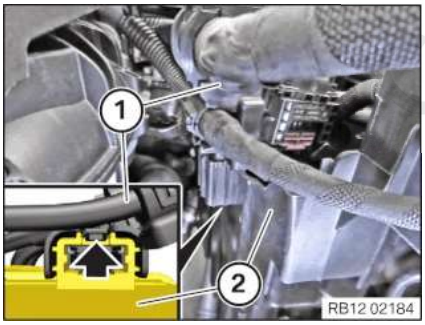
- Feed in and install the cable clip (1).
  Lock (arrow) must audibly engage.



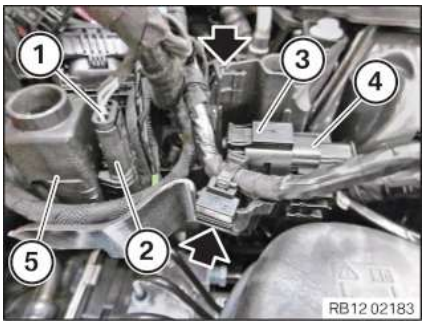
- Secure clamps (1).



- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

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WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

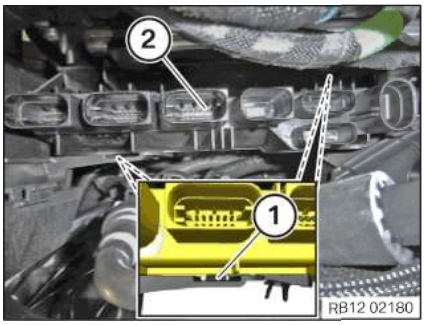
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Insert and install the integrated supply module (PDM) (2).

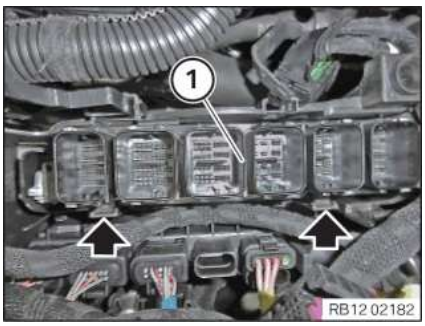
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.

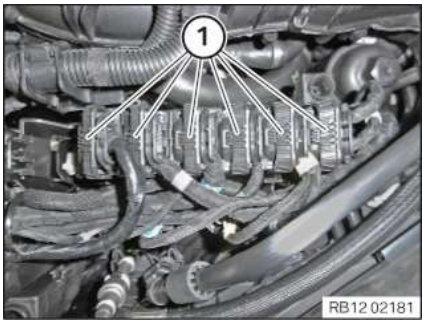
81 – Installing the DME control unit



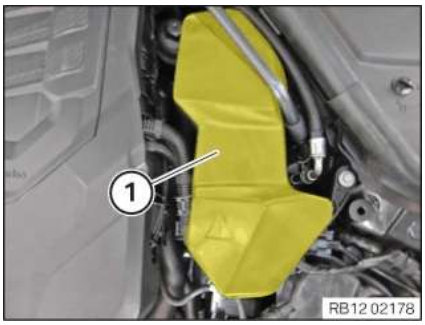
- Feed in and install DME control unit (1).

  The locks (arrows) must engage audibly.

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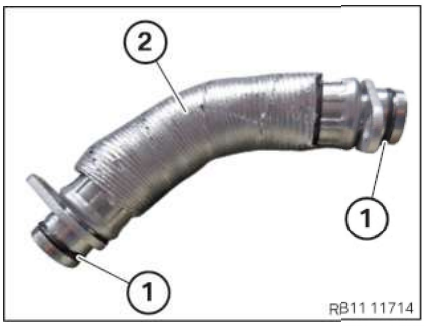


- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.

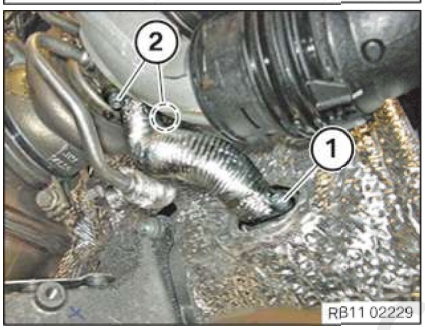


- Insert and install cover (1) into guides.

82 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).
  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

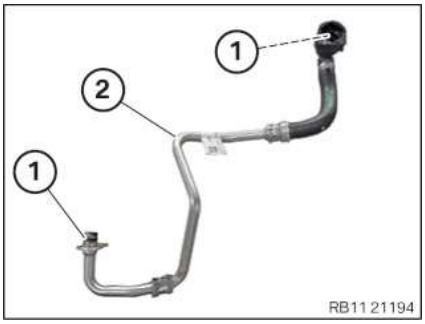
Oil return line to exhaust turbocharger/crankcase

M6x14	Tightening torque	8 Nm

83 – Install the coolant return line for the exhaust turbocharger

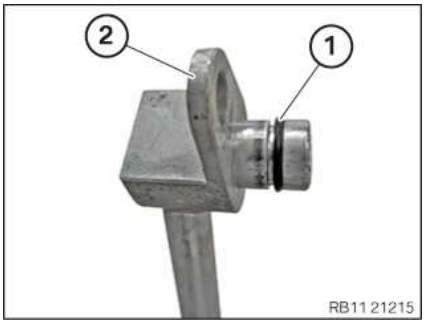
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



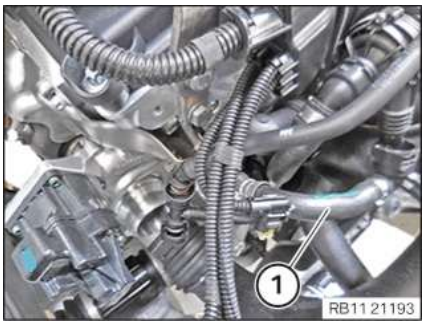
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).
  Parts: O-rings

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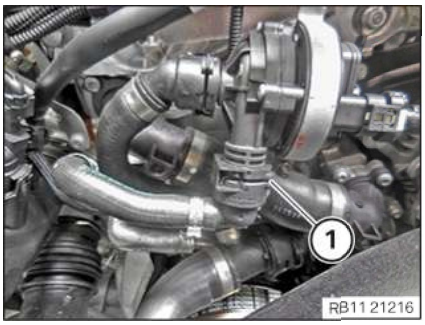


- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

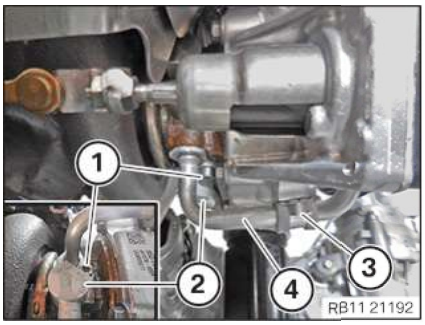
  Parts: O-ring



- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

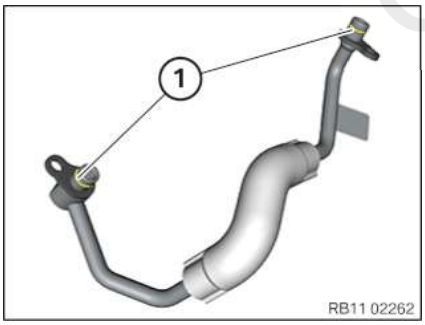
M6 x 12	Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

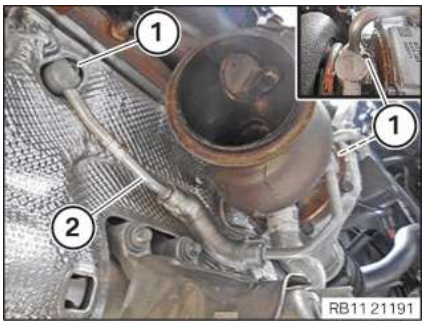
M6	Tightening torque	8 Nm

84 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12	Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12	Tightening torque	8 Nm

85 – Install catalytic converter

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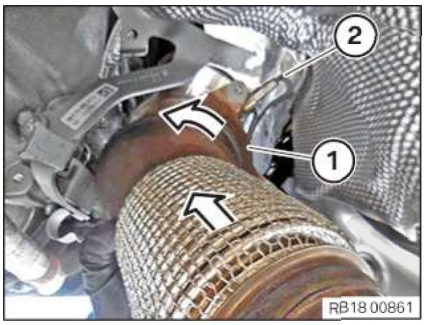
- Renew the V-clip (1).

  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket



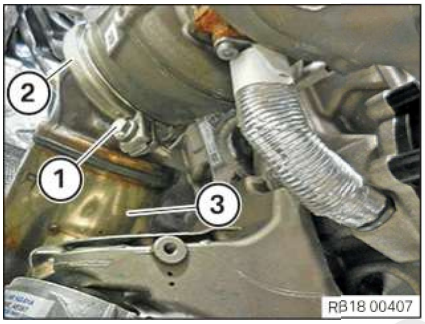
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

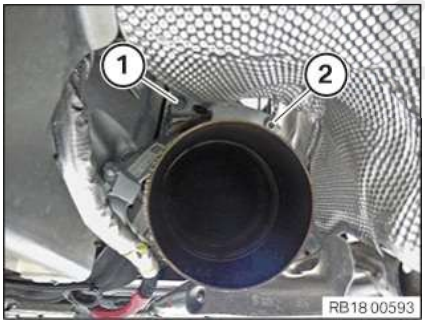
- Remove and install heavy components with the aid of another person/other persons.

- Guide in and install the catalytic converter (1) in the direction of arrow.
- Make sure that the monitoring oxygen sensor (2) **is not damaged.**



- Renew the V-clip (2).

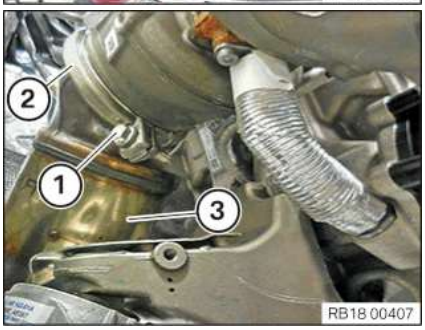
  Parts: V-band clamp
- Feed in and install V-clip (2) on the catalytic converter (3).
- Position the bolt (1).



- Renew the screw (1).

  Parts: Screw
- Position the bolt (1).
- Renew nut (2).

  Parts: Nut
- Position the nut (2).



- Position the catalytic converter (3).
- Position V-clip (2).

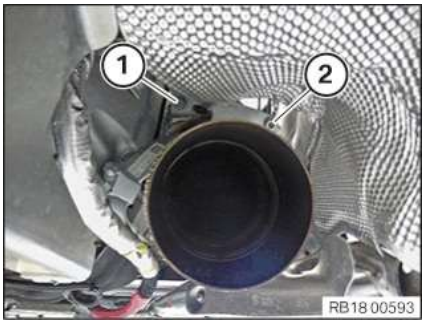
Note: Ensure correct mounting orientation of the V-clip.

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

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- Tighten down screw (1).

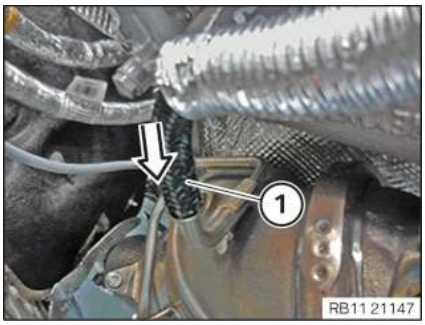
Catalytic converter to holder

M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm



- Check the pressure hose (1) for damage and renew hardened pressure hose (1) if necessary.
- Connect the pressure hose (1) in direction of arrow to the limit position.

86 – Installing the complete exhaust system

CAUTION

Component with heavy weight.

Danger of injury!

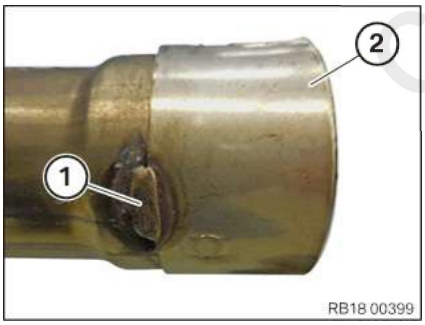
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



CAUTION

Swarf resulting from sawing or grinding components.

Danger of injury!

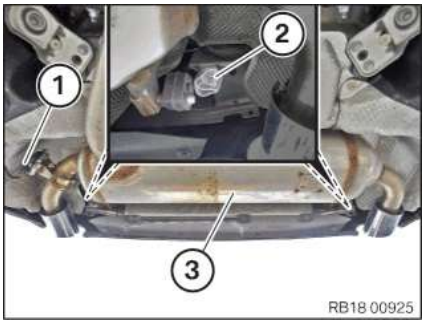
- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp

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- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

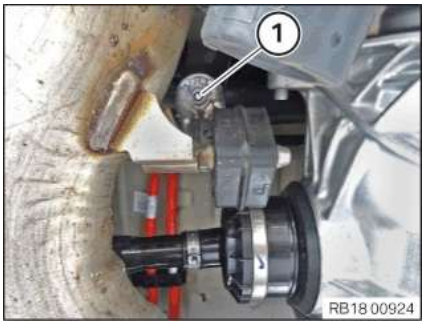
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

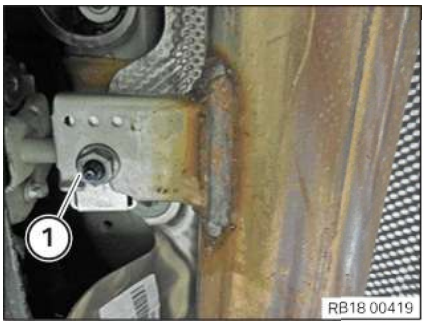


- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm

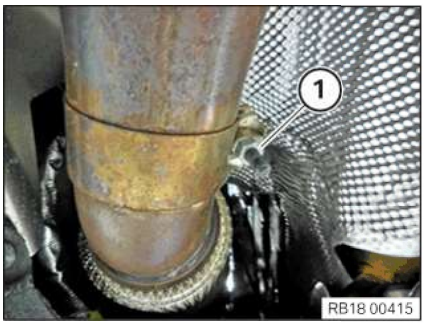


- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

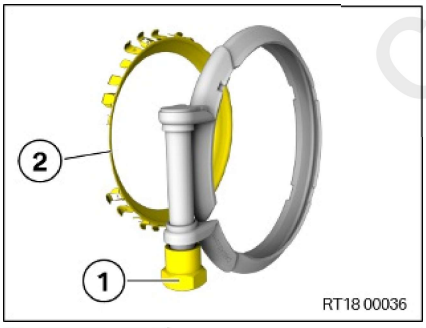
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

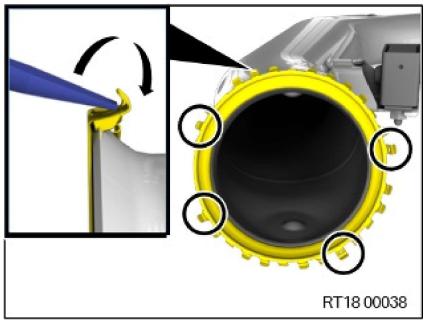


- **Equipment specification 2 (V-clips)**

  Renew V-band clamp.

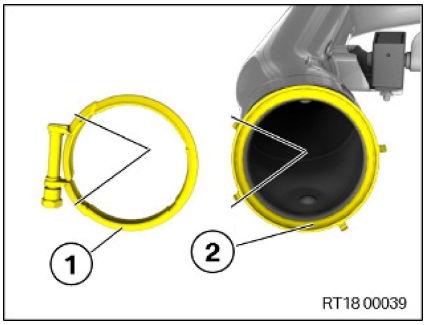
  Parts: V-band clamp

  Unscrew the nut (1) and remove the sealing ring (2).

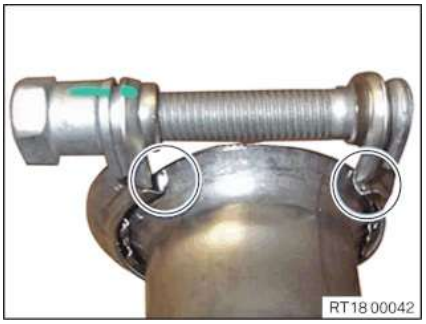


- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.

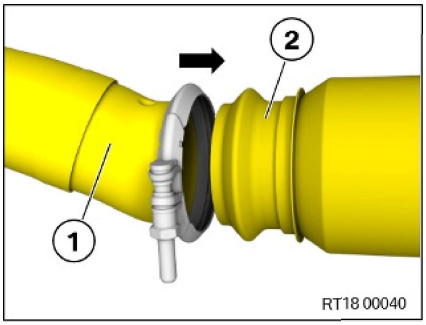
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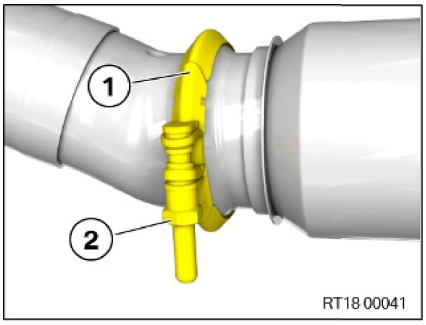
- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).



- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.



- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).

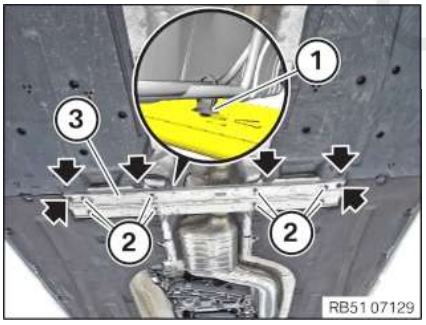


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

87 – Install the connecting supports on the tunnel



- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- Tighten screws (arrows).

Connecting support to tunnel

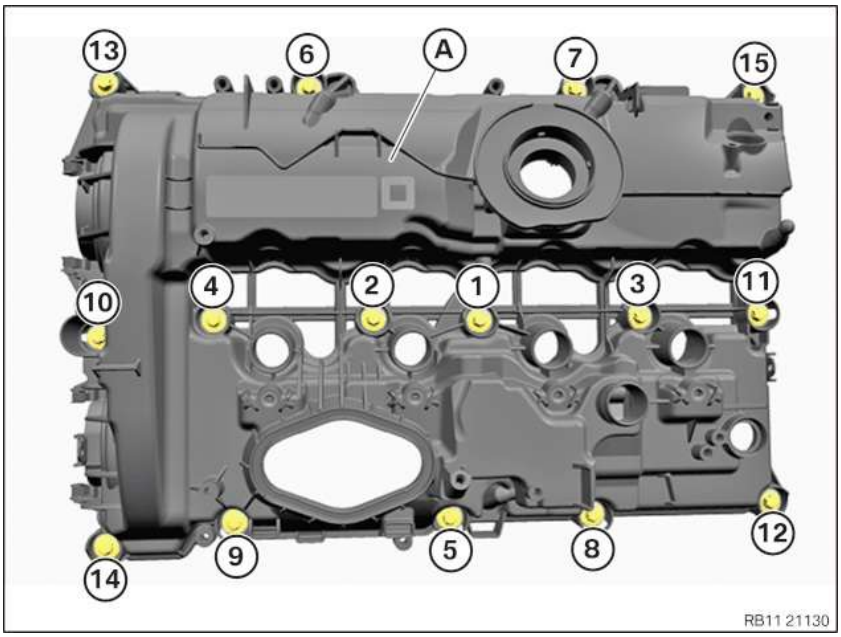
M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

88 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

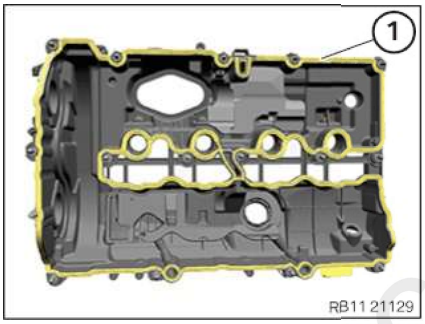
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

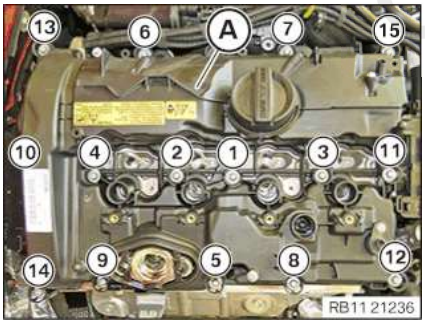
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

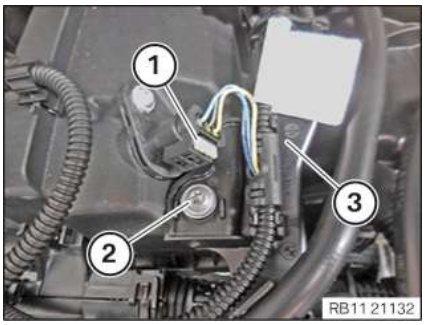
Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

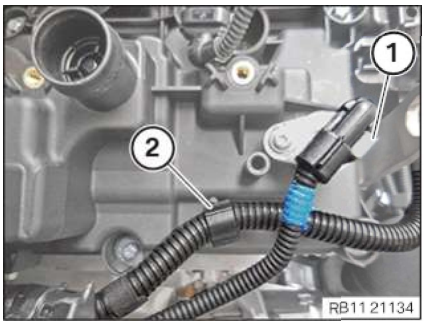


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

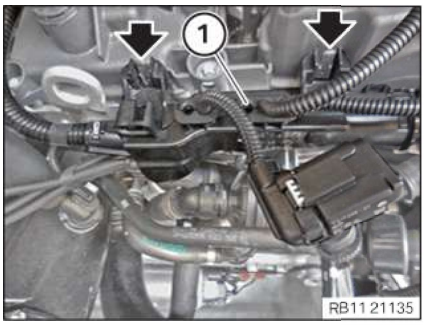
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

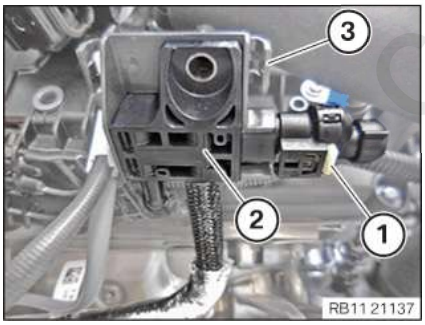
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



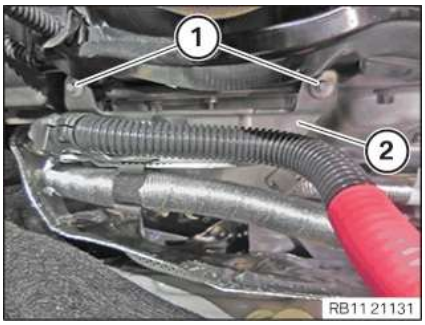
- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

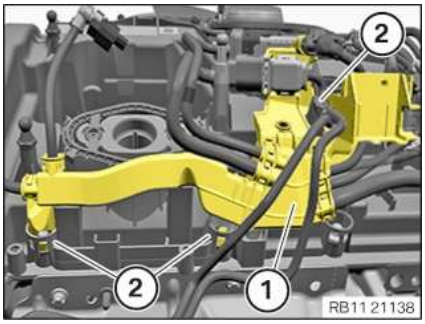
- Route the positive battery cable without abrasions and do not trap.

- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

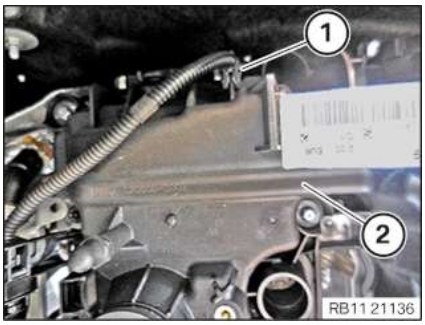
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

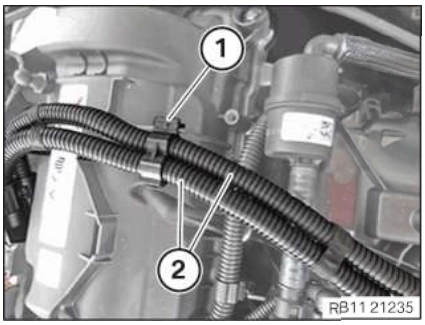
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- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

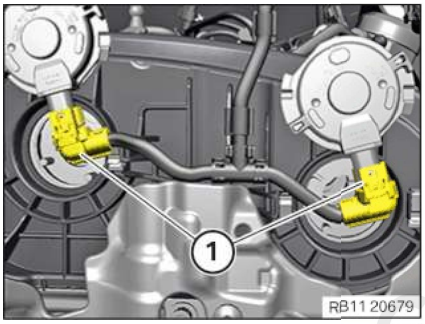


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

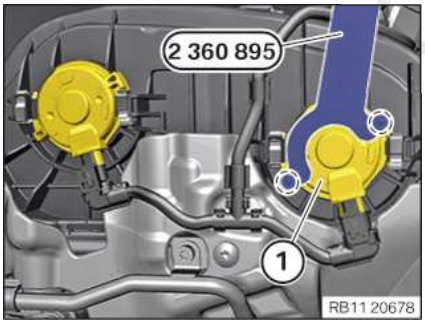
89 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

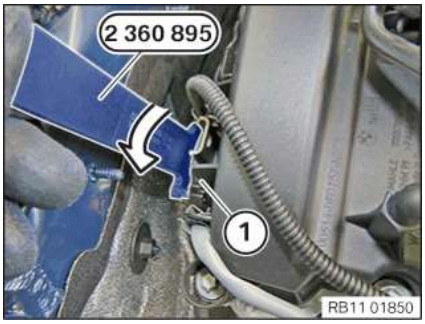
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



NOTICE

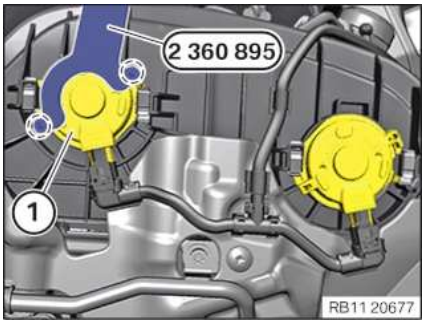
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

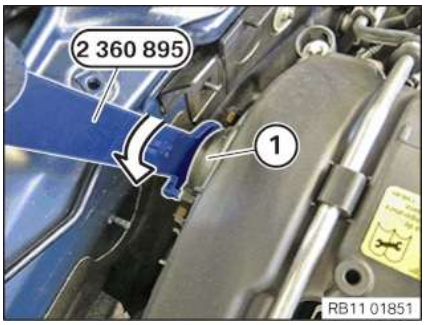
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NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

90 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

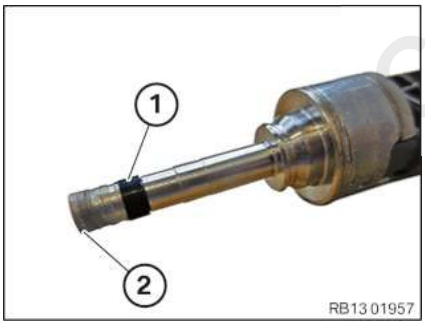
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

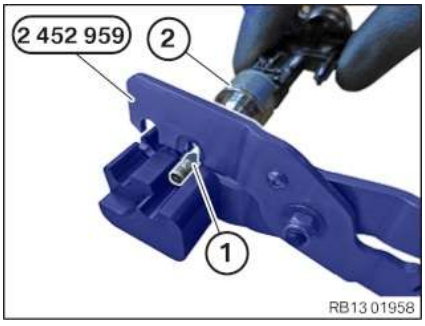
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

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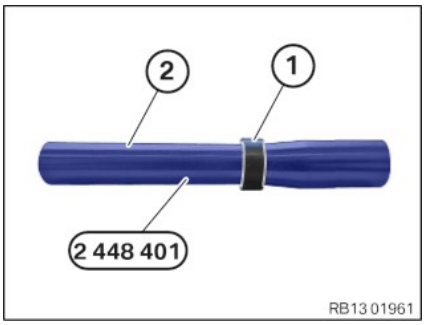


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

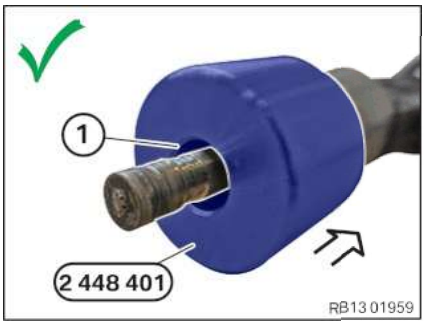
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

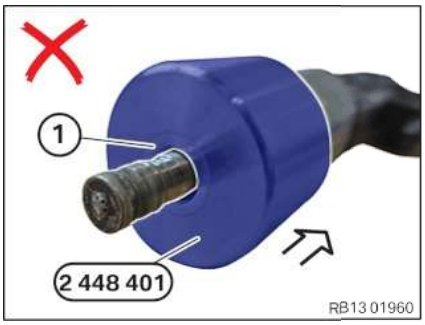


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



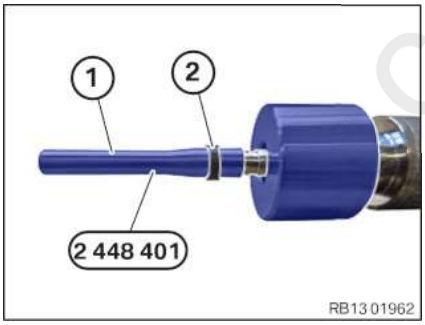
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

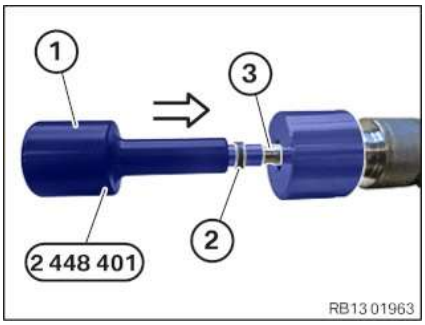


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

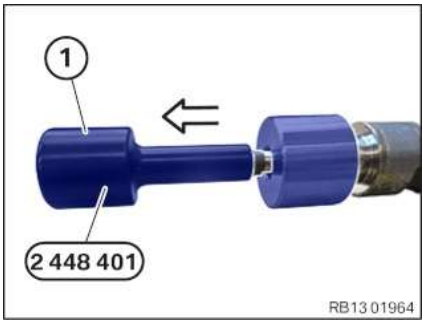


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

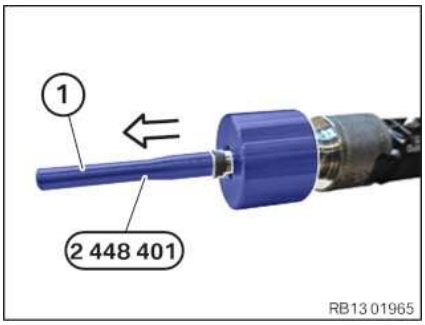


- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

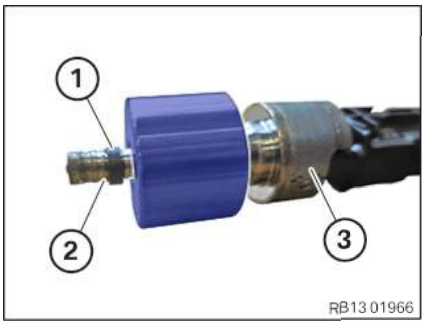
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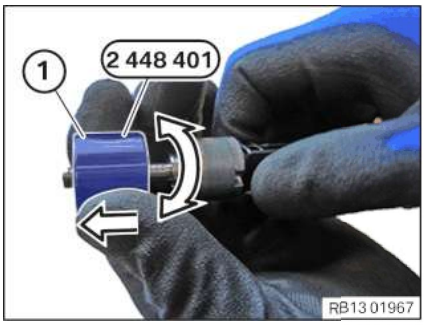
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

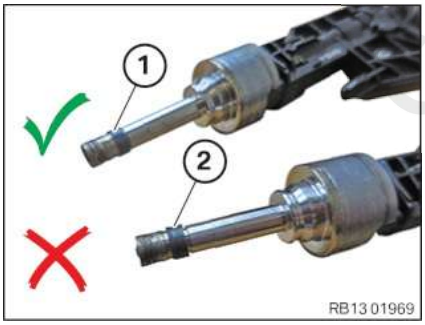


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).



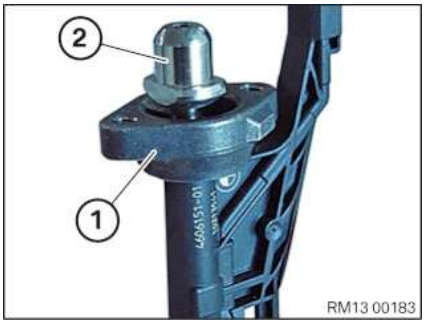
- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

91 – Installing the rail with injectors

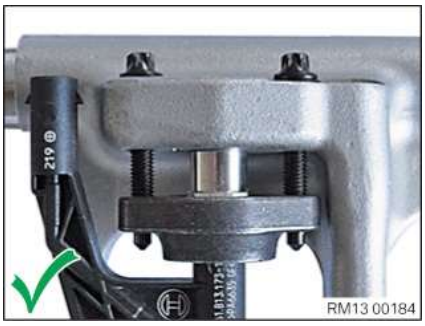
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

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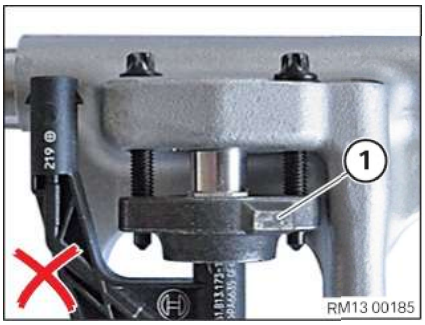


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



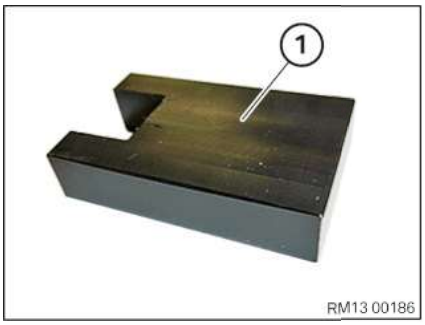
- If applicable, note the position of the cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



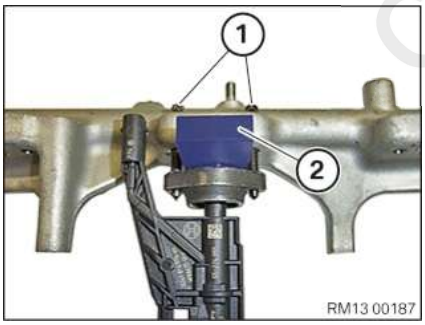
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

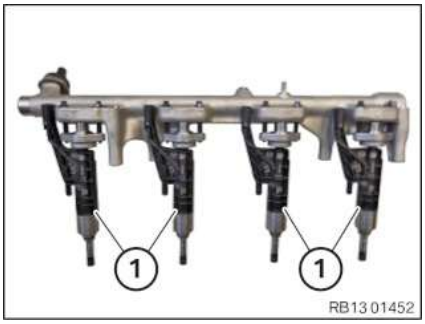
  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



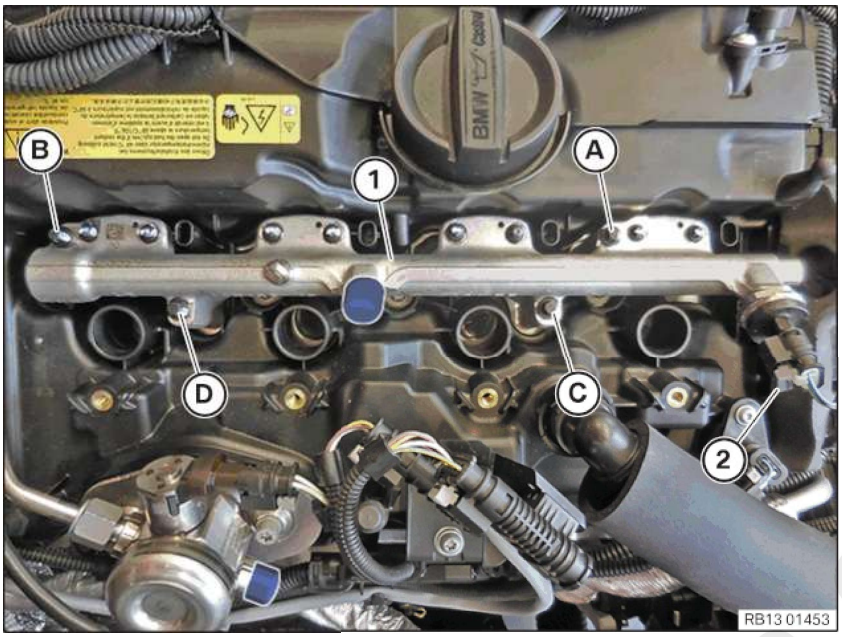
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

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- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.



- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

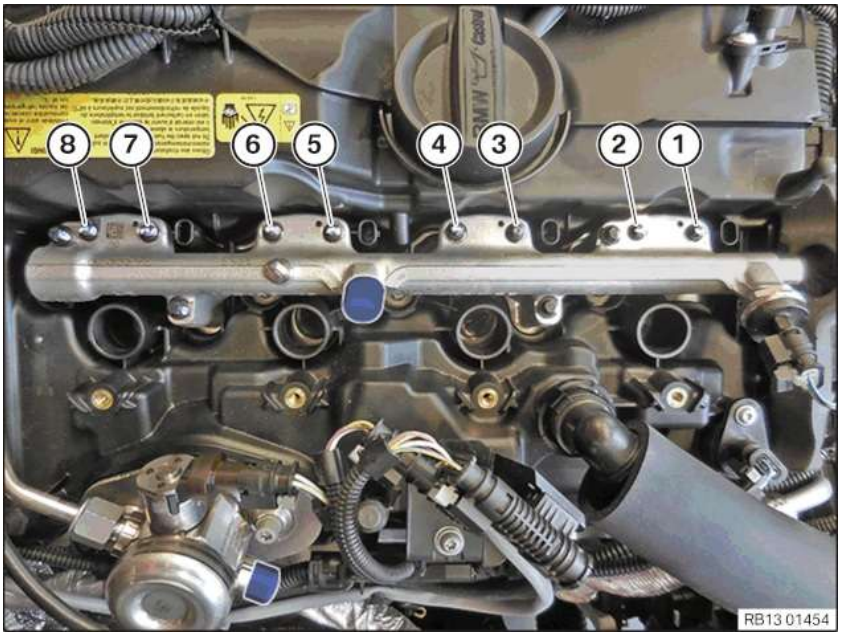
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

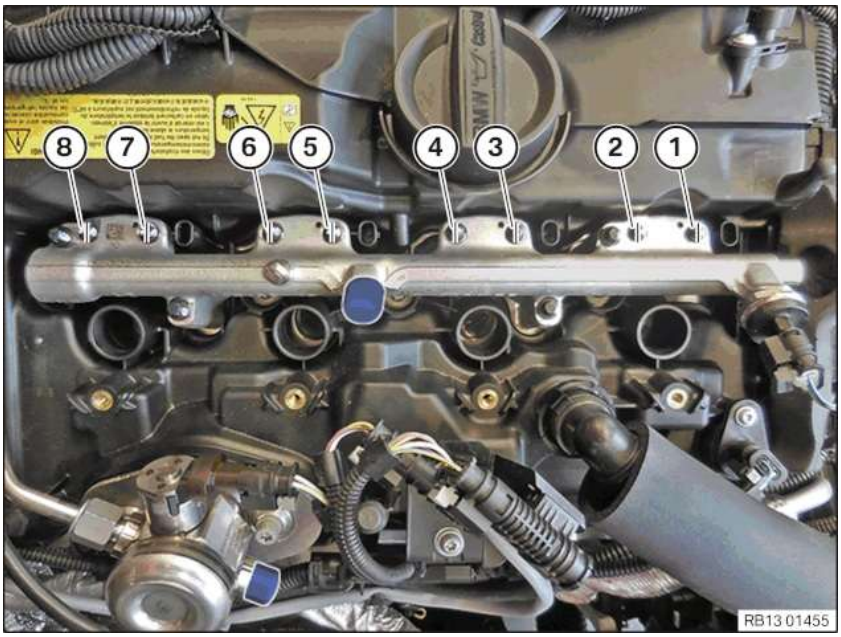
  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

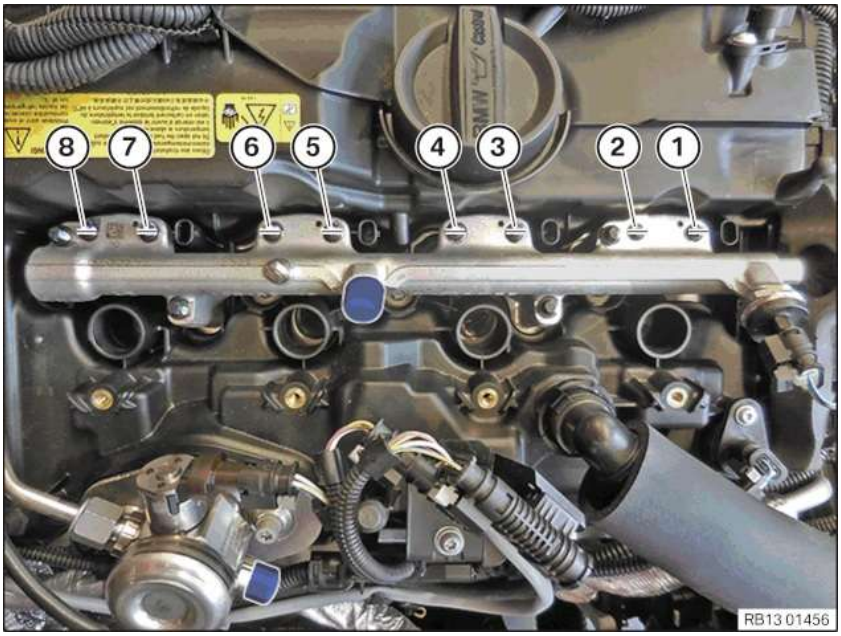
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.



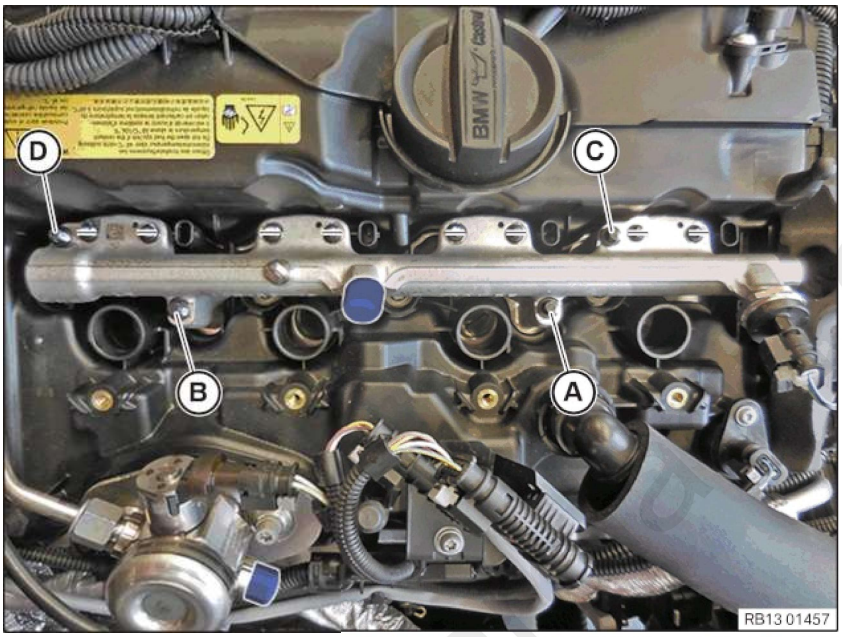
- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.

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- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

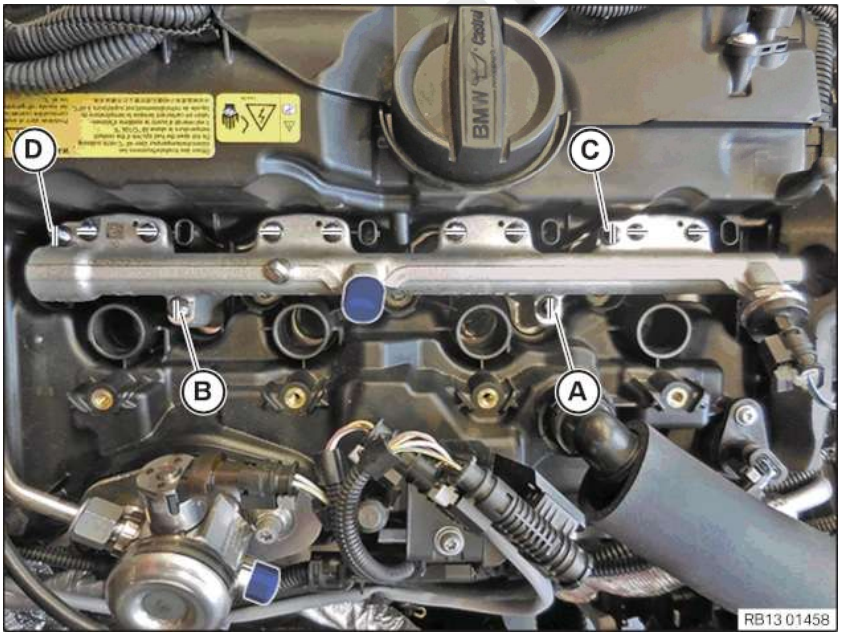
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

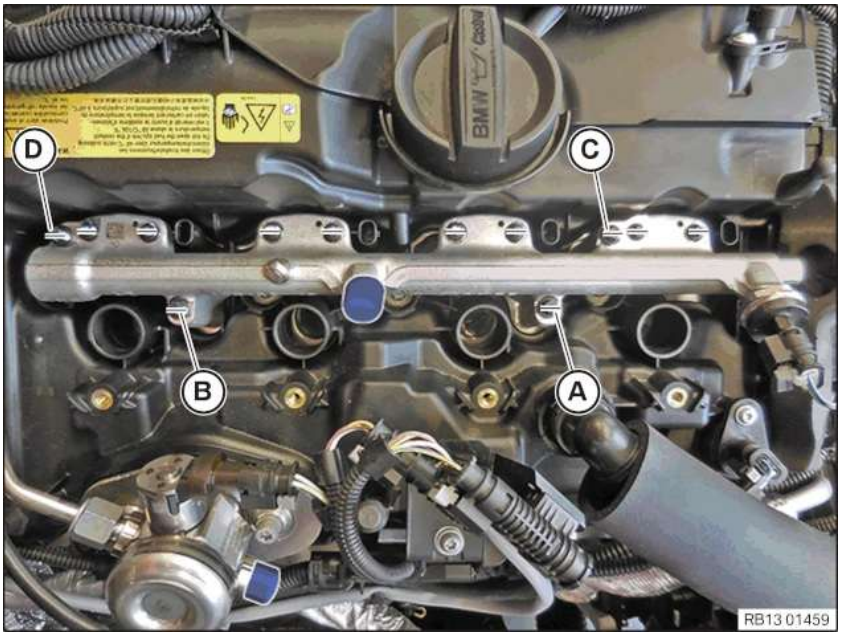
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

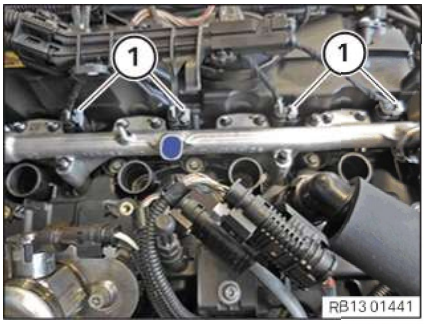


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



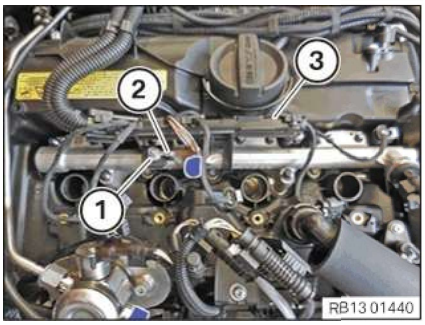
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6	Tightening torque	5 Nm

92 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

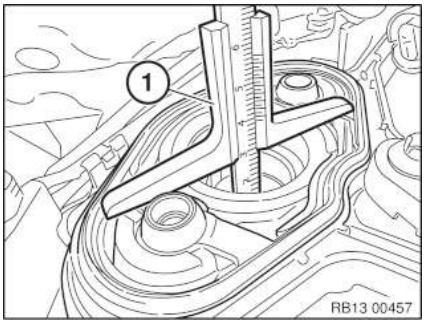
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

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- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

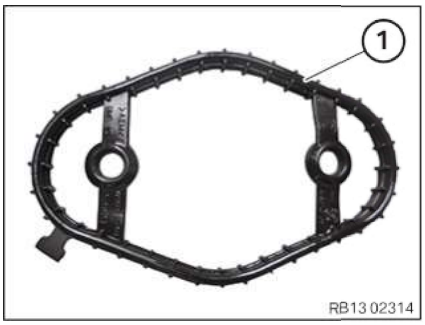
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

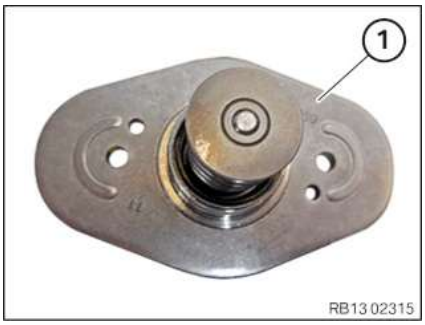
The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

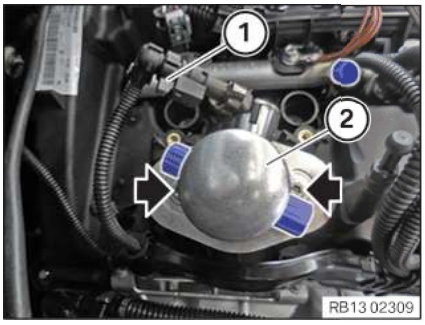
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

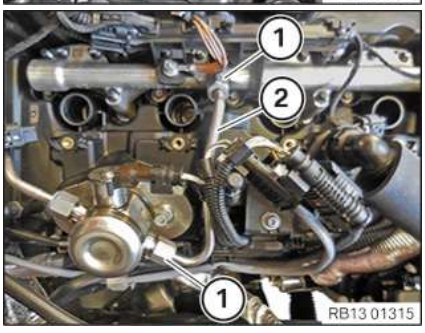
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

93 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

94 – Installing fuel delivery line

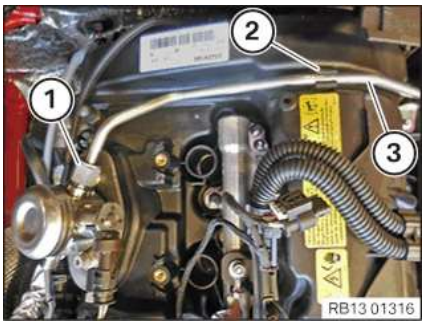
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RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

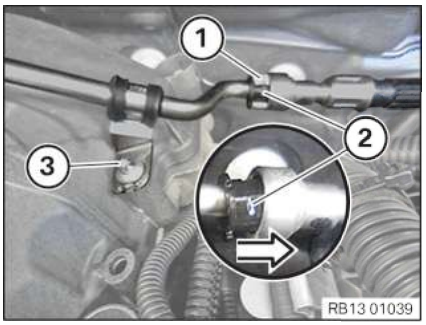
- Route all cables without abrasions, do not trap and crush.



- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

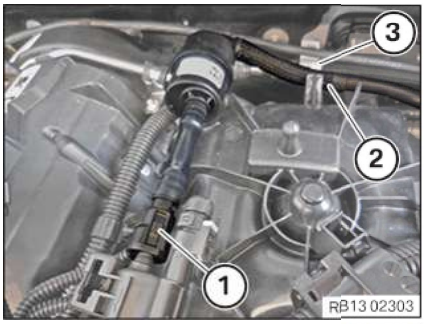
M14		Tightening torque	31 Nm



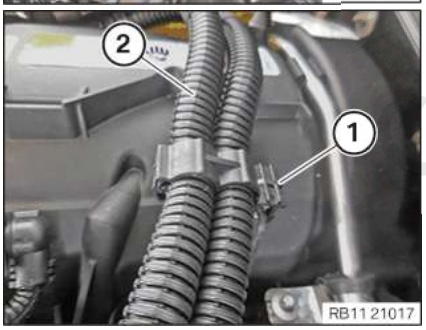
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

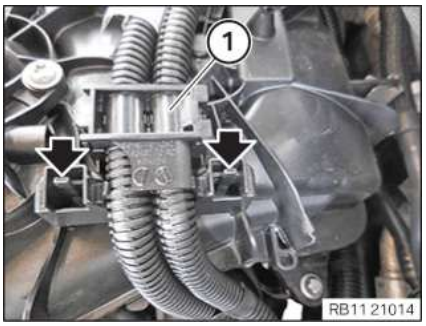
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).



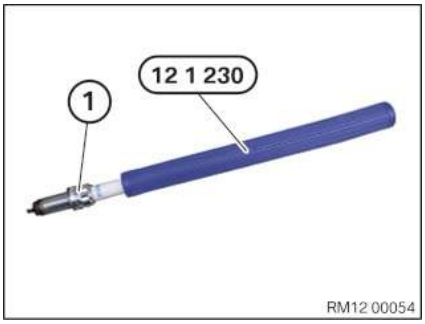
- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

95 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.

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- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

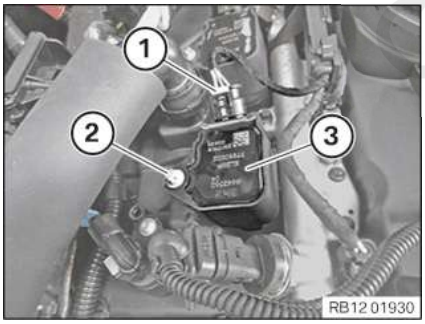
Spark plugs

M12x1.25		Tightening torque	23 Nm

96 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.



▸ **Install ignition coil.**

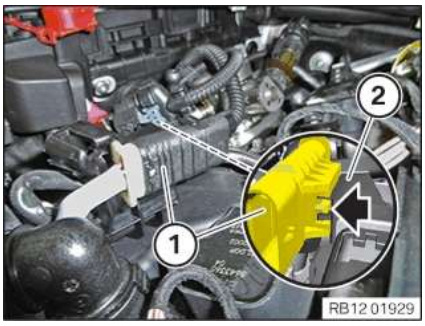
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

  The connector (1) must engage audibly.

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- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

97 – Install the control sensor

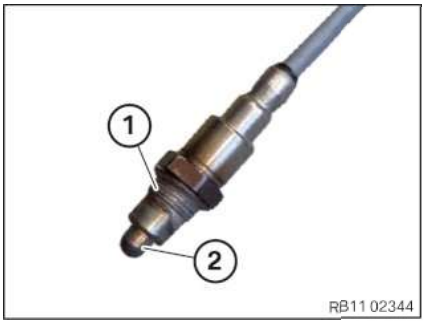
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

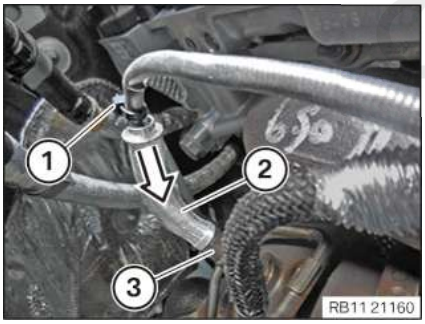
  (2) = Sensor ceramics



- Screw the control sensor (1) in and tighten it with the special tool 0 491 074 (11 7 020).

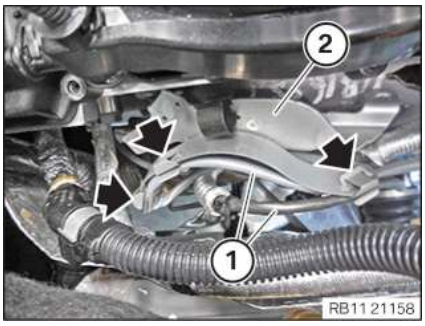
Control sensor

M18x1.5	Tightening torque	50 Nm



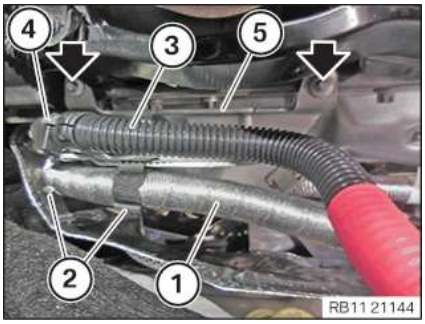
- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

  Parts: Cable strap
- Guide in and install the cable strap (1).



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).

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CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

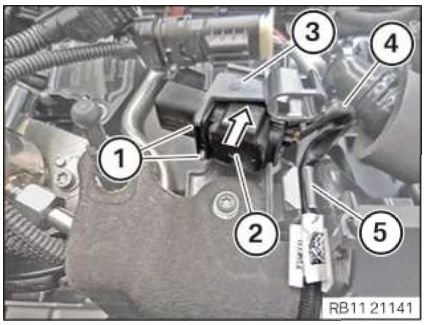
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

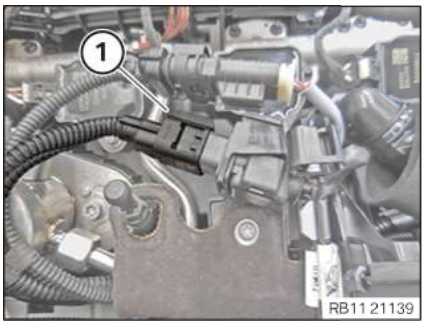
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).



- Guide in the connector (2) in the direction of arrow at the carrier plate (3) and install.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).

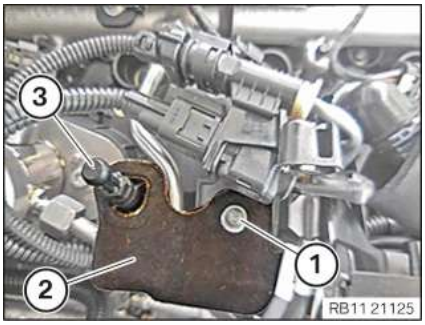


- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Connect and lock the connector (1).
- Guide the connector (1) into the carrier plate in the direction of arrow.
- Ensure the connector (1) audibly engages with the carrier plate.

98 – Install the cylinder head cover acoustic cover

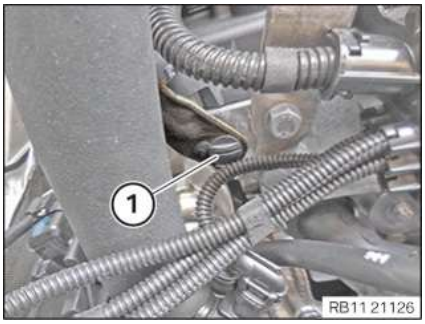


- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

Acoustic cover (side) to cylinder head cover

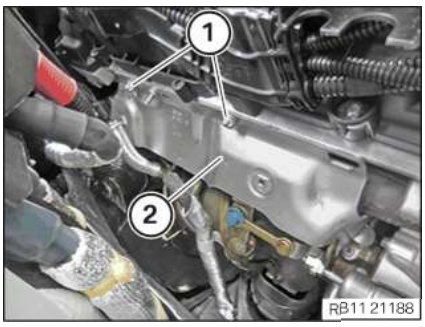
TS6 x 20			8 Nm

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- Secure the clip (1).

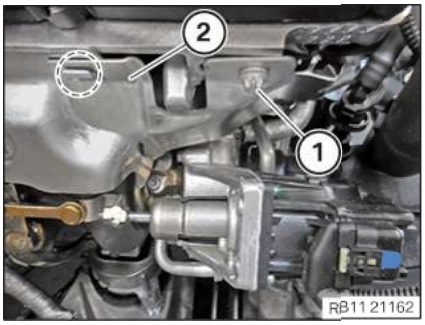
99 – Installing the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

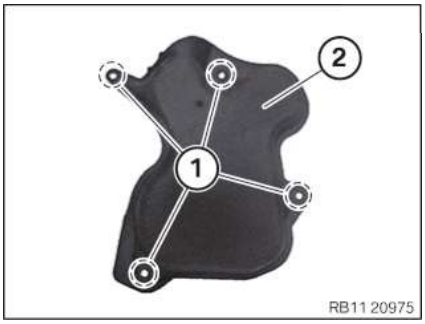


- Tighten down screw (1).

Heat shield to clamping strip

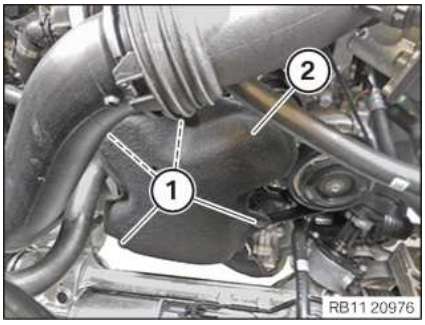
M6 x 12	Tightening torque	8 Nm

100 – Install the acoustic cover for the engine at the front



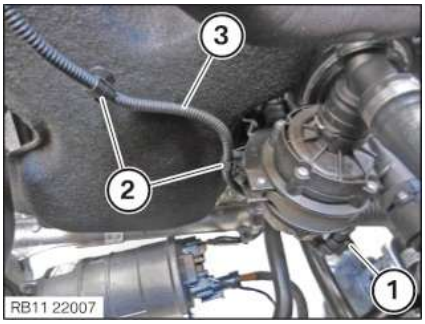
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



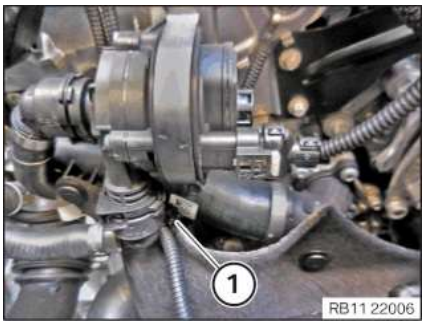
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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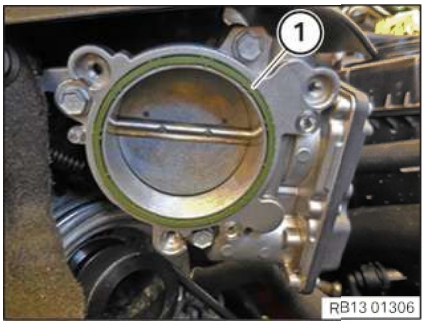
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



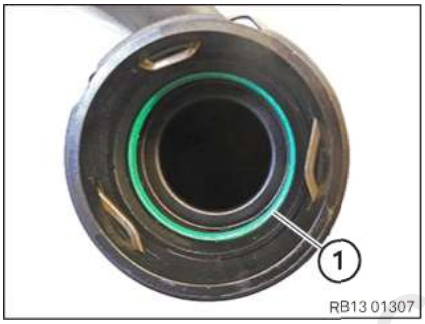
- Secure clamps (1).

101 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring

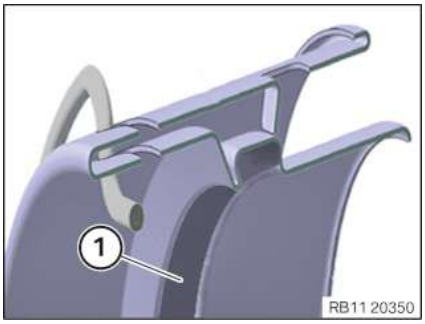


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

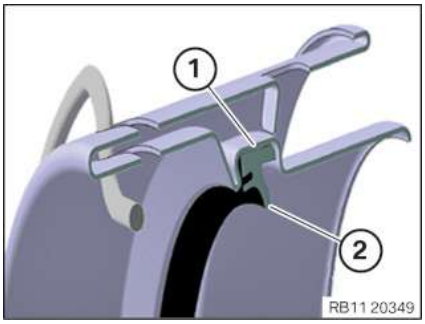
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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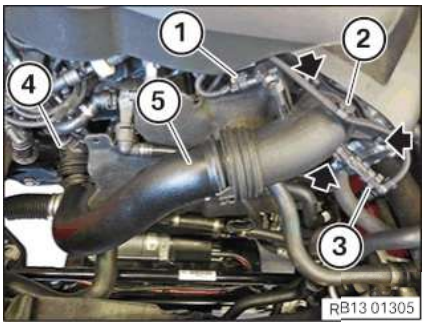
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

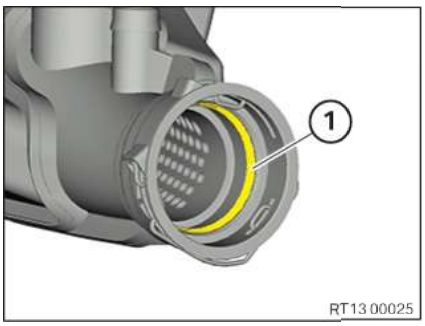
Charge air line to throttle body

M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

102 – Installing the clean air pipe with resonator

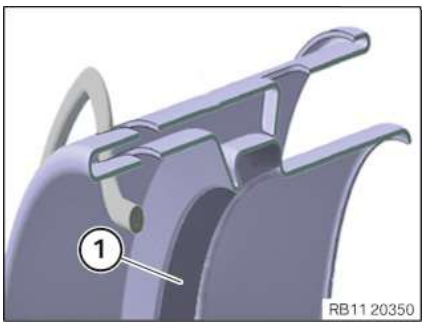


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

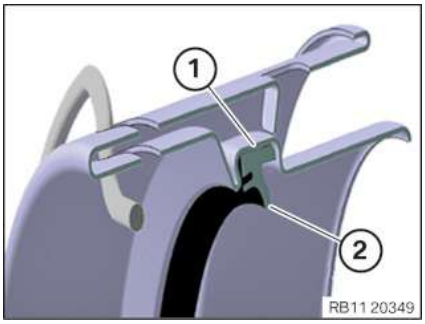
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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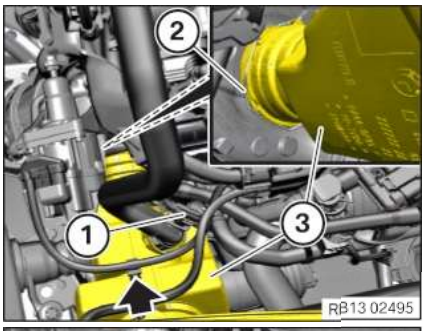
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

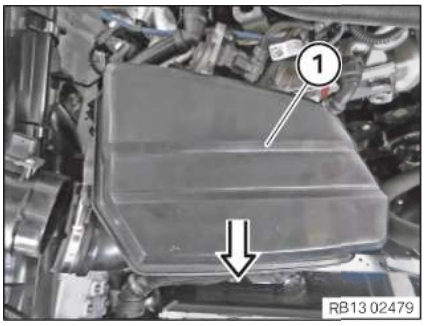
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



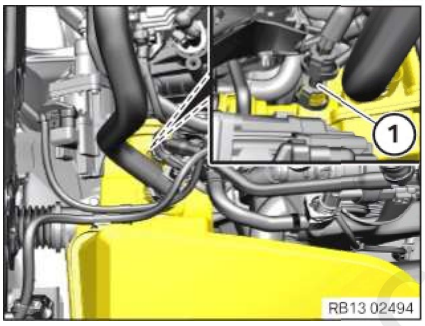
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

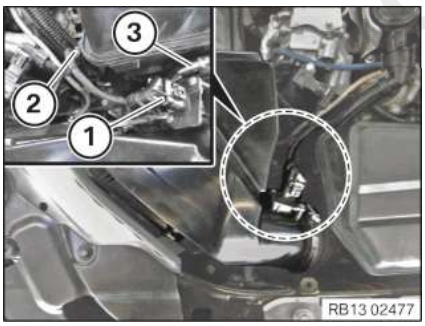
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

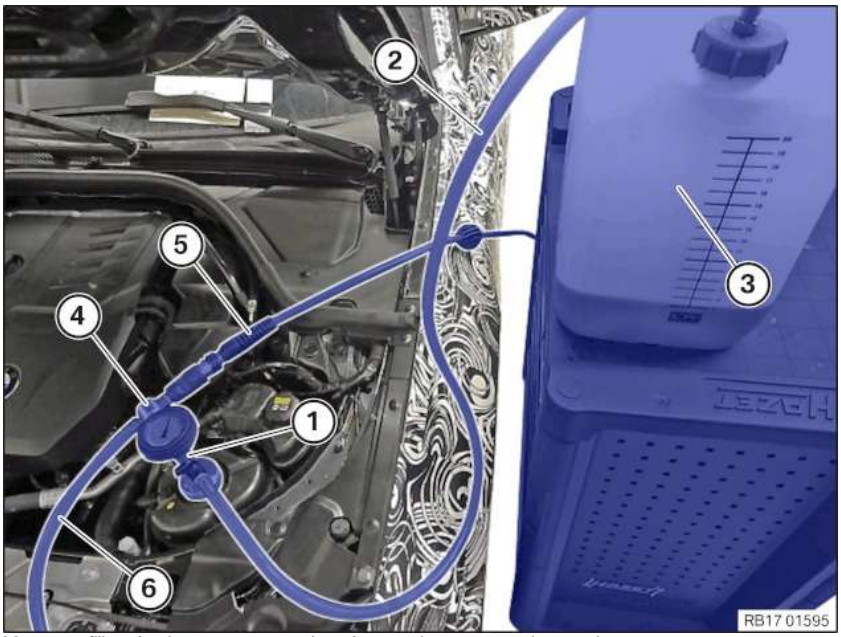
  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

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TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

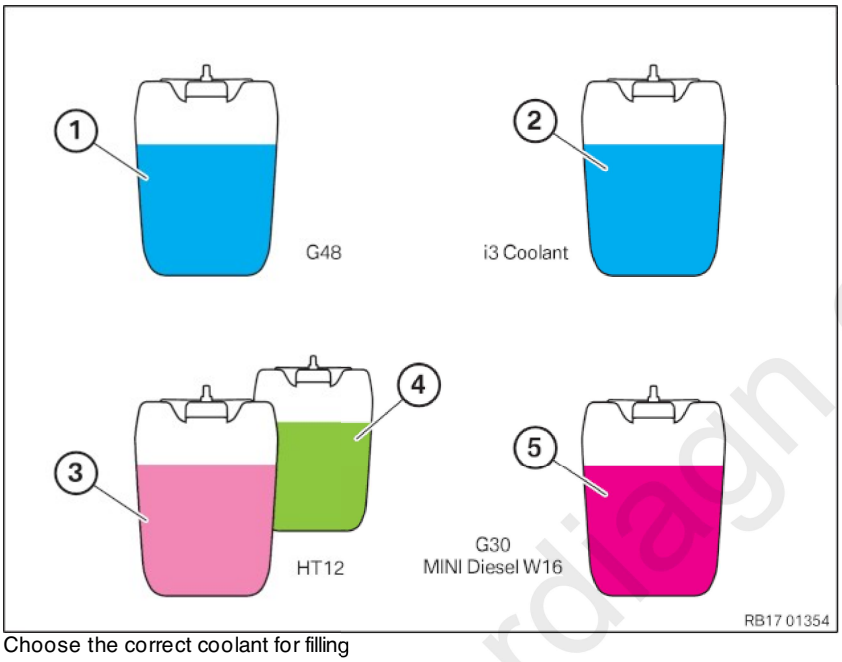
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. **G48 (Blue)** G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.
2. **i3 coolant (blue)** is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.
3. **HT12 (Pink)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
4. **HT12 (Green)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
5. **G30 (Pink)** must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

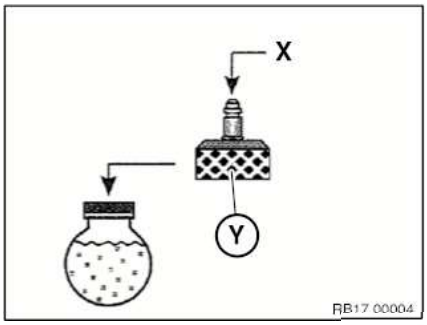
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

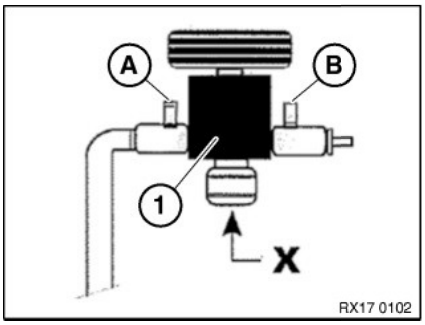
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

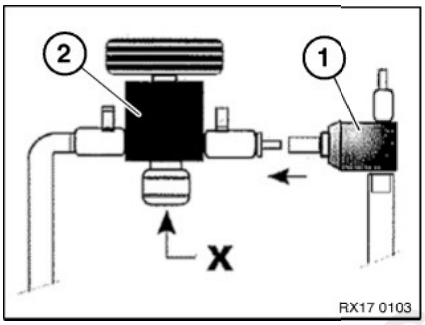
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



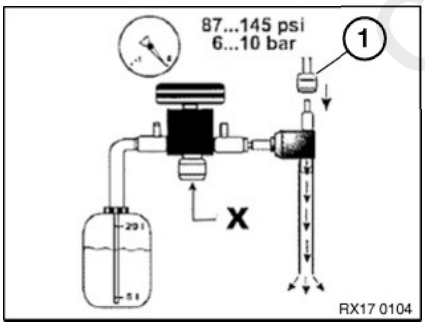
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



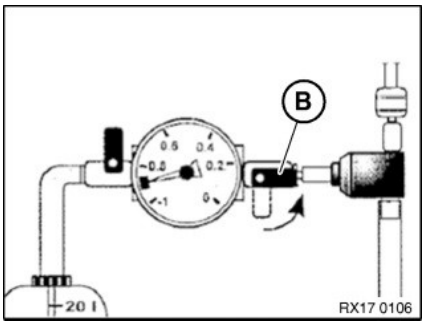
- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.

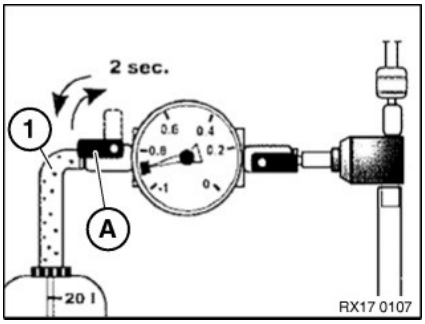


- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.



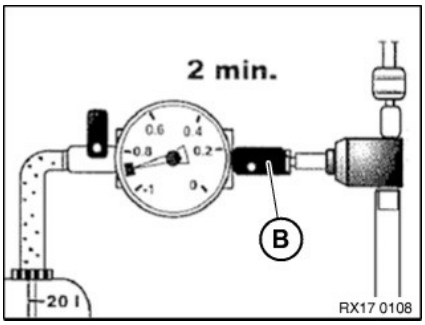
- Open shut-off valve (B).
  The venturi nozzle produces a flow noise.

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- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

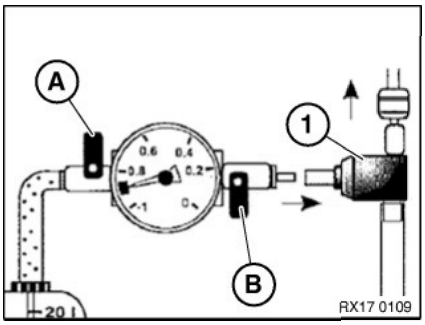


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

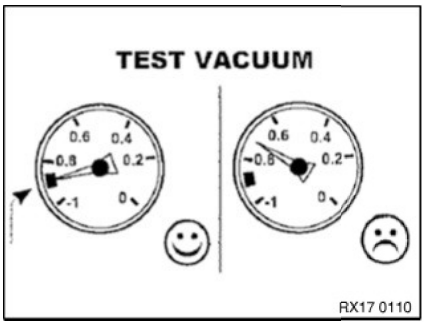
TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).



Check

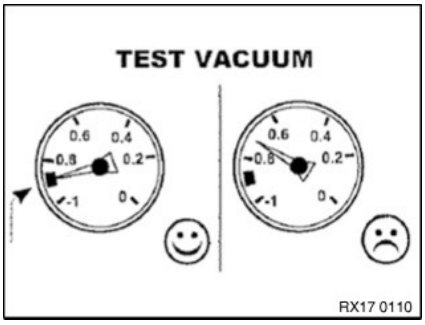
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.



Check

- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

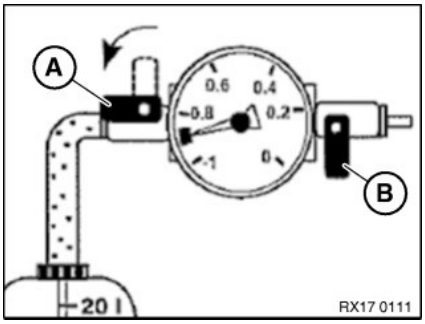
Result

» Vacuum remains constant.

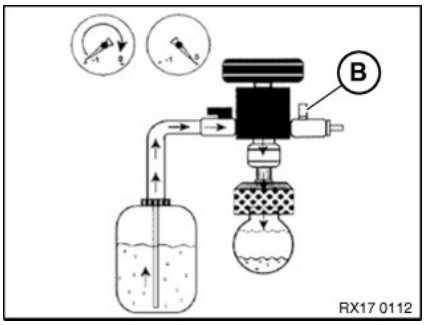
Measure

- Continue with filling.

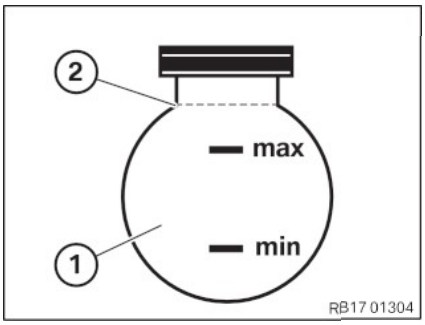
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- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



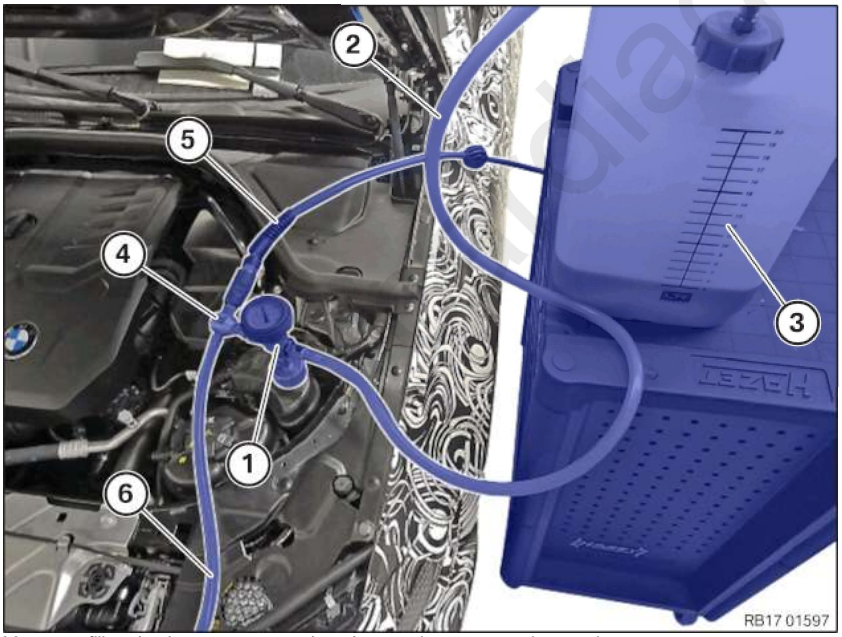
- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

104 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity

of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

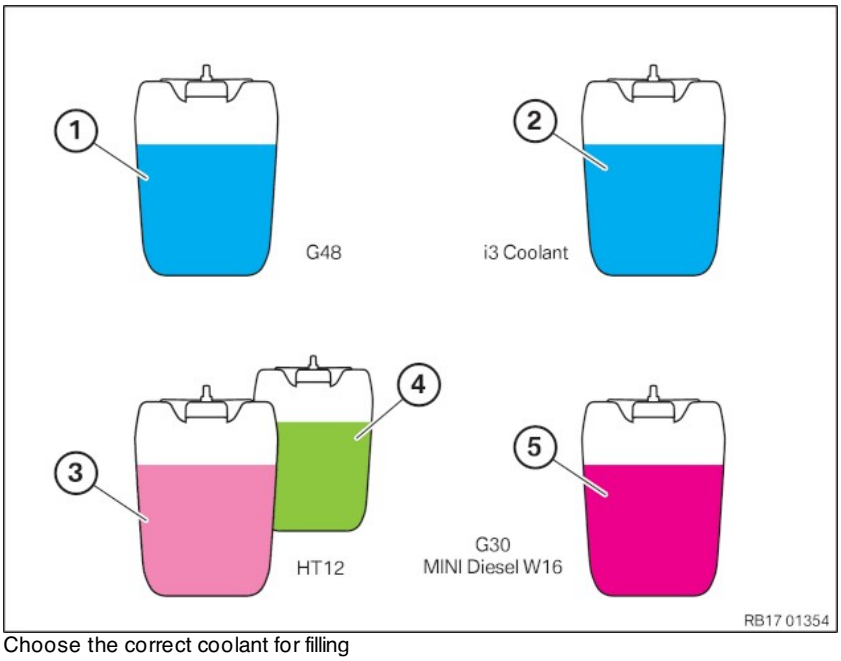
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. **G48 (Blue)** G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.
2. **i3 coolant (blue)** is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.
3. **HT12 (Pink)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
4. **HT12 (Green)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
5. **G30 (Pink)** must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

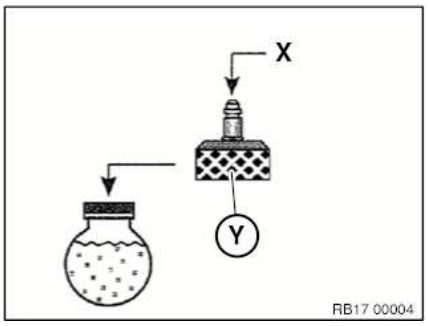
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

Capacity of low-temperature coolant circuit G20

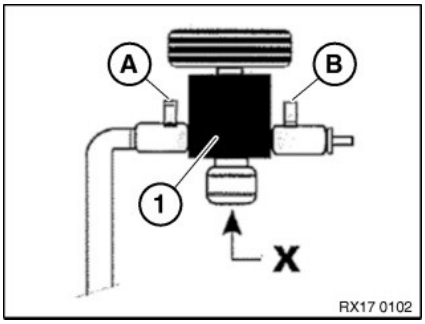
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

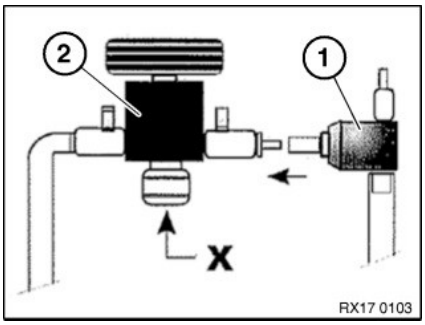


- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

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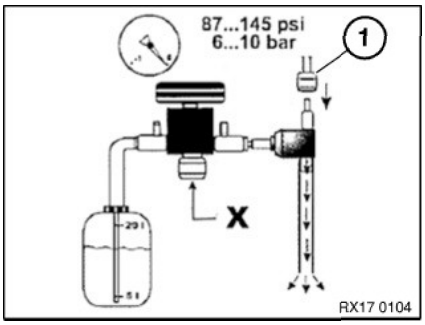


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



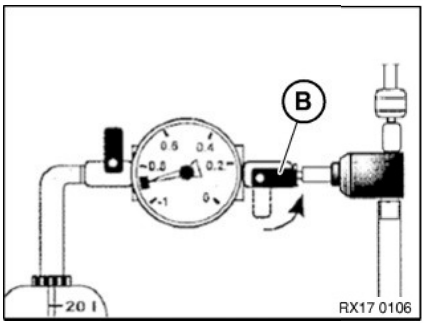
- Connect Venturi nozzle (1) to the vacuum filler device (2).

  (X)is the connection on the coolant expansion tank.



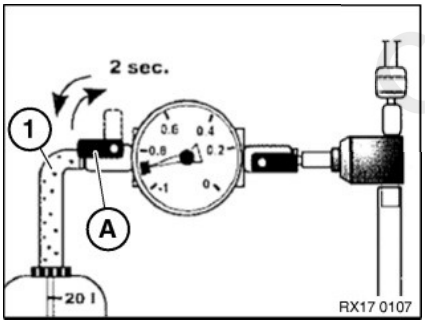
- Connect compressed air (1).

  (X)is the connection on the coolant expansion tank.



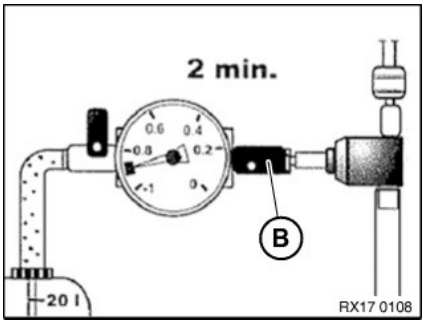
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.



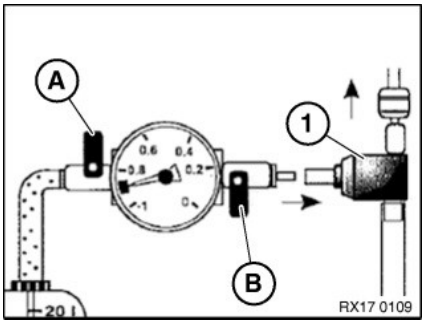
- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

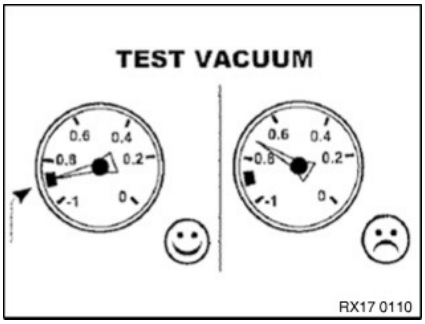
- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).

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- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

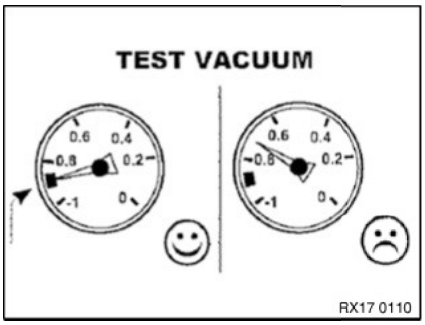
Result

» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



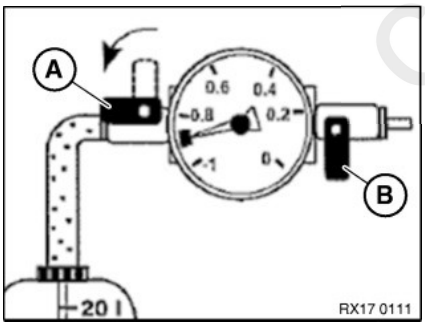
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

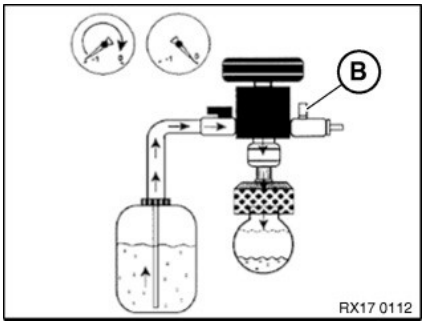
» Vacuum remains constant.

Measure

- Continue with filling.

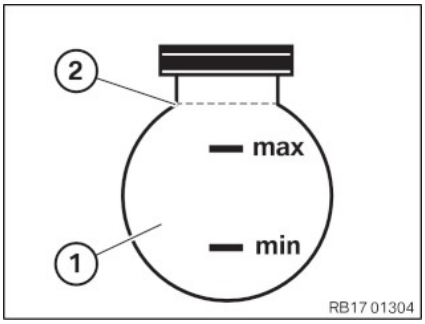


- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).

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- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

105 – Disconnecting all battery earth leads



- See additional information.

106 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

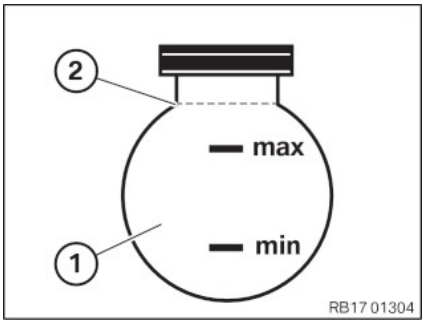
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

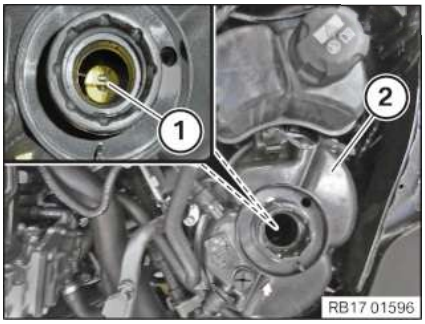
  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

  The engine speed **drops** to the idle speed.
- Observe the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

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107 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

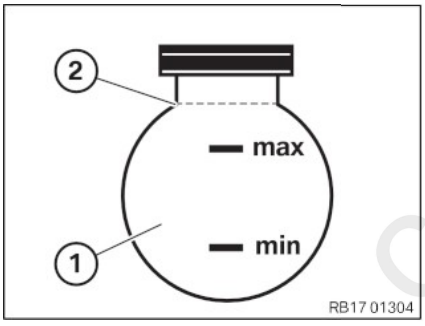
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

  The cooling system bleeding routine will start.

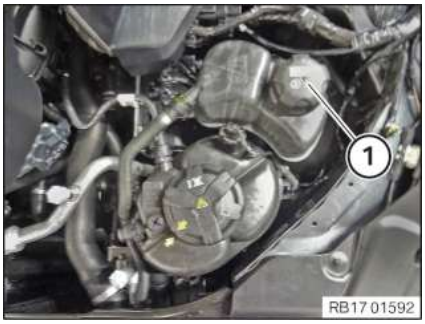
  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.

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- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

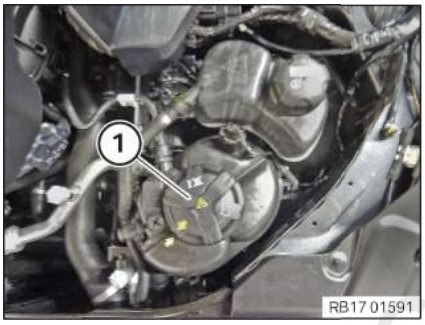
108 – Check the high-temperature cooling system for watertightness

WARNING

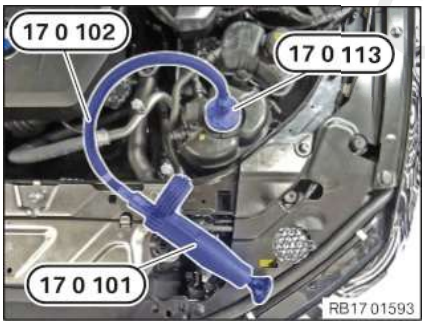
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Loosen sealing cap (1).



- Attach the special tool 0 494 418 (17 0 101) with special tools 0 494 419 (17 0 102) and 0 494 642 (17 0 113) from the set of special tools 0 494 417 (17 0 100).
- Build up excess pressure and wait for approximately 2 minutes.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

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TECHNICAL INFORMATION

If the described test step is not completed successfully: repeat test step twice. Only replace the sealing cap after three tests with an incorrect opening pressure.

When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has cooled down. These traces of coolant do not indicate whether the sealing cap is defective or not.

Escaping coolant vapours when the vehicle is at standstill may cause the pressure relief valve to stick to the sealing cap. This may cause an incorrect opening pressure.

- Screw on sealing cap (1) on special tool 0 494 643 (17 0 114) from the set of special tools 0 494 417 (17 0 100).
- Build up the pressure with special tools 0 494 418 (17 0 101) and 0 494 419 (17 0 102) from the set of special tools 0 494 417 (17 0 100).
- Observe on the pressure measuring device when the opening pressure has been reached.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

109 – Checking low-temperature cooling system for watertightness

WARNING

Hot surfaces.

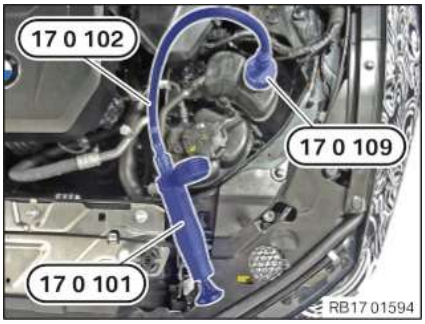
Risk of burning!

- Perform all work only on components that have cooled down.



- Loosen sealing cap (1).

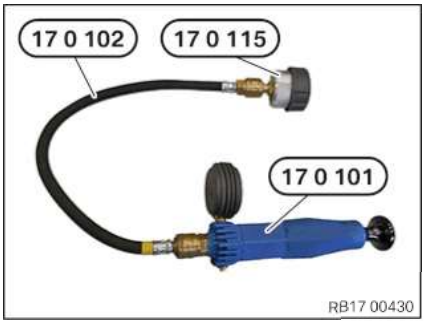
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- Attach the special tool 0 494 418 (17 0 101) with special tools 0 494 419 (17 0 102) and 0 494 426 (17 0 109) from the set of special tools 0 494 417 (17 0 100).
- Build up excess pressure and wait for approximately 2 minutes.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



TECHNICAL INFORMATION

If the described test step is not completed successfully: repeat test step twice. Only replace the sealing cap after three tests with an incorrect opening pressure.

When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has cooled down. These traces of coolant do not indicate whether the sealing cap is defective or not.

Escaping coolant vapours when the vehicle is at standstill may cause the pressure relief valve to stick to the sealing cap. This may cause an incorrect opening pressure.

- Screw on sealing cap (1) on special tool 0 495 889 (17 0 115) from the set of special tools 0 494 417 (17 0 100).
- Build up the pressure with special tools 0 494 418 (17 0 101) and 0 494 419 (17 0 102) from the set of special tools 0 494 417 (17 0 100).
- Observe on the pressure measuring device when the opening pressure has been reached.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

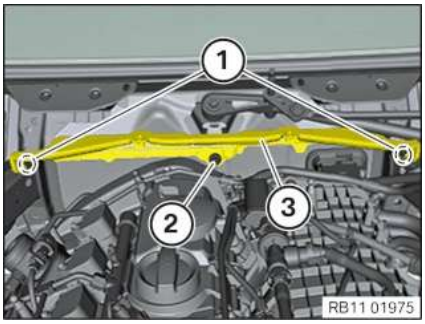


- Close sealing cap (1).

110 – Check engine oil level

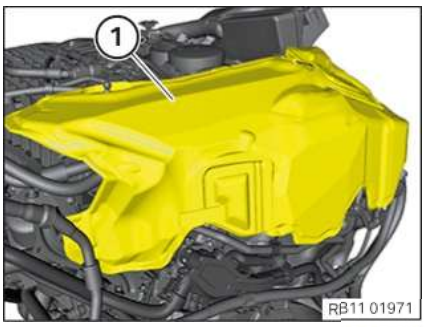
- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

111 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

112 – Installing acoustic cover at rear

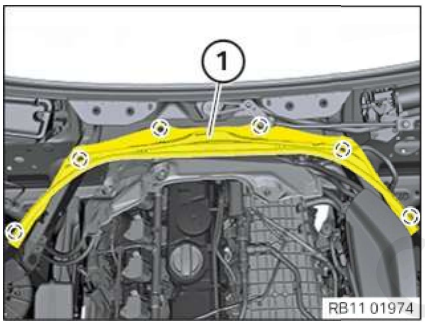


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

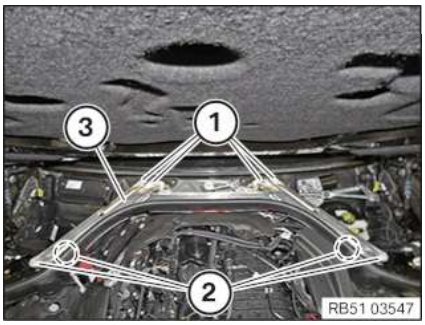
113 – Installing the centre bulkhead upper part



- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

114 – Installing cowl panel cover

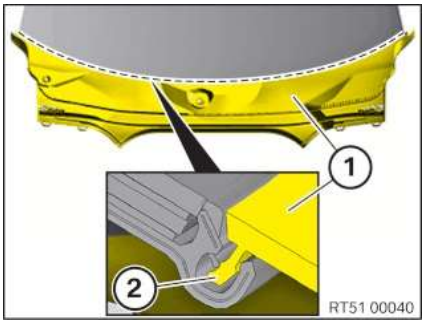
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RISK OF DAMAGE

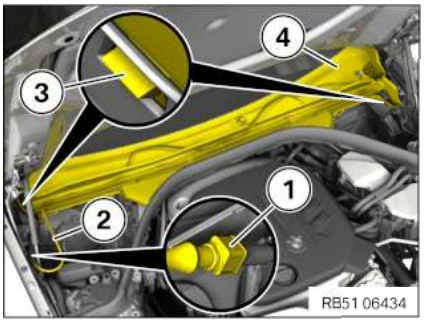
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

115 – Installing both wiper arms

NOTICE

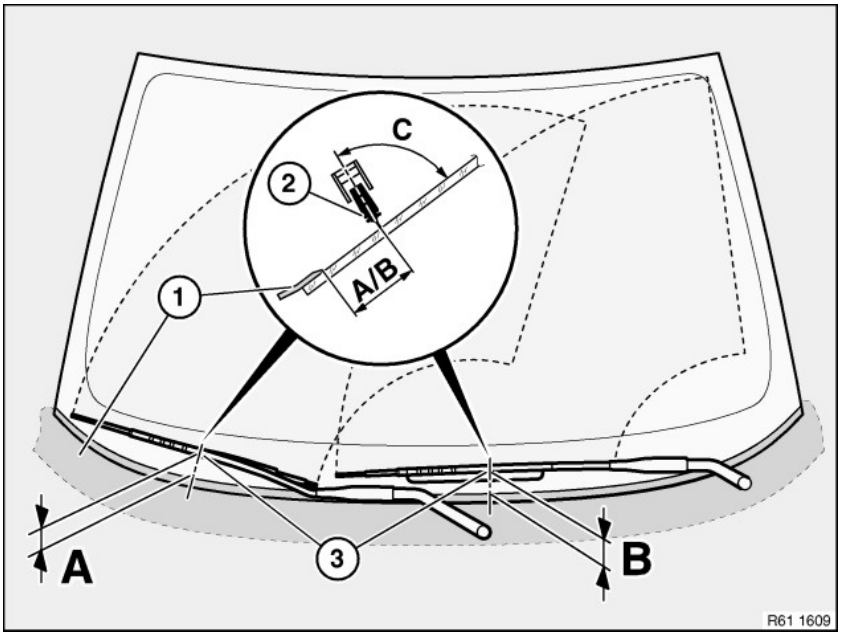
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.

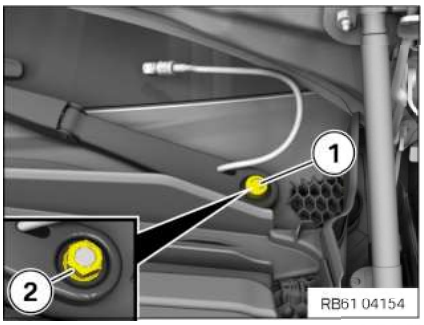
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

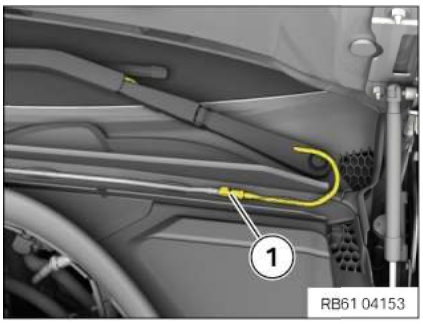


- Tighten nut (2).

Windscreen wiper arm

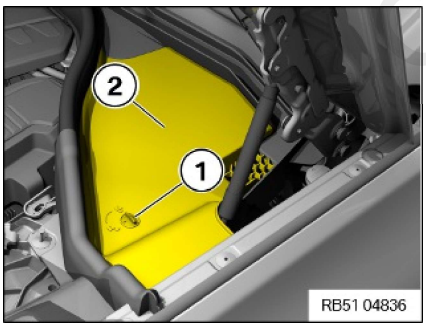
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



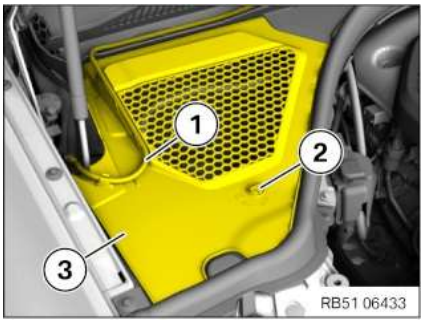
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

116 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

117 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

118 – Install the seal for the bonnet

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- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

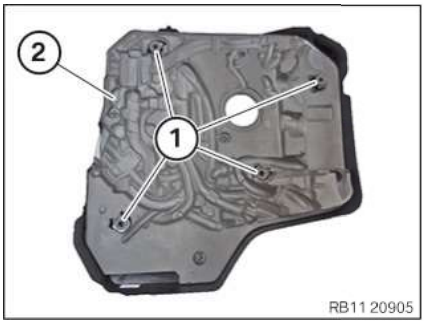
119 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

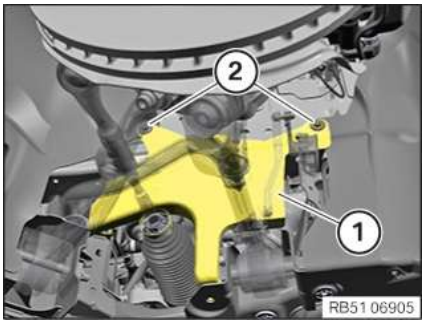


- Clip in the acoustic cover (1) into the holders in the **marked** areas.
  The acoustic cover (1) must audibly engage into place.

120 – Install the cover of the steering assembly

Prerequisite

The underbody protection of the steering gear is removed.



- Position the cover (1).
- Tighten the screws (2).

Cover, steering unit

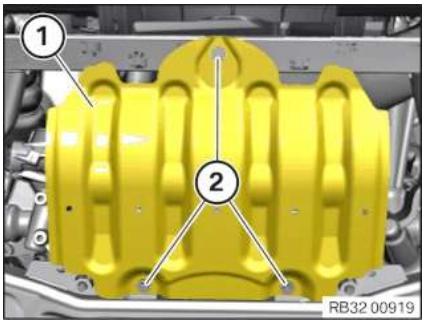
Screw		Tightening torque	3 Nm

121 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

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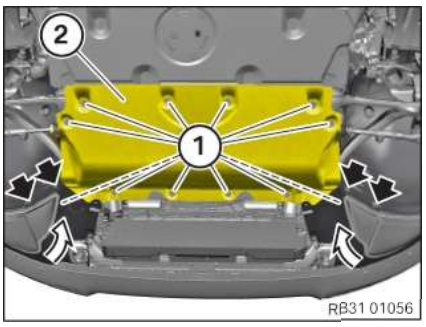


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

122 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

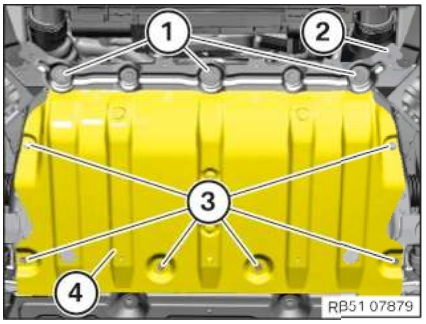
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

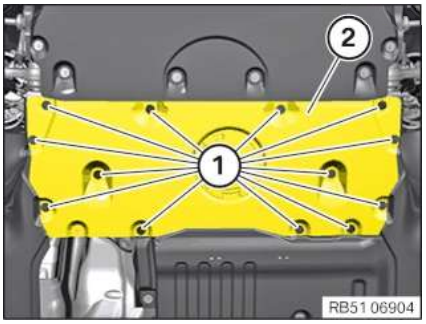
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

123 – Installing the centre underbody protection



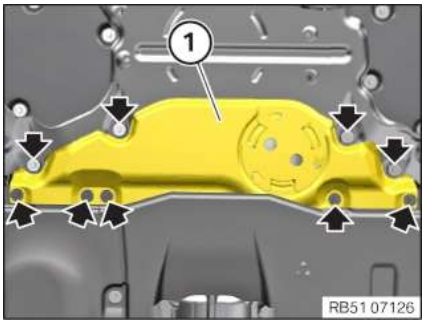
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

  Guide in and install the centre of underbody protection (1).

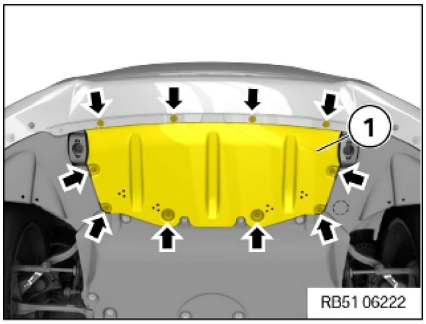
  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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124 – Installing the front underbody protection



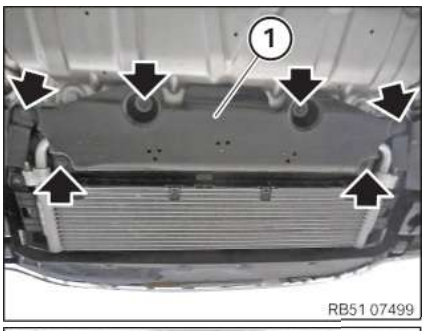
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



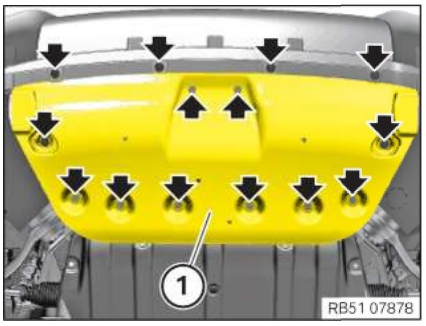
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

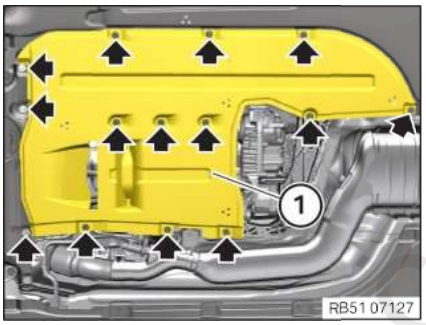
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

125 – Installing underbody protection at rear



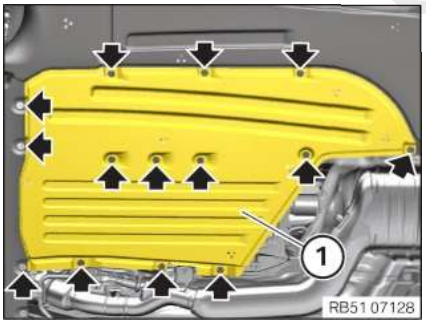
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

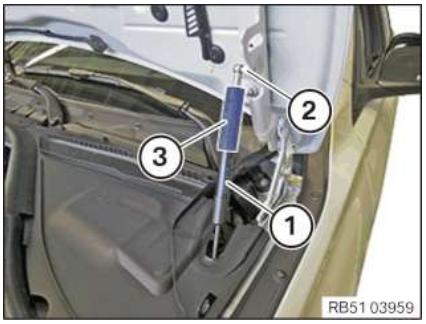
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

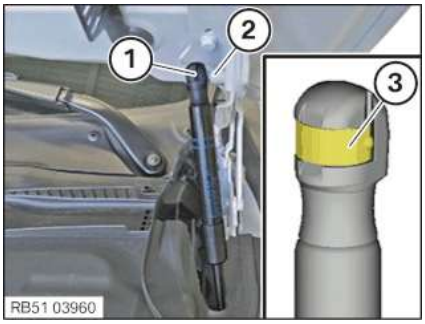
Hexagon screw		Tightening torque	3 Nm

126 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side			Used in step 41
Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head			Used in step 496575
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 496575
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 58
M8		Tightening torque	21,5 Nm

Ventilation connection/special tool to cylinder head			Used in step 63
M10			18 Nm

Coolant temperature sensor at cylinder head			Used in step 63
Sensor		Tightening torque	13,5 Nm

Cylinder head to crankcase			Used in step 64
M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °

Cylinder head bolt to timing case cover			Used in step 64
M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head			Used in step 64
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head			Used in step 64
M6x16			8 Nm

Cable routing to cylinder head, rear			Used in step 64
M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head			Used in step 64
M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft			Used in step 64
M6x16		Tightening torque	8 Nm

Manifold support for intake air to cylinder head			Used in step 64
M6X16		Tightening torque	8 Nm

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Holder for electrical auxiliary coolant pump on cylinder head — Used in step 64

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 64

M6			8 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 64

M6x12		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 7172

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 74

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Coolant line to coolant pump/cylinder head — Used in step 76

M6x20		Tightening torque	8 Nm

Intake plenum to cylinder head — Used in step 77

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 77

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 77

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 77

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 77101

M6		Tightening torque	8 Nm

Control unit holder on spring strut dome — Used in step 79

Hexagon screw		Tightening torque	8 Nm

Oil return line to exhaust turbocharger/crankcase — Used in step 82

M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger — Used in step 8384

M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger — Used in step 83

M6		Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 84

M6 x 12		Tightening torque	8 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger — Used in step 85

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Catalytic converter to holder — Used in step 85

M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder — Used in step 85

M8	Renew nut.	Tightening torque	19 Nm

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Rear silencer to body / bumper support			Used in step 86
M8	Replace nuts.	Tightening torque	19 Nm

Exhaust system to rear axle carrier			Used in step 86
Nut M8	Renew nut.	Tightening torque	19 Nm

Front silencer / petrol particulate filter on transmission bracket			Used in step 86
M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter			Used in step 86
Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter			Used in step 86
V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

Connecting support to tunnel			Used in step 87
M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Cylinder head cover to cylinder head			Used in step 88
M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover			Used in step 88
M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover			Used in step 8897
6X18		Tightening torque	6 Nm

Ground cable to rail			Used in step 91
M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange			Used in step 92
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail			Used in step 93
M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump			Used in step 94
M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover			Used in step 94
M6 screw		Tightening torque	6,5 Nm

Spark plugs			Used in step 95
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 96
Screw		Tightening torque	8 Nm

Control sensor			Used in step 97
M18x1.5		Tightening torque	50 Nm

Acoustic cover (side) to cylinder head cover			Used in step 98
TS6 x 20			8 Nm

Heat shield to cylinder head			Used in step 99
M8 x 12		Tightening torque	19 Nm

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Heat shield to clamping strip			Used in step 99
M6 x 12		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 102
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 113
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 113
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 113
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 115
Combination hexagon nut		Tightening torque	35 Nm

Cover, steering unit			Used in step 120
Screw		Tightening torque	3 Nm

Bumper buffer device steering on front axle support			Used in step 121
M10		Tightening torque	56 Nm

Underbody protection of the steering gear			Used in step 122
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 122
Thermoplastic hexagon screw		Tightening torque	3 Nm

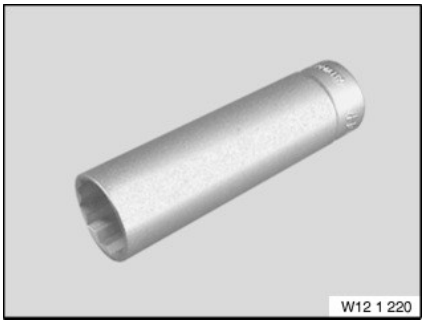
Holder underride guard to front axle support			Used in step 122
M10		Tightening torque	56 Nm

Underbody protection			Used in step 123125
Hexagon screw		Tightening torque	3 Nm

Underbody protection front			Used in step 124
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

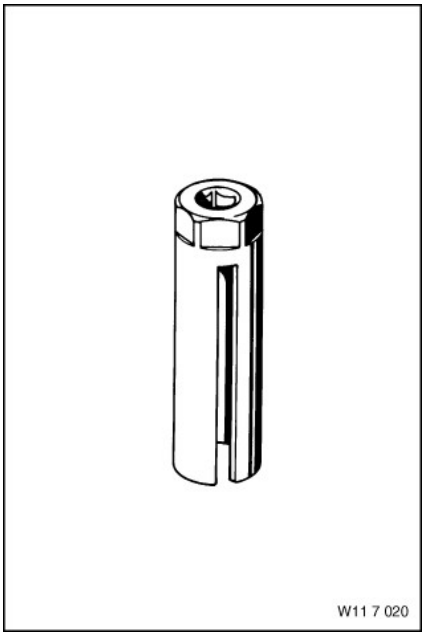
0 495 560 (12 1 220) Socket



Common		Used in step 2095
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

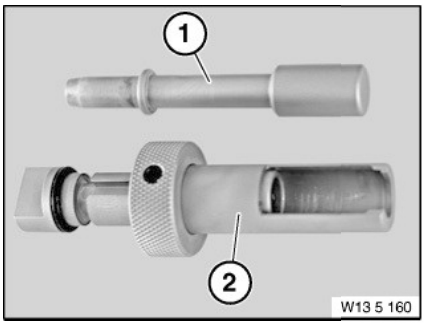
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0 491 074 (11 7 020) Socket wrench insert



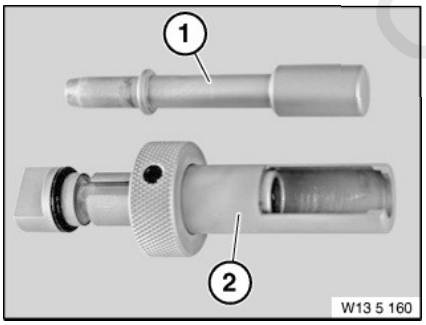
Common	Used in step 2397
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

0 496 567 (13 5 161) Fastener



Common	Used in step 25
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

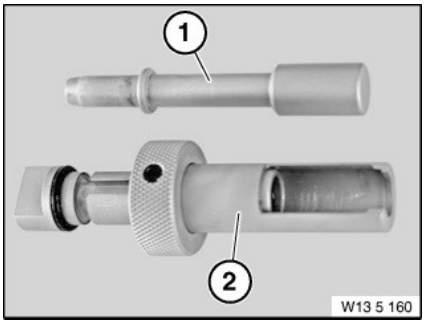
0 496 568 (13 5 162) Fastener



Common	Used in step 25
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 565 (13 5 160) Fastener

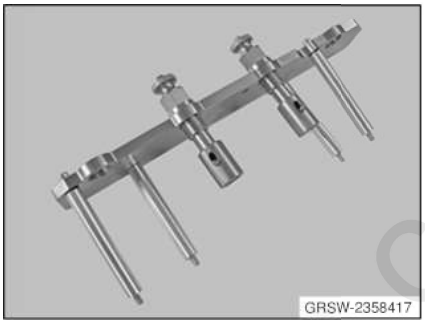


Common	Used in step 25
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

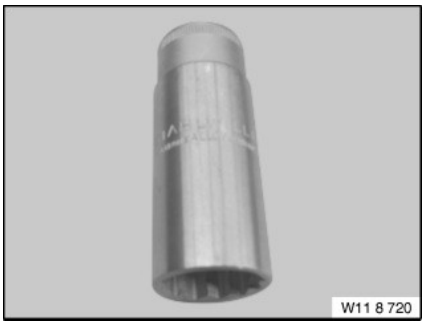
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

2 358 417 Device



Common	Used in step 26
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 26
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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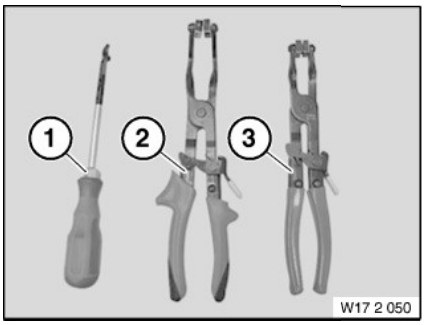
2 360 895 Pin wrench



Common Used in step 2889

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 794 (17 2 050) Pliers



Common Used in step 4877

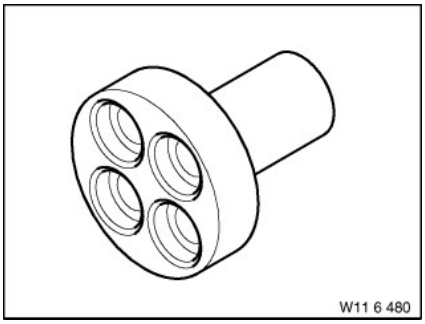
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 493 380 (11 6 480) Connector



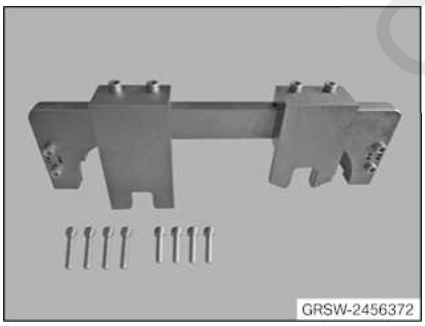
Common	Used in step 49737592
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 497375
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 4957657375
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 495775
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



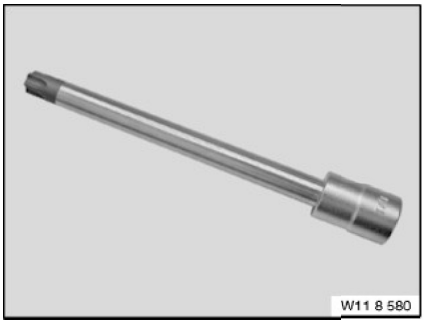
Common	Used in step 51527172
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 51527172
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

0 495 747 (11 8 580) Socket wrench



Common	Used in step 5864
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

2 220 718 Workshop crane



Common	Used in step 58
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

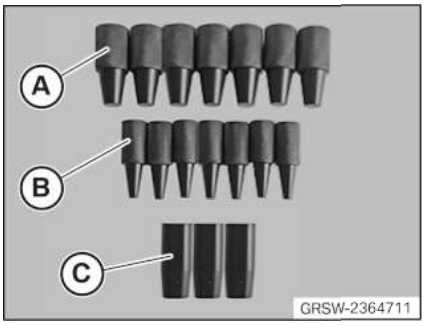
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2 459 012 Holder



Common	Used in step 5864
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 364 711 Plug



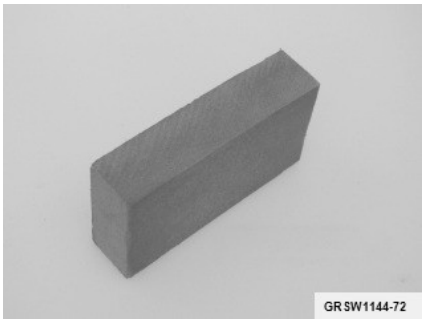
Common	Used in step 6061
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

0 495 103 (11 4 471) Scraper



Common	Used in step 61
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

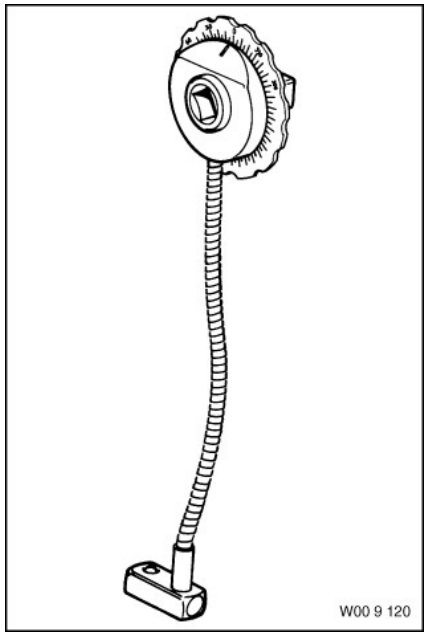
0 495 104 (11 4 472) Extractor



Common	Used in step 61
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

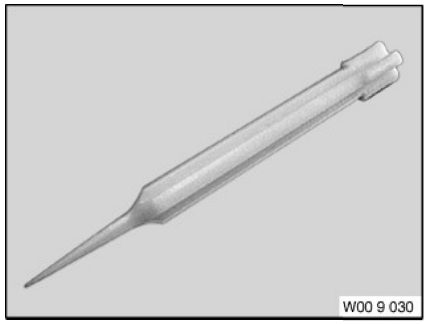
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0 490 504 (00 9 120) Torque angle measuring dial



Common	Used in step 64
Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common	Used in step 648384
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

2 455 654 Tensioning tool



Common	Used in step 7073
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 452 959 Pliers



Common	Used in step 90
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 90
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

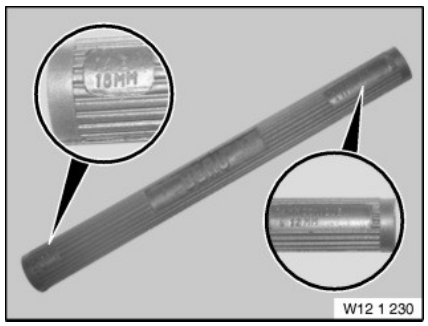
2 358 022 Gauge



Common	Used in step 91
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 065 (12 1 230) Fitting aid

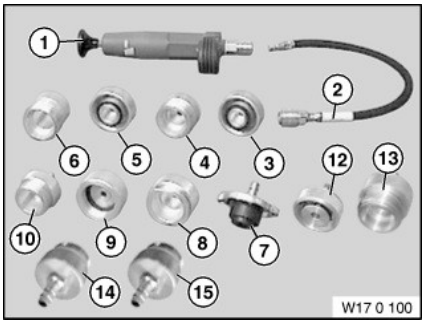


Common	Used in step 95
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 494 417 (17 0 100) Tester

Used in step 103104108109

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Common

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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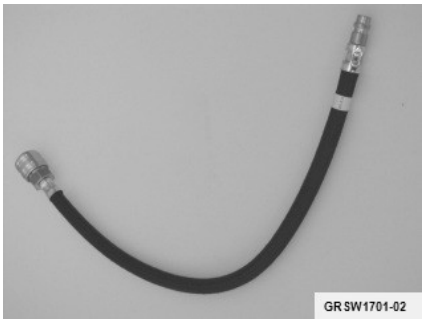
0 494 418 (17 0 101) Pump



Common Used in step 108109

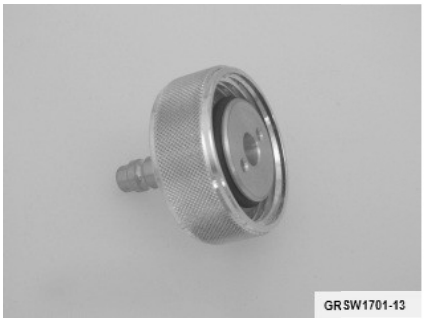
Usage	
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 419 (17 0 102) Hose



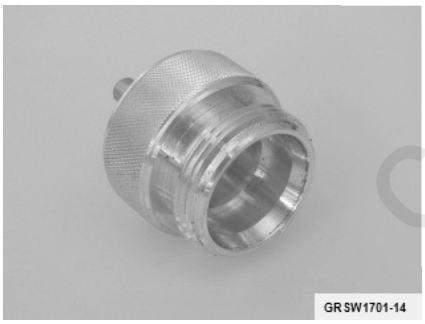
Common	Used in step 108109
Usage	(hose with quick-release coupling)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 642 (17 0 113) Adapter



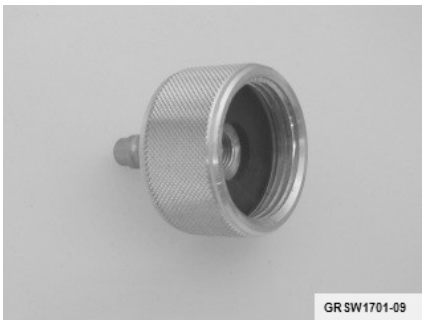
Common	Used in step 108
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 643 (17 0 114) Adapter



Common	Used in step 108
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

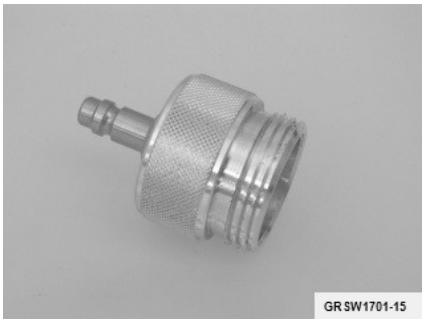
0 494 426 (17 0 109) Adapter



Common	Used in step 109
Usage	For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 495 889 (17 0 115) Adapter



Common		Used in step 109
Usage	For radiator cap Model series: N12, N14	
Included in the tool or work	0 494 417	
Storage location		
Replaced by		
In connection with		
SI-Number	01 26 06 (321)	

Overview Technical Data

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system	Used in step 108109
Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

Distance from window pane edge to wiper blade	Used in step 115
Wiper arm right (A)	57,5 ±5 mm
Wiper arm left (B)	63,3 ±4 mm

Capacity of high-temperature coolant circuit G20	Used in step 103
B48B20O1/B46B20O1	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Capacity of low-temperature coolant circuit G20	Used in step 104
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

Repair instructions (PRE)	Used in step
Repair notes on renewing the cylinder head	

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	1581
11 00 ... Overview of consumables (Electronic Parts Catalogue)	97

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	1105
61 20 900 Disconnecting and connecting battery earth lead	1105
61 20 900 Disconnecting and connecting battery earth lead	1105
61 20 900 Disconnecting and connecting battery earth lead	1105
61 20 900 Disconnecting and connecting battery earth lead	1105
61 20 900 Disconnecting and connecting battery earth lead	1105
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1105
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1105
61 20 900 Disconnecting and connecting battery earth lead	1105
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1105
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	1105
61 20 900 Disconnecting and connecting battery earth lead	1105
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61 20 900 Disconnecting and connecting battery earth lead	1105
61 20 900 Disconnecting and connecting battery earth lead	1105
61 20 900 Disconnecting and connecting battery earth lead	1105
61 20 900 Disconnecting and connecting battery earth lead	1105
61 35 ... Notes on ESD protection (Electro Static Discharge)	15161926284780
13 53 ... Clean the cylinder head around the injectors due to grit / dust	26
61 13 ... Unlocking and disconnecting different plug connections	262988
61 35 ... Notes on ESD protection (Electro Static Discharge)	2847
61 00 730 Encode/program control unit(s) (after vehicle test)	81
17 00 ... Notes for working on cooling system.	103104

Operating materials	Used in step
Main group 17	103104

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11 12 101 Replace cylinder head gasket

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

Engine compartment lid is open.

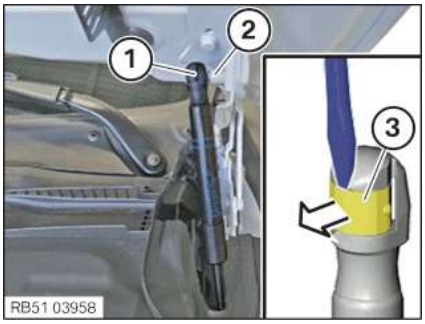
CAUTION

Shutting bonnet or tailgate.

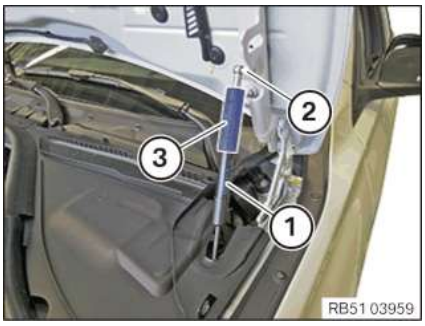
Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

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- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

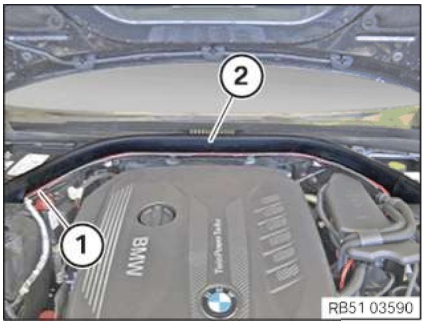


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

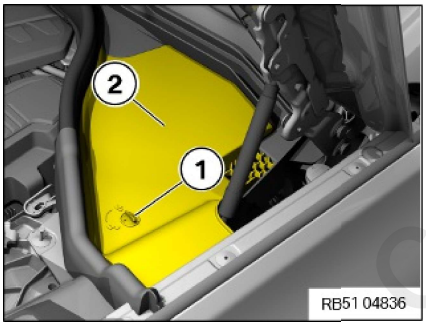
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



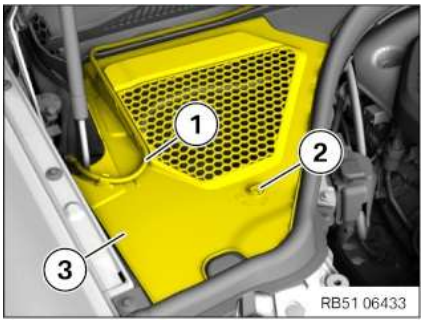
- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment



- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Remove the wiper arm**

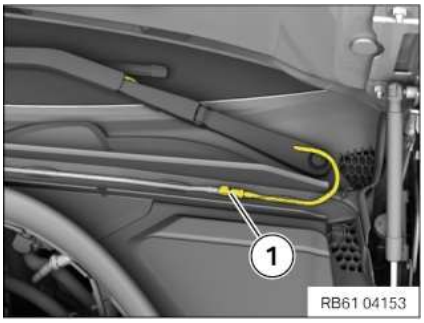
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RISK OF DAMAGE

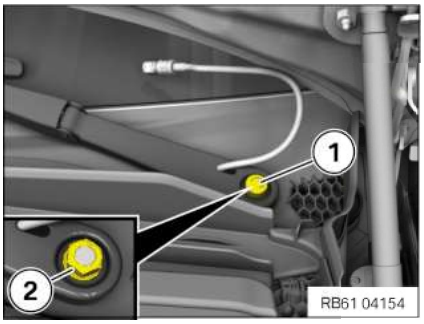
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

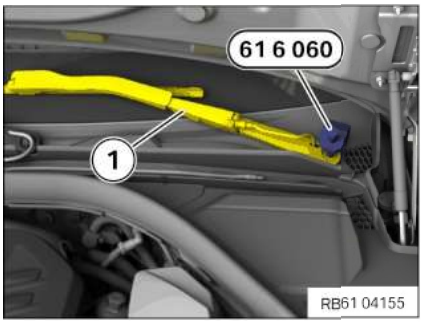
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.

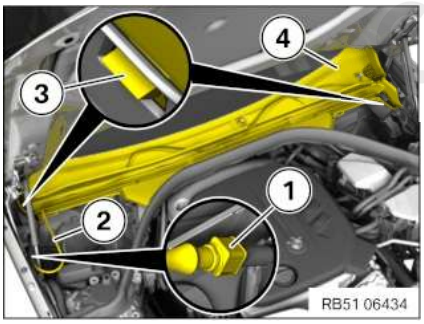


- Remove the protective cap (1).
- Loosen nut (2).

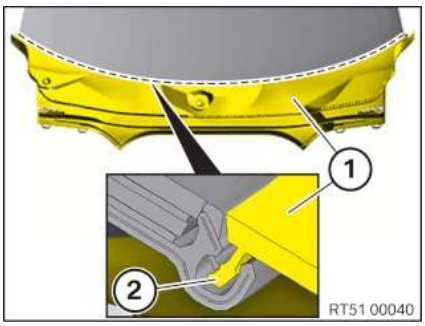


- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover



- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).



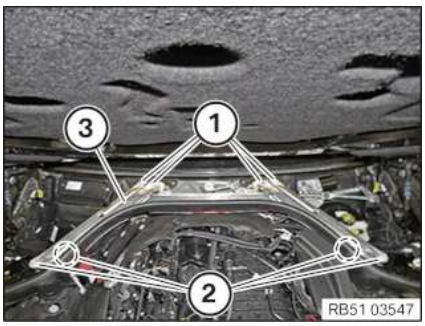
- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

8 – Removing the centre bulkhead upper part

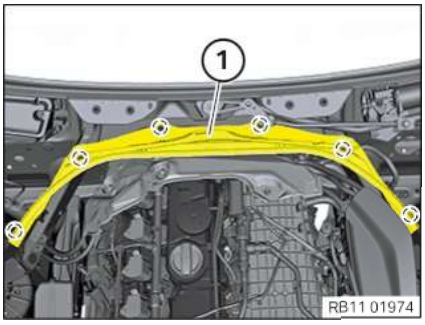
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TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

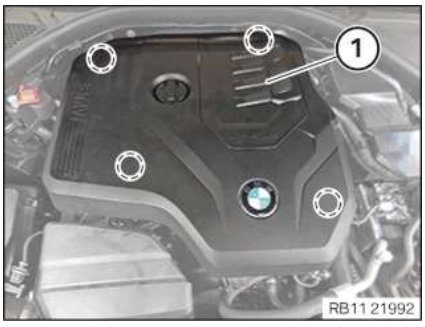
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

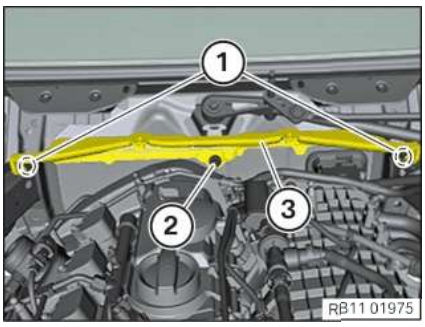
10 – Removing acoustic cover at rear

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- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing the clean air pipe with the resonator

WARNING

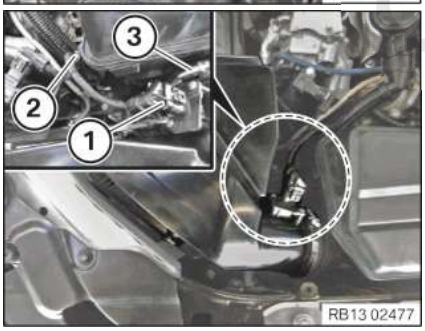
Hot surfaces.

Risk of burning!

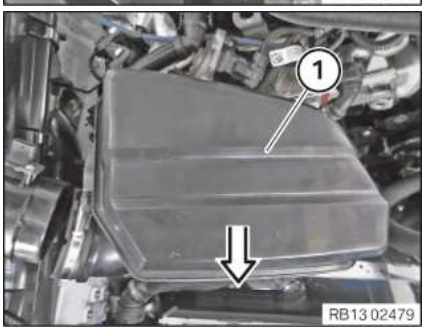
- Perform all work only on components that have cooled down.



- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

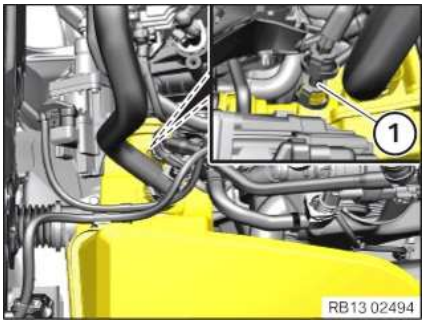


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

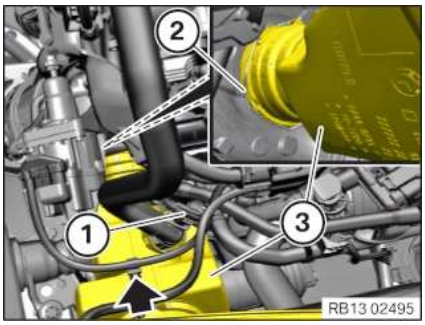


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

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- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

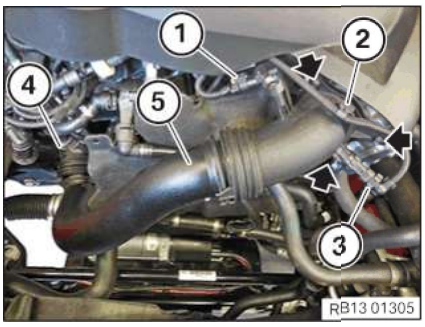
13 – Remove charge air line

WARNING

Hot surfaces.

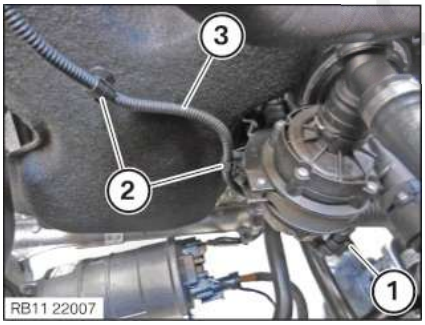
Risk of burning!

- Perform all work only on components that have cooled down.

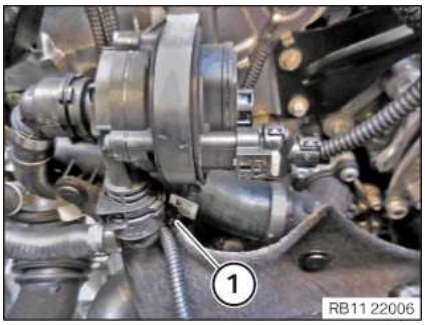


- Unlock and loosen the connector (1) on the charging pressure sensor.
- Unlock and loosen clamp (2).
- Unlock and disconnect the connector (3) from the charge-air temperature sensor.
- Remove screws (arrows).
- Unlock and loosen the clamp (4) on the exhaust turbocharger.
- Guide out and remove charge air line (5).

14 – Removing the acoustic cover for the engine at the front

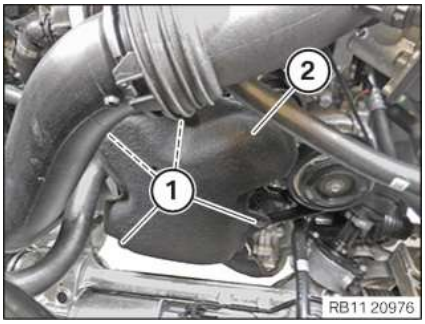


- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).

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- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.
For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

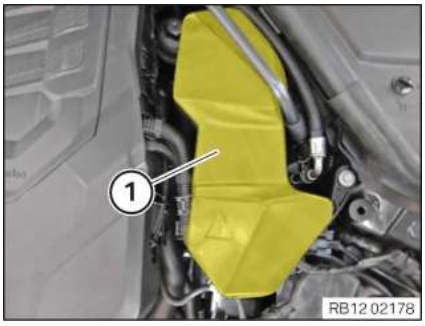
In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.
For additional information see: 61 00 ... Programming/encoding control unit(s)

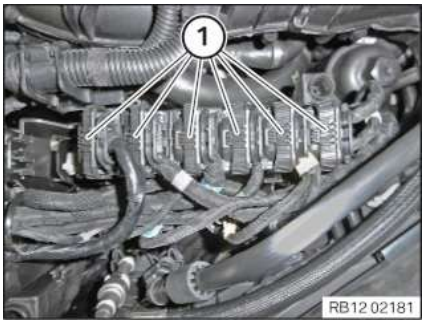
TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

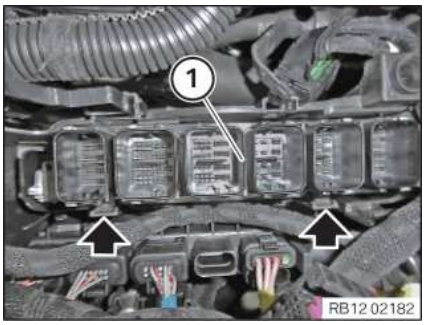


- Pull the cover (1) towards the top and feed out.

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- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

16 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

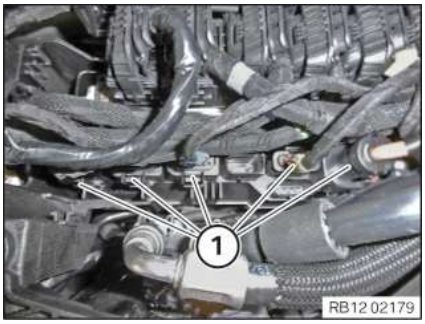
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Electrostatic discharge.

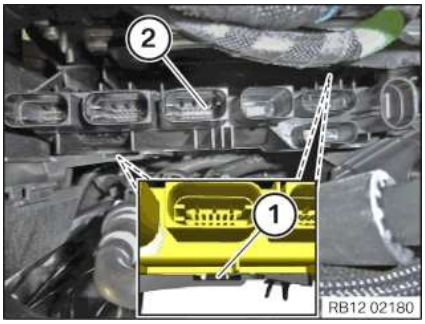
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



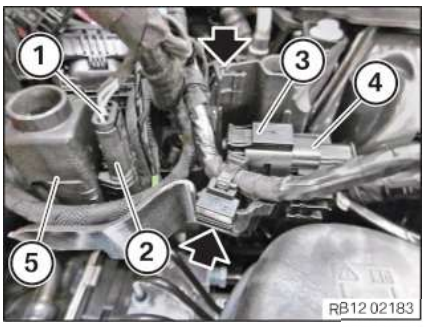
- Unlock and disconnect plug connections (1).

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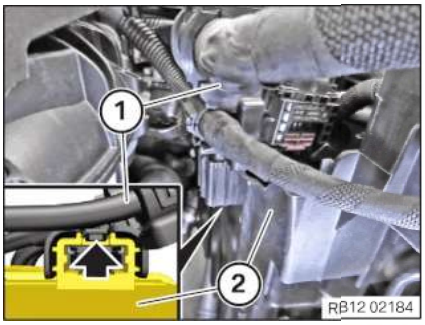


- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

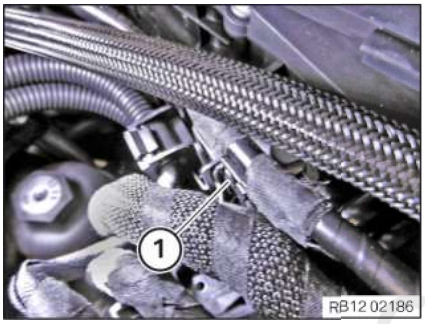
17 – Removing the control unit holder



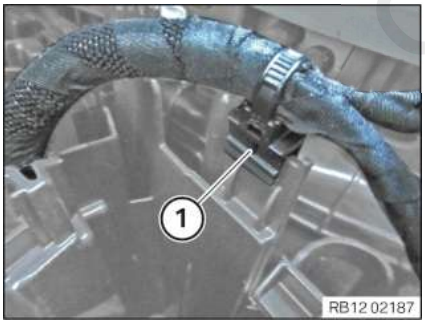
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).



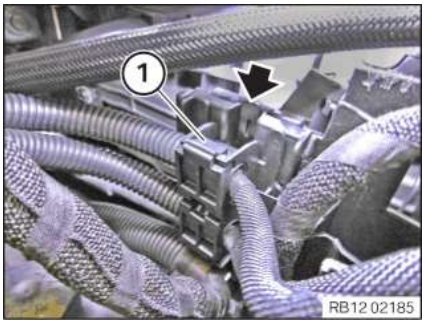
- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).



- Loosen clamp (1).

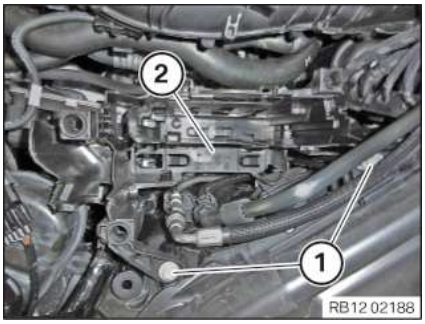


- Loosen clamp (1).



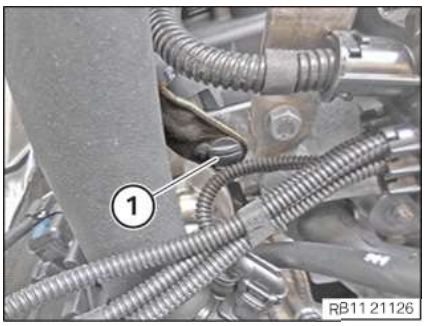
- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.

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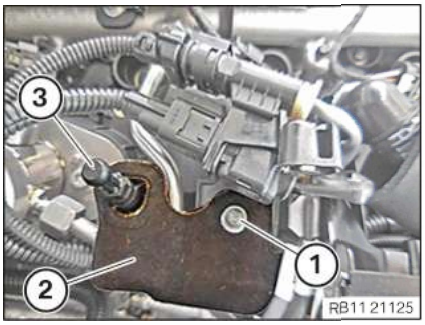


- Loosen screws (1).
- Guide out and remove the control unit holder (2).

18 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

19 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

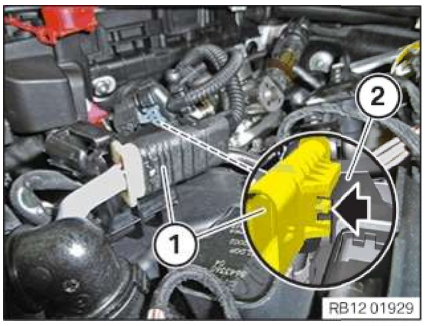
Electrostatic discharge.

Damage to or destruction of electrical components.

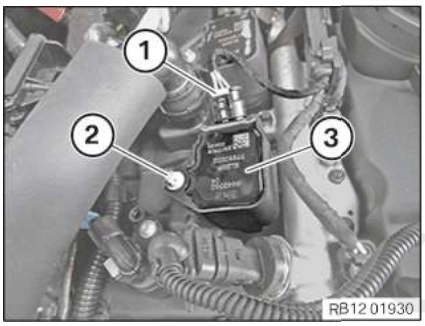
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

20 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

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TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

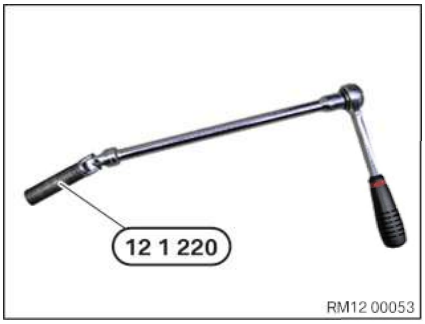
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

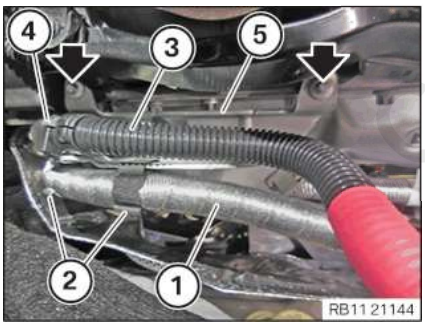
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

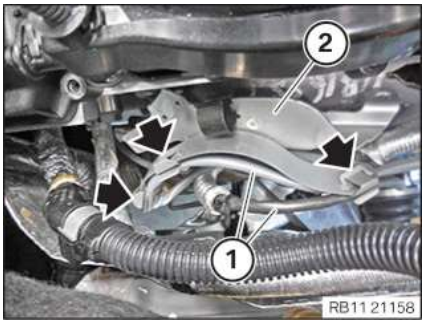


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

21 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

22 – Remove the heat shield on the cylinder head

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WARNING

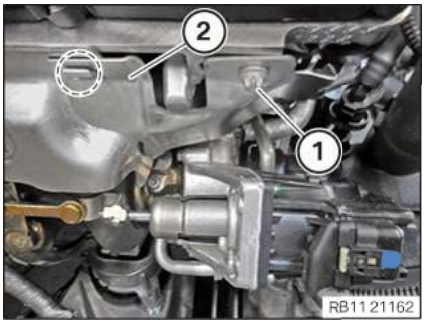
Hot surfaces.

Risk of burning!

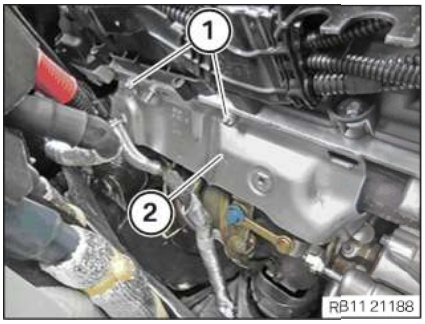
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.



- Loosen screws (1).
- Feed out and remove the heat shield (2).

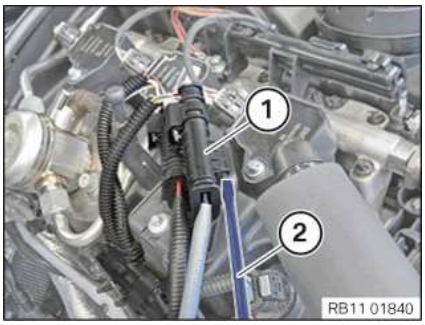
23 – Remove the control sensor

WARNING

Hot surfaces.

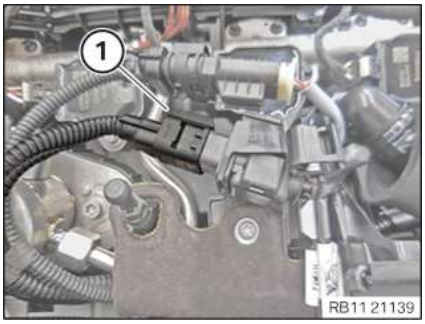
Risk of burning!

- Perform all work only on components that have cooled down.

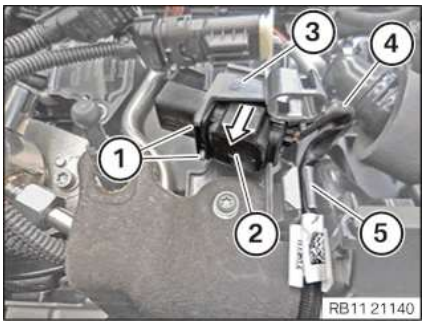


- Unlock connector (1) with screwdriver (2) and remove from the carrier plate.
- Unlock and loosen connector (1).

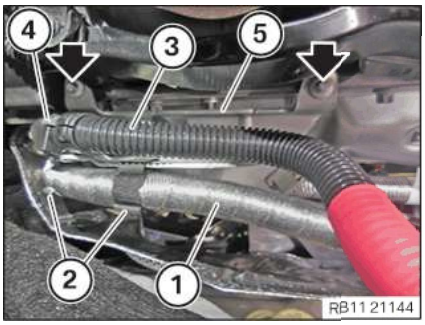
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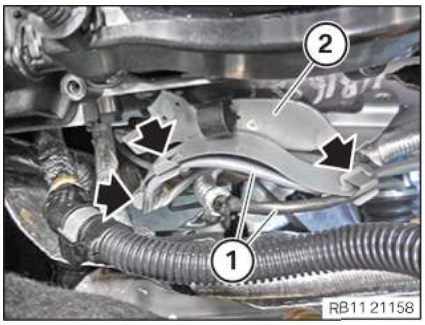
- Unlock and loosen connector (1).



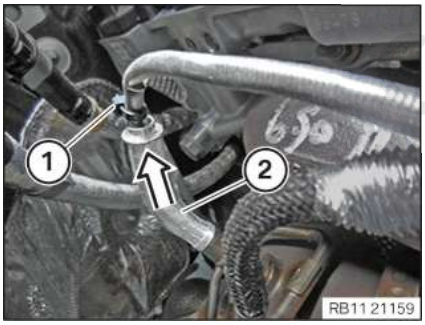
- Unlock the locks (1).
- Guide the connector (2) out of the bracket (3)in the **direction of the arrow** and set it aside.
- Release the cable (4) from the clamp (5).



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.



- Unfasten cable strap (1).
- Feed out the heat shield (2) **in direction of arrow** and set it aside.



- Release and remove the control sensor (1) with the special tool 0 491 074 (11 7 020).

24 – Remove the high pressure line between the high pressure pump and the rail

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WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

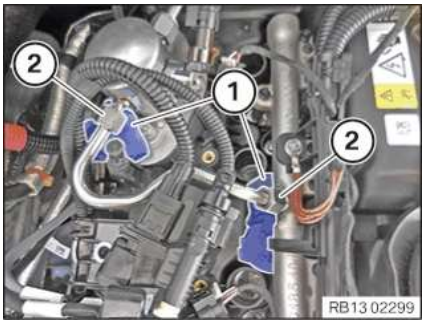
- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

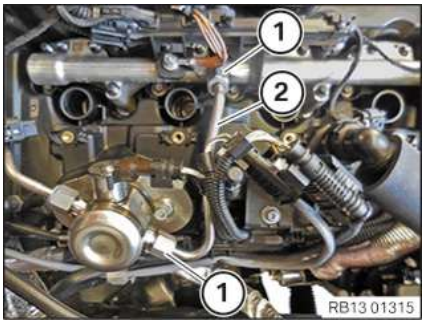


- Have the special tool ready.



- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).

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- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

25 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

RISK OF DAMAGE

Contaminant or foreign body.

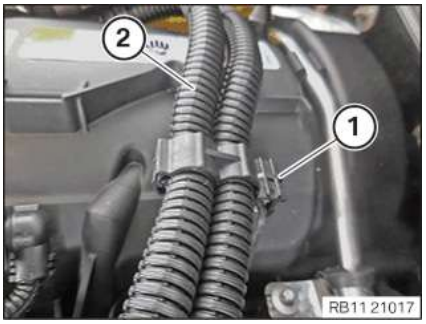
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

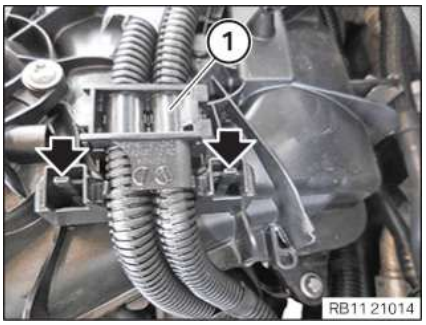
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

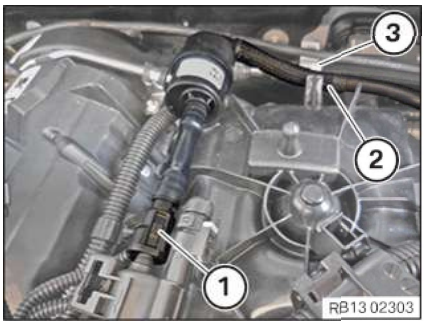
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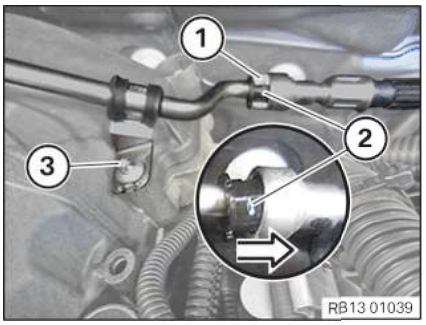
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



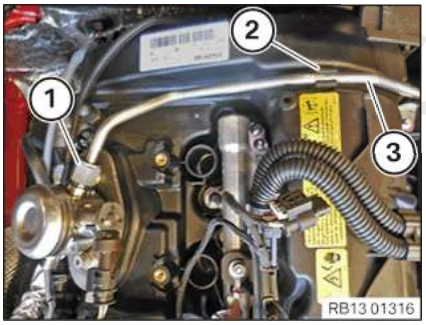
- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.



- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).



- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

26 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

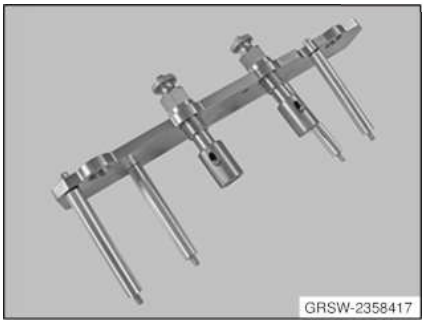
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Prepare special tool .

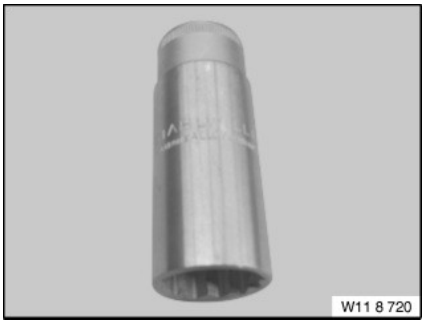


- Prepare special tool 2 358 417.

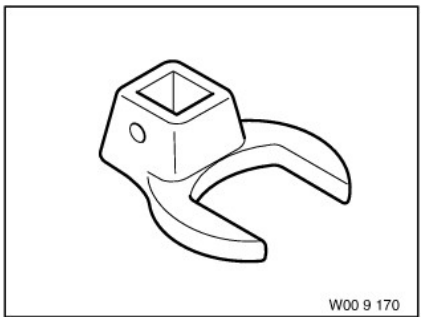


- Prepare special tool .

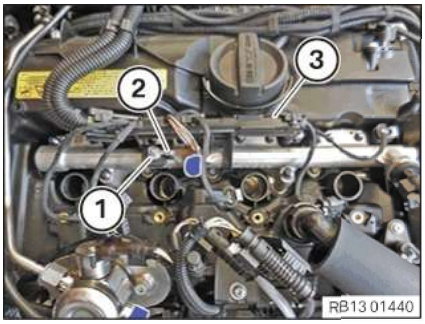
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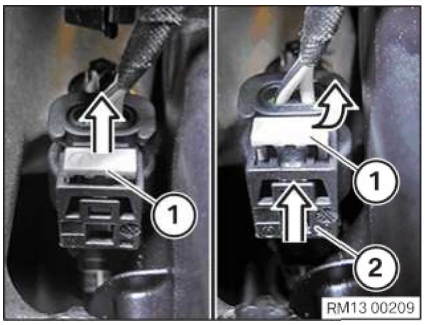
- Prepare special tool 0 496 106 (11 8 720).



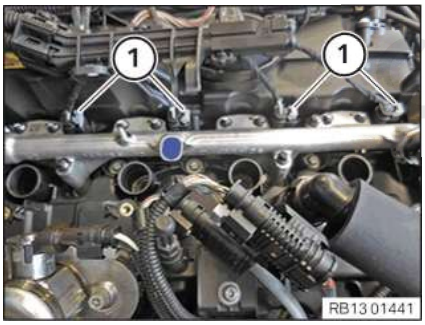
- Prepare special tool .



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.



- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



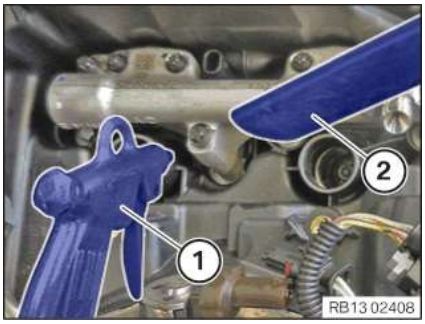
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.



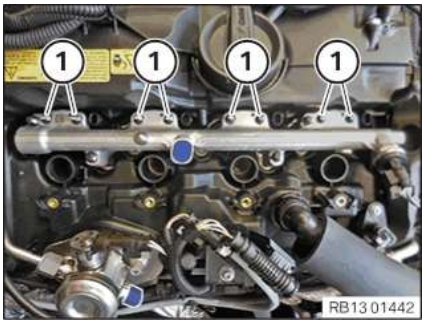
TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.

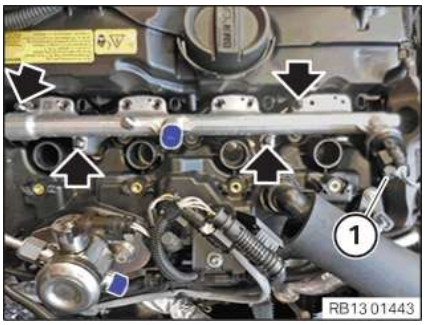
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- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

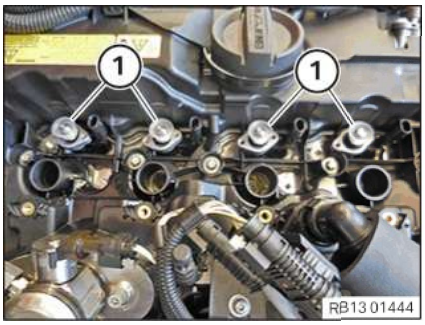


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

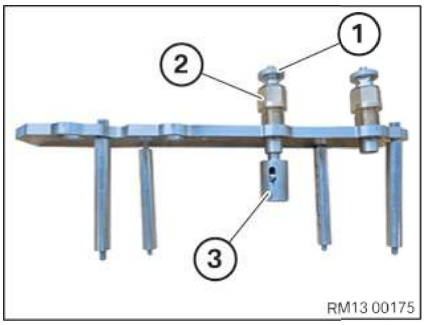
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

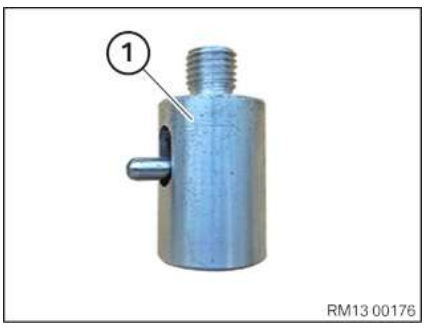
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

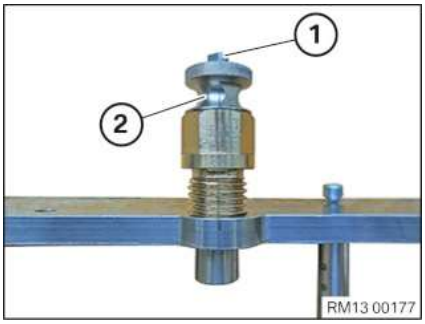
  The special tool 2 358 417 consists of:

  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector

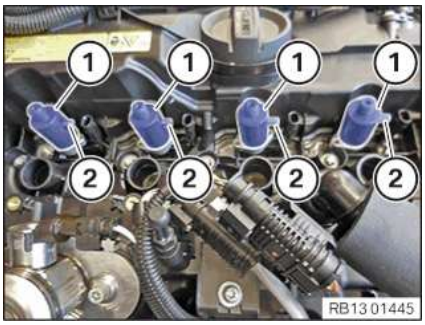


- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.

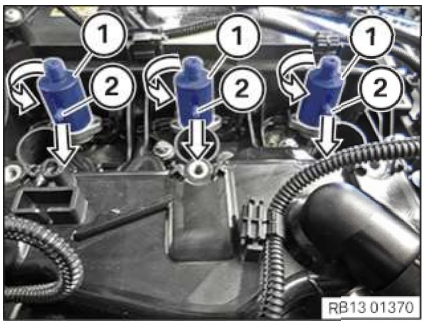
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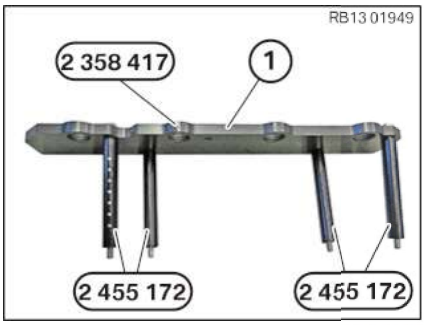
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



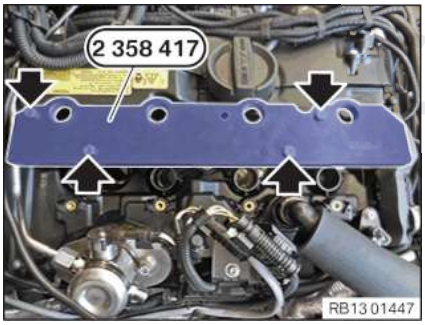
- Install all fixtures (1) for the injectors.
  The fixtures (1) are not locked when the levers (2) are up.



- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



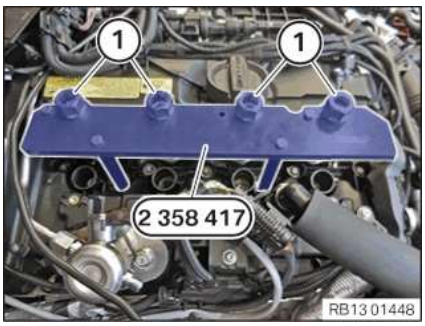
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).

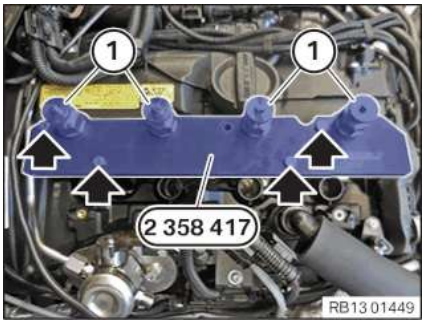


TECHNICAL INFORMATION

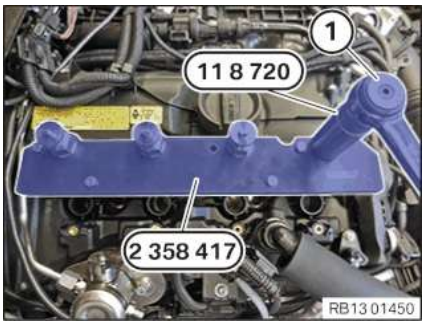
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.

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- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.



- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

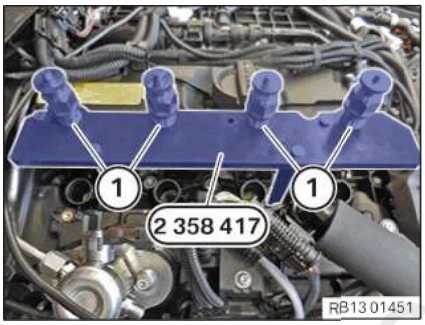


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

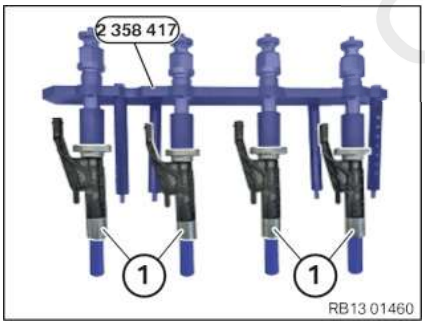
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

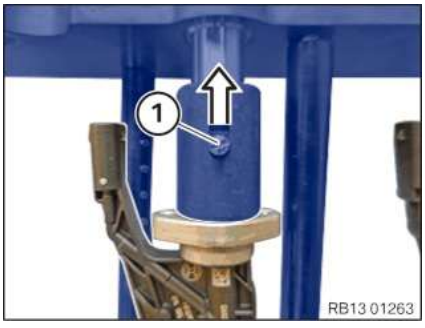


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

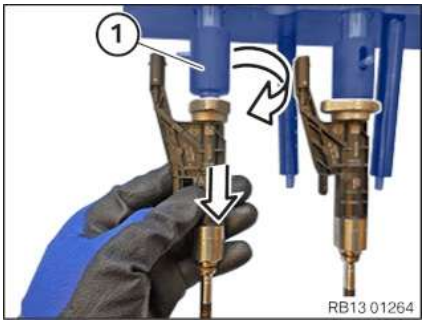


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

27 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

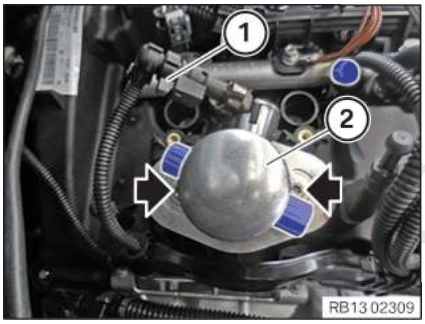
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

28 – Removing both actuators

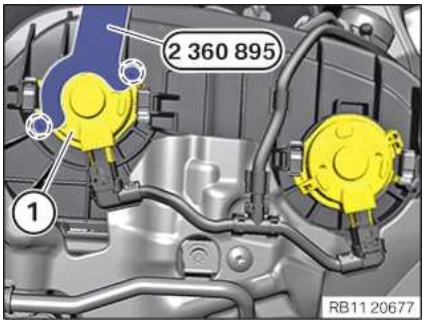
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

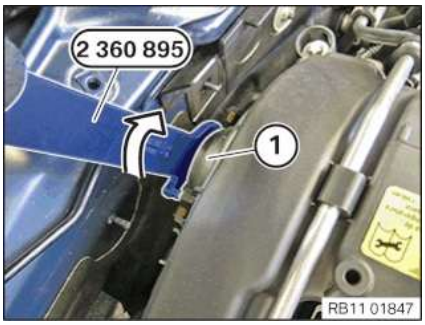
cardiagn.com



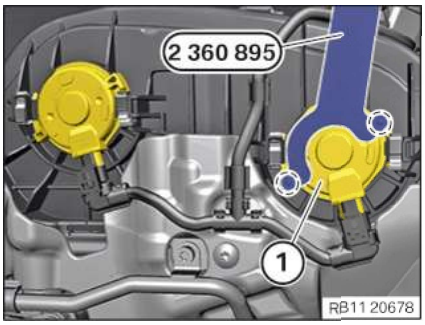
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



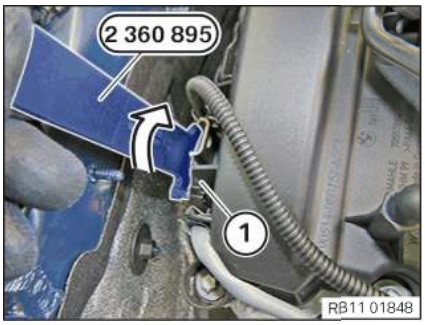
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



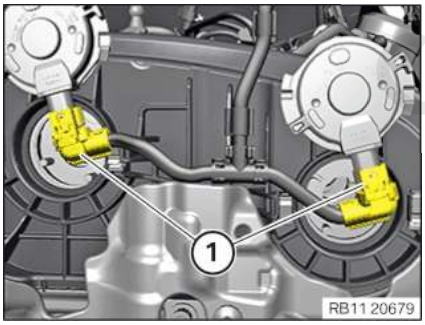
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

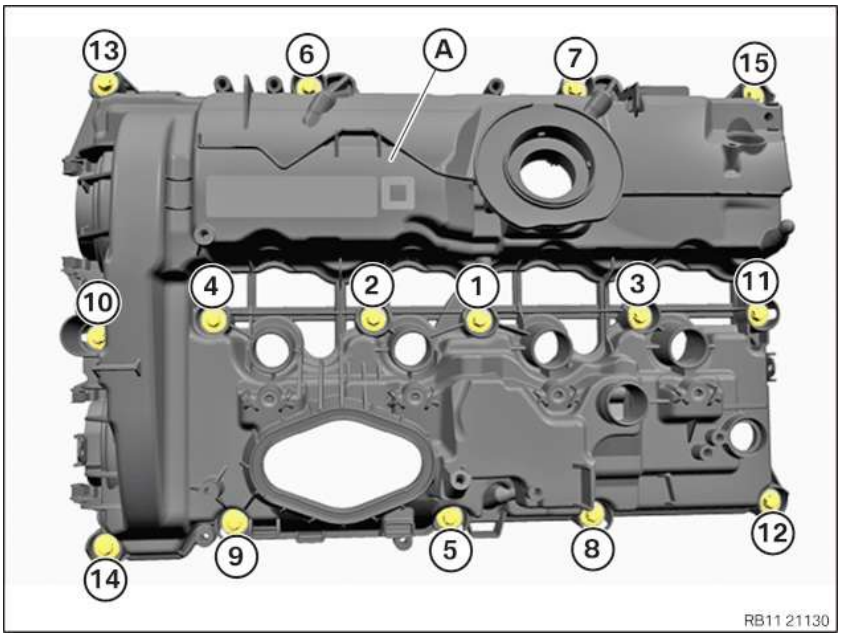
The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

29 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

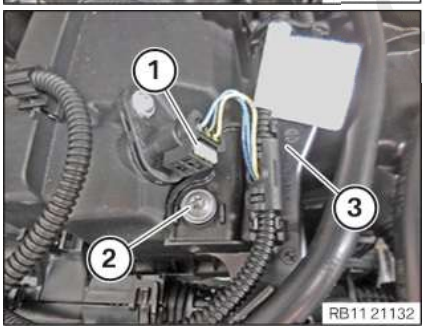
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

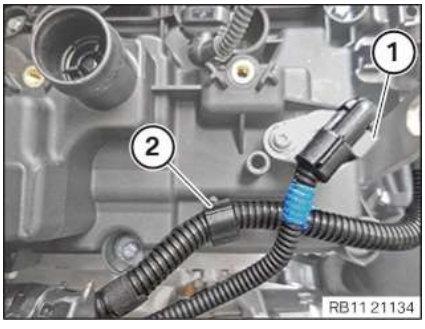
- Do not pull on the wires when disconnecting connectors and plug connections.



- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

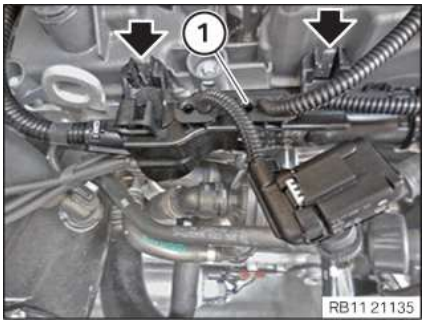


- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.

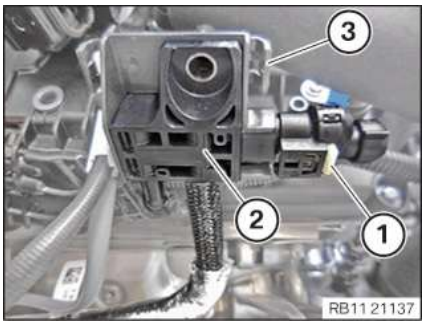


- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).

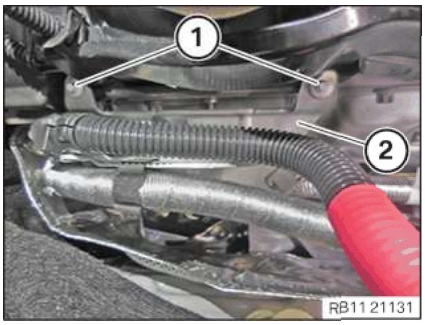
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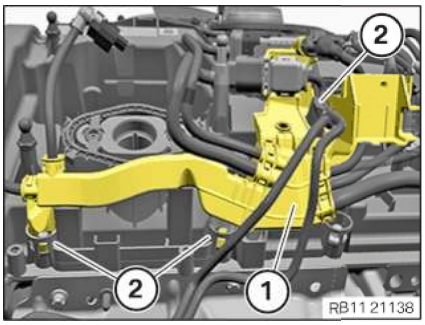
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



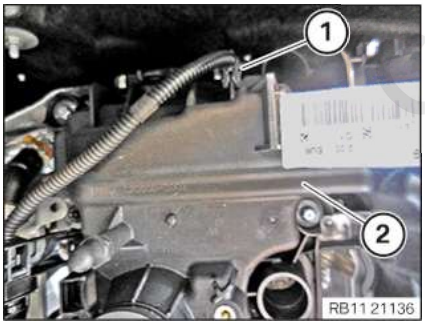
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



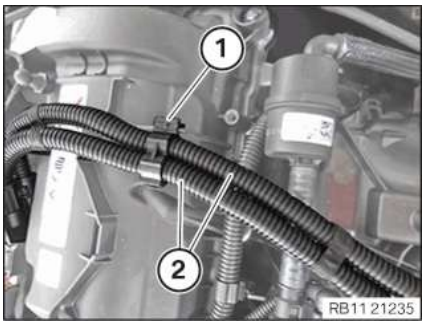
- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.



- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

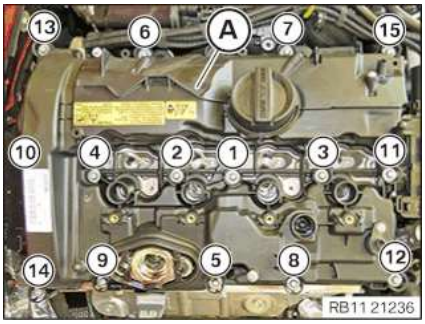


- Loosen clamp (1).



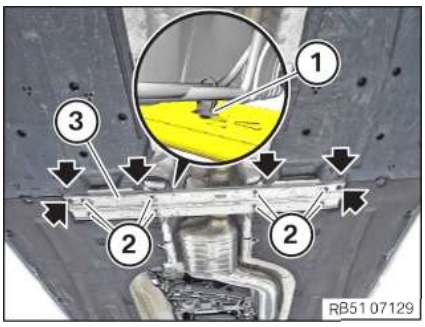
- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.

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- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

30 – Remove the connecting support from the tunnel



- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

31 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

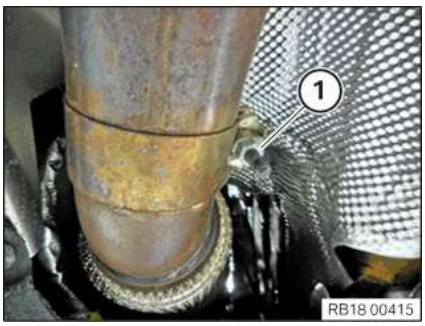
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

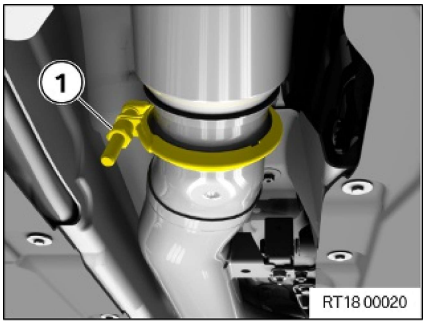
- Remove and install heavy components with the aid of another person/other persons.



- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).

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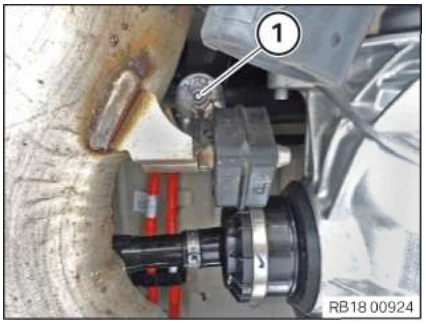


- **Equipment specification 2 (V-clips)**

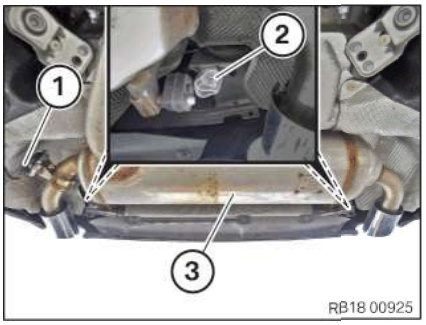
  Unfasten clamp (1).



- Loosen nut (1).

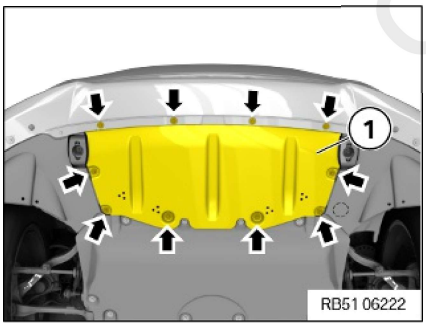


- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

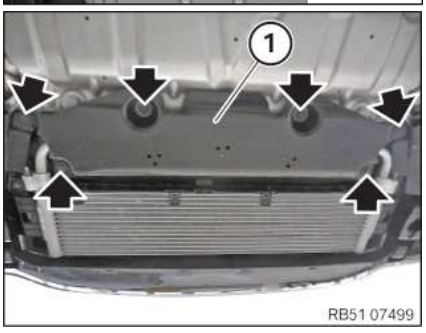
32 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed front underbody protection (1) backwards out of the bumper panel.

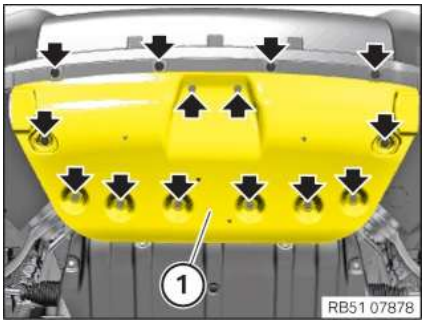


- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

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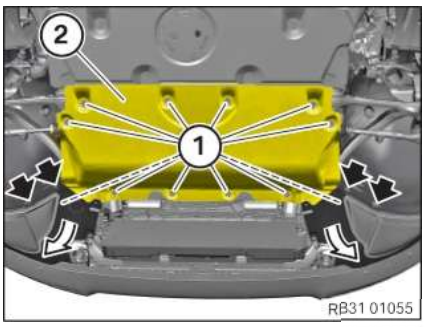


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

33 – Remove the underbody protection of the steering gear



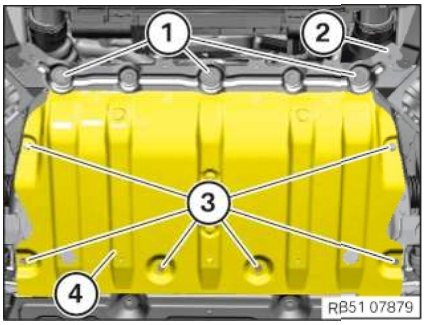
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

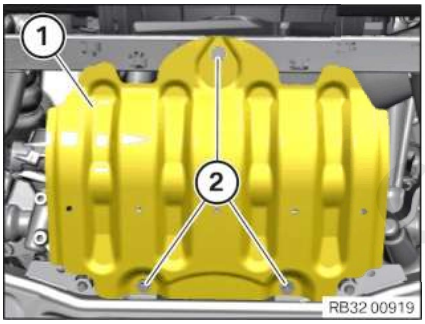
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

34 – If installed: Removing the steering start protection

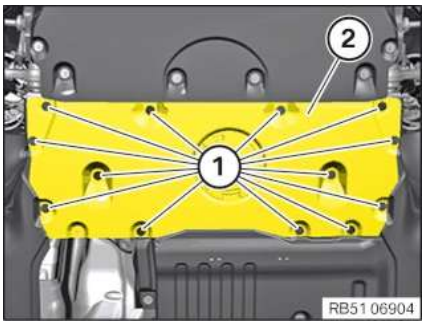
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

35 – Removing the centre underbody protection

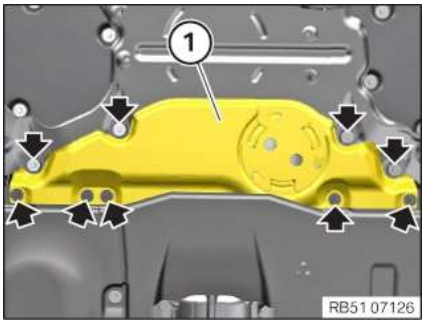


- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

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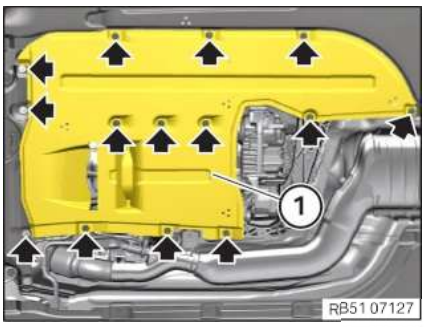


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

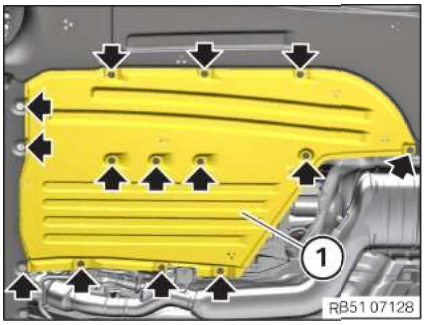
36 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

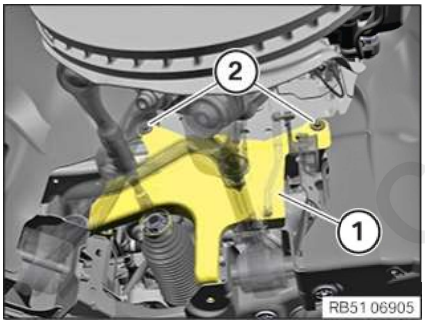
  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

37 – Remove the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.



- Loosen screws (2).
- Remove the cover (1).

38 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

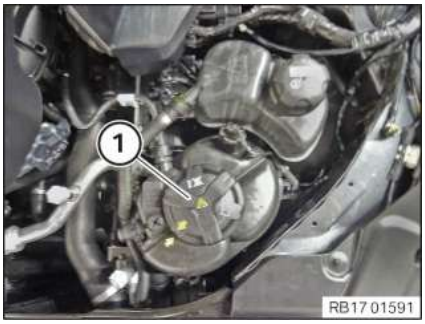
When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

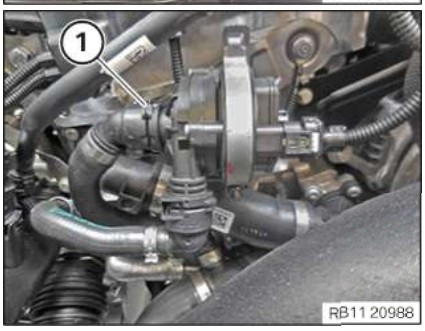
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TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

39 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

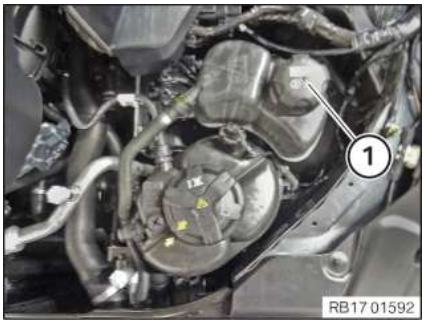
When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

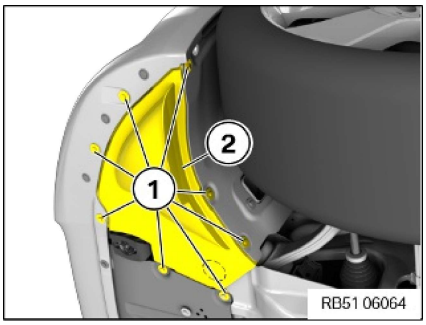
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

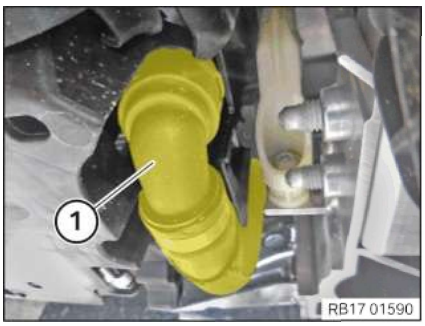
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- Loosen sealing cap (1).



- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

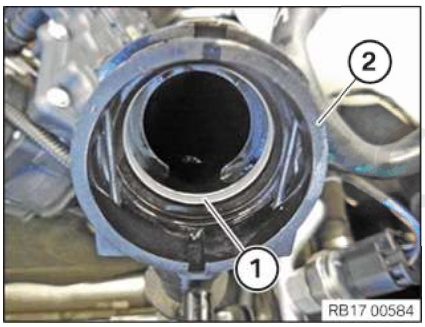


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

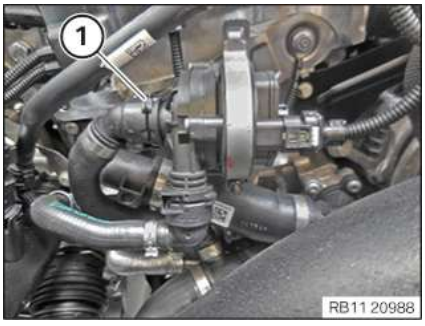
40 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

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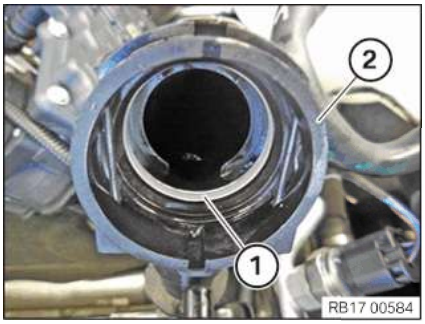


- Connect and lock coolant line (1).
  Coolant line (1) must audibly engage.

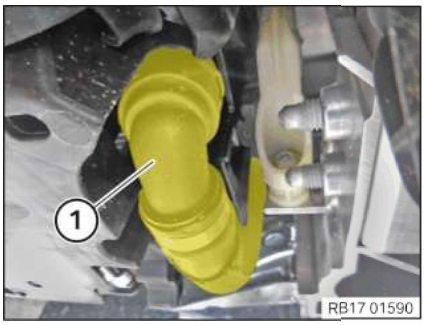
41 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

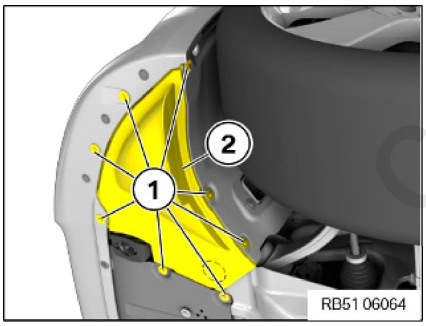
Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).
  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

42 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Heavy component.

Heavy components can lead to injury or damage.

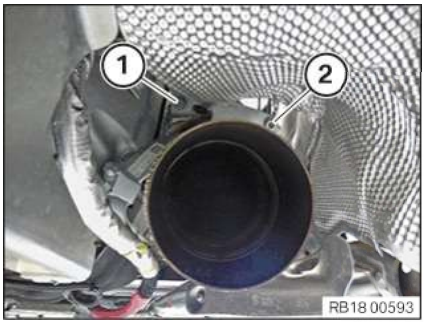
- Remove and install heavy components with the aid of another person/other persons.

CAUTION

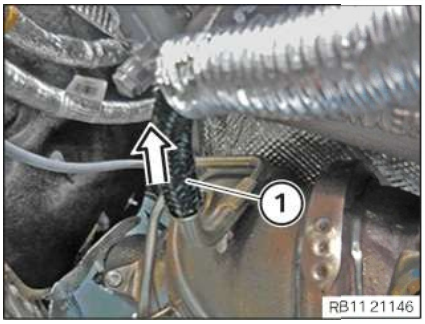
Component with heavy weight.

Danger of injury!

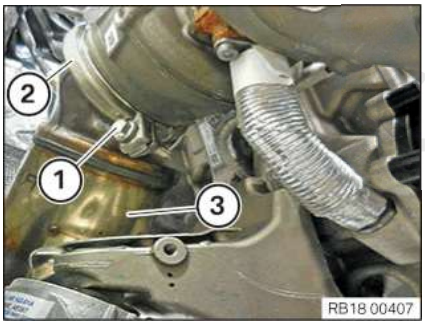
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.



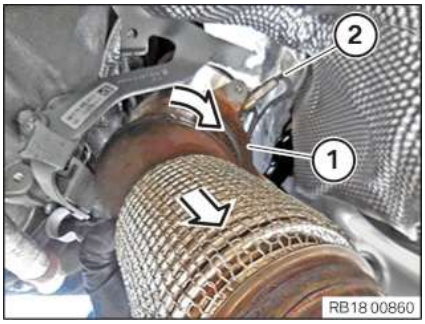
- Loosen screw (1).
- Loosen nut (2).



- Pull off pressure hose (1) in direction of arrow and set it aside.



- Loosen screw (1).
- Feed out V-clip (2) on catalytic converter (3) and remove.



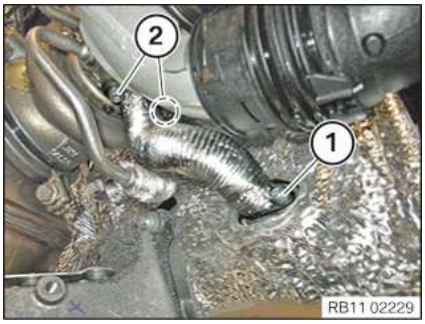
- Guide out catalytic converter (1) in direction of arrow and remove.
- Ensure that monitoring oxygen sensor (2) is**not** damaged.

43 – Removing the oil return line for the exhaust turbocharger

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TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

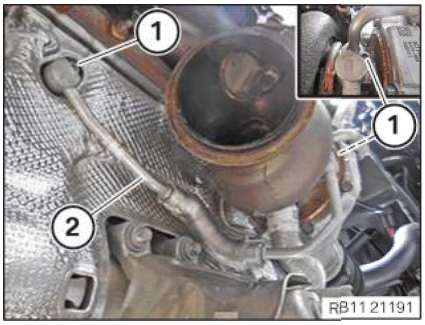


- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

44 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

45 – Remove the coolant return line for the exhaust turbocharger

WARNING

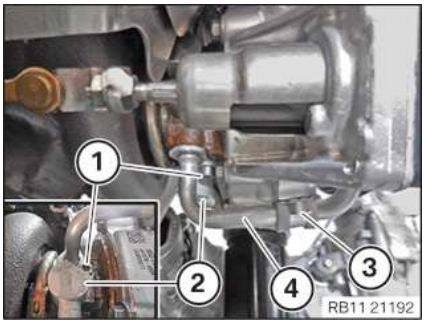
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

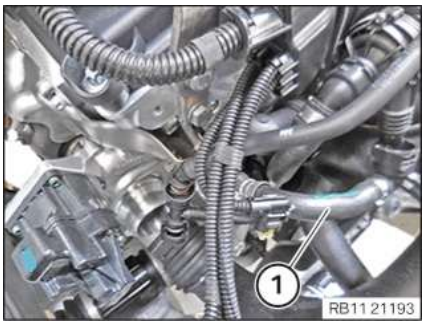


- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.

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- Unlock and release the coolant return line for the exhaust turbocharger (1).



- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

46 – Remove the coolant line between the coolant pump and the cylinder head

WARNING

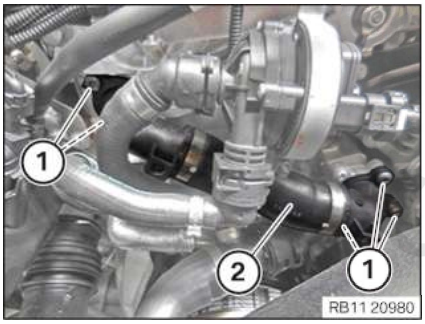
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Remove the coolant line (2).
- Catch and dispose of escaping coolant.

47 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

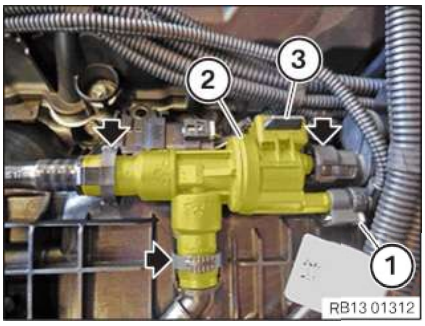
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

48 – Removing the intake plenum

RISK OF DAMAGE

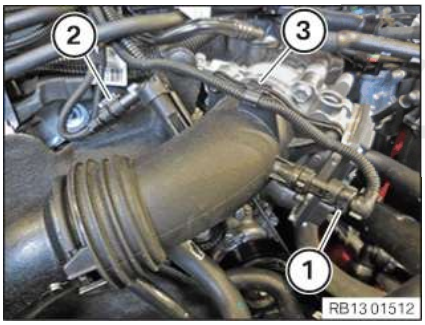
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

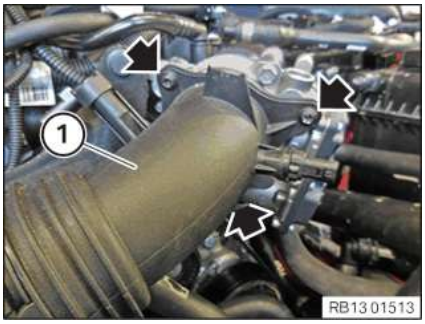
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

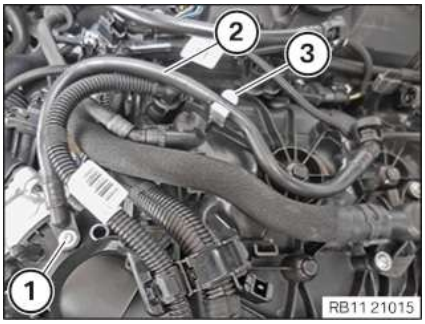


- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).

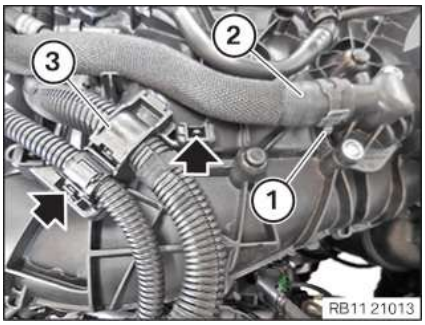


- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.

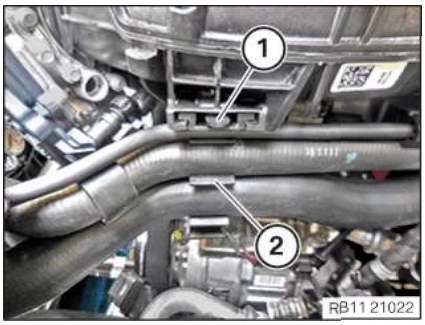
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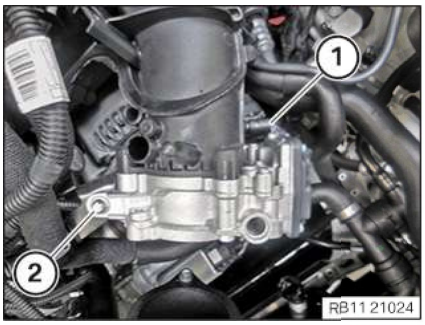
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



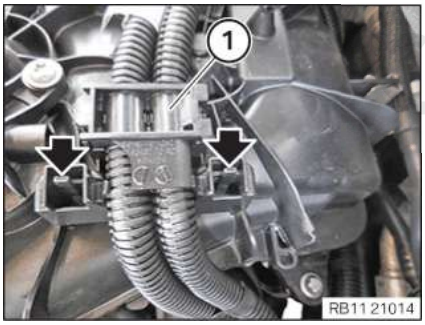
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



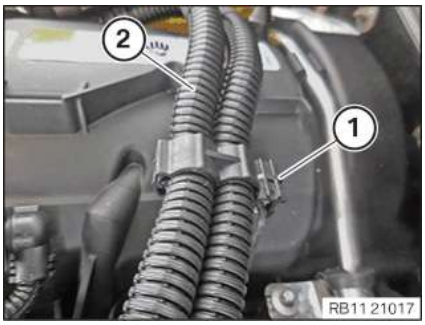
- Unlock the lock (1).
- Thread out holder (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

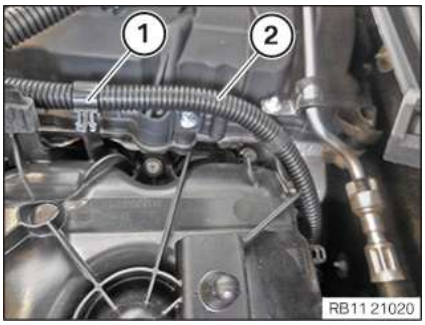


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.

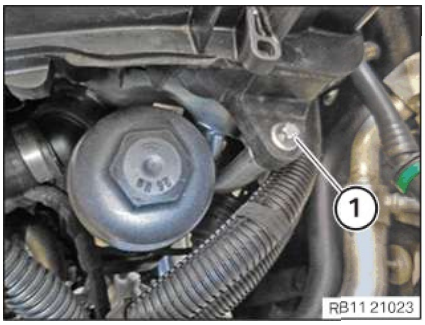
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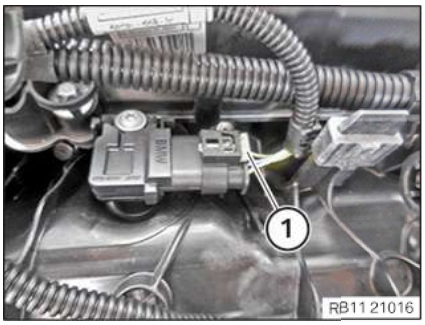
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



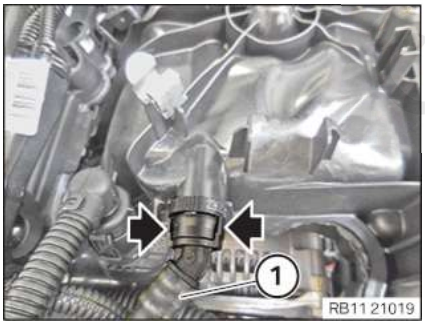
- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.



- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

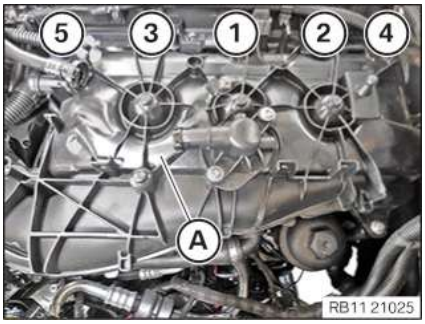


- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.

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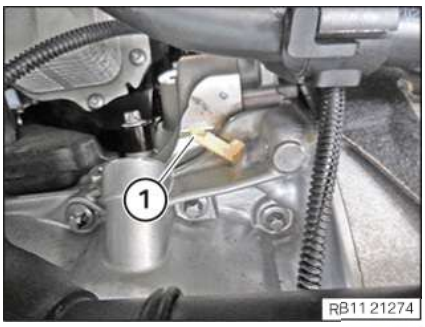


TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

49 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



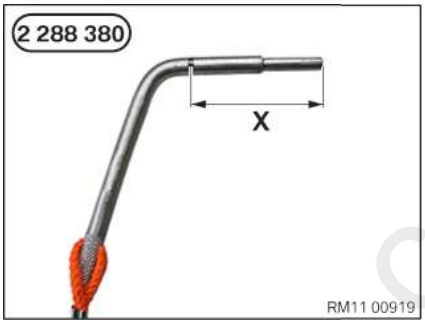
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

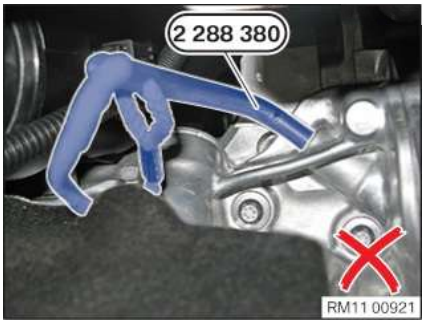
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

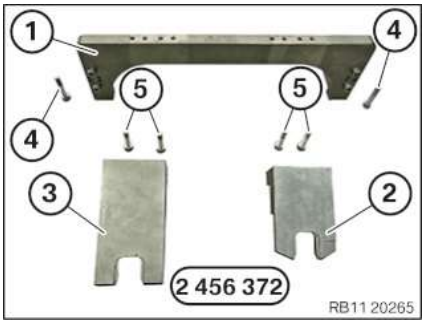


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

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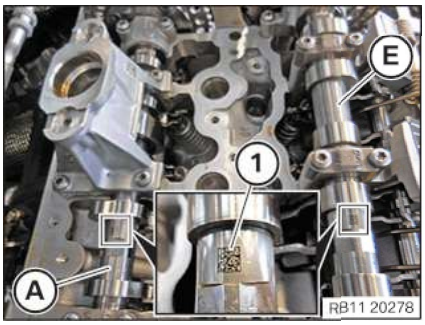
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

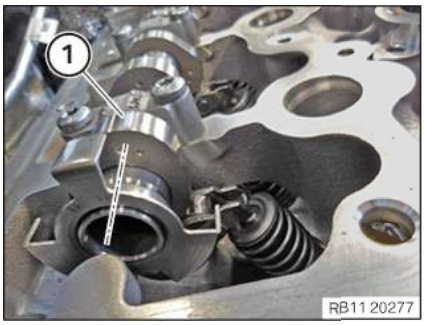


- Overview of the test gauges from the set of special tools 2 358 122:

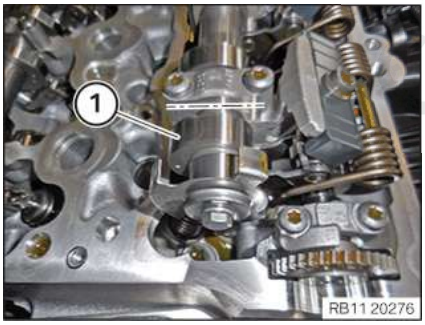
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



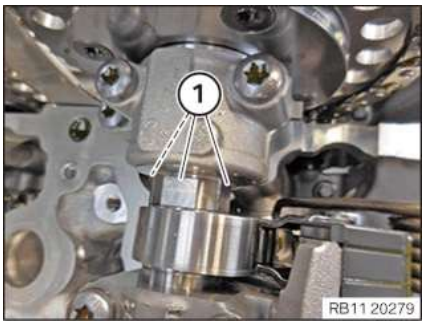
- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

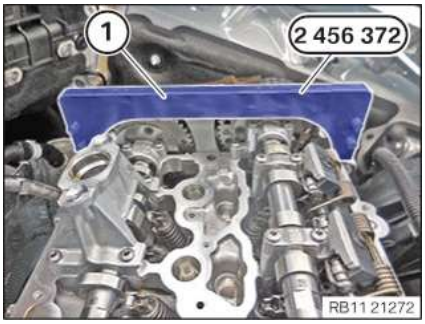


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

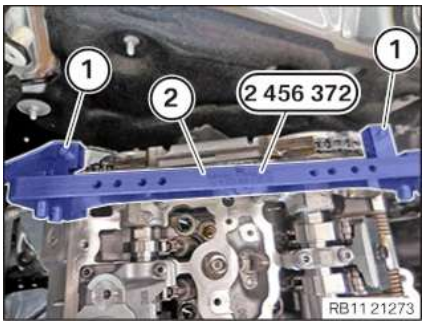


- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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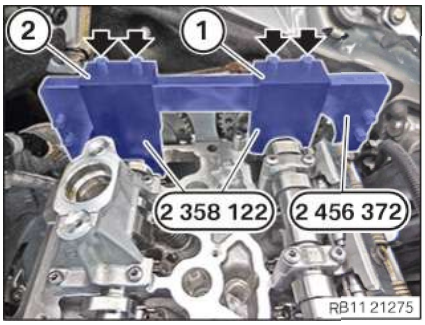
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

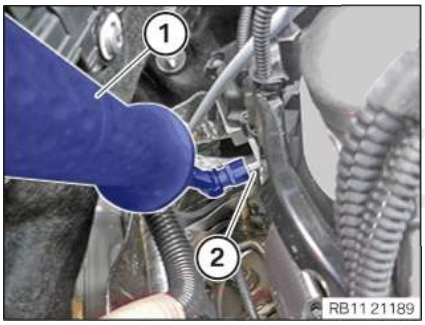
Test gauge to basic carrier

M6		Tightening torque	8 Nm

50 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

51 – Releasing the VANOS central valve of the intake adjuster

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- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

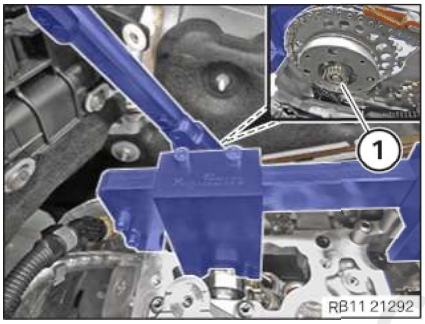
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

52 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

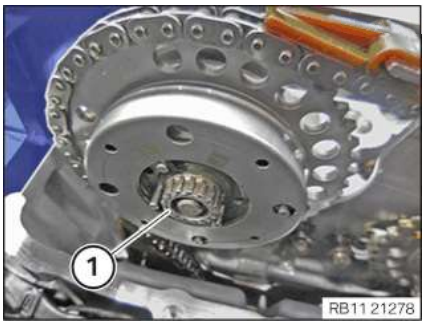


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

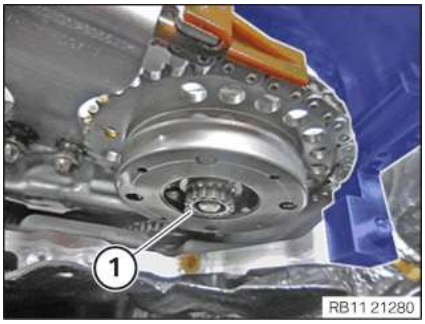
53 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

54 – Remove the VANOS central valve of the exhaust camshaft adjuster

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- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

55 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

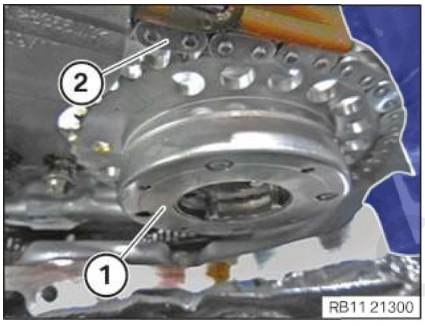


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

56 – Remove exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

57 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

58 – Remove cylinder head.

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CAUTION

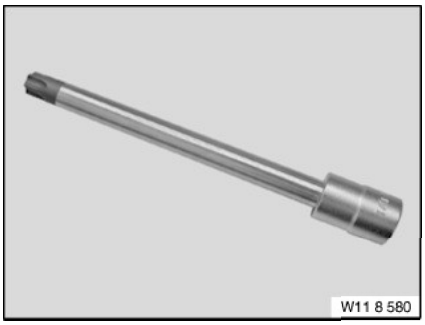
Heavy component.

Heavy components can lead to injury or damage.

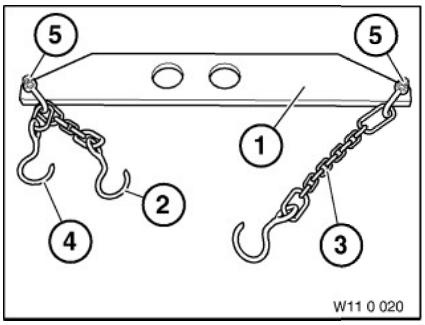
- Remove and install heavy components with the aid of another person/other persons.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



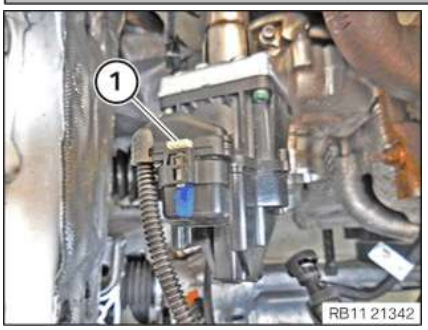
- Prepare special tool 0 495 747 (11 8 580).



- Prepare special tool .

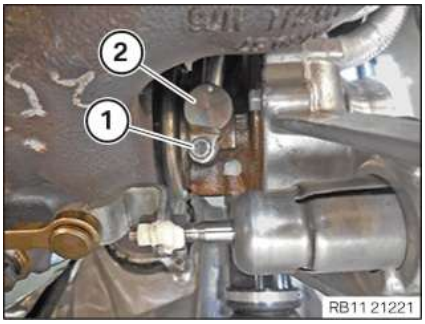


- Prepare the workshop crane 2 220 718.

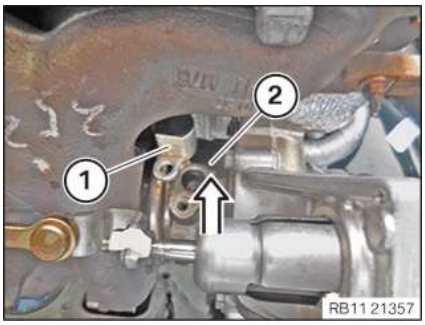


- Unlock plug connection (1) and disconnect.

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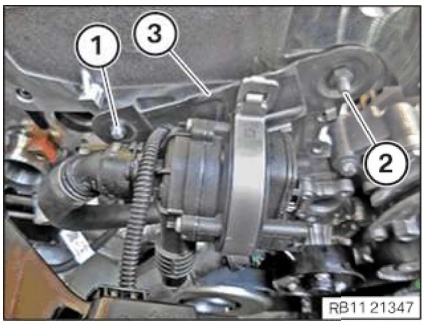
- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.



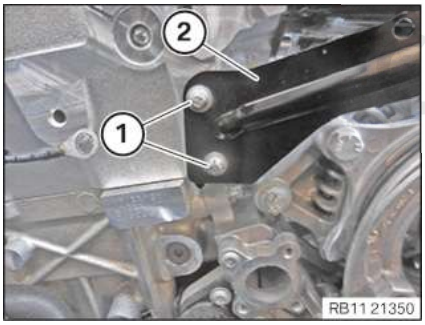
- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.

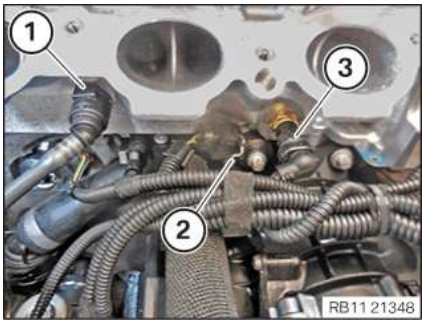


- Loosen screws (1).
- Thread out holder (2) and set aside.

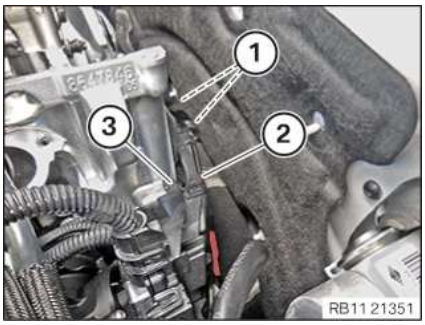


- Unlock plug connection (1) and disconnect.

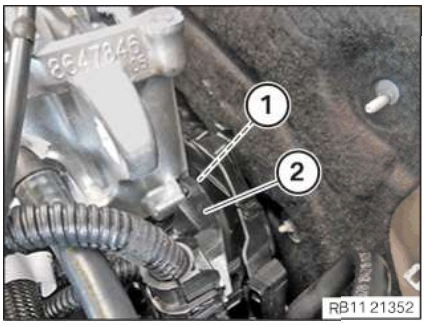
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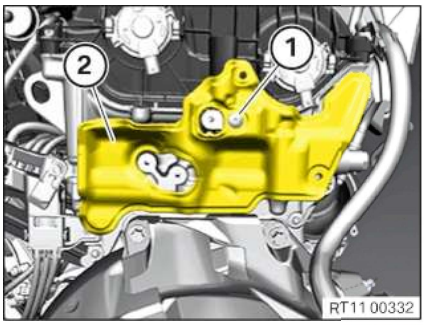
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



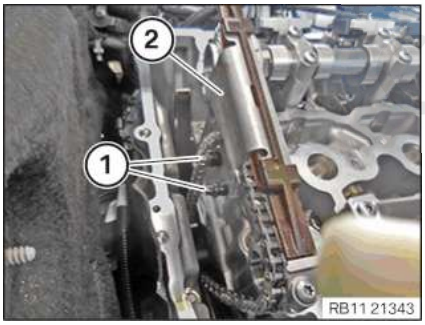
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



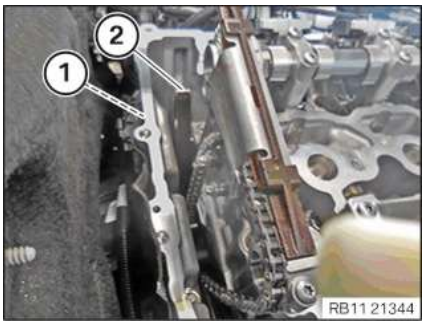
NOTICE

The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).



- Loosen screws (1).
- Guide out the slide rail (2) and remove.



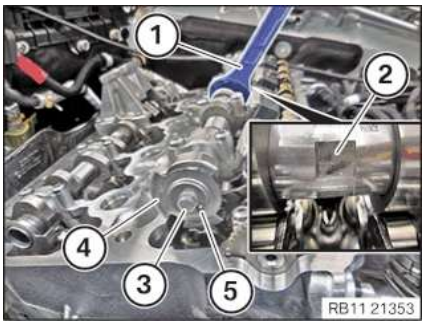
- Release the bearing journal (1) from the guide rail (2).



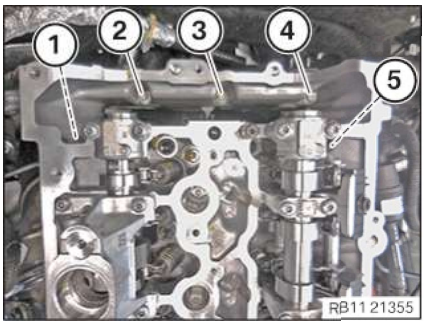
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

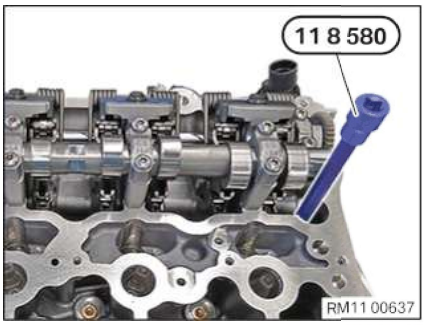
M8		Tightening torque	21,5 Nm



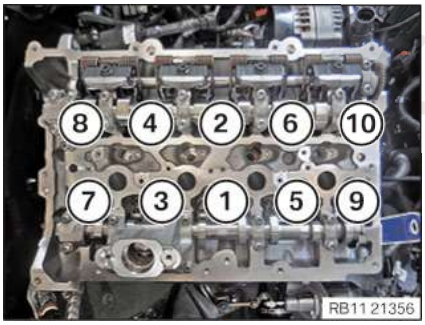
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.



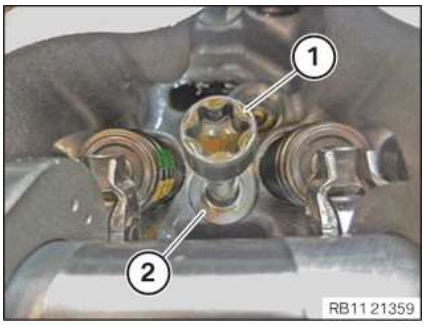
- Loosen the cylinder head bolts in the sequence from (5) to (1).



- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

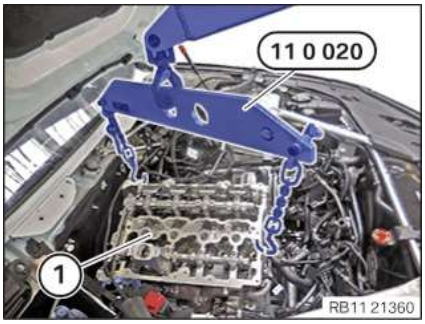


- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).

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CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to the guide rails.

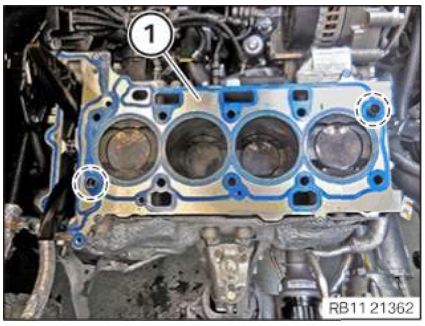
Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Attach special tool to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an **auxiliary person**, the workshop crane and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

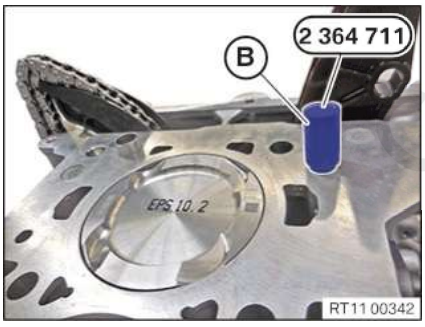
MAIN WORK

59 – Removing the cylinder head gasket



- Guide out and remove cylinder head gasket (1) in the **marked** area.

60 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

61 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

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- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.



CAUTION

Swirling dirt particles caused by compressed air.

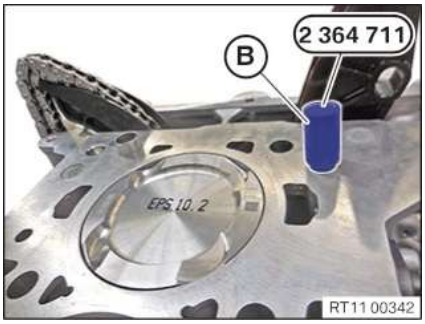
Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

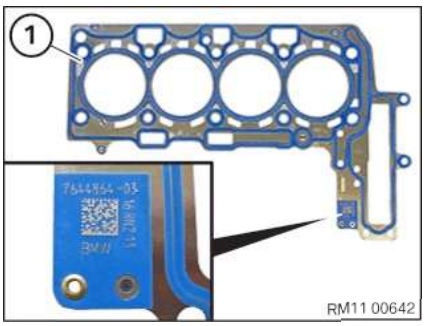
- Clean all the threaded holes in the **marked** area of the crankcase with compressed air.

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- Remove special tool (B) contained in the set of special tools 2 364 711.

62 – Renewing the cylinder head gasket

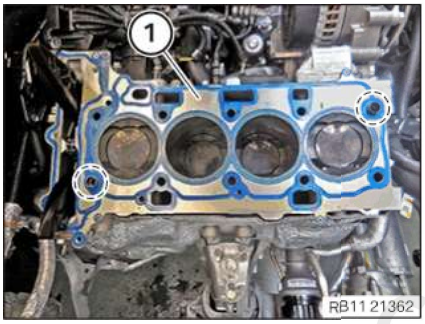


- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional thicker gasket 0.3 mm is available for service personnel.



- Check fitting sleeves (1) in the **marked** area for damage and, if necessary, renew them.



- Guide cylinder head gasket (1) into the **marked** area and install it.

POSTPROCESSES

63 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

- Dry threaded holes (e.g. using compressed air).

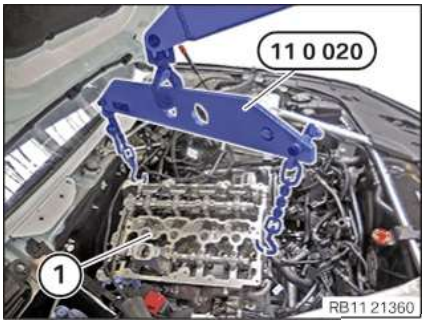
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TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



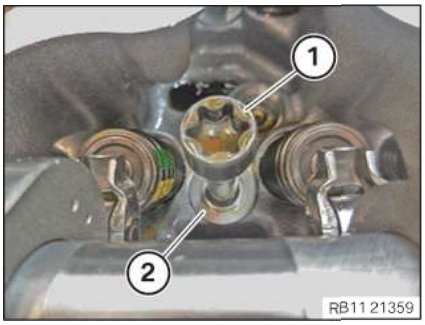
RISK OF DAMAGE

Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

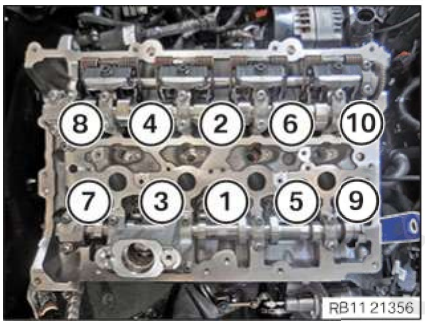
- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.



- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of engine block.
- Guide in and install cylinder head bolts (1).



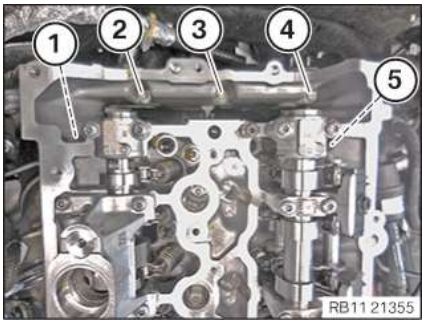
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °



- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

Cylinder head bolt to timing case cover

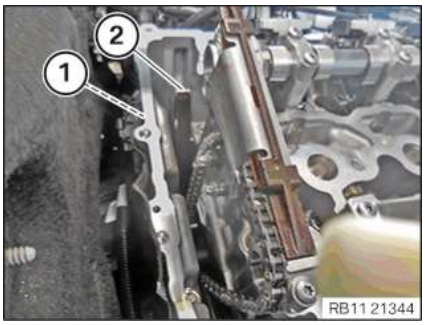
M8x40	Renew screws.	Tightening torque	19 Nm

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- Renew bearing journal (1).

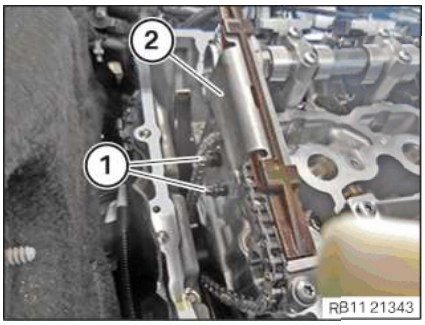
  Parts: Bearing journal



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

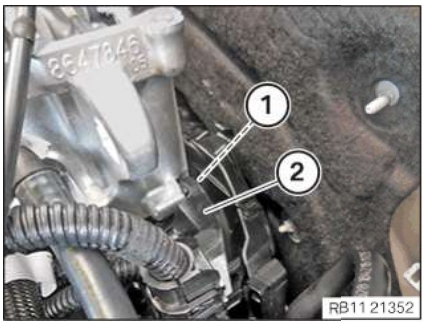
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

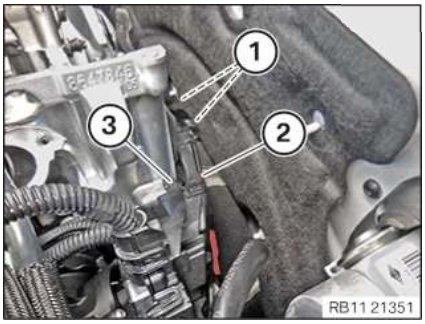
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

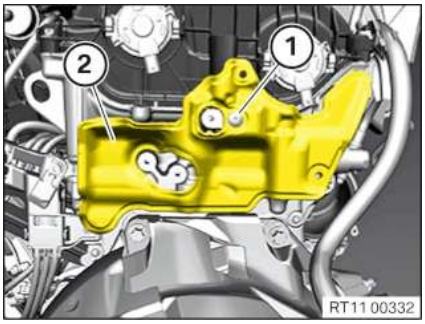
- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm

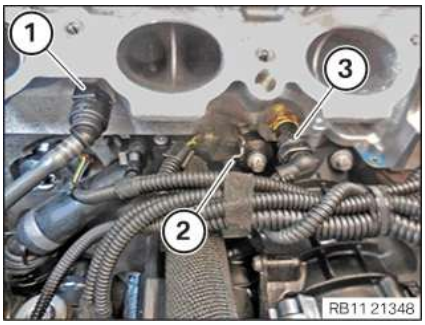
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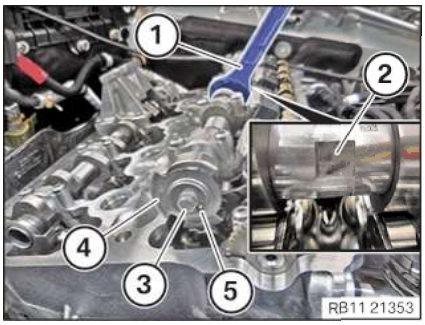
- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



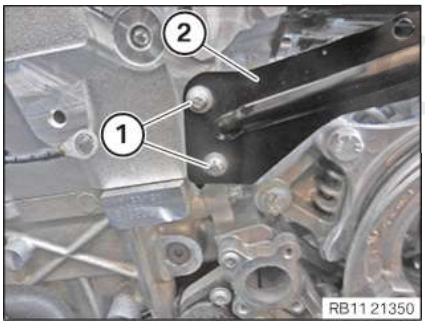
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm



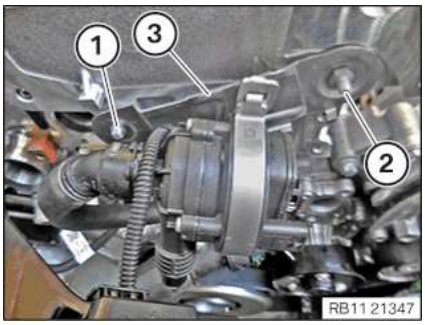
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

Holder for electrical auxiliary coolant pump on cylinder head

M6		Tightening torque	7 Nm

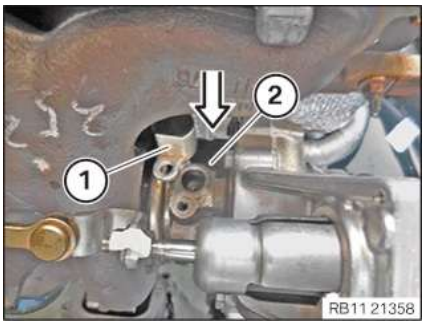
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- Thread in ground cable (2) and install.
- Tighten nut (1).

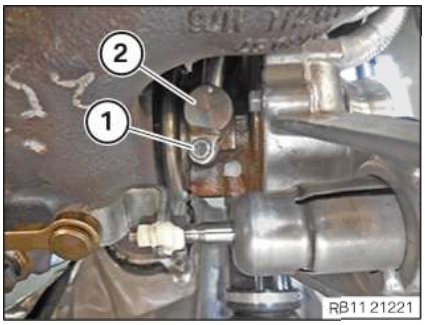
Standard screw connection M6

M6		8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

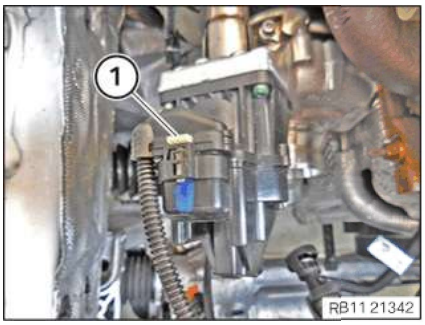
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm

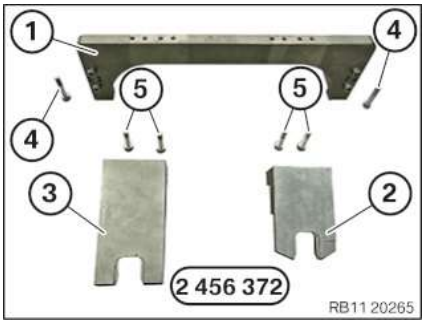


- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

64 – Adjust the camshafts with the special tool



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

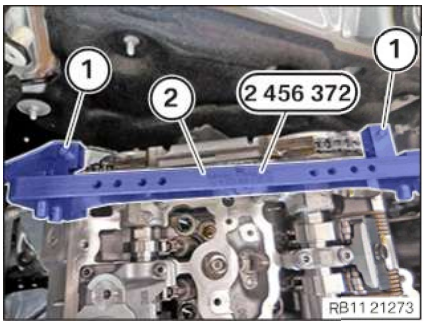
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- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



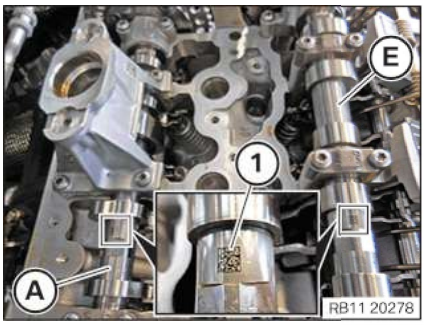
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



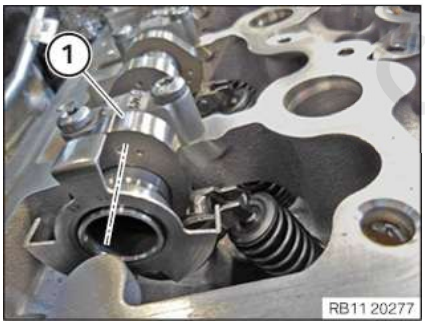
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

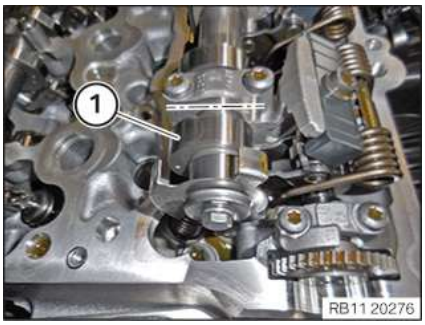
M6		Tightening torque	8 Nm



- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.

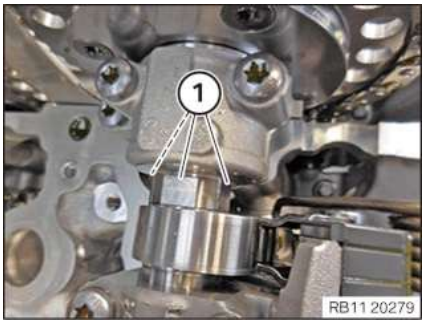


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

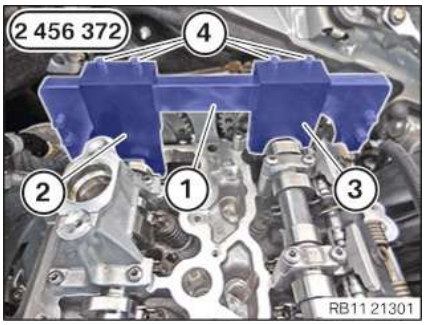


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

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- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

65 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

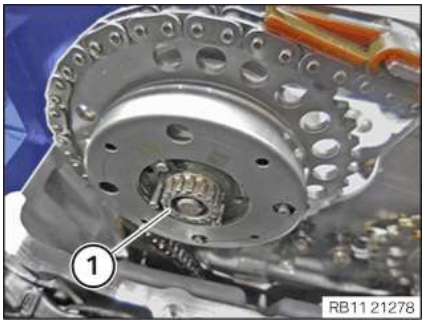


- Keep intake adjuster (1) marked IN ready.



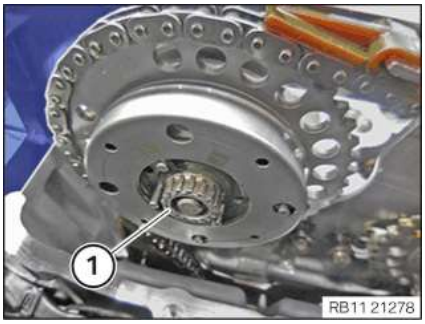
- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

66 – Install the VANOS central valve of the intake adjuster

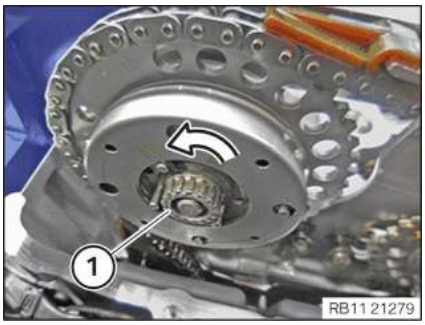


- Guide in the VANOS central valve (1) of the intake adjuster and install.

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- Hand-tighten the VANOS central valve (1) of the intake adjuster.



- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

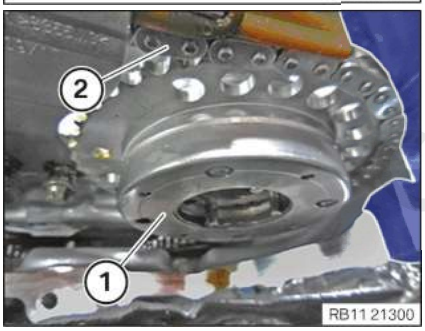
67 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

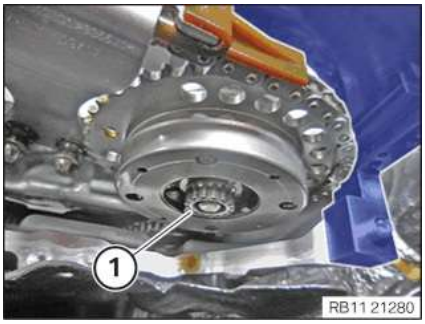


- Keep exhaust camshaft adjuster (1) marked EX ready.



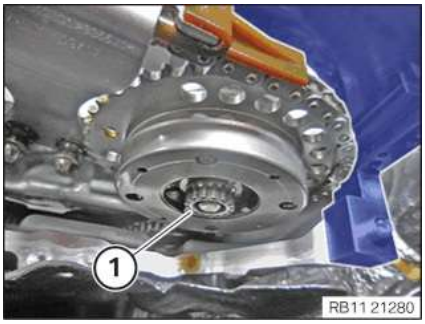
- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

68 – Installing the VANOS central valve of the exhaust camshaft adjuster

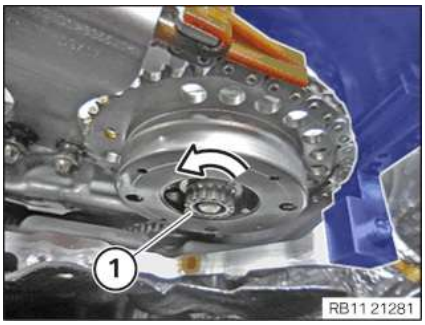


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.

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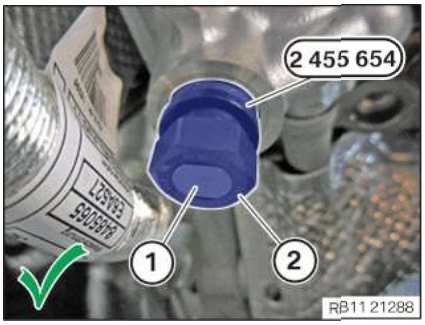


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



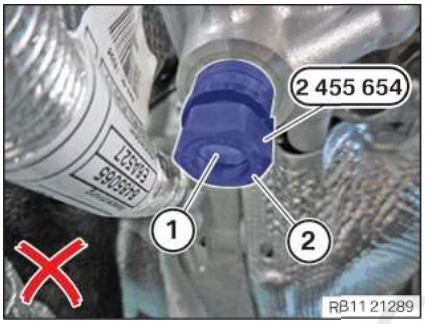
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

69 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

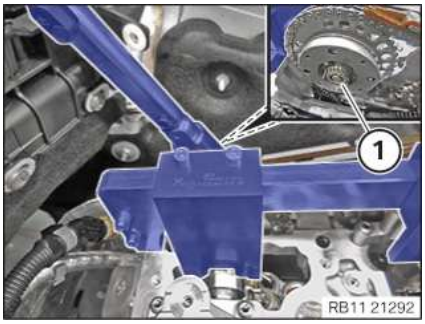
  The timing chain is **not correctly** pre-tensioned.

70 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

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- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

71 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

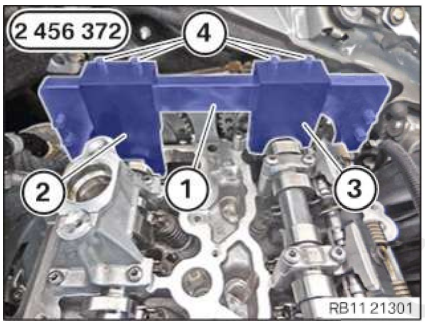


- Tighten the VANOS central valve (1) of the intake adjuster.

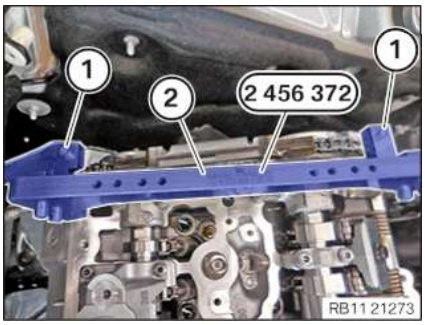
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

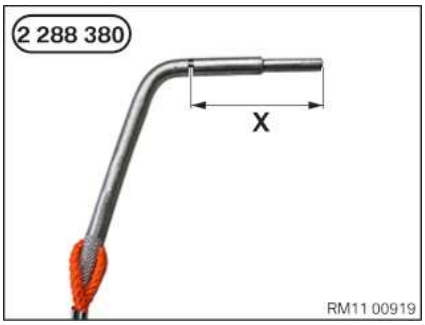
72 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.

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- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

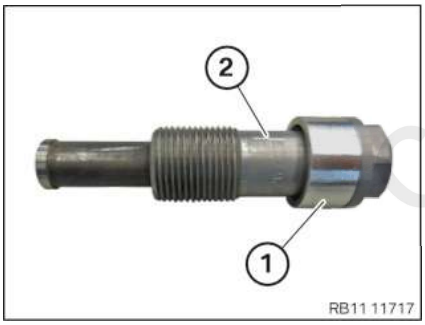
73 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



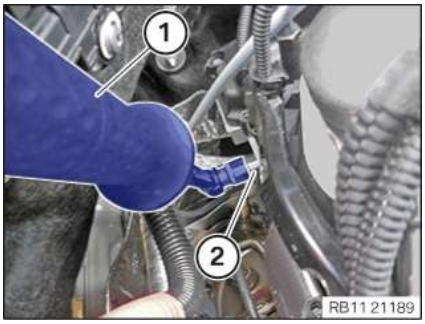
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

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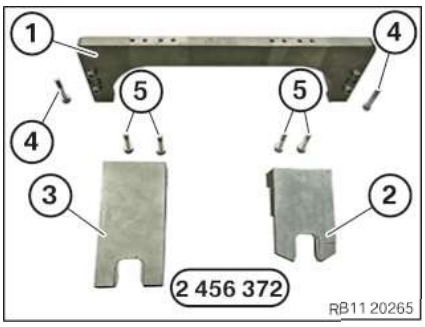


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

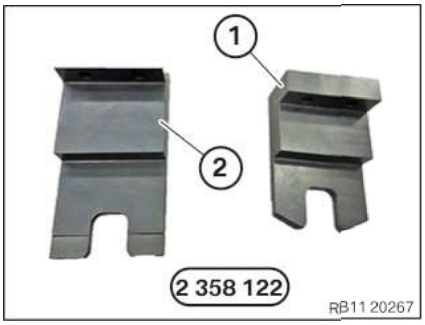
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

74 – Checking camshaft timing



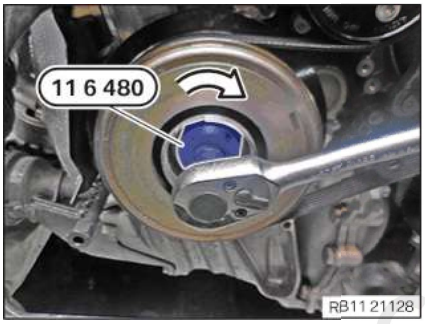
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



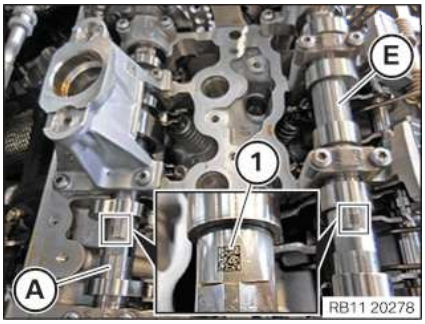
RISK OF DAMAGE

Damage to the engine.

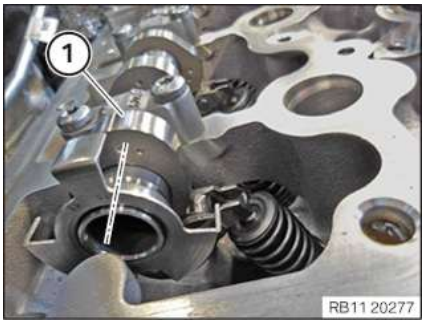
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

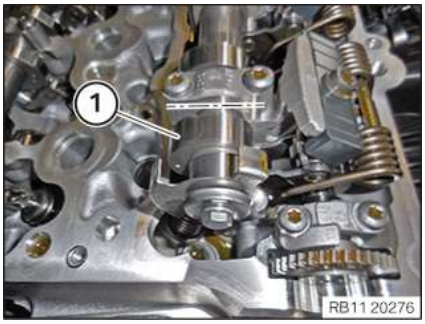


- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.

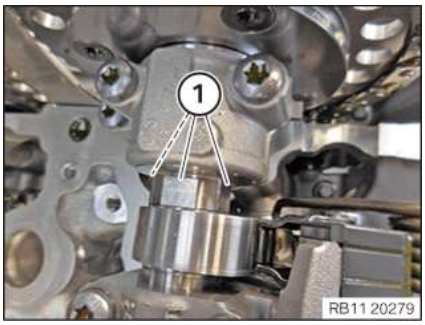


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

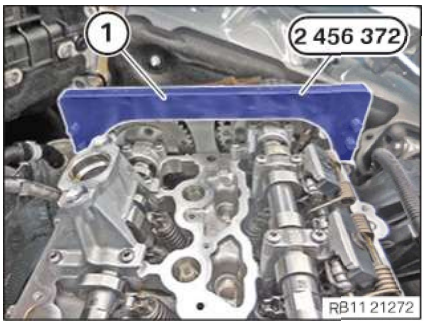
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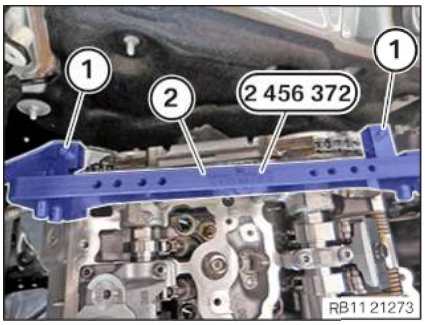
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



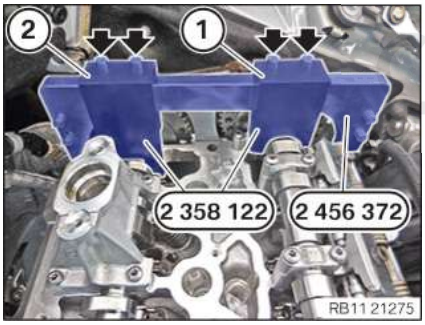
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

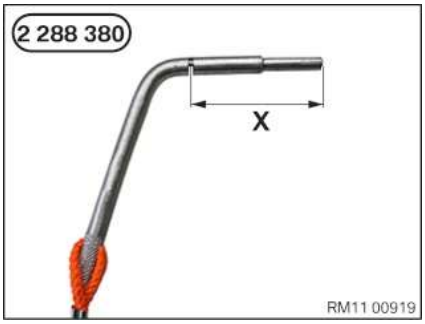
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

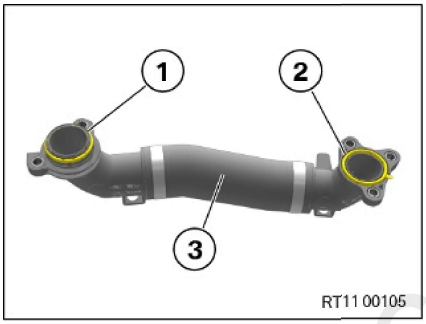


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

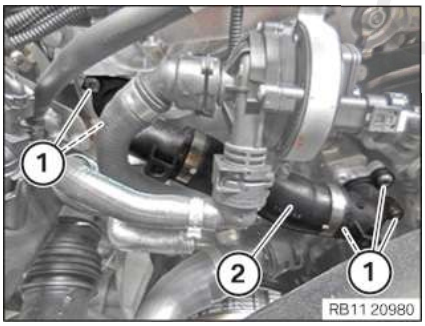
  The engine **is in the** TDC firing position of cylinder 1.

75 – Install the coolant line between the coolant pump and the cylinder head



- Check the sealing rings (1) and (2) for damage and if necessary, renew the coolant line (3).

  Parts: Sealing ring



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques. Non-observance of these requirements may result in leaks and damage.

- Feed in and install coolant line (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

Coolant line to coolant pump/cylinder head

M6x20		Tightening torque	8 Nm

76 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

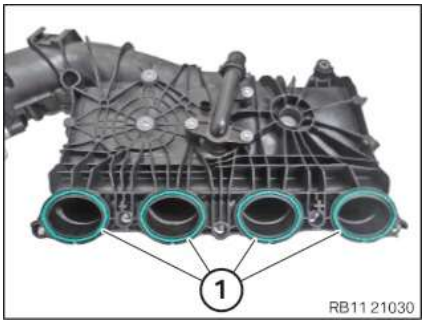
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

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TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

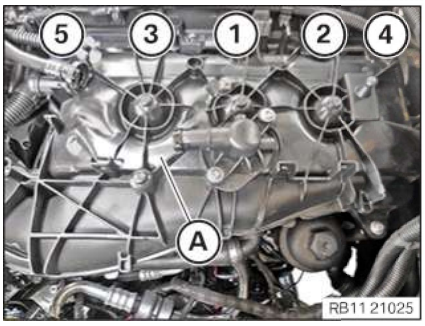


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

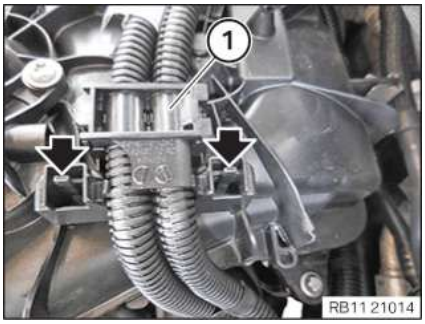


- Tighten down screw (1).

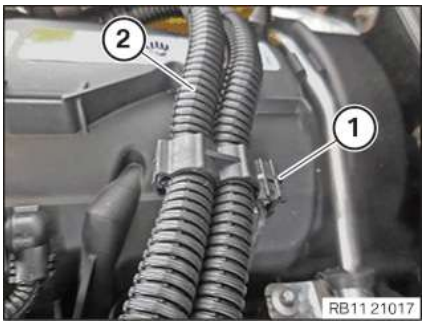
Intake plenum to support

M6X25		Tightening torque	8 Nm

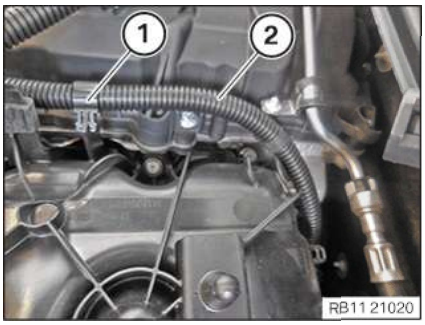
carmanuals.com



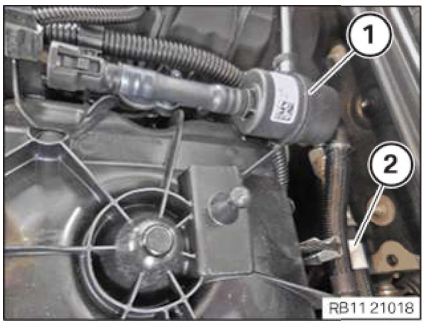
- Insert and install the wiring harness section (1) for the injectors and ignition coils.
  The locks (arrows) must engage audibly.



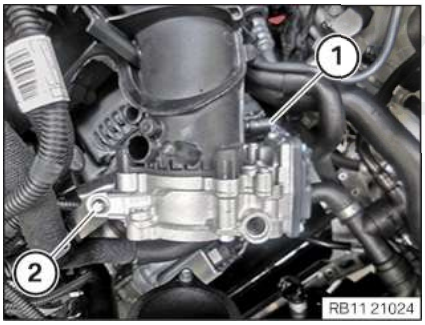
- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



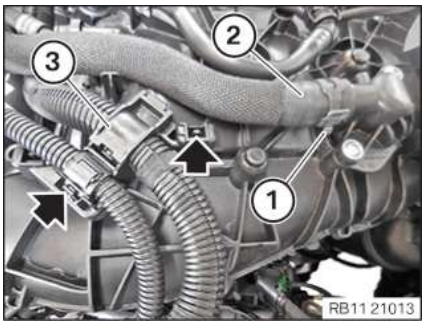
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

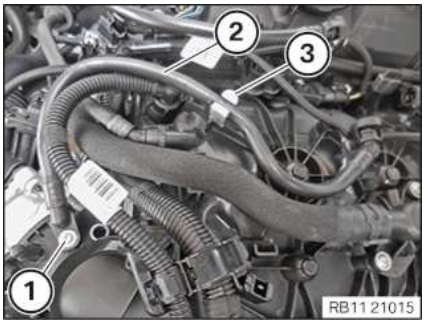
Throttle body to holder

M6X25		Tightening torque	8 Nm



- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

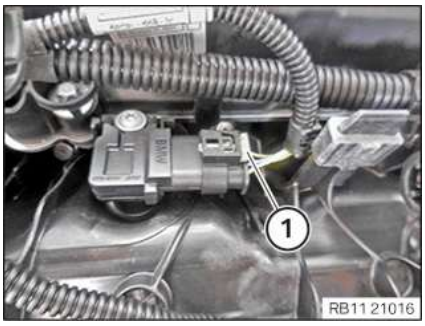
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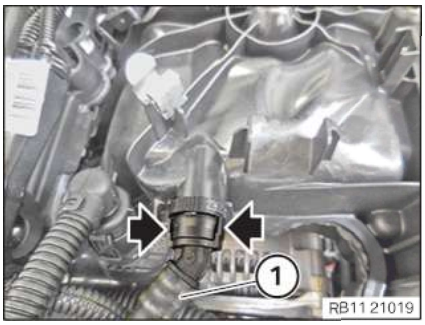
- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

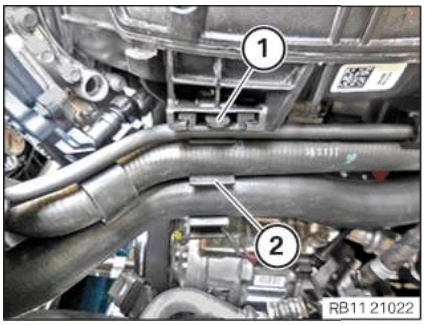
Oval-head screw		Tightening torque	3 Nm



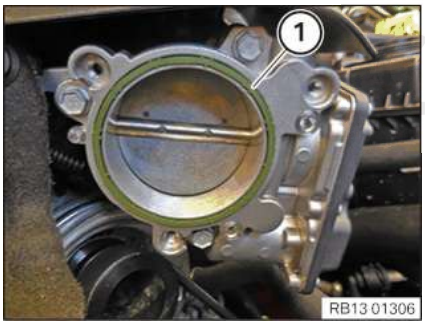
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.



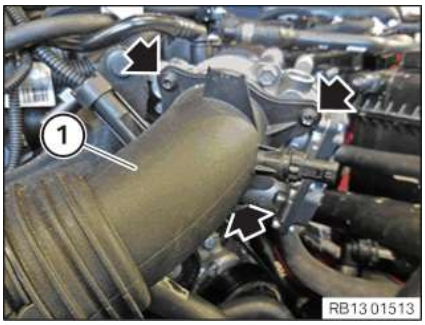
- Insert and install the tank ventilation line (1).
  The locks (arrows) must engage audibly.



- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).
  Parts: Gasket

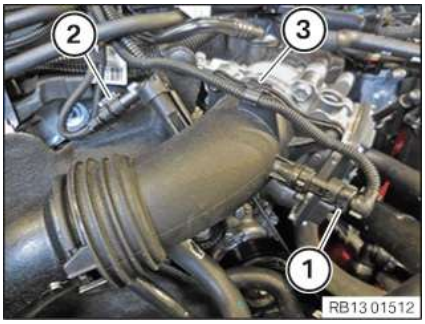


- Insert and install charge air line (1).
- Tighten screws (arrows).

Charge air line to throttle body

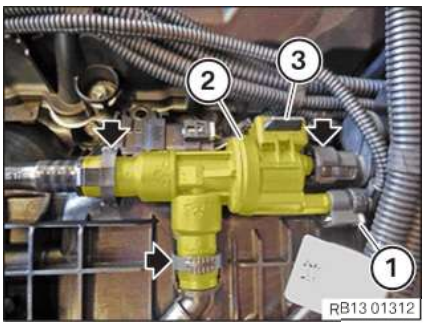
M6		Tightening torque	8 Nm

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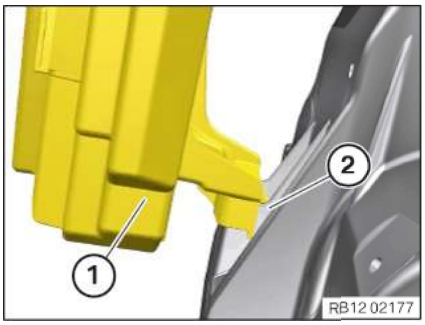
- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

77 – Installing the tank vent valve

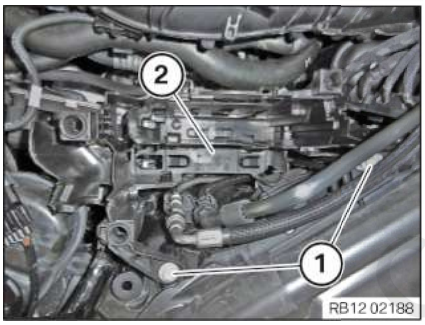


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).
  The connector (1) must engage audibly.

78 – Installing the control unit holder



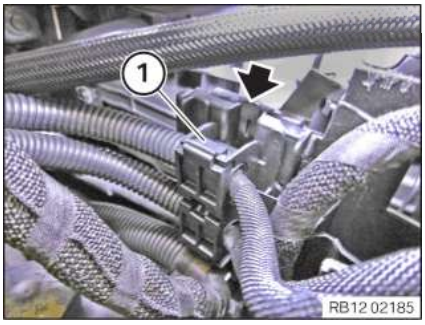
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



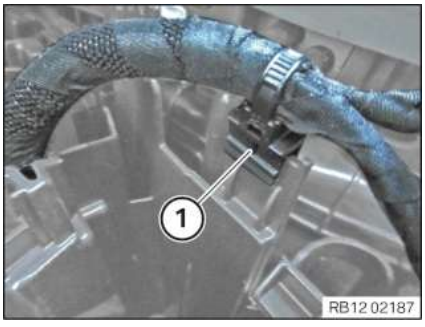
- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

Hexagon screw		Tightening torque	8 Nm

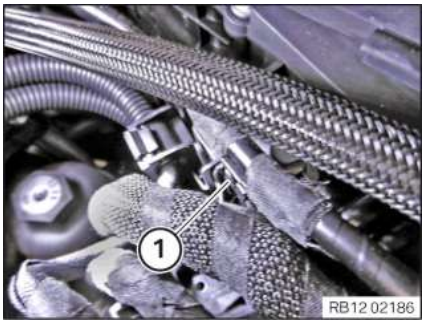


- Feed in and install the cable clip (1).
  Lock (arrow) must audibly engage.

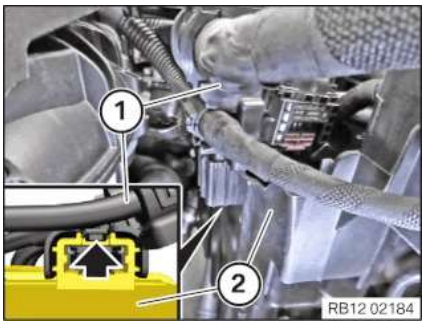


- Secure clamps (1).

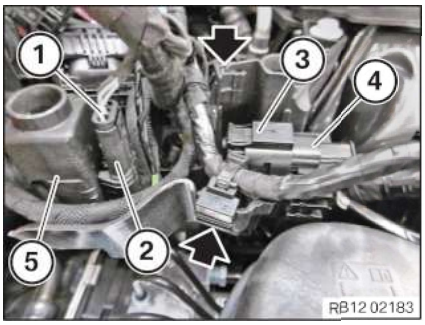
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- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

79 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

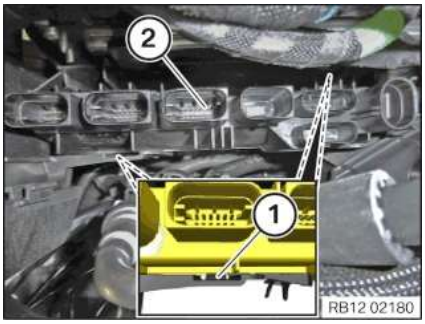
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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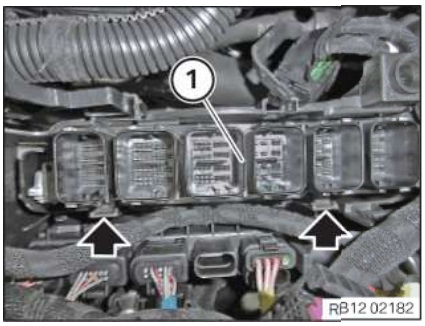


- Insert and install the integrated supply module (PDM) (2).
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).

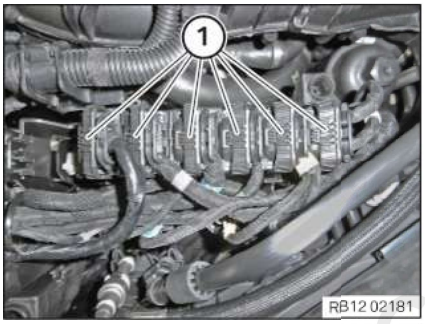


- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

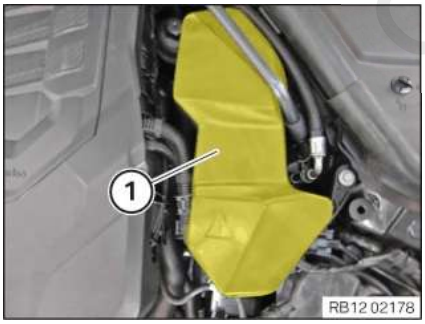
80 – Installing the DME control unit



- Feed in and install DME control unit (1).
  The locks (arrows) must engage audibly.

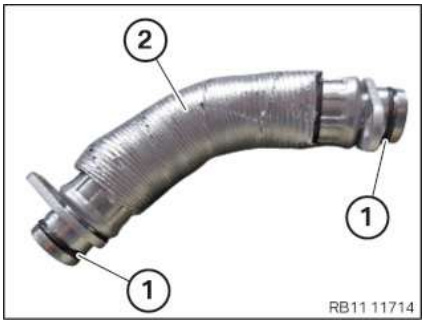


- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.



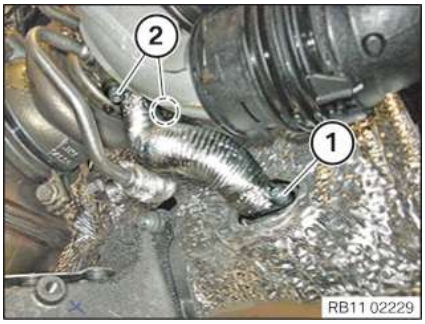
- Insert and install cover (1) into guides.

81 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).
  Parts: Sealing ring

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- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

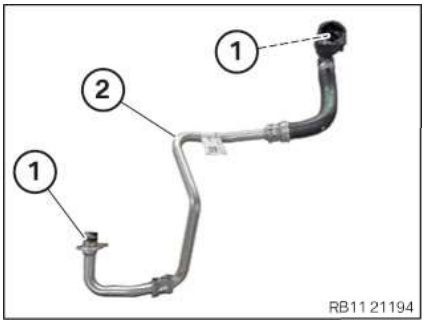
Oil return line to exhaust turbocharger/crankcase

M6x14		Tightening torque	8 Nm

82 – Install the coolant return line for the exhaust turbocharger

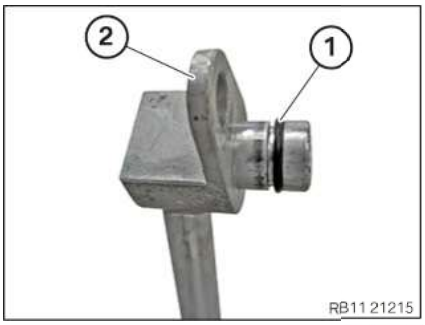
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



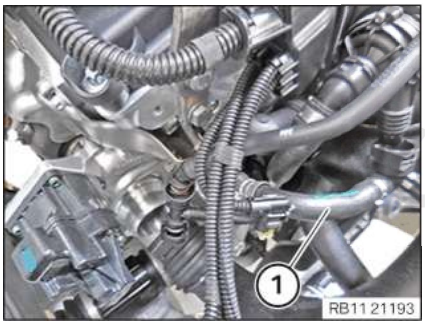
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-ring

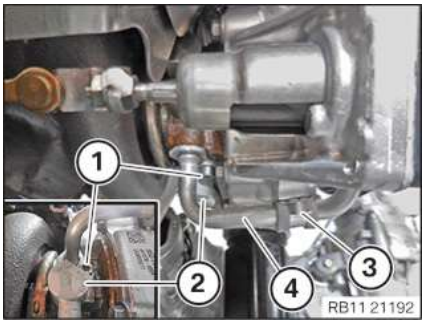


- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.

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- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

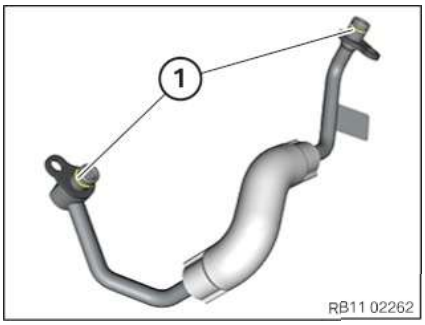
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

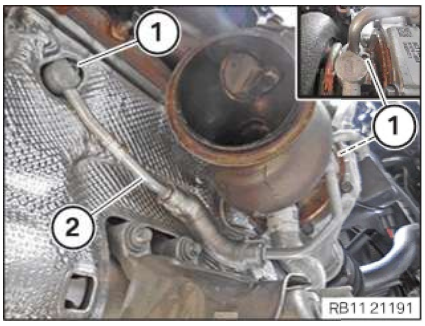
M6		Tightening torque	8 Nm

83 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

84 – Install catalytic converter



- Renew the V-clip (1).

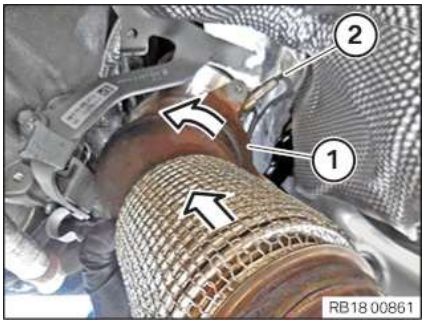
  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket

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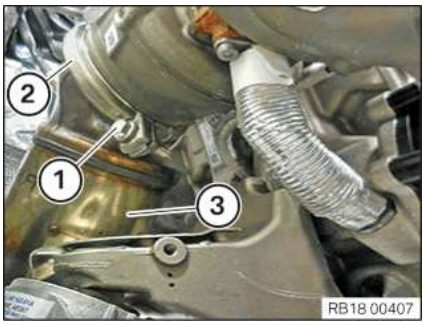
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

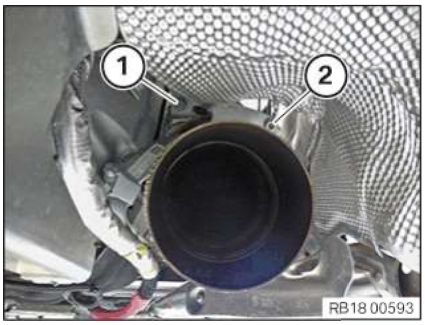
- Remove and install heavy components with the aid of another person/other persons.

- Guide in and install the catalytic converter (1) in the direction of arrow.
- Make sure that the monitoring oxygen sensor (2) **is not damaged.**



- Renew the V-clip (2).

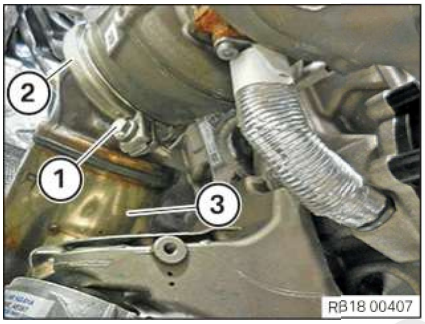
  Parts: V-band clamp
- Feed in and install V-clip (2) on the catalytic converter (3).
- Position the bolt (1).



- Renew the screw (1).

  Parts: Screw
- Position the bolt (1).
- Renew nut (2).

  Parts: Nut
- Position the nut (2).



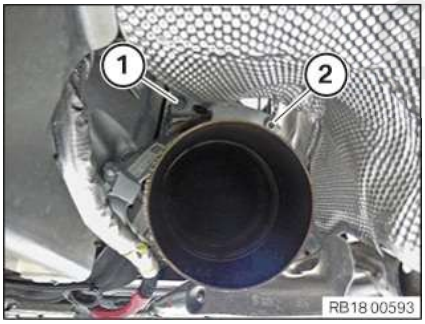
- Position the catalytic converter (3).
- Position V-clip (2).

Note: Ensure correct mounting orientation of the V-clip.

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm



- Tighten down screw (1).

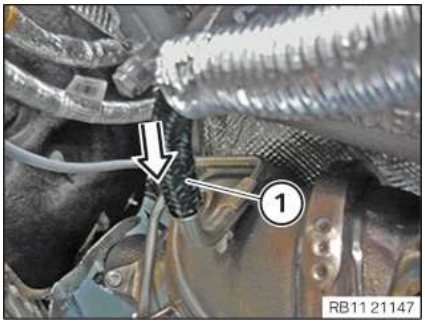
Catalytic converter to holder

M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm



- Check the pressure hose (1) for damage and renew hardened pressure hose (1) if necessary.
- Connect the pressure hose (1) in direction of arrow to the limit position.

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CAUTION

Component with heavy weight.

Danger of injury!

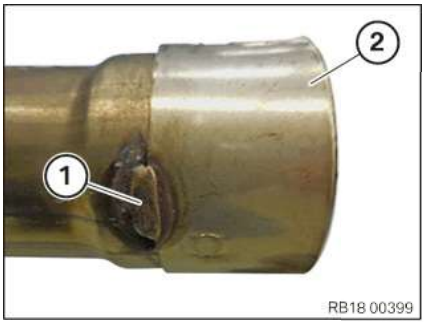
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



CAUTION

Swarf resulting from sawing or grinding components.

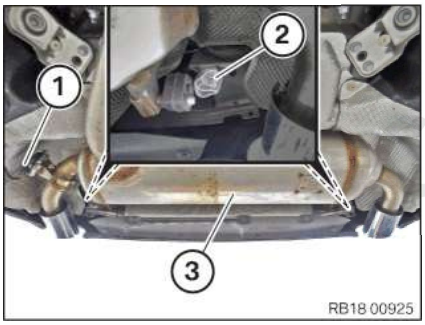
Danger of injury!

- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp



- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

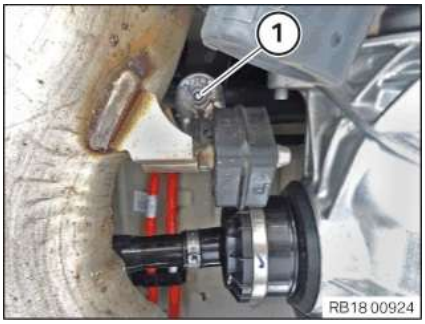
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm

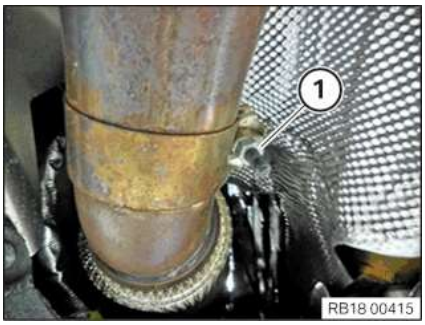


- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

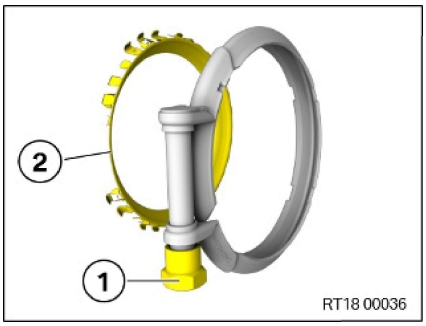
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

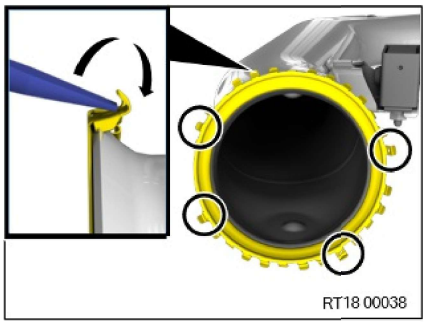


- **Equipment specification 2 (V-clips)**

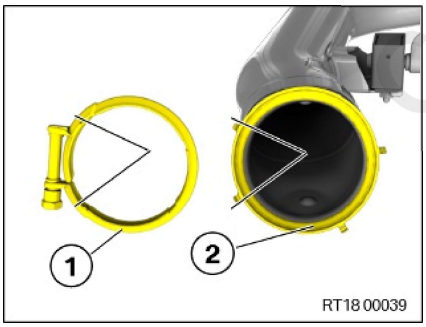
  Renew V-band clamp.

  Parts: V-band clamp

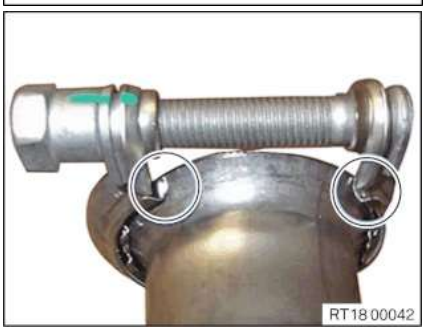
  Unscrew the nut (1) and remove the sealing ring (2).



- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.

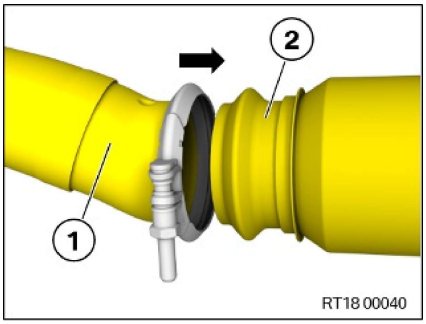


- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).

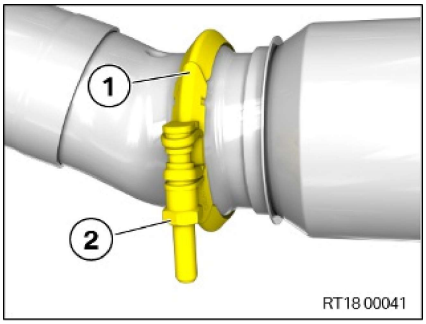


- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.

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- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).

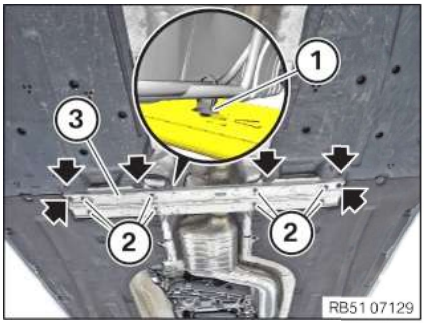


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

86 – Install the connecting supports on the tunnel



- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- Tighten screws (arrows).

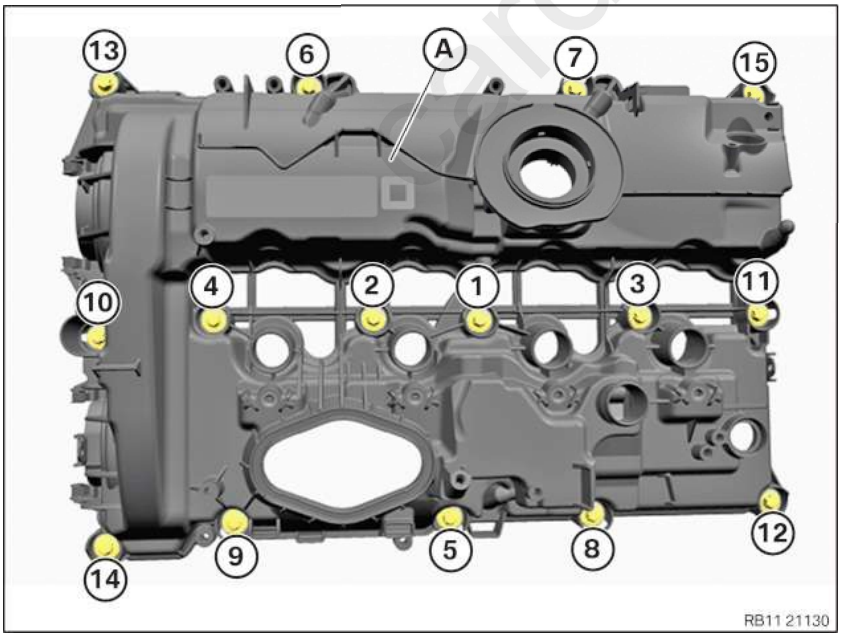
Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

87 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

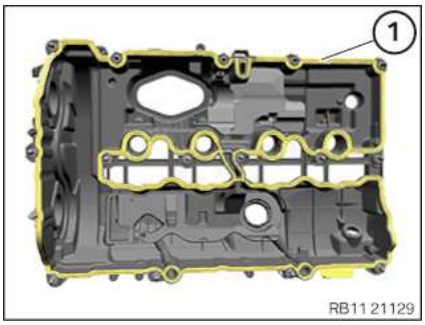
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RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

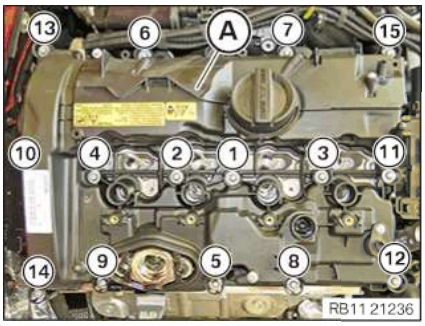
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques. Non-observance of these requirements may result in leaks and damage.

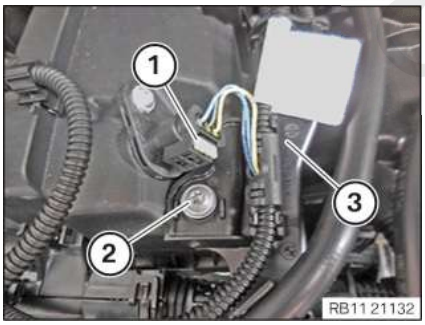
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.



- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

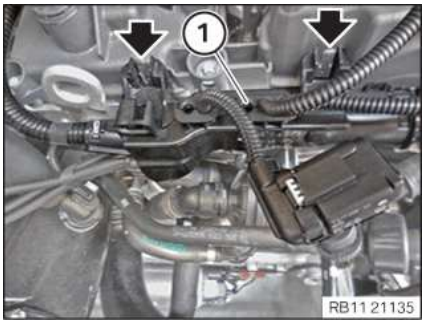
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

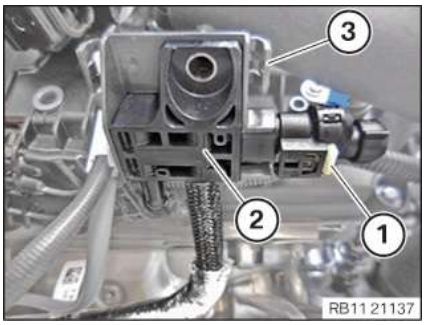


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

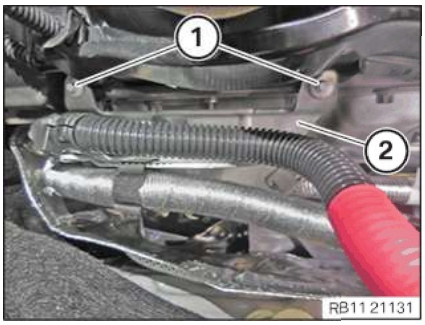
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- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

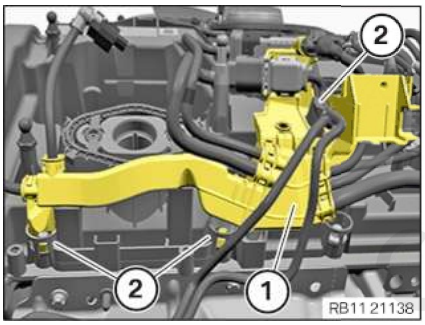
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

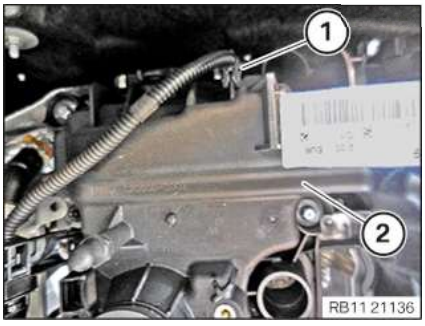
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

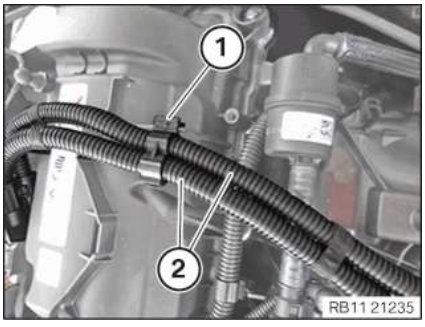
6X18	Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.



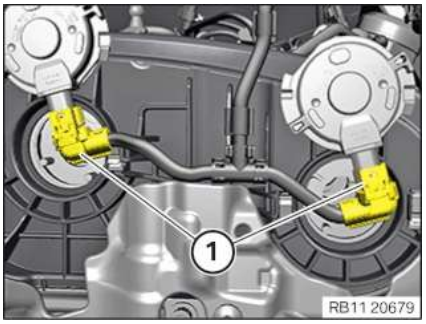
- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

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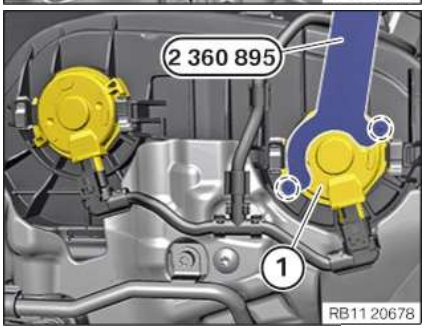
88 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

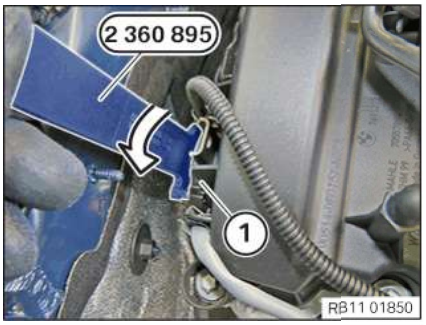
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



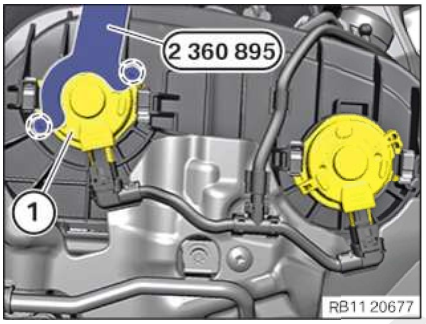
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



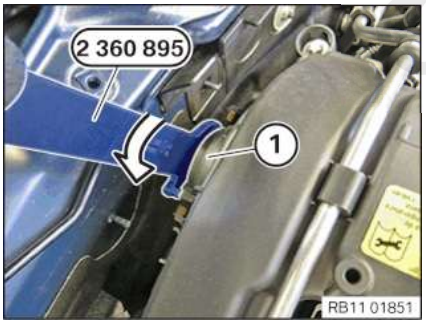
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

89 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

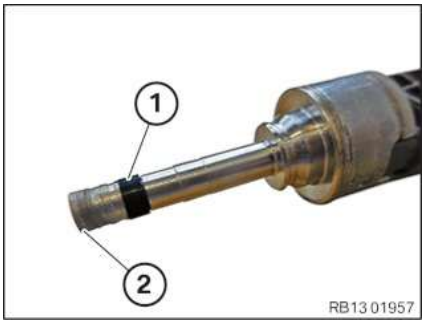
- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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TECHNICAL INFORMATION

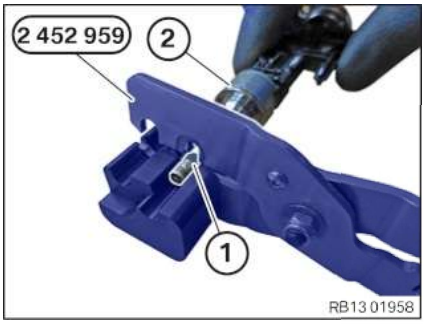
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

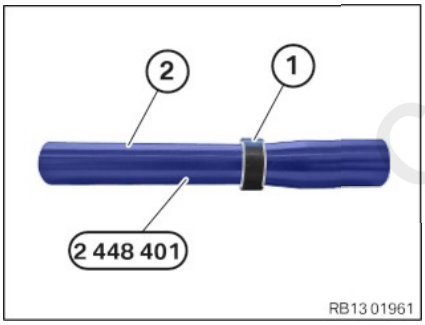


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

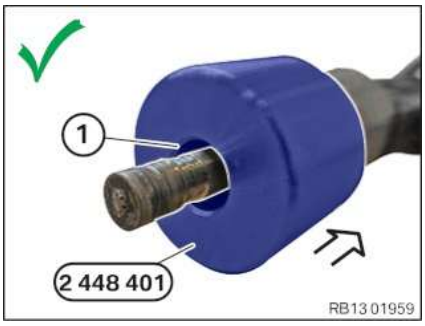
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



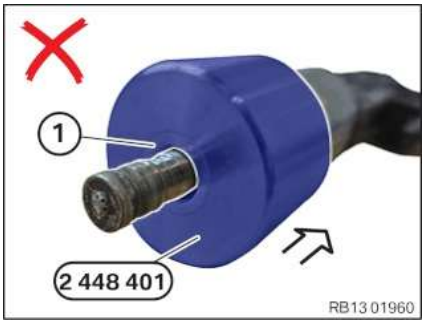
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

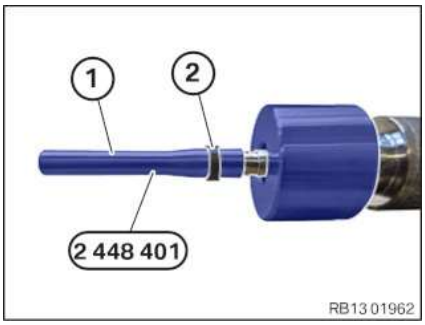
  The larger diameter of the assembly sleeve (1) must point to the injector tip.

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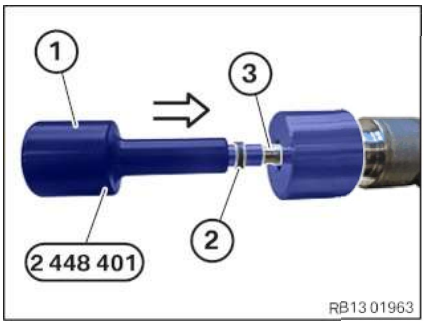


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

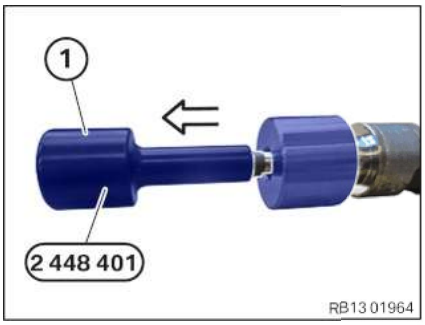
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



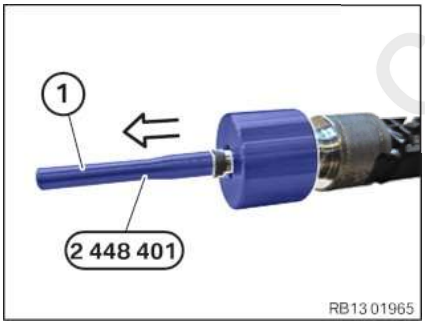
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



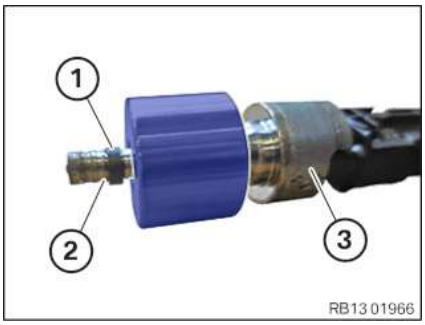
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

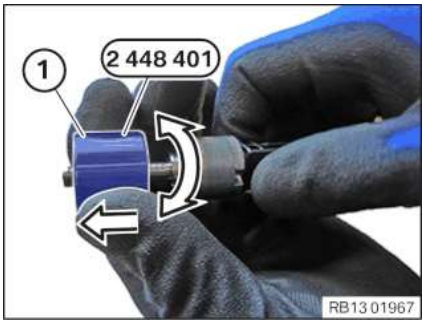


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



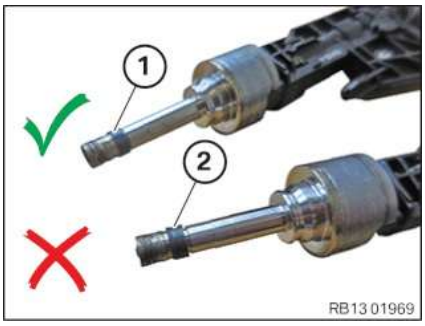
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

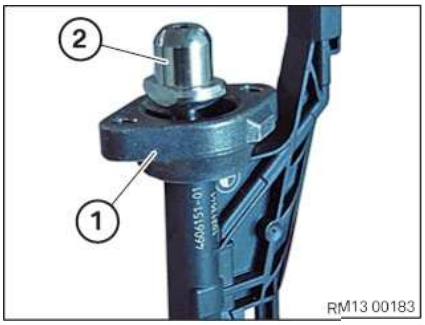


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

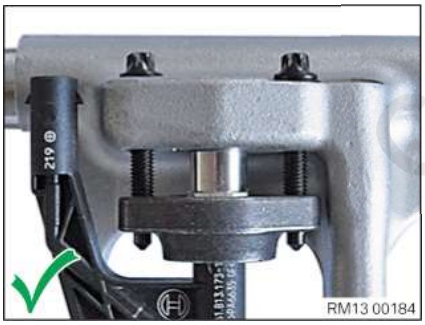
90 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

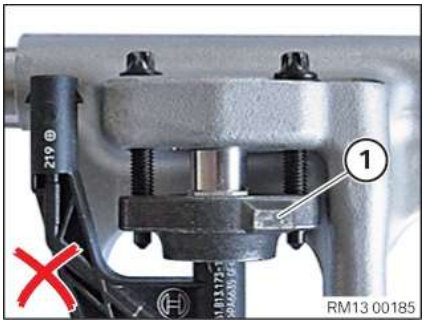


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

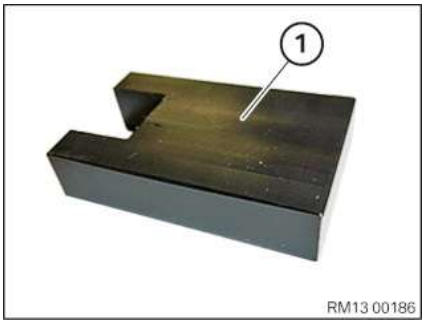
  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.

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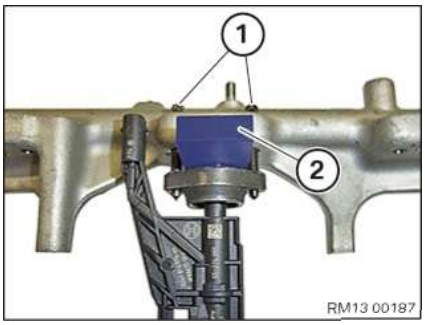
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



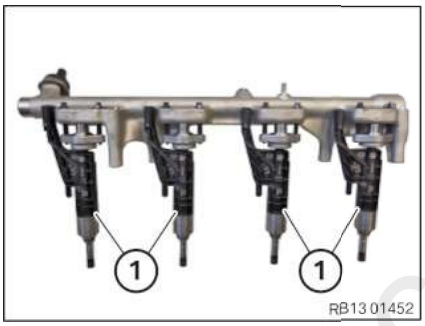
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



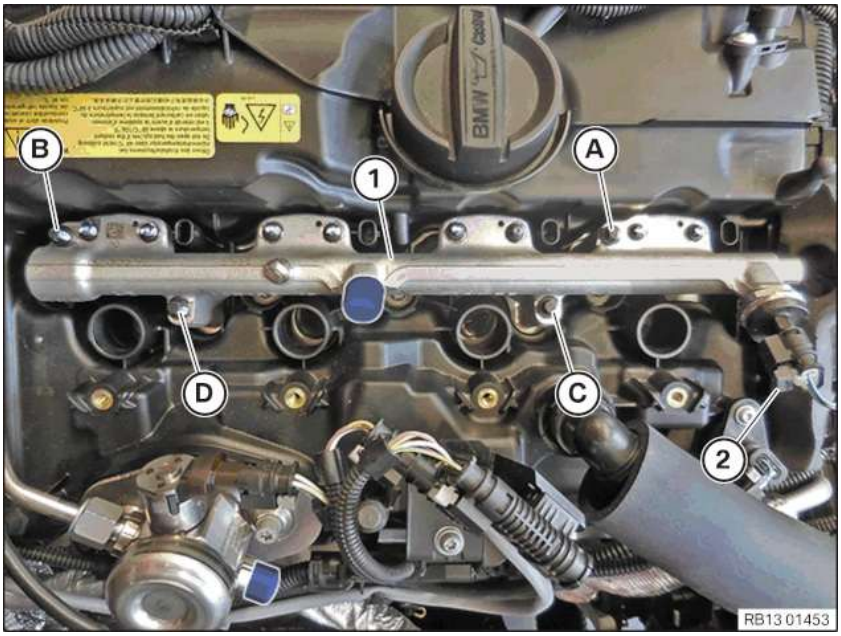
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

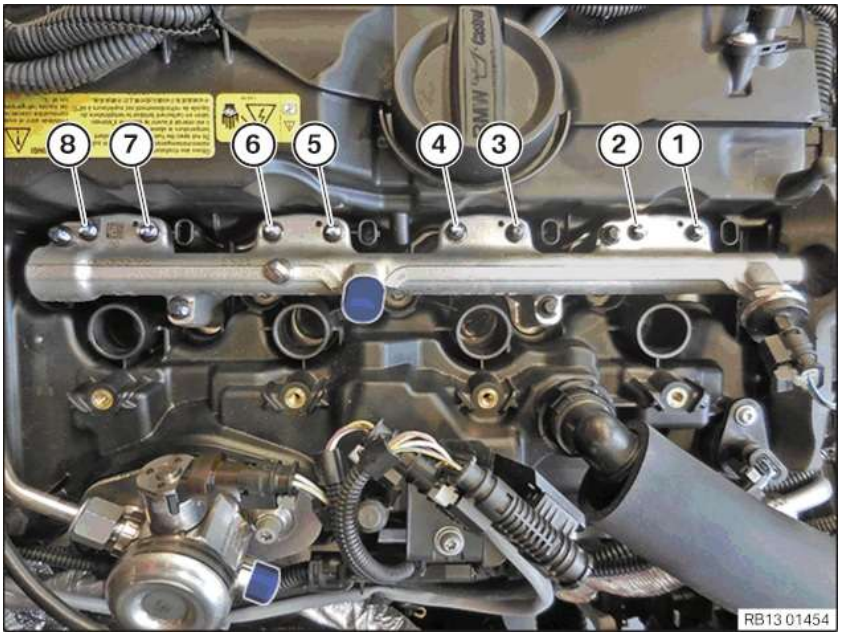
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

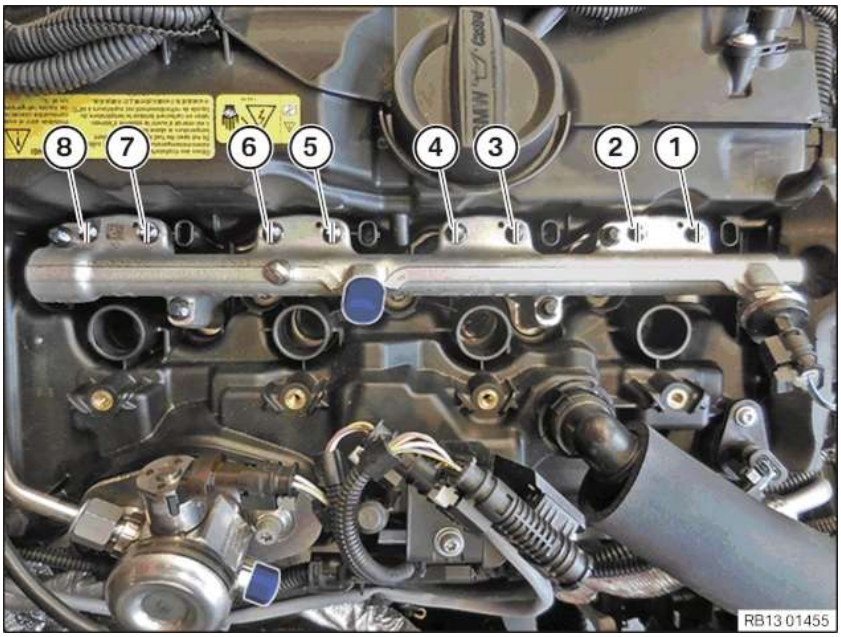
  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

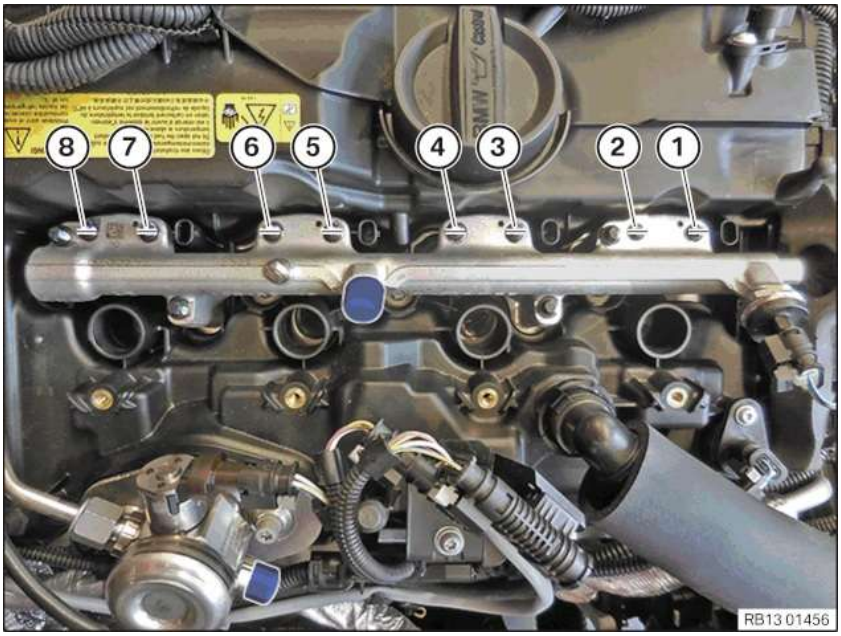
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.



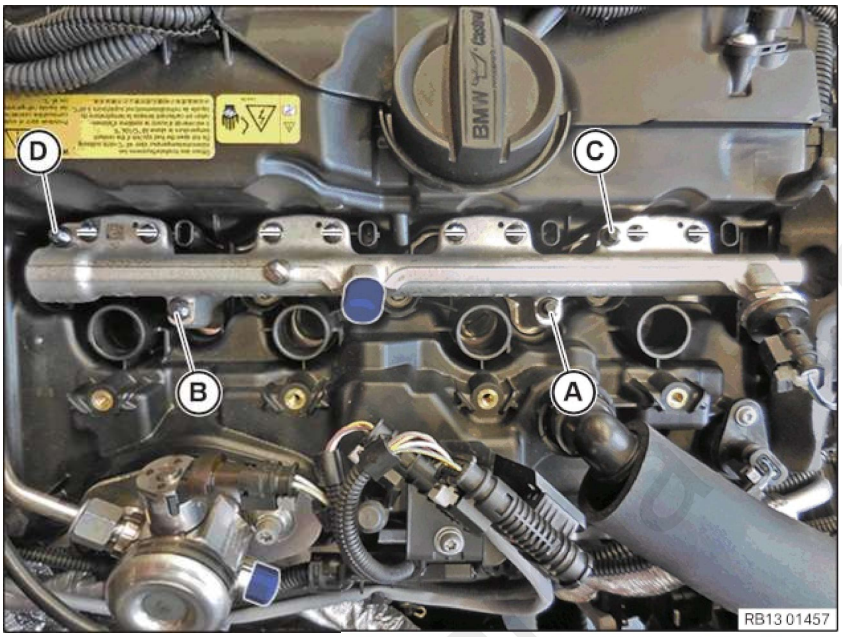
- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.

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- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

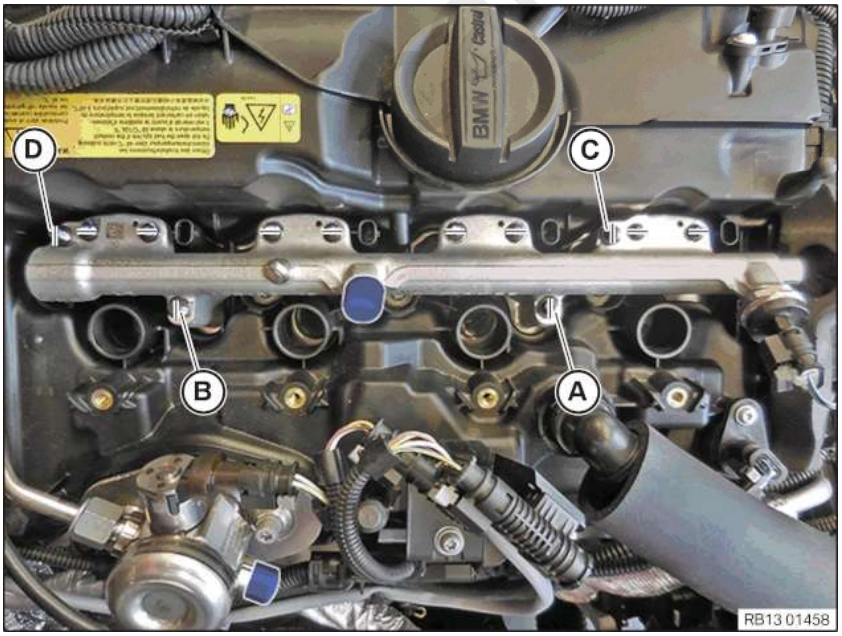
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

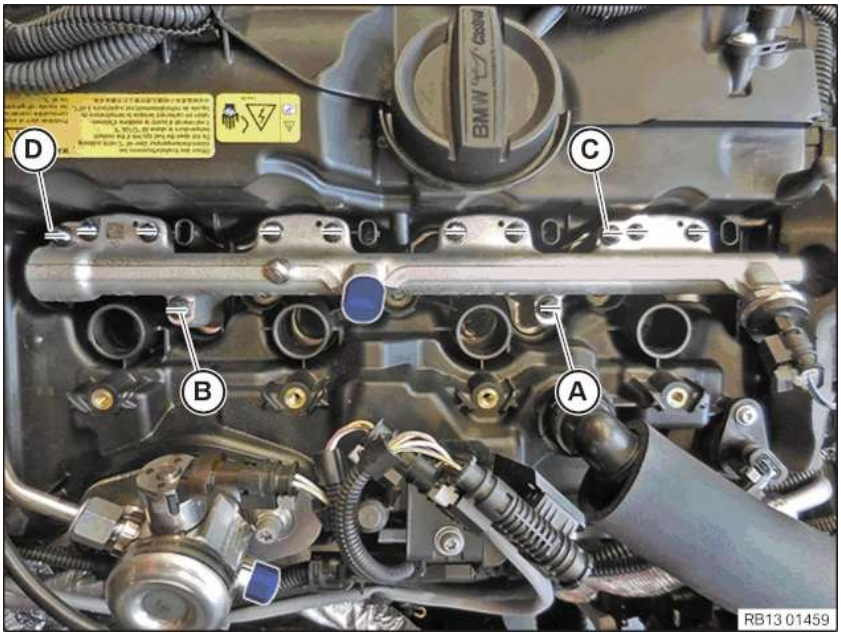
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

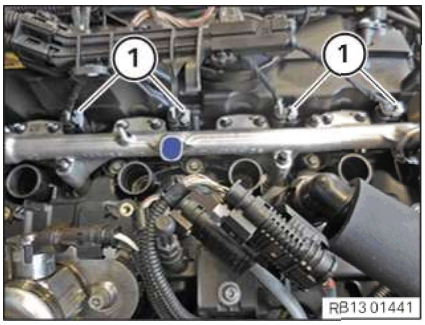


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



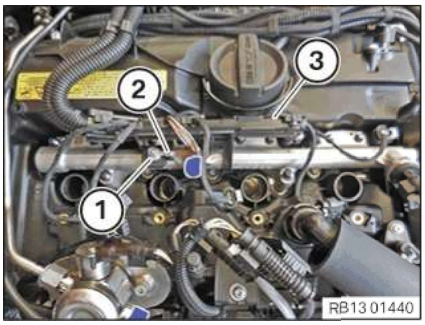
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6	Tightening torque	5 Nm

91 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

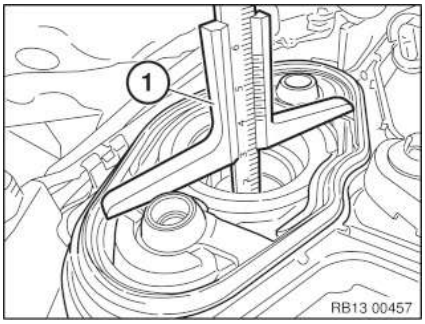
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

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- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

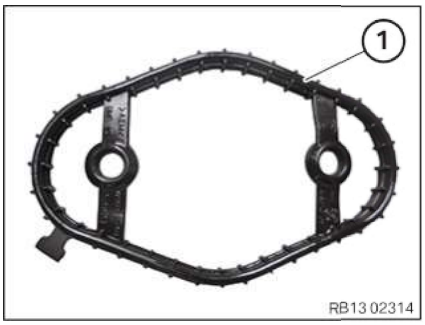
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

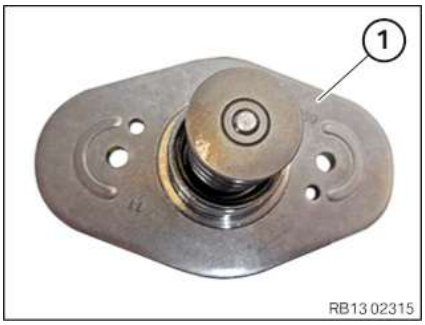
The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

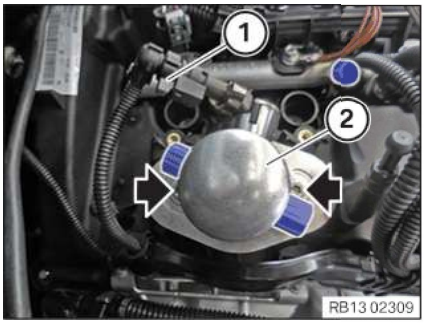
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

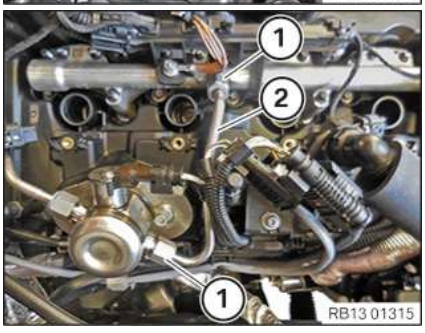
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

92 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

93 – Installing fuel delivery line

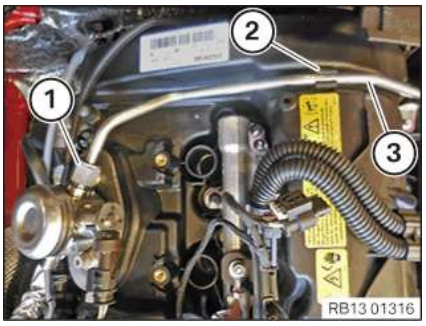
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RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

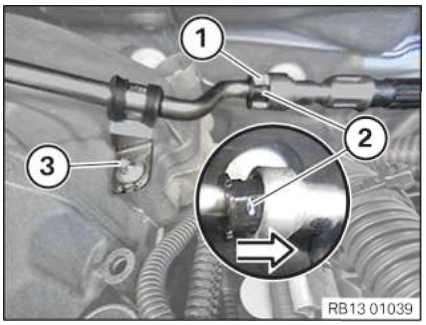
- Route all cables without abrasions, do not trap and crush.



- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

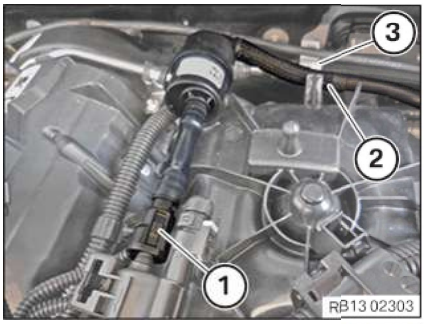
M14		Tightening torque	31 Nm



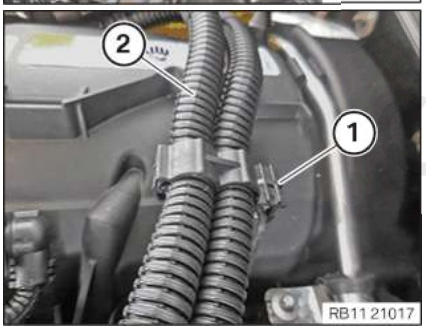
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

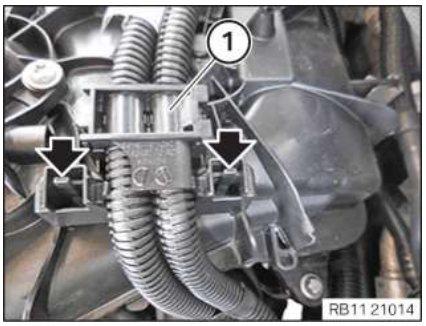
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).



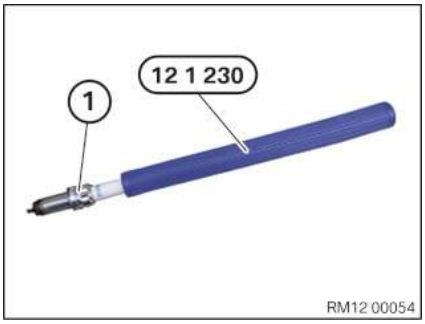
- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

94 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.

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- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

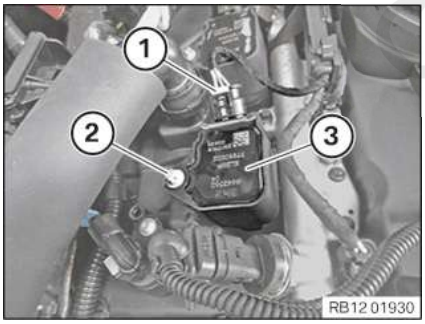
Spark plugs

M12x1.25		Tightening torque	23 Nm

95 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.



▸ **Install ignition coil.**

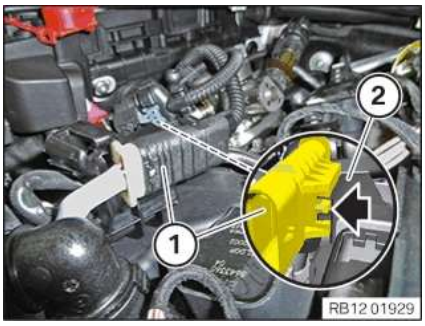
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

  The connector (1) must engage audibly.

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- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

96 – Install the control sensor

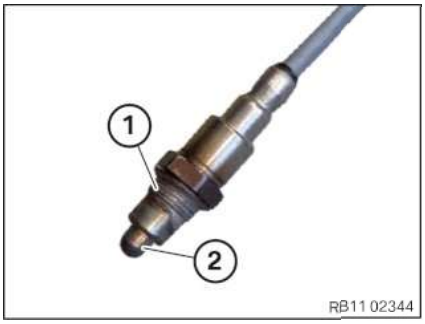
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

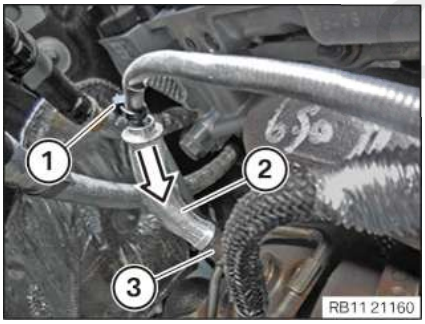
  (2) = Sensor ceramics



- Screw the control sensor (1) in and tighten it with the special tool 0 491 074 (11 7 020).

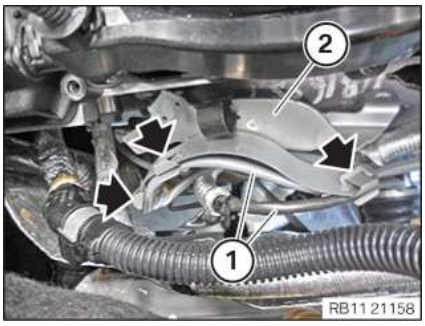
Control sensor

M18x1.5	Tightening torque	50 Nm



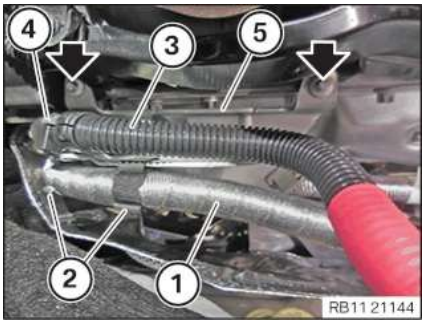
- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

  Parts: Cable strap
- Guide in and install the cable strap (1).



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).

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CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

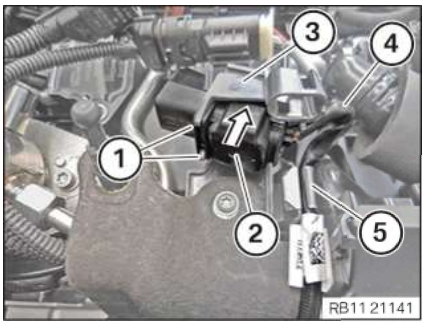
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

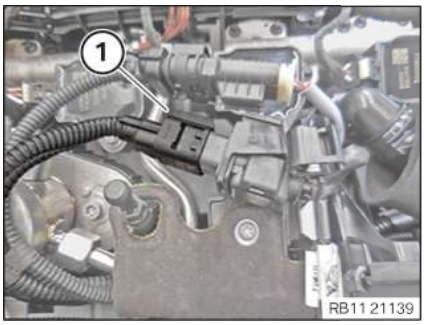
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).



- Guide in the connector (2) in the direction of arrow at the carrier plate (3) and install.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).

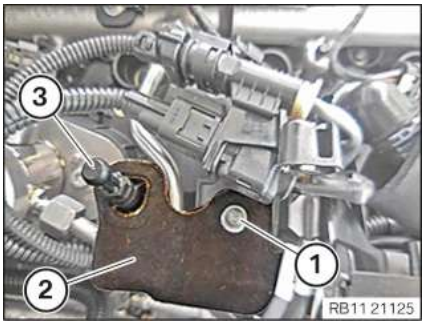


- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Connect and lock the connector (1).
- Guide the connector (1) into the carrier plate in the direction of arrow.
- Ensure the connector (1) audibly engages with the carrier plate.

97 – Install the cylinder head cover acoustic cover

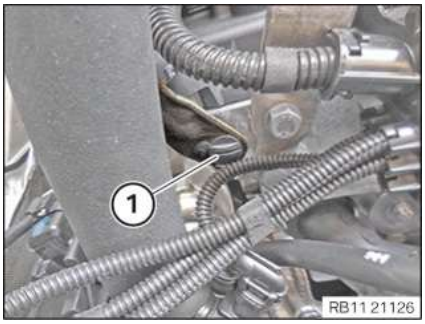


- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

Acoustic cover (side) to cylinder head cover

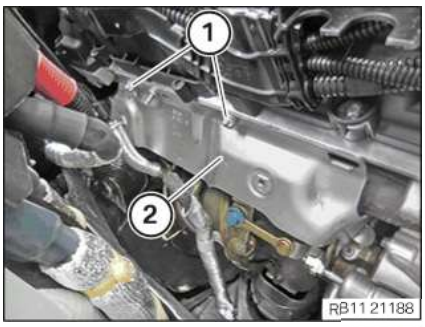
TS6 x 20			8 Nm

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- Secure the clip (1).

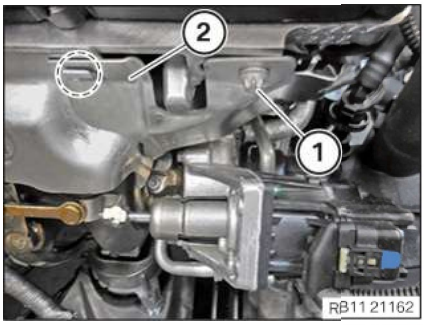
98 – Installing the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

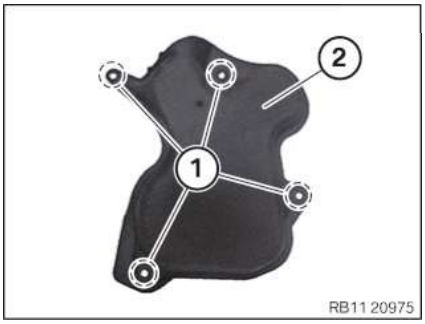


- Tighten down screw (1).

Heat shield to clamping strip

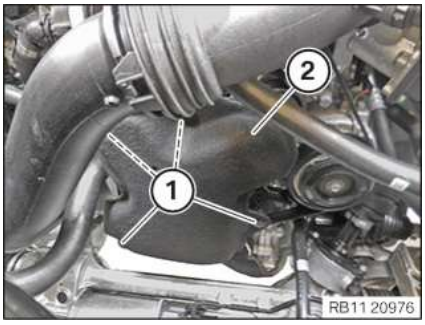
M6 x 12	Tightening torque	8 Nm

99 – Install the acoustic cover for the engine at the front



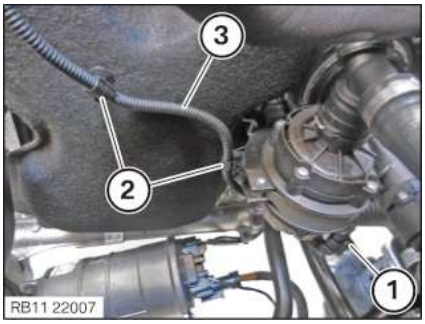
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



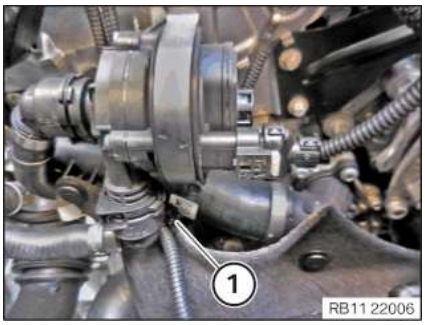
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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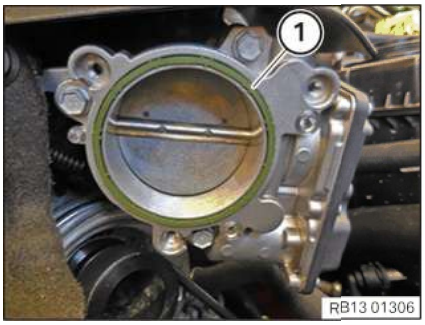
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



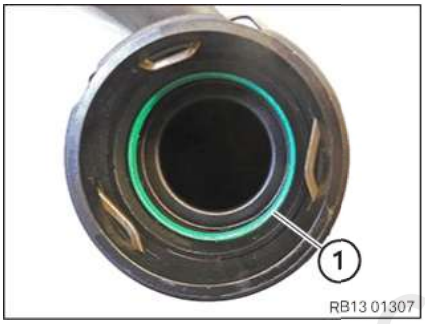
- Secure clamps (1).

100 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring

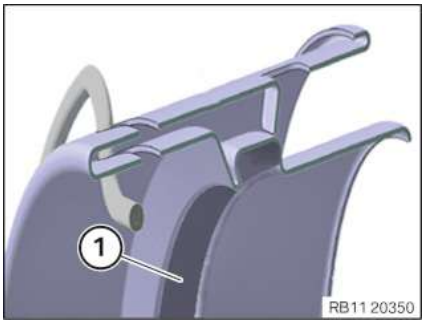


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

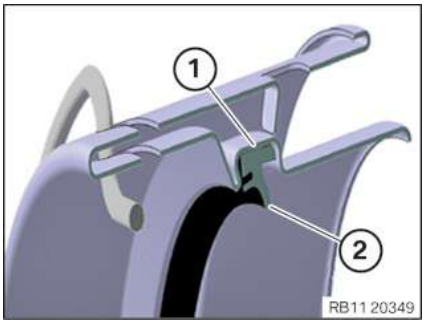
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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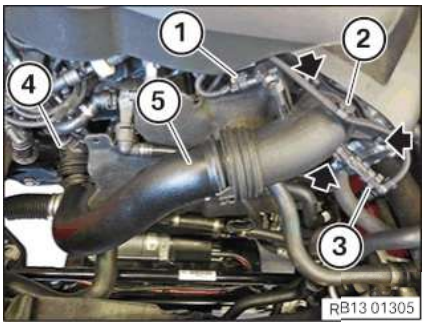
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

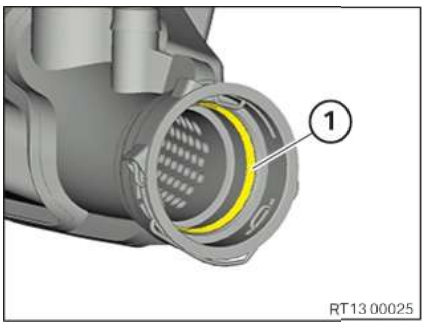
Charge air line to throttle body

M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

101 – Installing the clean air pipe with resonator

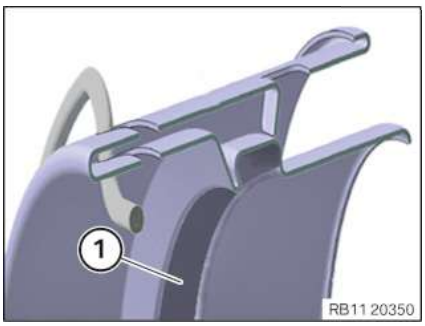


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

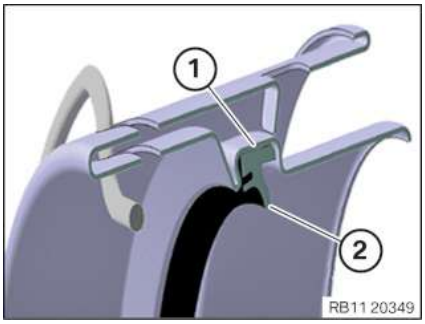
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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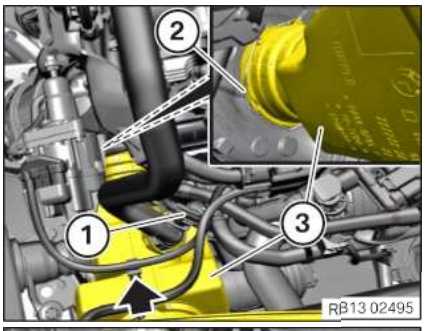
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

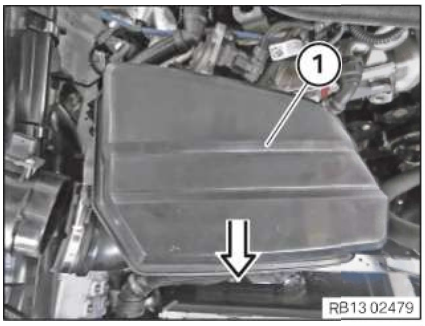
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



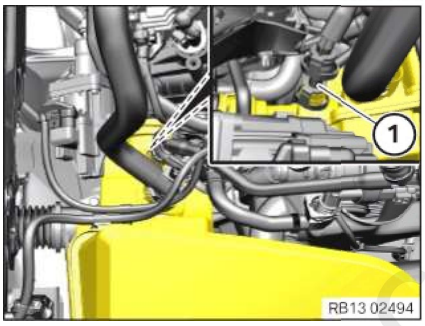
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

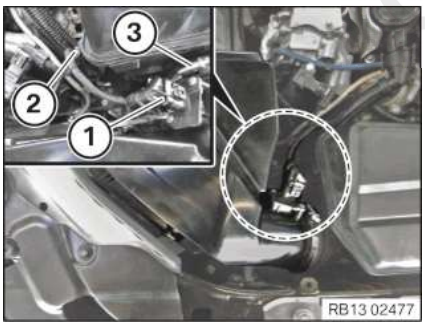
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

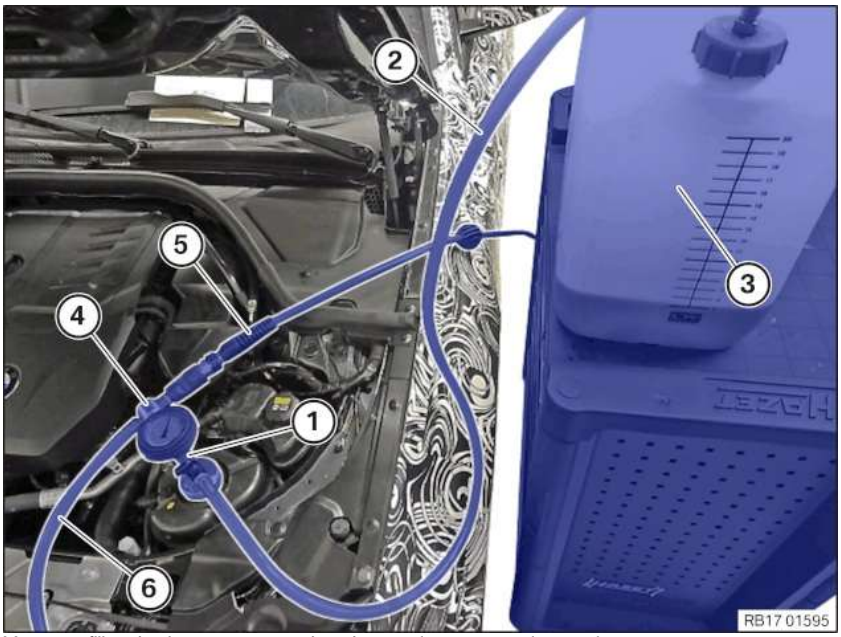
  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

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TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

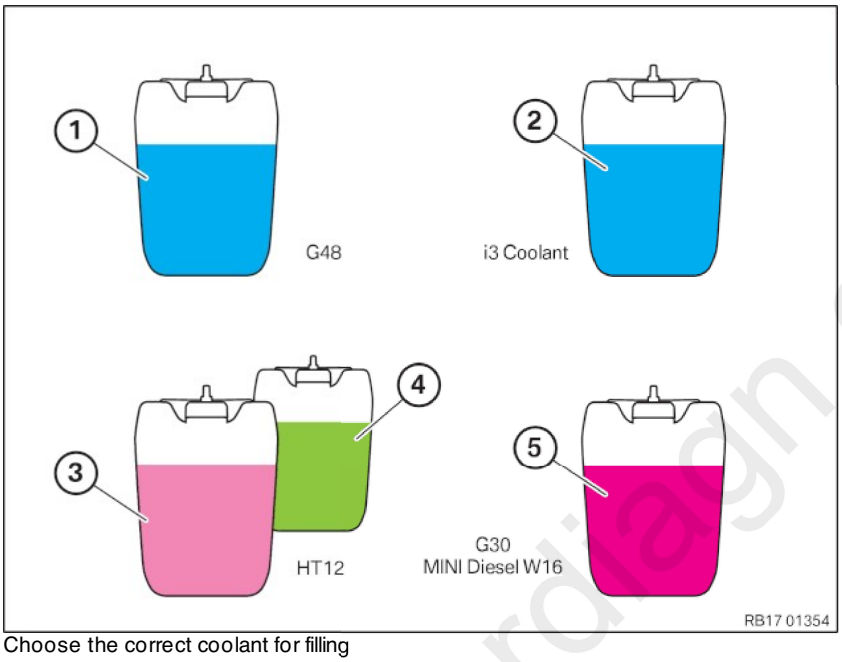
A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. **G48 (Blue)** G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.
2. **i3 coolant (blue)** is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.
3. **HT12 (Pink)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
4. **HT12 (Green)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
5. **G30 (Pink)** must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

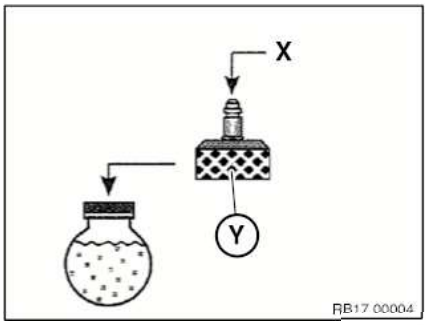
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

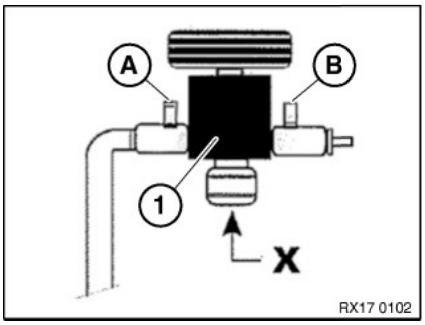
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

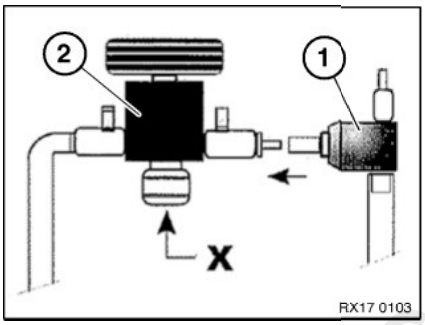
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



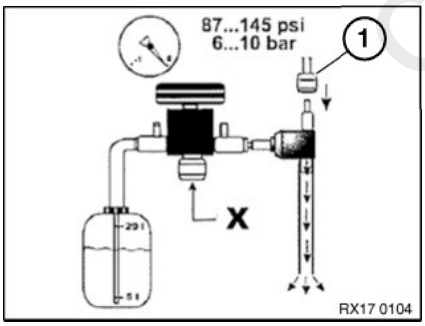
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



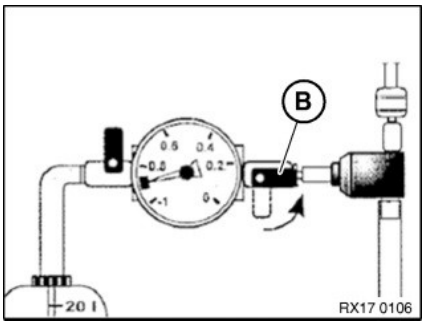
- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.

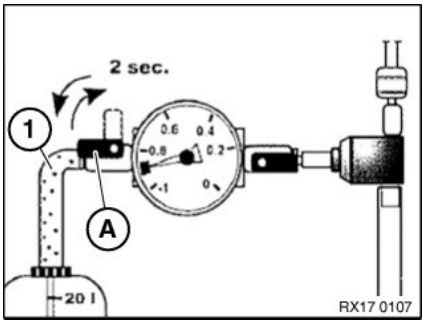


- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.



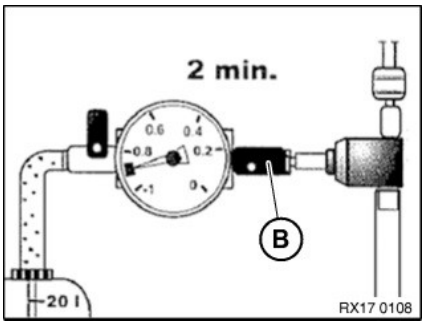
- Open shut-off valve (B).
  The venturi nozzle produces a flow noise.

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- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

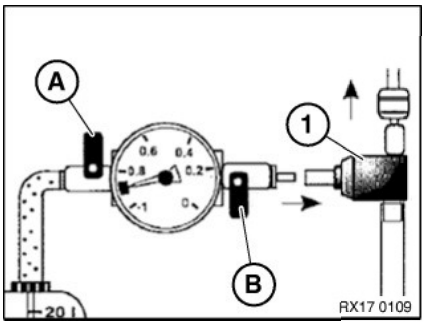


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

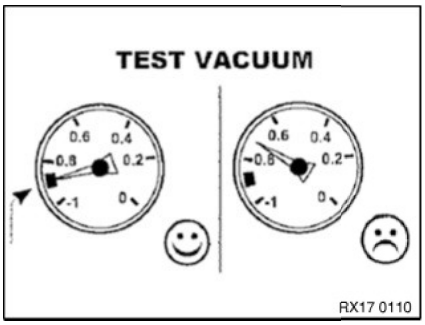
TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).



Check

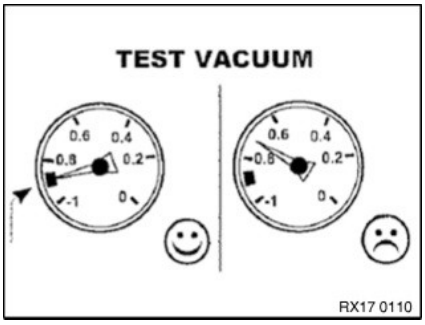
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.



Check

- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

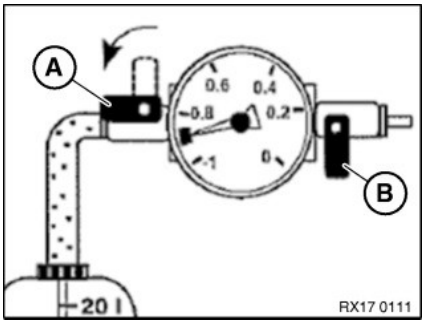
Result

» Vacuum remains constant.

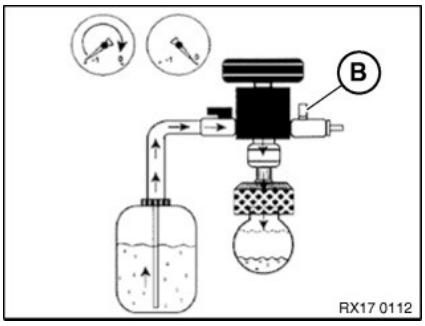
Measure

- Continue with filling.

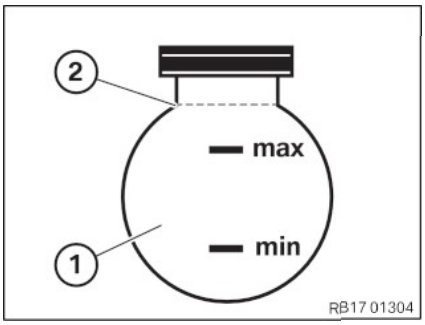
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- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



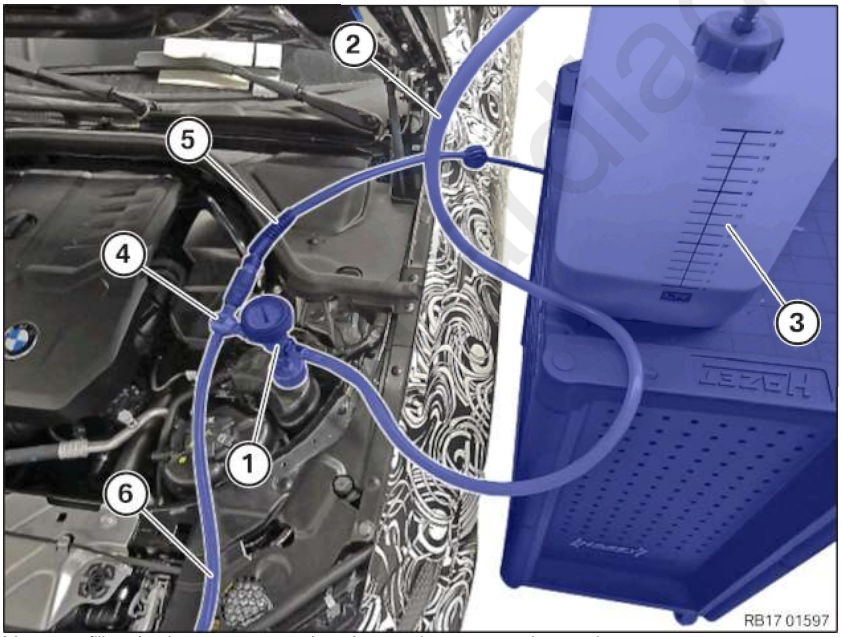
- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

103 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity

of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

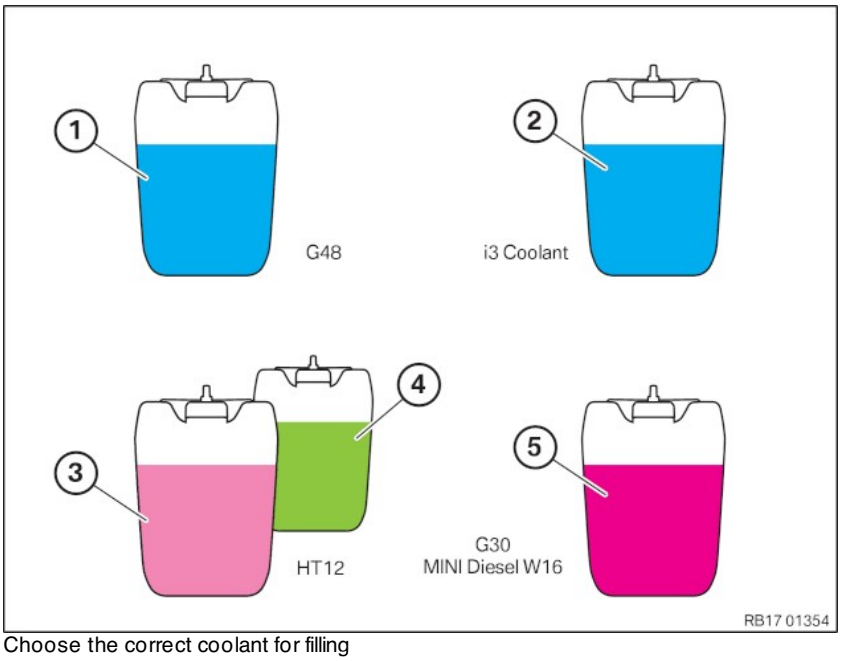
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. **G48 (Blue)** G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.
2. **i3 coolant (blue)** is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.
3. **HT12 (Pink)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
4. **HT12 (Green)** HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.
5. **G30 (Pink)** must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

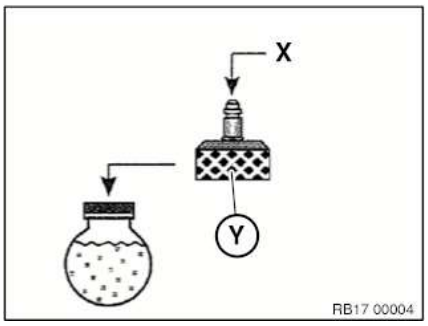
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

Capacity of low-temperature coolant circuit G20

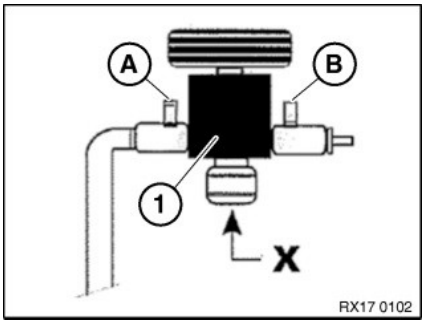
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

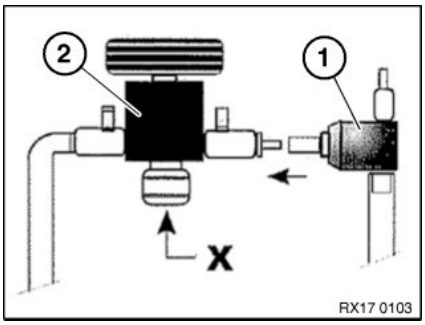


- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

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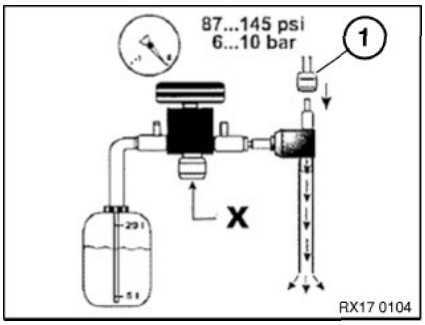


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



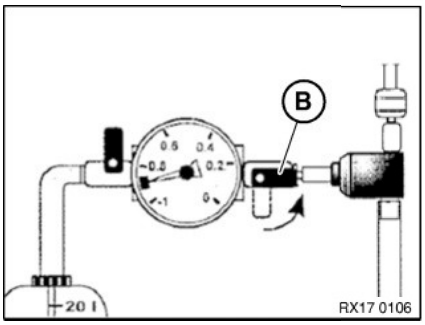
- Connect Venturi nozzle (1) to the vacuum filler device (2).

  (X)is the connection on the coolant expansion tank.



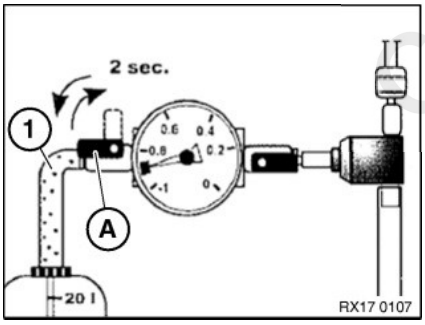
- Connect compressed air (1).

  (X)is the connection on the coolant expansion tank.



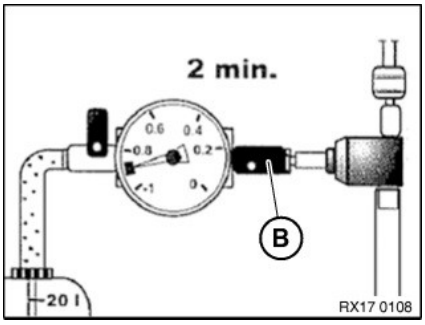
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.



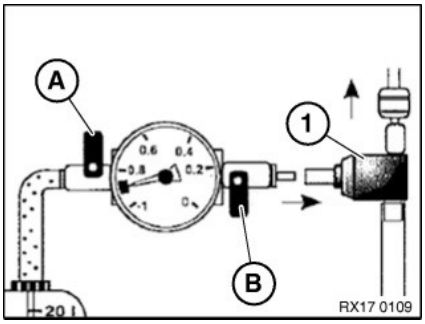
- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

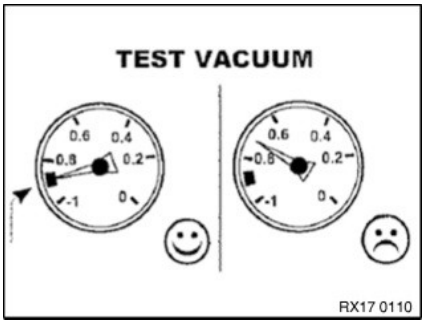
- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).

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- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

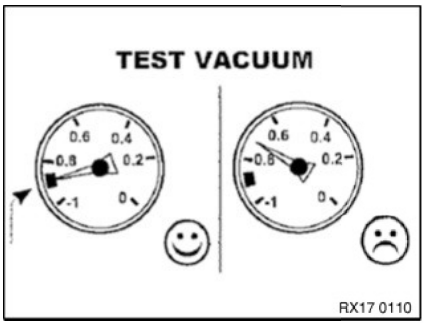
Result

» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



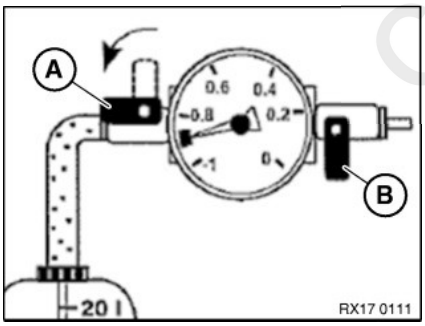
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

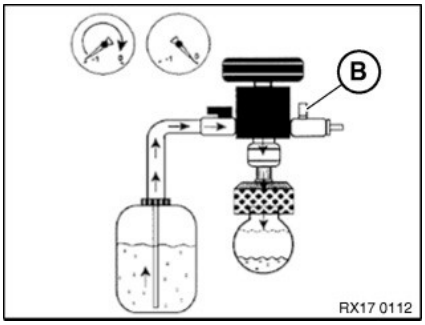
» Vacuum remains constant.

Measure

- Continue with filling.

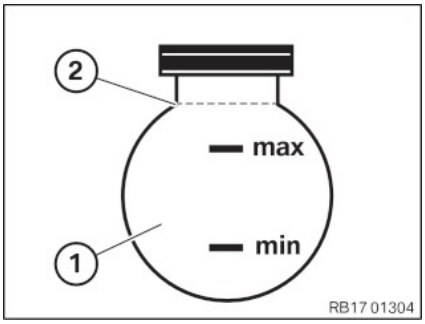


- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).

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- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

104 – Disconnecting all battery earth leads



- See additional information.

105 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

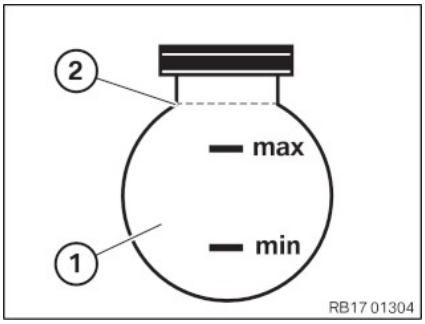
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

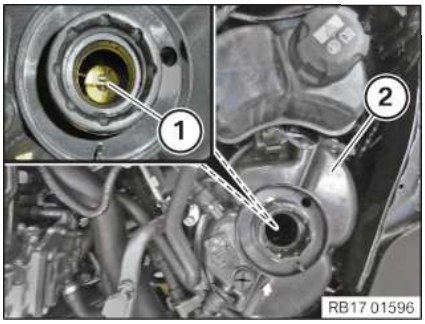
  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

  The engine speed **drops** to the idle speed.
- Observe the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

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106 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

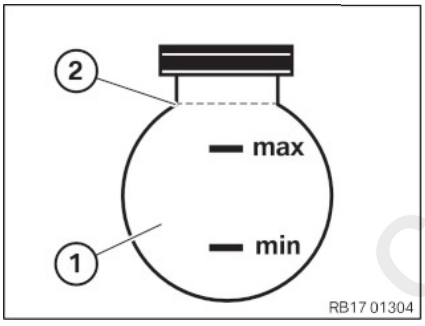
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

  The cooling system bleeding routine will start.

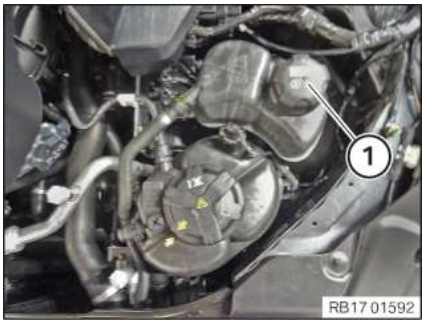
  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.

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- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

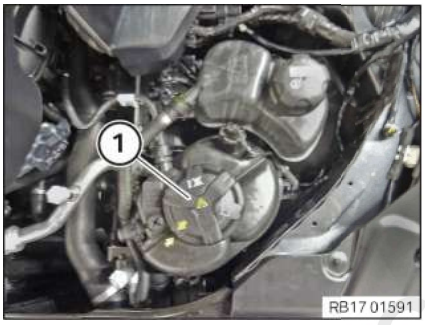
107 – Check the high-temperature cooling system for watertightness

WARNING

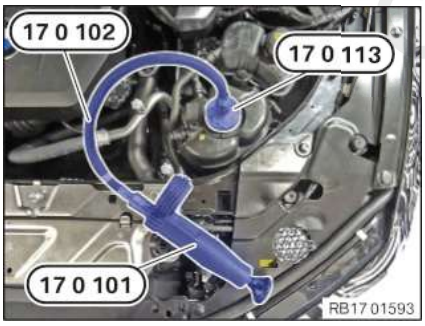
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Loosen sealing cap (1).



- Attach the special tool 0 494 418 (17 0 101) with special tools 0 494 419 (17 0 102) and 0 494 642 (17 0 113) from the set of special tools 0 494 417 (17 0 100).
- Build up excess pressure and wait for approximately 2 minutes.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

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TECHNICAL INFORMATION

If the described test step is not completed successfully: repeat test step twice. Only replace the sealing cap after three tests with an incorrect opening pressure.

When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has cooled down. These traces of coolant do not indicate whether the sealing cap is defective or not.

Escaping coolant vapours when the vehicle is at standstill may cause the pressure relief valve to stick to the sealing cap. This may cause an incorrect opening pressure.

- Screw on sealing cap (1) on special tool 0 494 643 (17 0 114) from the set of special tools 0 494 417 (17 0 100).
- Build up the pressure with special tools 0 494 418 (17 0 101) and 0 494 419 (17 0 102) from the set of special tools 0 494 417 (17 0 100).
- Observe on the pressure measuring device when the opening pressure has been reached.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

108 – Checking low-temperature cooling system for watertightness

WARNING

Hot surfaces.

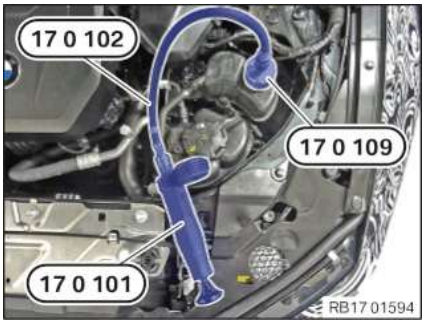
Risk of burning!

- Perform all work only on components that have cooled down.



- Loosen sealing cap (1).

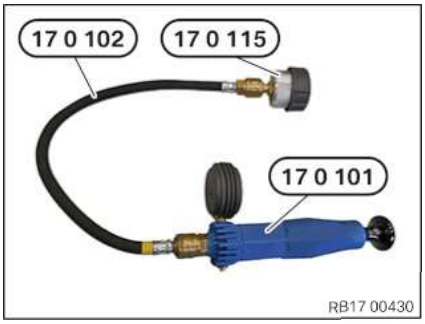
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- Attach the special tool 0 494 418 (17 0 101) with special tools 0 494 419 (17 0 102) and 0 494 426 (17 0 109) from the set of special tools 0 494 417 (17 0 100).
- Build up excess pressure and wait for approximately 2 minutes.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar



TECHNICAL INFORMATION

If the described test step is not completed successfully: repeat test step twice. Only replace the sealing cap after three tests with an incorrect opening pressure.

When driving at high ambient temperatures, the design may cause the pressure relief valve in the sealing cap to open slightly and air to escape together with dissolved coolant. This coolant vapour condenses on the surface of the coolant expansion tank and leaves traces of coolant when the vehicle has cooled down. These traces of coolant do not indicate whether the sealing cap is defective or not.

Escaping coolant vapours when the vehicle is at standstill may cause the pressure relief valve to stick to the sealing cap. This may cause an incorrect opening pressure.

- Screw on sealing cap (1) on special tool 0 495 889 (17 0 115) from the set of special tools 0 494 417 (17 0 100).
- Build up the pressure with special tools 0 494 418 (17 0 101) and 0 494 419 (17 0 102) from the set of special tools 0 494 417 (17 0 100).
- Observe on the pressure measuring device when the opening pressure has been reached.

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system

Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

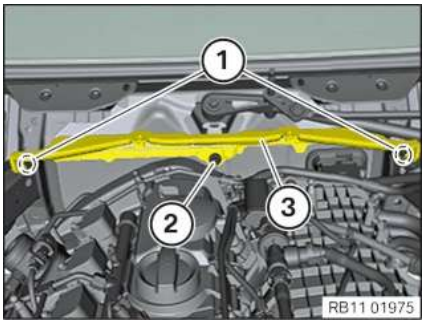


- Close sealing cap (1).

109 – Check engine oil level

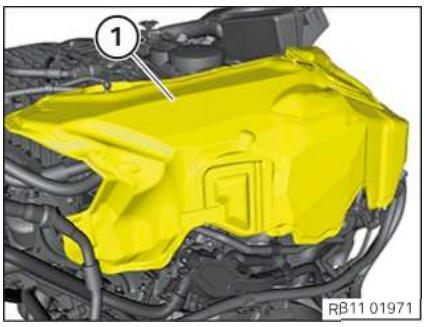
- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

110 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

111 – Installing acoustic cover at rear

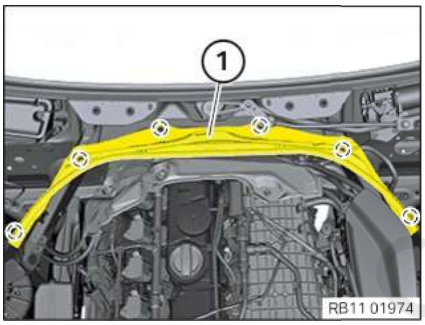


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

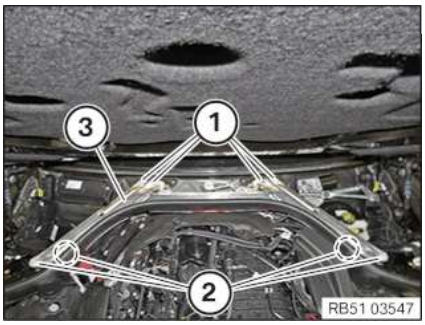
112 – Installing the centre bulkhead upper part



- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

113 – Installing cowl panel cover

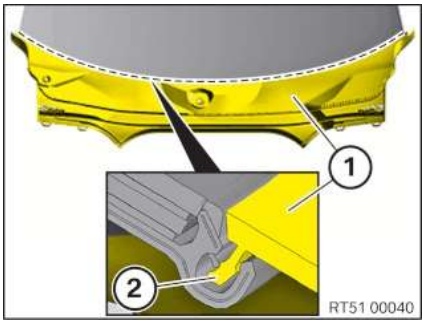
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RISK OF DAMAGE

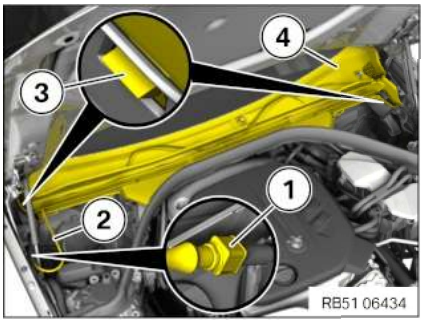
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

114 – Installing both wiper arms

NOTICE

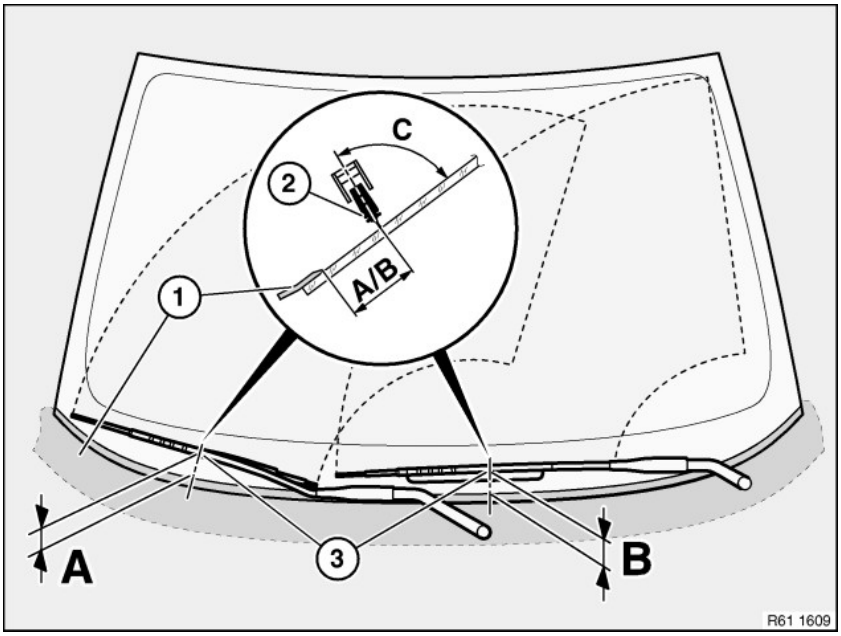
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.

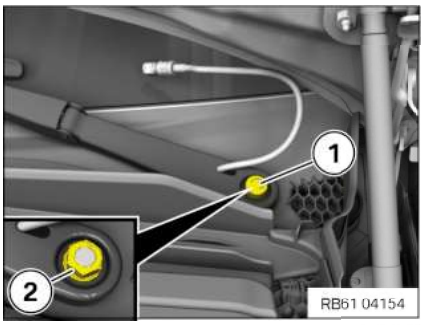
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- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

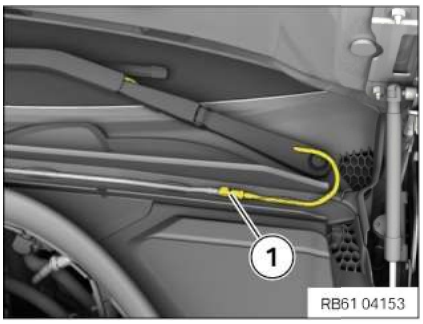


- Tighten nut (2).

Windscreen wiper arm

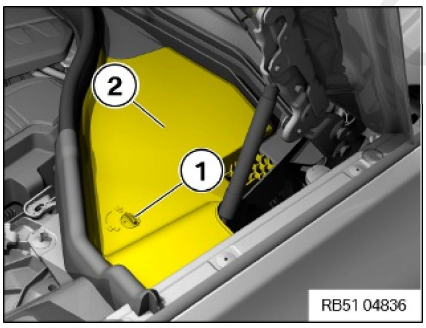
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



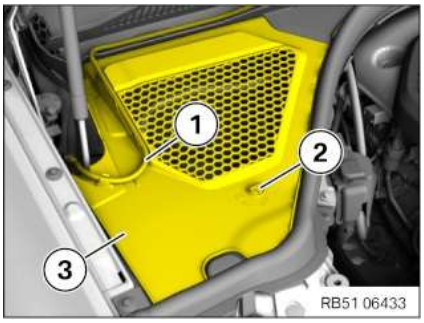
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

115 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

116 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

117 – Install the seal for the bonnet

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- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

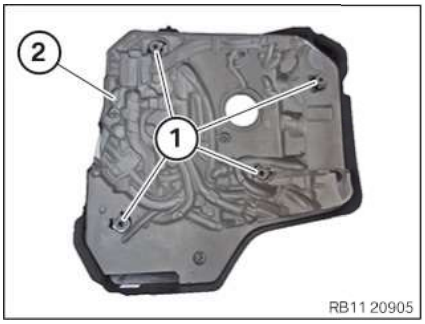
118 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

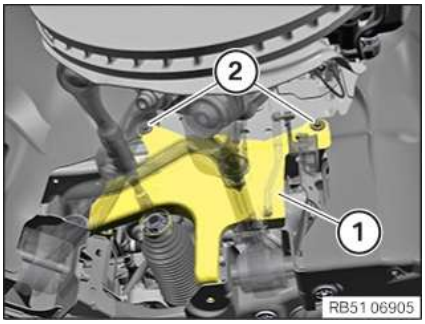


- Clip in the acoustic cover (1) into the holders in the **marked** areas.
  The acoustic cover (1) must audibly engage into place.

119 – Install the cover of the steering assembly

Prerequisite

The underbody protection of the steering gear is removed.



- Position the cover (1).
- Tighten the screws (2).

Cover, steering unit

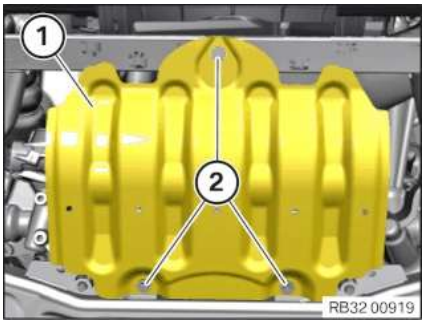
Screw		Tightening torque	3 Nm

120 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

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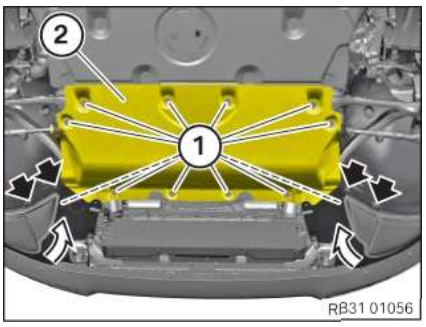


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

121 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

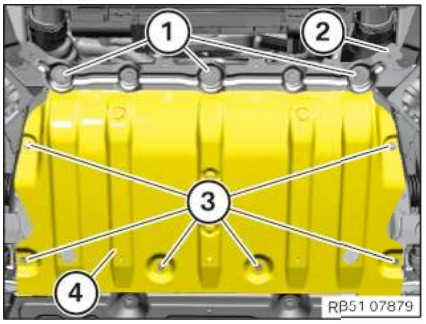
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

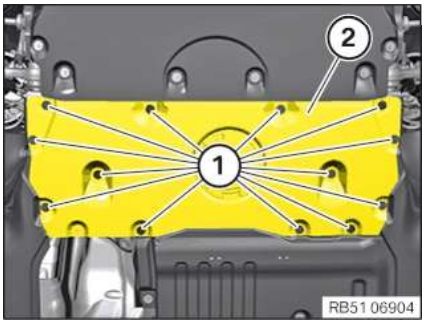
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

122 – Installing the centre underbody protection



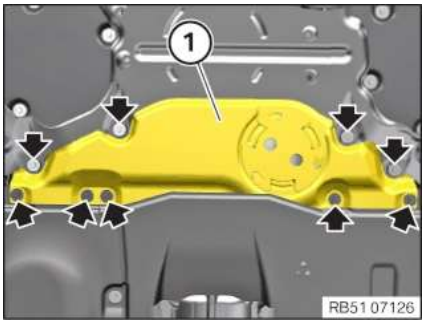
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

  Guide in and install the centre of underbody protection (1).

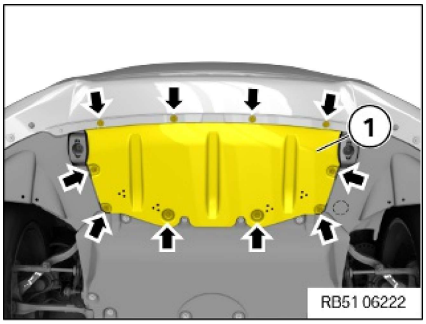
  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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123 – Installing the front underbody protection



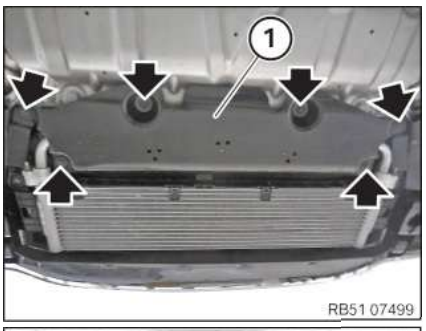
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



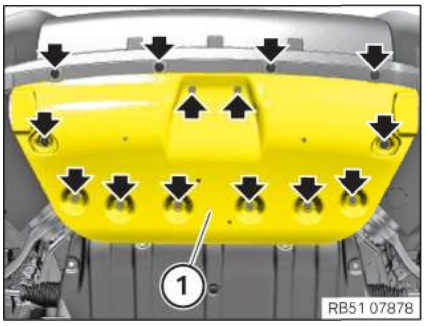
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

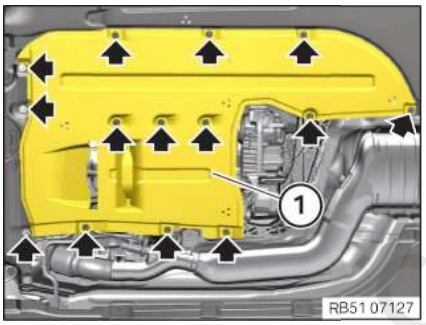
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

124 – Installing underbody protection at rear



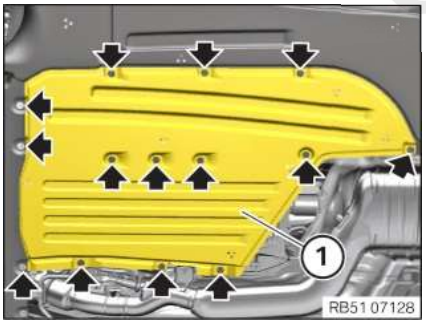
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

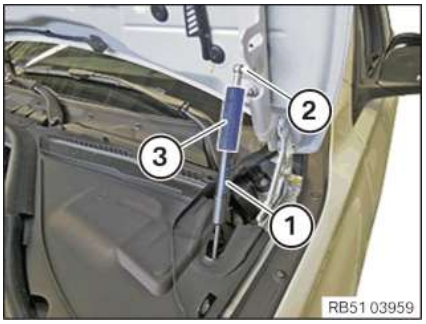
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

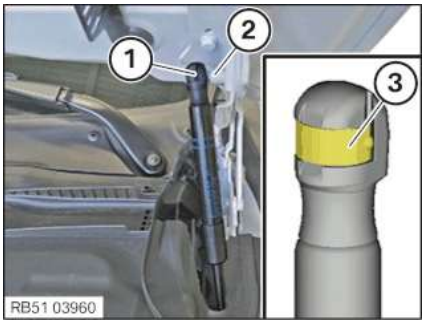
Hexagon screw		Tightening torque	3 Nm

125 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side			Used in step 41
Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head			Used in step 496474
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 496474
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 58
M8		Tightening torque	21,5 Nm

Cylinder head to crankcase			Used in step 63
M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °

Cylinder head bolt to timing case cover			Used in step 63
M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head			Used in step 63
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head			Used in step 63
M6x16			8 Nm

Cable routing to cylinder head, rear			Used in step 63
M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head			Used in step 63
M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft			Used in step 63
M6x16		Tightening torque	8 Nm

Manifold support for intake air to cylinder head			Used in step 63
M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head			Used in step 63
M6		Tightening torque	7 Nm

Standard screw connection M6			Used in step 63
M6			8 Nm

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Oil feed line to exhaust turbocharger/crankcase — Used in step 63

M6x12		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 7071

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 73

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Coolant line to coolant pump/cylinder head — Used in step 75

M6x20		Tightening torque	8 Nm

Intake plenum to cylinder head — Used in step 76

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 76

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 76

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 76

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 76100

M6		Tightening torque	8 Nm

Control unit holder on spring strut dome — Used in step 78

Hexagon screw		Tightening torque	8 Nm

Oil return line to exhaust turbocharger/crankcase — Used in step 81

M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger — Used in step 8283

M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger — Used in step 82

M6		Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 83

M6 x 12		Tightening torque	8 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger — Used in step 84

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Catalytic converter to holder — Used in step 84

M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder — Used in step 84

M8	Renew nut.	Tightening torque	19 Nm

Rear silencer to body / bumper support — Used in step 85

M8	Replace nuts.	Tightening torque	19 Nm

Exhaust system to rear axle carrier — Used in step 85

Nut M8	Renew nut.	Tightening torque	19 Nm

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Front silencer / petrol particulate filter on transmission bracket — Used in step 85

M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter — Used in step 85

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter — Used in step 85

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

Connecting support to tunnel — Used in step 86

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Cylinder head cover to cylinder head — Used in step 87

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 87

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 8796

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 90

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 91

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 92

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 93

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 93

M6 screw		Tightening torque	6,5 Nm

Spark plugs — Used in step 94

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 95

Screw		Tightening torque	8 Nm

Control sensor — Used in step 96

M18x1.5		Tightening torque	50 Nm

Acoustic cover (side) to cylinder head cover — Used in step 97

TS6 x 20			8 Nm

Heat shield to cylinder head — Used in step 98

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 98

M6 x 12		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 101

Clamp		Tightening torque	3 Nm

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Bulkhead upper part to bottom bulkhead			Used in step 112
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 112
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 112
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 114
Combination hexagon nut		Tightening torque	35 Nm

Cover, steering unit			Used in step 119
Screw		Tightening torque	3 Nm

Bumper buffer device steering on front axle support			Used in step 120
M10		Tightening torque	56 Nm

Underbody protection of the steering gear			Used in step 121
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 121
Thermoplastic hexagon screw		Tightening torque	3 Nm

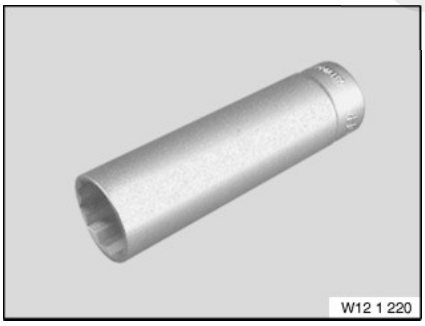
Holder underride guard to front axle support			Used in step 121
M10		Tightening torque	56 Nm

Underbody protection			Used in step 122124
Hexagon screw		Tightening torque	3 Nm

Underbody protection front			Used in step 123
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

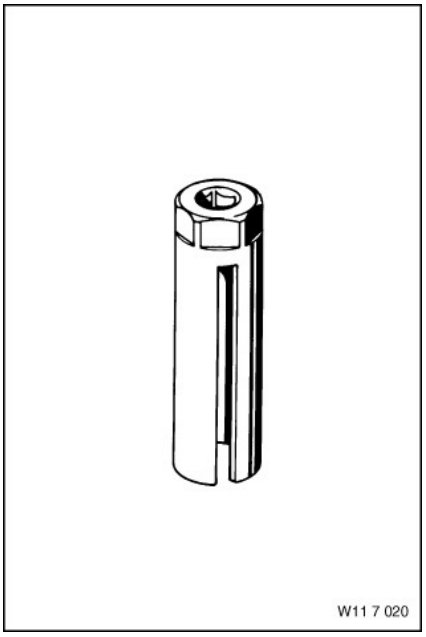
0 495 560 (12 1 220) Socket



Common		Used in step 2094
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

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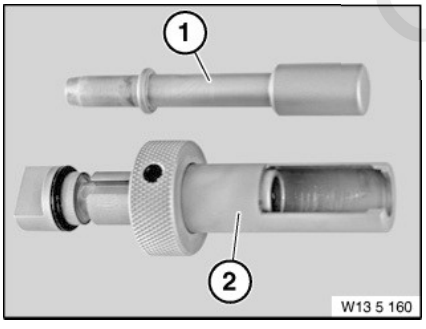
0 491 074 (11 7 020) Socket wrench insert



Common	Used in step 2396
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

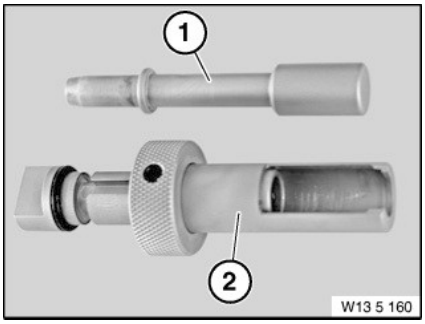
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0 496 567 (13 5 161) Fastener



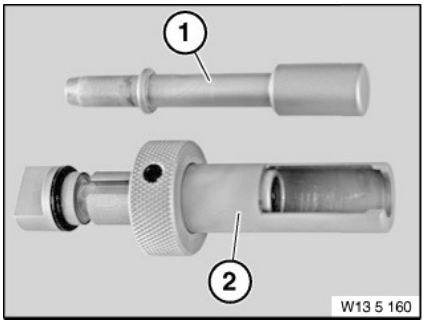
Common	Used in step 25
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 568 (13 5 162) Fastener



Common	Used in step 25
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener

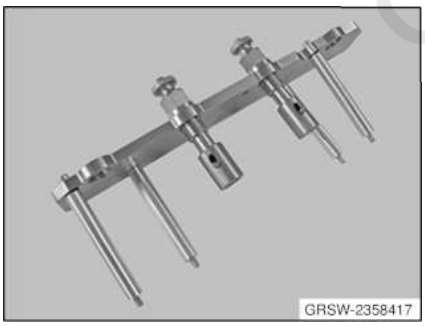


Common	Used in step 25
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

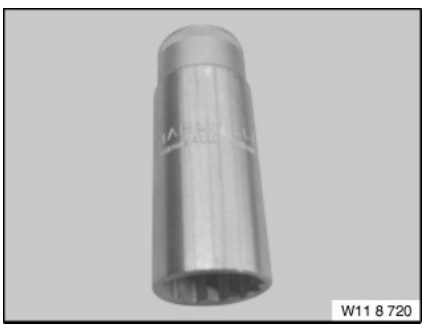
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

2 358 417 Device



Common	Used in step 26
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 26
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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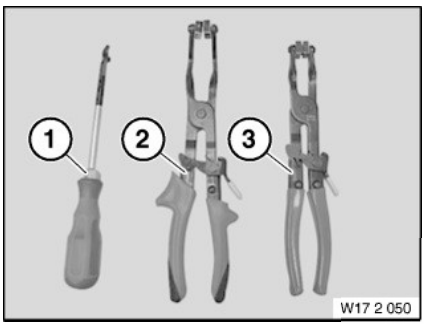
2 360 895 Pin wrench



Common Used in step 2888

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 794 (17 2 050) Pliers



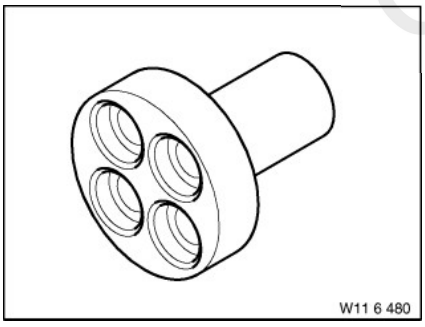
Common Used in step 4876

Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

0 493 380 (11 6 480) Connector



Common Used in step 49727491

Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud

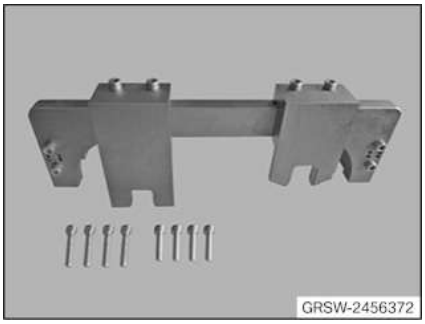


Common Used in step 497274

Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

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2 456 372 Gauge



Common	Used in step 4957647274
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 495774
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



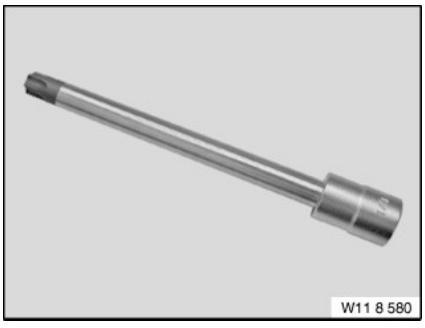
Common	Used in step 51527071
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 51527071
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

0 495 747 (11 8 580) Socket wrench



Common	Used in step 5863
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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2 220 718 Workshop crane



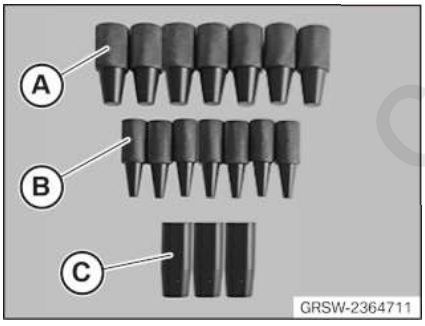
Common	Used in step 58
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

2 459 012 Holder



Common	Used in step 5863
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 364 711 Plug



Common	Used in step 6061
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

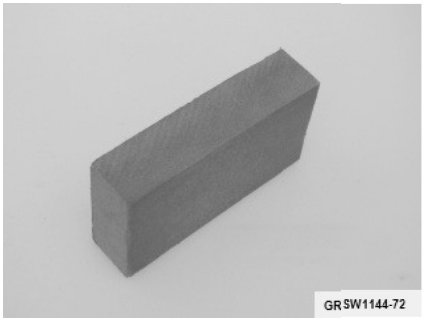
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0 495 103 (11 4 471) Scraper



Common	Used in step 61
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

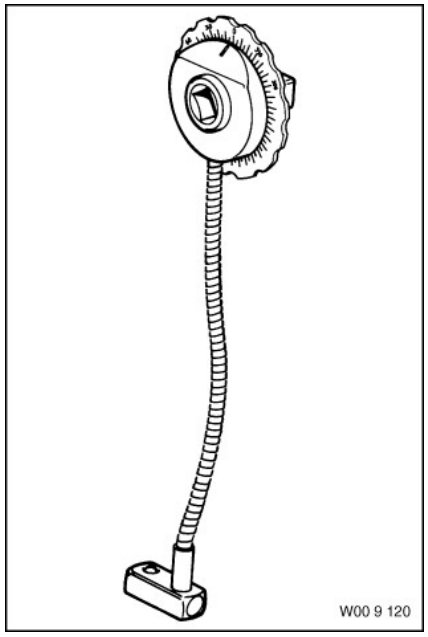
0 495 104 (11 4 472) Extractor



Common	Used in step 61
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

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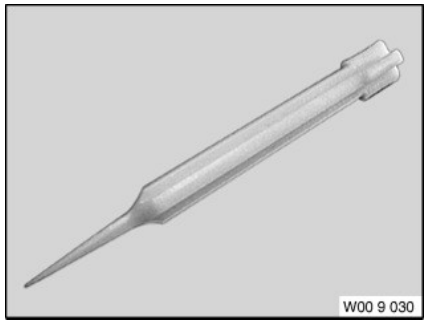
0 490 504 (00 9 120) Torque angle measuring dial



Common	Used in step 63
Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

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0 496 714 (00 9 030) Wedge



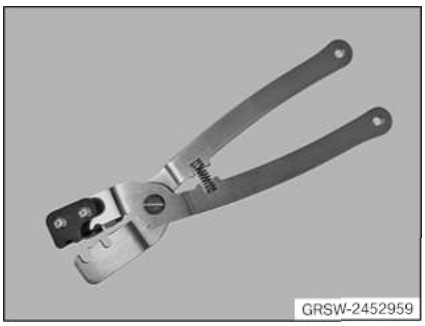
Common	Used in step 638283
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

2 455 654 Tensioning tool



Common	Used in step 6972
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 89
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



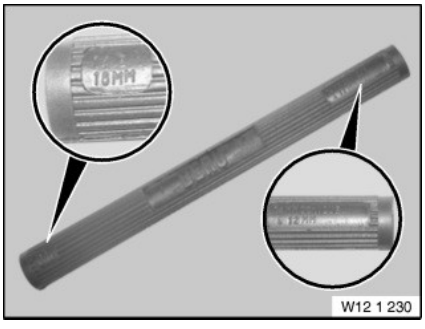
Common	Used in step 89
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 90
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

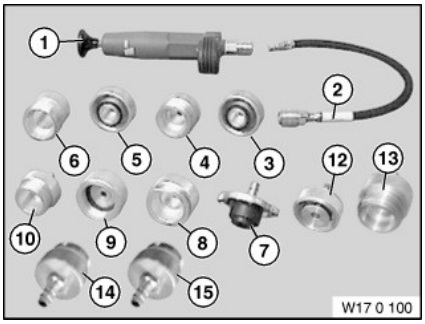
0 496 065 (12 1 230) Fitting aid



Common	Used in step 94
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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0 494 417 (17 0 100) Tester



Common		Used in step	102103107108
Usage	For checking engine cooling system on watertightness. For checking radiator cap.		
Included in the tool or work			
Storage location	Individual		
Replaced by			
In connection with			
SI-Number	01 07 02 (884)		

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

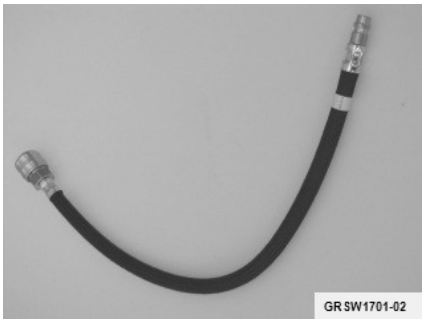
0 494 418 (17 0 101) Pump



Common		Used in step	107108
Usage			
Included in the tool or work	0 494 417		
Storage location			
Replaced by			
In connection with			
SI-Number			

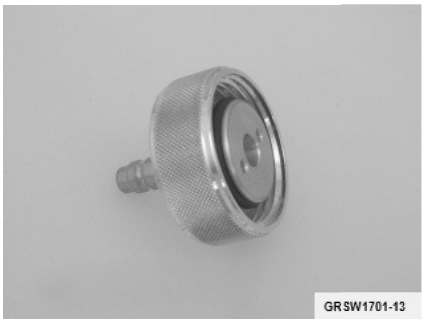
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0 494 419 (17 0 102) Hose



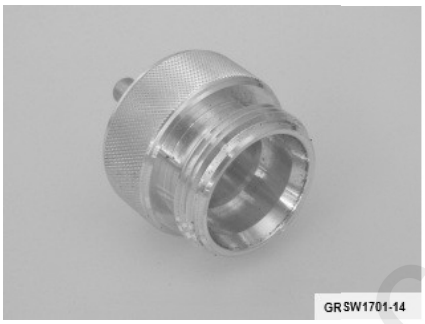
Common	Used in step 107108
Usage	(hose with quick-release coupling)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 642 (17 0 113) Adapter



Common	Used in step 107
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 643 (17 0 114) Adapter



Common	Used in step 107
Usage	For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

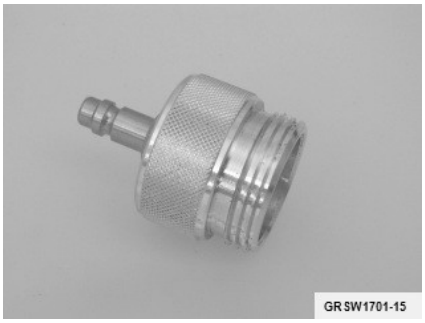
0 494 426 (17 0 109) Adapter



Common	Used in step 108
Usage	For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051
Included in the tool or work	0 494 417
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 495 889 (17 0 115) Adapter



Common		Used in step 108
Usage	For radiator cap Model series: N12, N14	
Included in the tool or work	0 494 417	
Storage location		
Replaced by		
In connection with		
SI-Number	01 26 06 (321)	

Overview Technical Data

Opening pressure of sealing cap / test pressure of high-temperature coolant circuit cooling system	Used in step 107108
Pressure relief valve opens when the pressure exceeds the ambient pressure.	min. 1,4 bar
Electric changeover valve must open at latest when the pressure is lower than the ambient pressure.	max. 0,1 bar
Test pressure for cooling system (gauge pressure)	1,5 bar

Distance from window pane edge to wiper blade	Used in step 114
Wiper arm right (A)	57,5 ±5 mm
Wiper arm left (B)	63,3 ±4 mm

Capacity of high-temperature coolant circuit G20	Used in step 102
B48B20O1/B46B20O1	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Capacity of low-temperature coolant circuit G20	Used in step 103
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	1580
11 00 ... Overview of consumables (Electronic Parts Catalogue)	96

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1104
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1104
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104

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61 20 900 Disconnecting and connecting battery earth lead	1104
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61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
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61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 20 900 Disconnecting and connecting battery earth lead	1104
61 35 ... Notes on ESD protection (Electro Static Discharge)	15161926284779
13 53 ... Clean the cylinder head around the injectors due to grit / dust	26
61 13 ... Unlocking and disconnecting different plug connections	262987
61 35 ... Notes on ESD protection (Electro Static Discharge)	2847
61 00 730 Encode/program control unit(s) (after vehicle test)	80
17 00 ... Notes for working on cooling system.	102103

Operating materials	**Used in step**
Main group 17	102103

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11 12 001 Replace the cylinder head cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

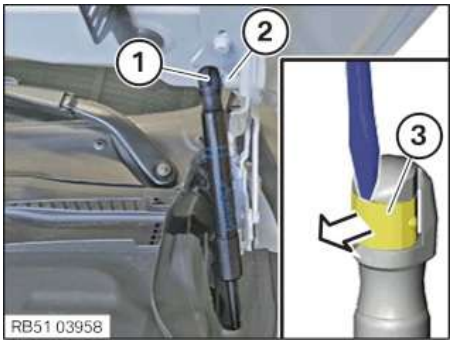
Engine compartment lid is open.

CAUTION

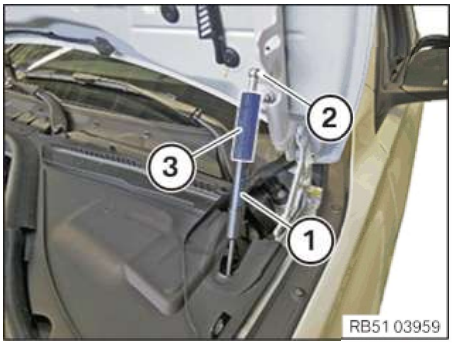
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

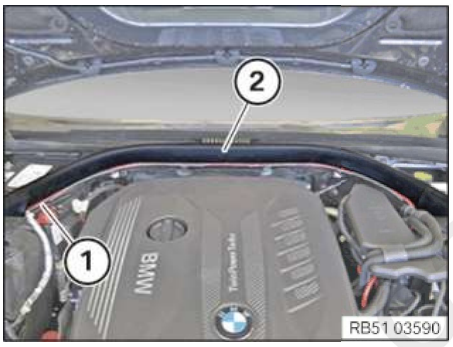


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

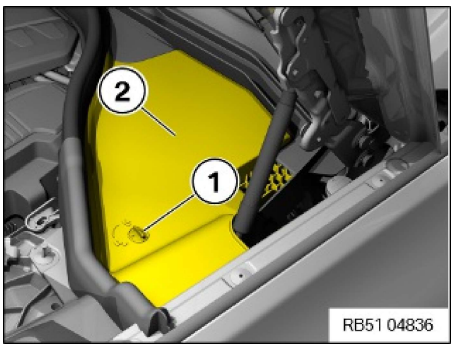
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

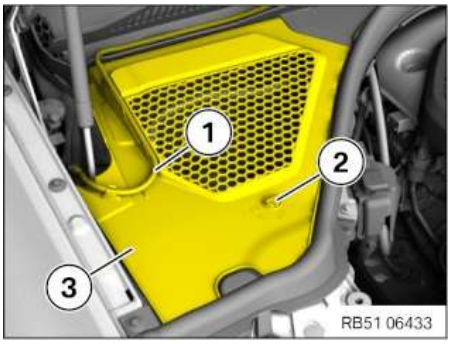
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

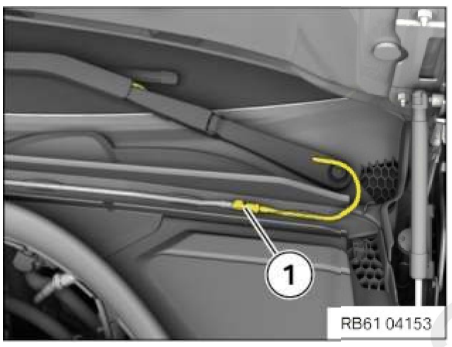
▶ **Remove the wiper arm**

RISK OF DAMAGE

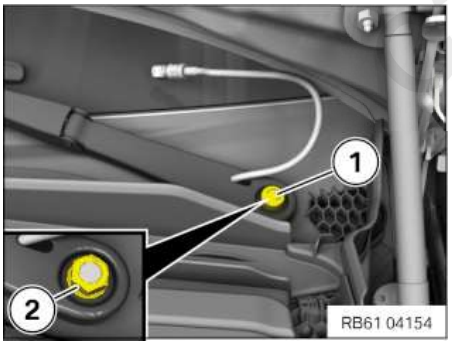
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

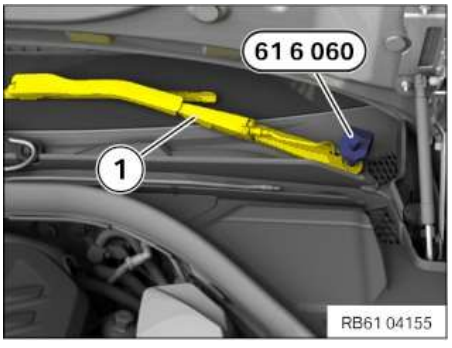
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



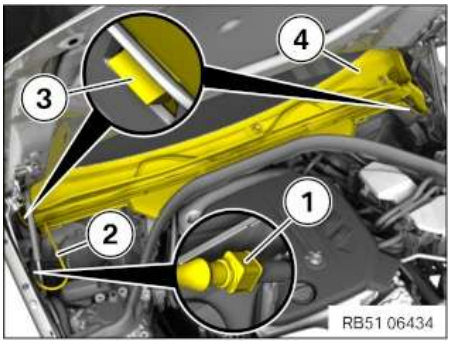
- Remove the protective cap (1).
- Loosen nut (2).



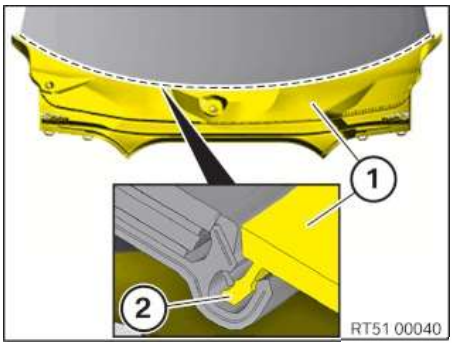
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

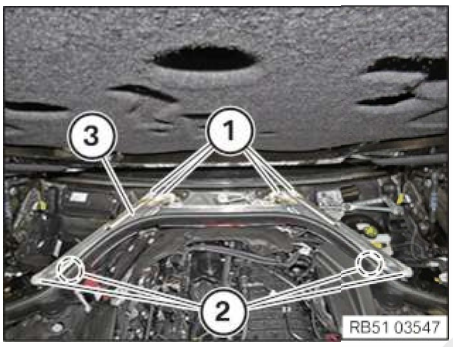


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

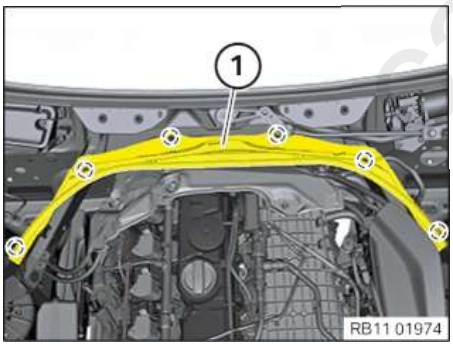
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

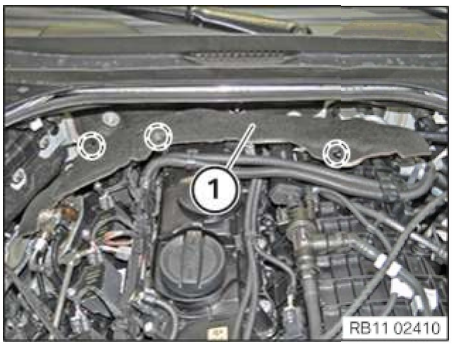
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



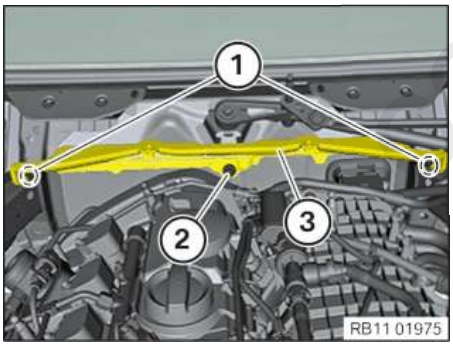
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

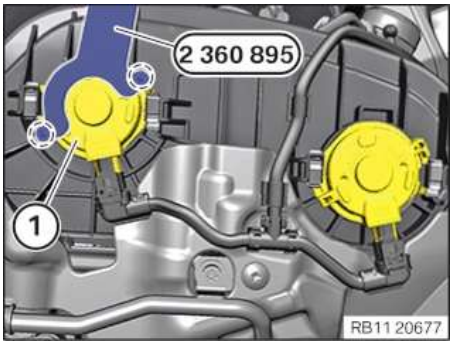
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

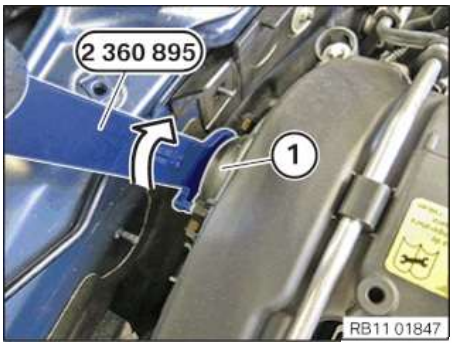
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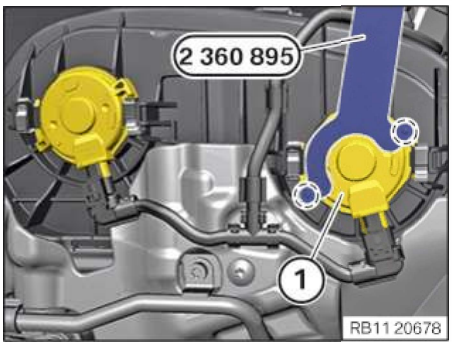
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



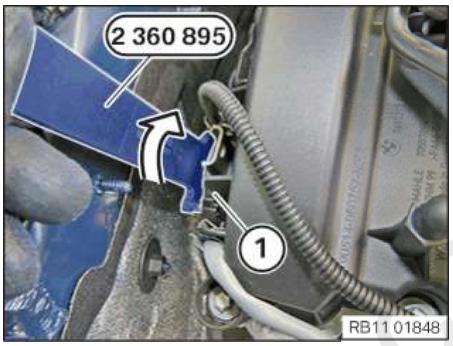
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



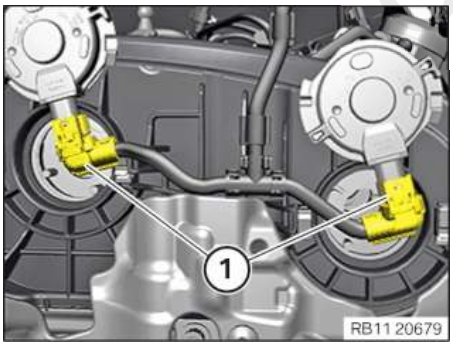
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

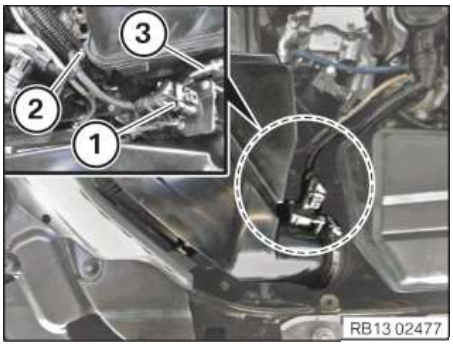
Risk of burning!

- Perform all work only on components that have cooled down.

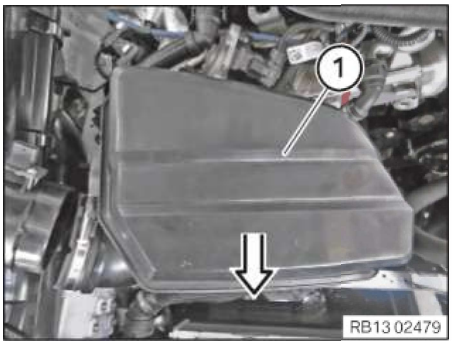
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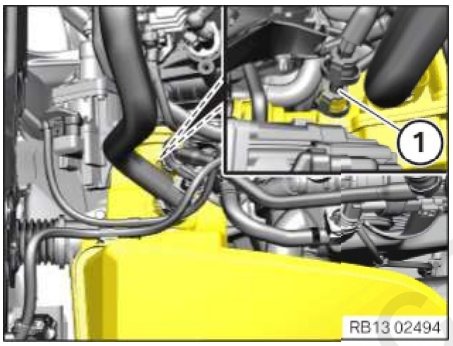
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



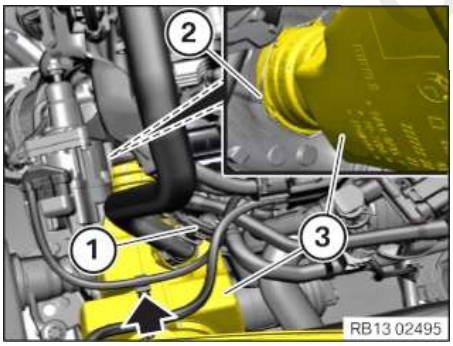
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



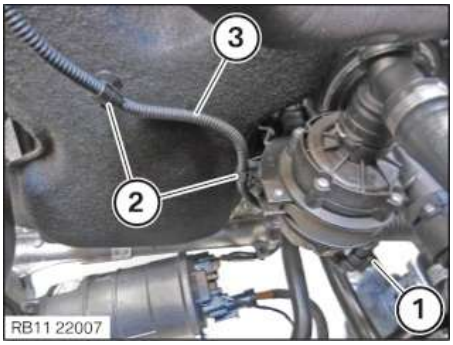
- Unlock and disconnect the tank ventilation line (1).



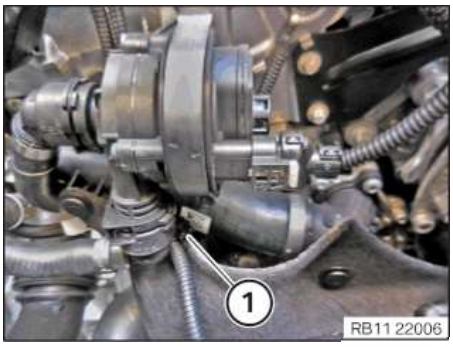
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

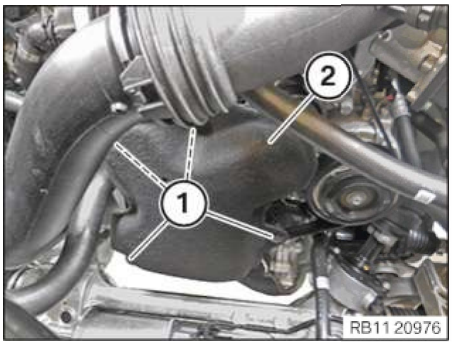
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

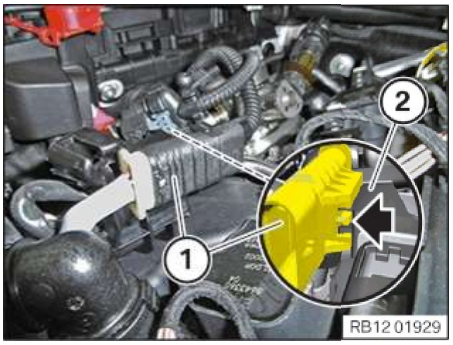
Electrostatic discharge.

Damage to or destruction of electrical components.

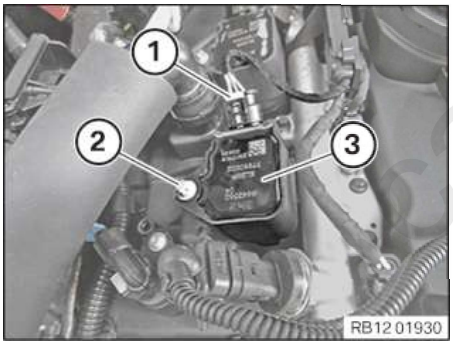
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.

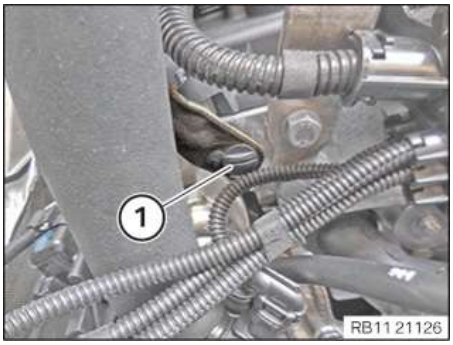


- Unlock connector (1) (arrow) and disconnect it from holder (2).



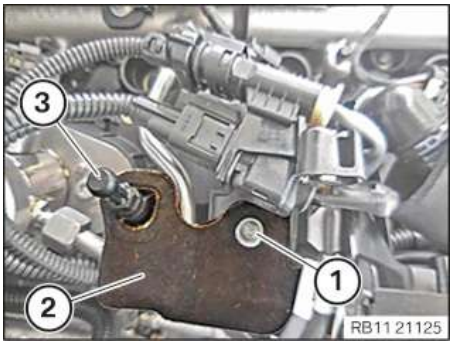
- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).

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- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

17 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

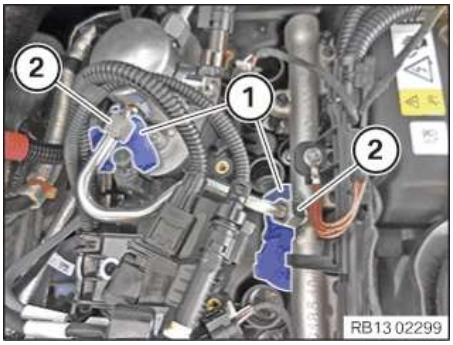
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

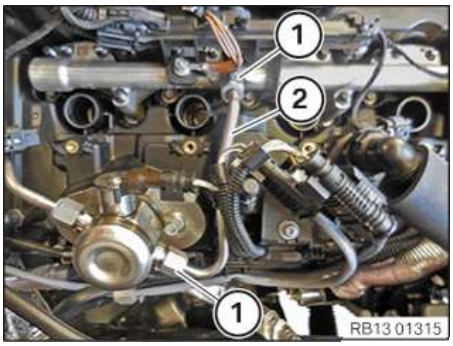


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

18 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

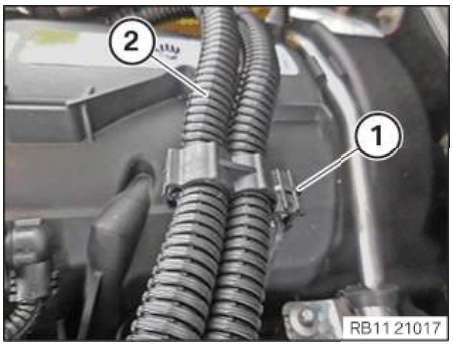
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

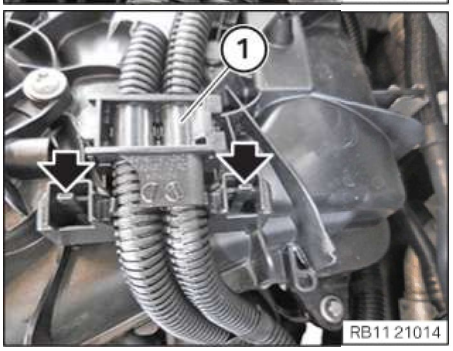
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

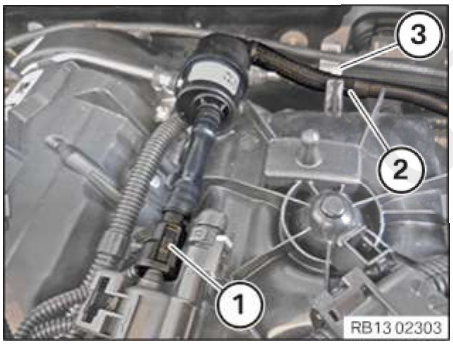
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



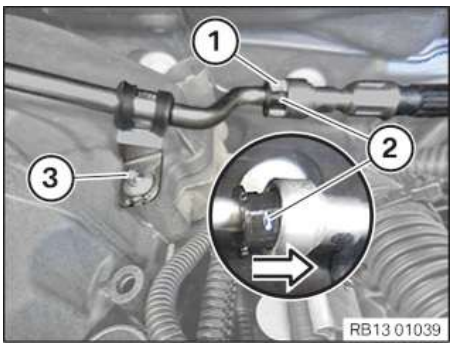
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

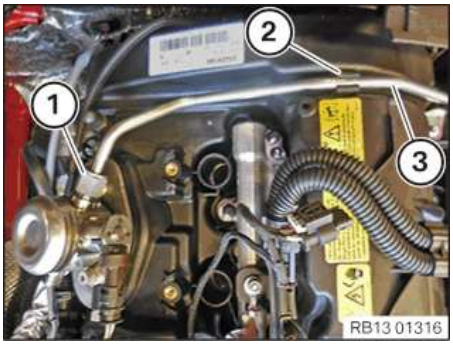


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

19 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

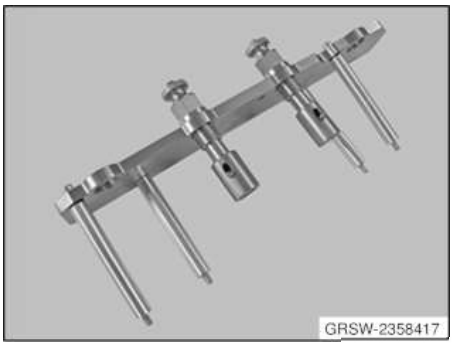
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



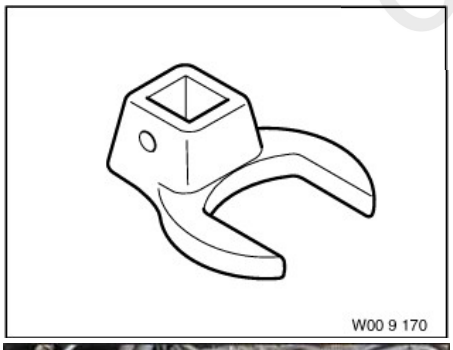
- Prepare special tool 2 358 417.



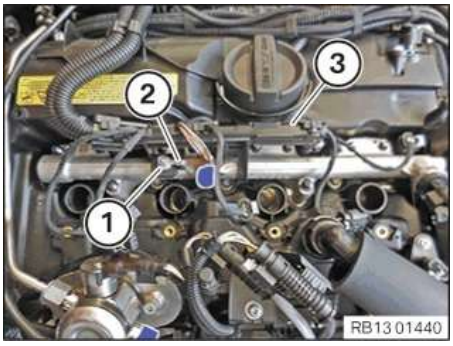
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

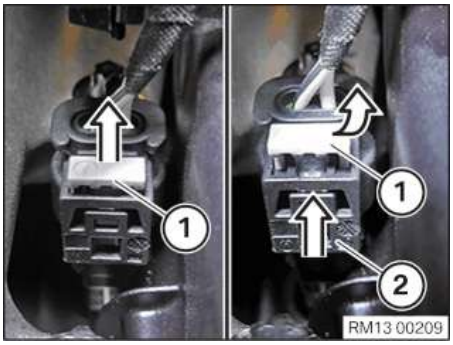


- Prepare special tool .

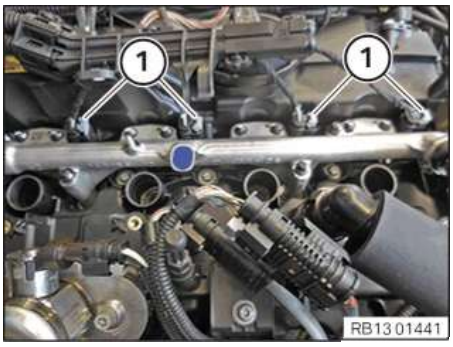


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



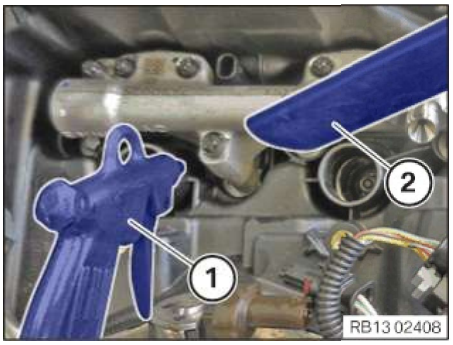
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

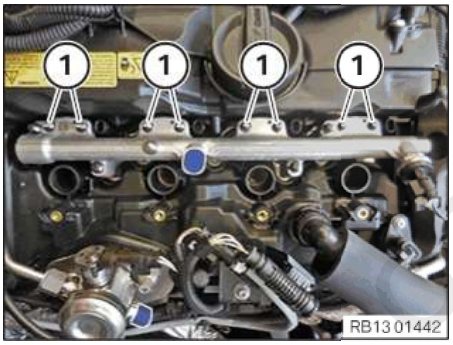


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

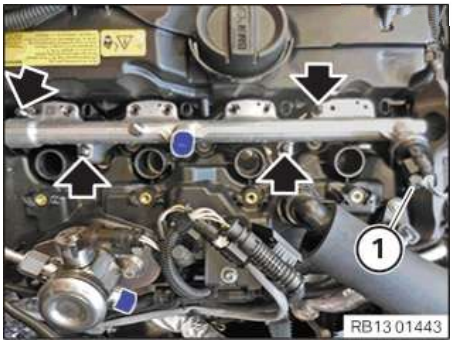
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



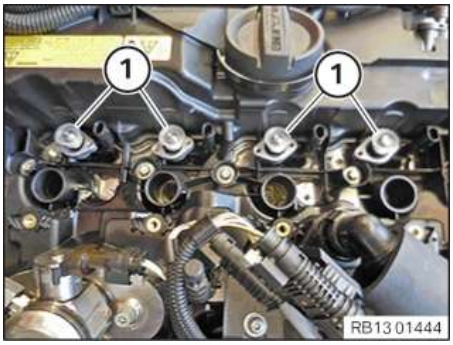
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

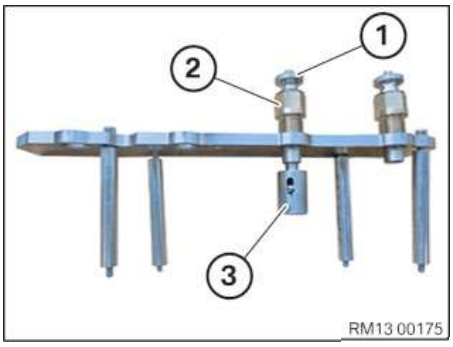
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

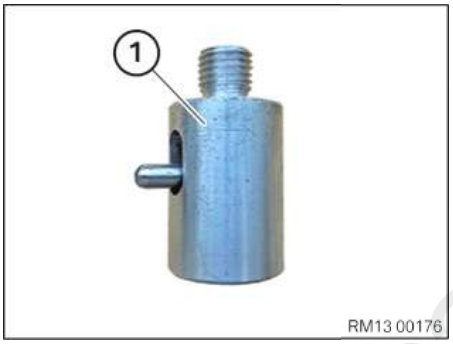
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

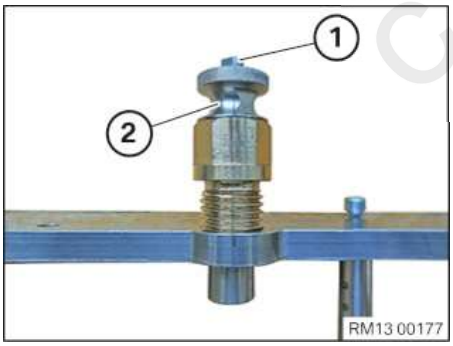
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

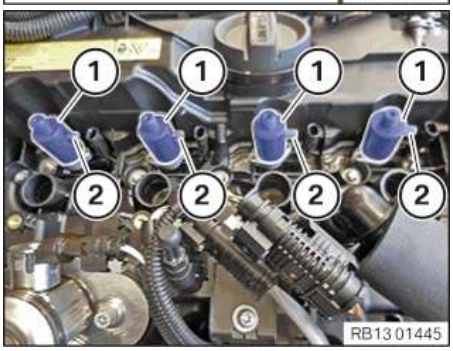
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



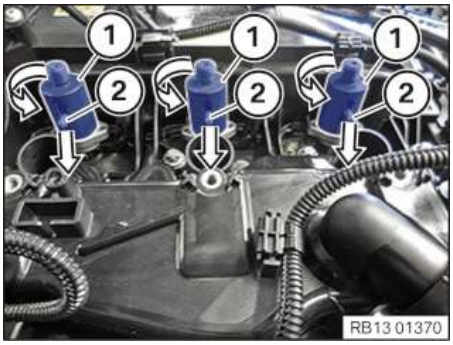
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



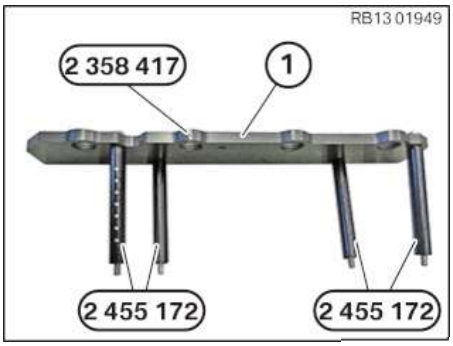
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

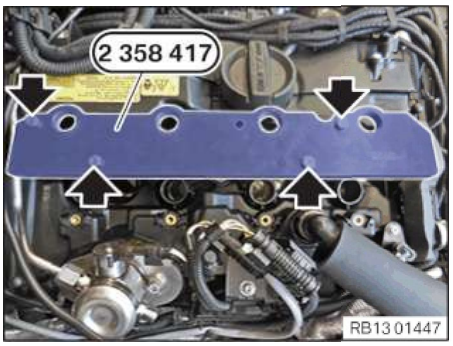
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



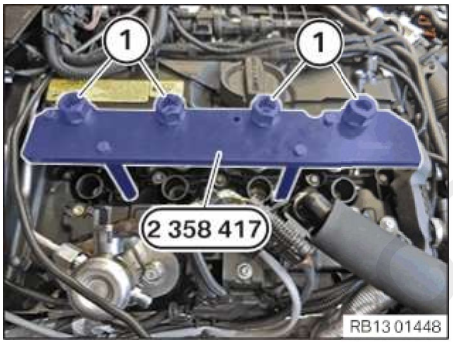
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

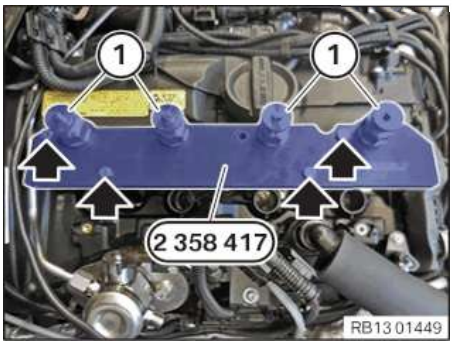
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

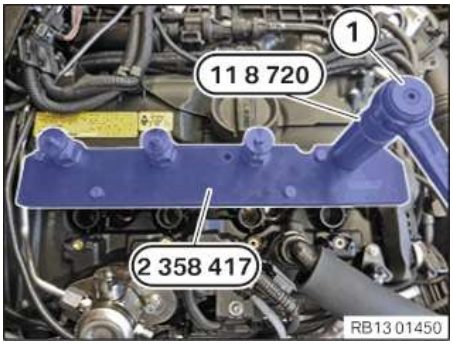
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

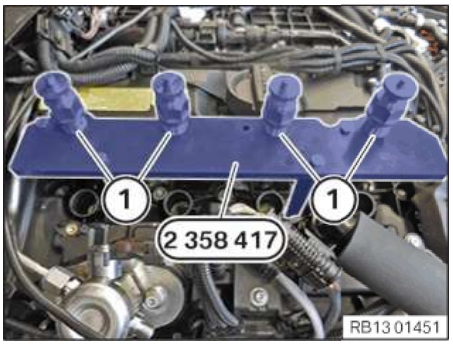


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

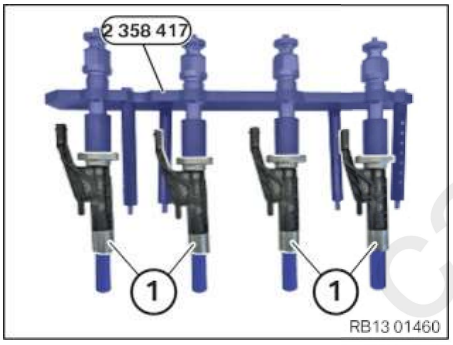
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

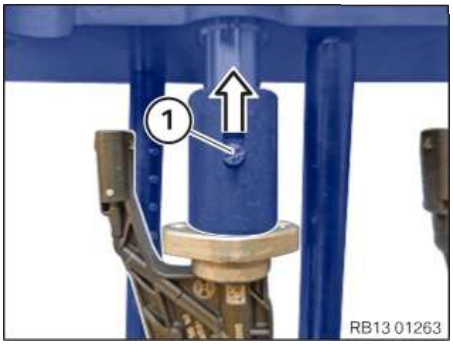


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

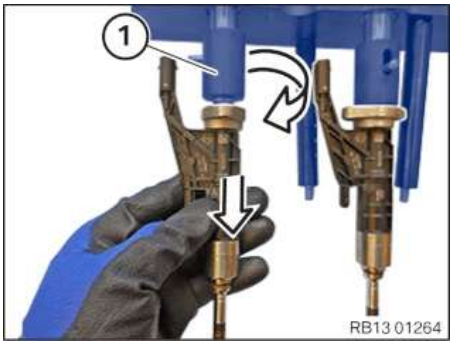


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

20 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

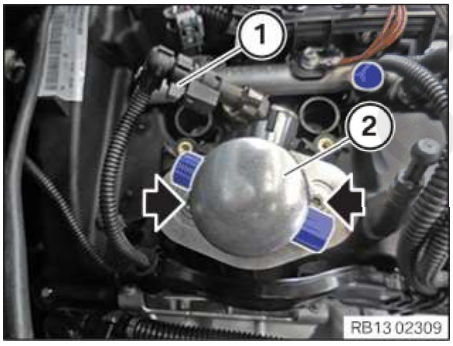
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

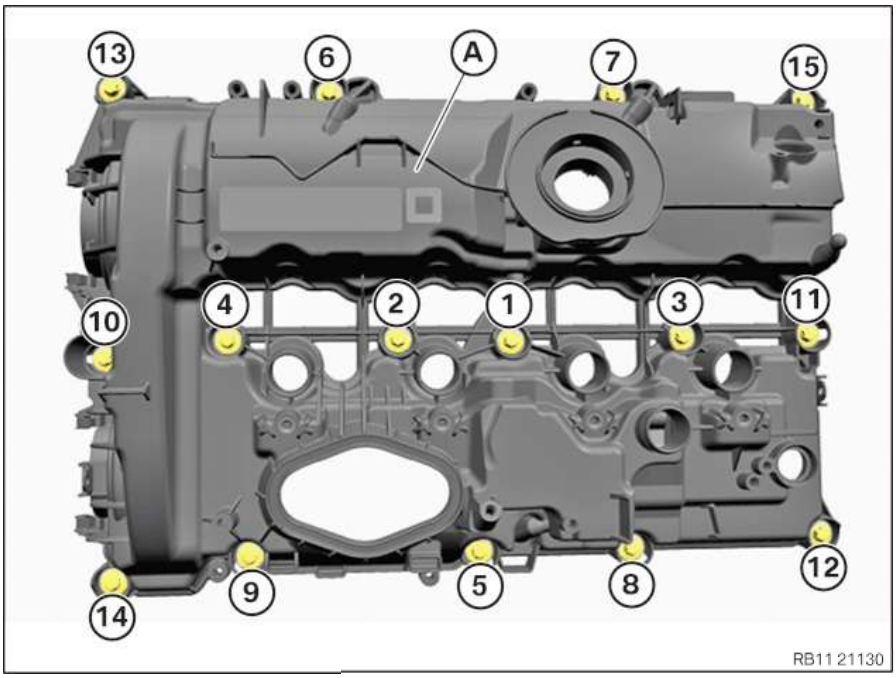


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

MAIN WORK

21 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

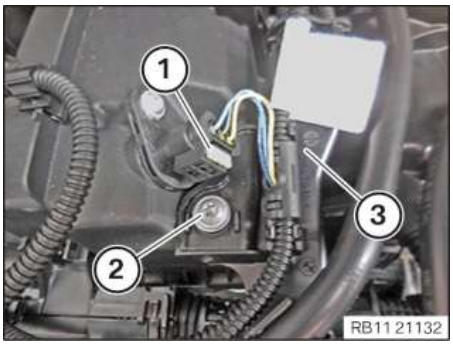
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

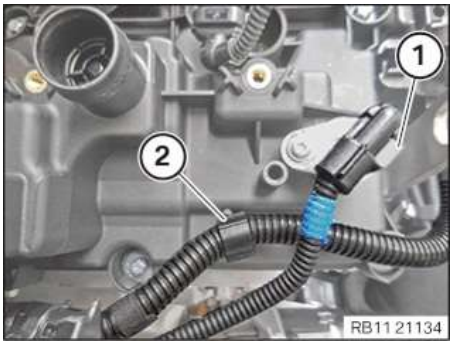
- Do not pull on the wires when disconnecting connectors and plug connections.



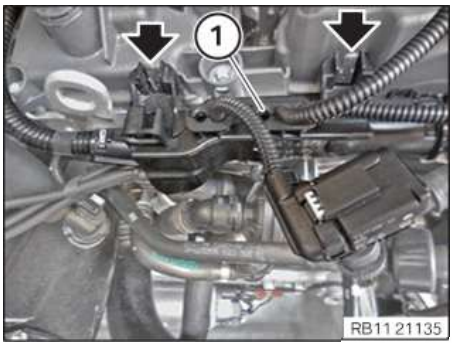
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



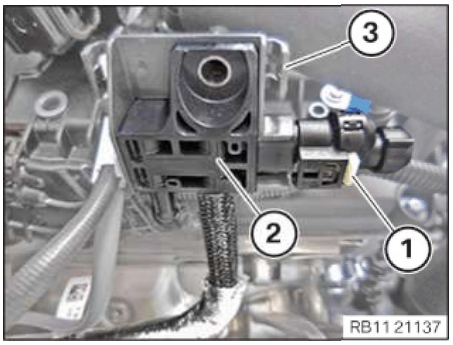
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



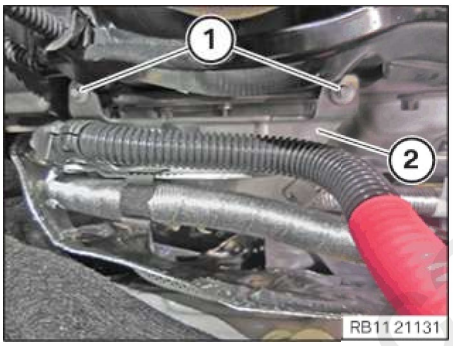
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



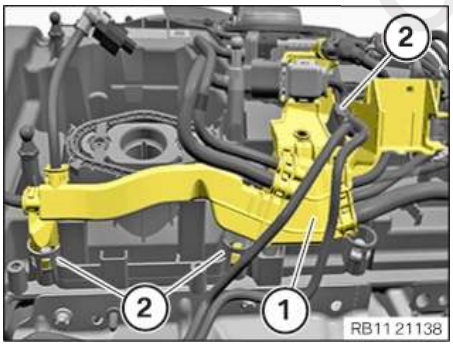
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



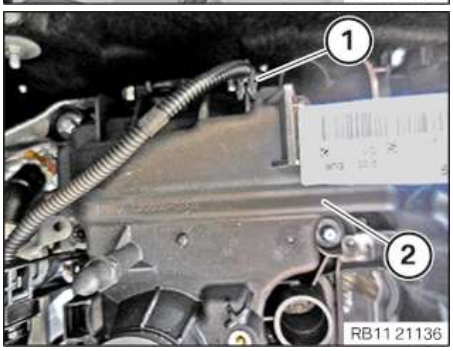
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

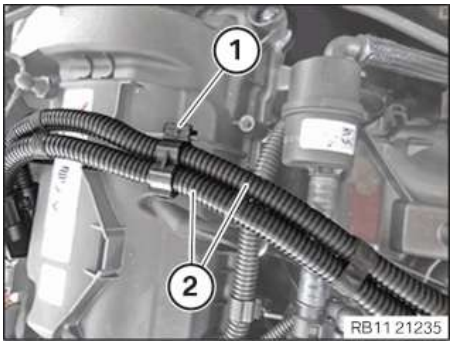


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

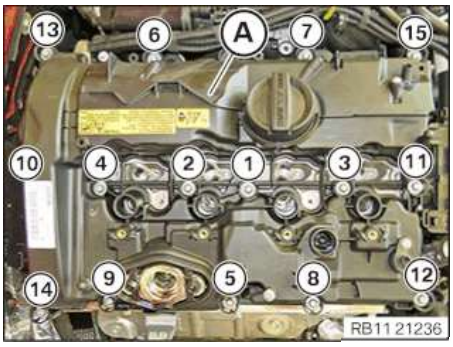


- Loosen clamp (1).

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- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

22 – Replacement: Cylinder head cover

RISK OF DAMAGE

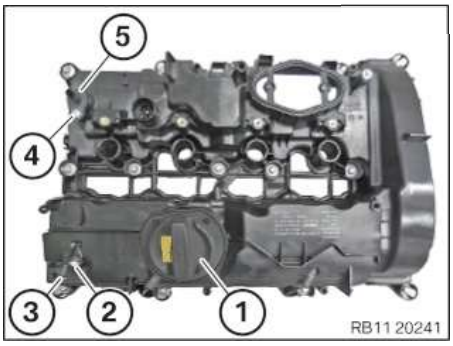
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

NOTICE

Schematic diagram is for example purposes. Some parts may differ in certain details.



- Loosen the oil filler cap (1).
- Loosen screw (2).
- Feed out and remove the intake camshaft sensor (3).
- Loosen screw (4).
- Feed out and remove the exhaust camshaft sensor (5).

▸ **Prepare the camshaft sensor**

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- Check sealing ring (1) for damage, renew if necessary.



- Insert and install the exhaust camshaft sensor (5).
- Tighten down screw (4).

Exhaust camshaft sensor to cylinder head cover

TS5x20		Tightening torque	4 Nm

- Insert and install the intake camshaft sensor (3).
- Tighten down screw (2).

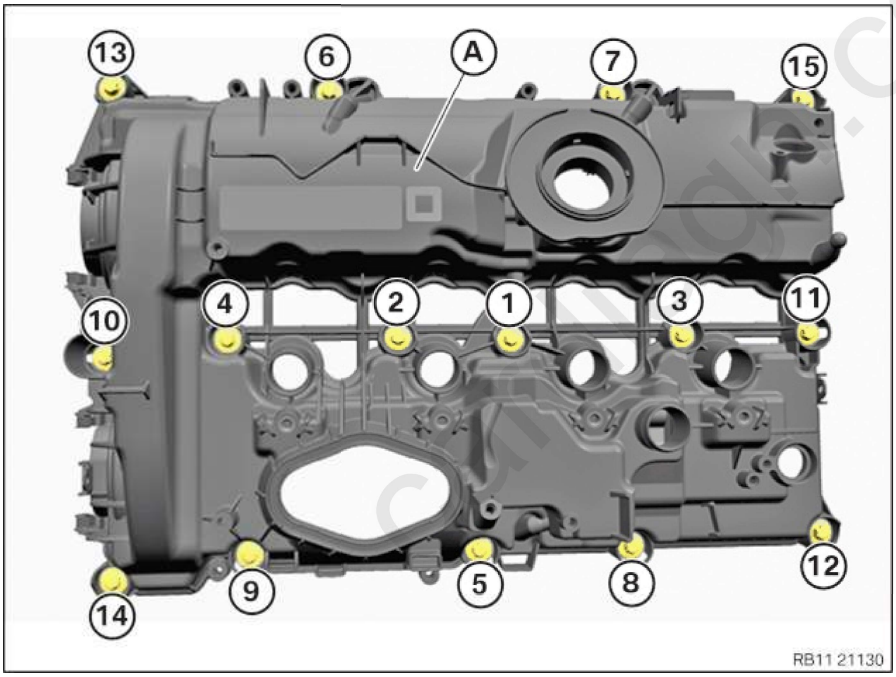
Intake camshaft sensor to cylinder head cover

TS5x20		Tightening torque	4 Nm

- Close oil filler cap (1).

23 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

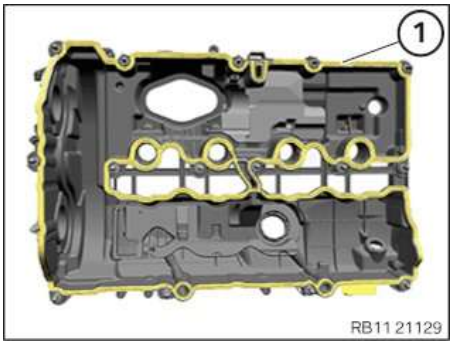
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

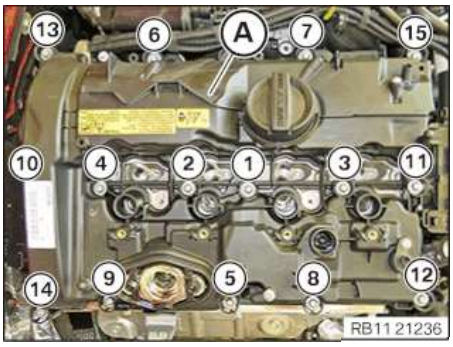
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

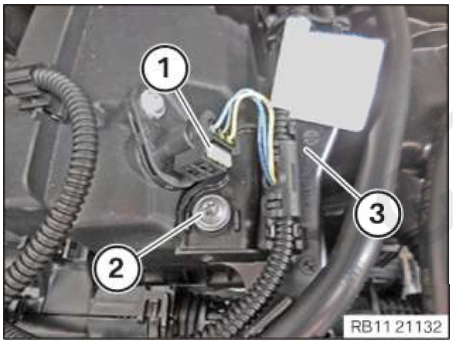
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

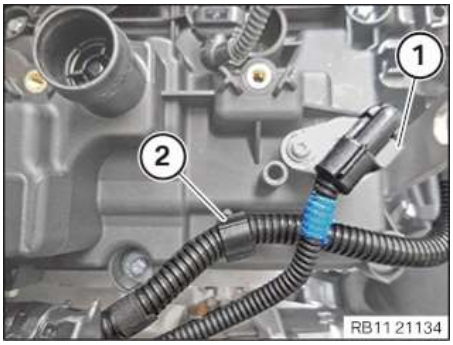


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

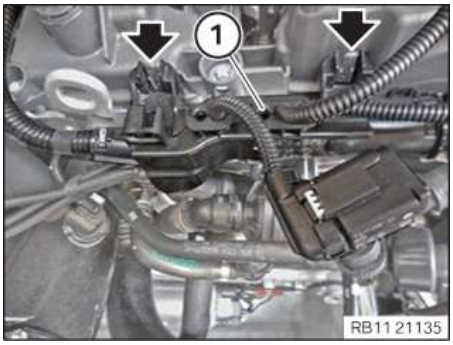
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

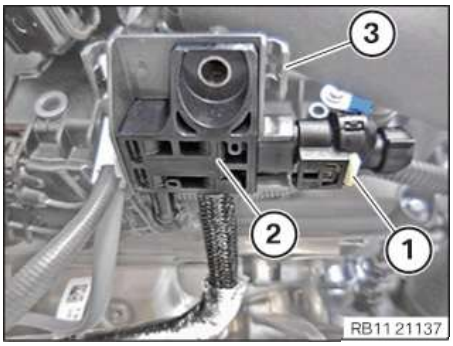


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

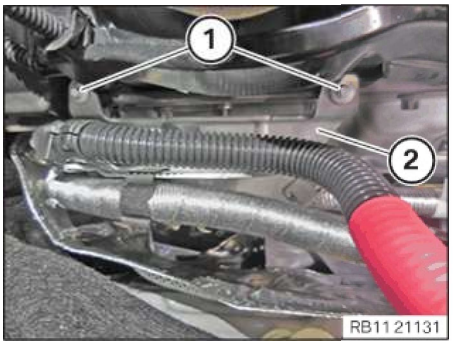
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- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

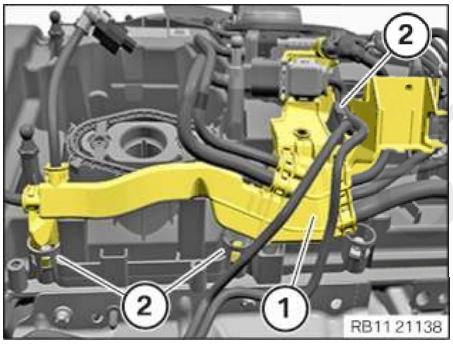
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

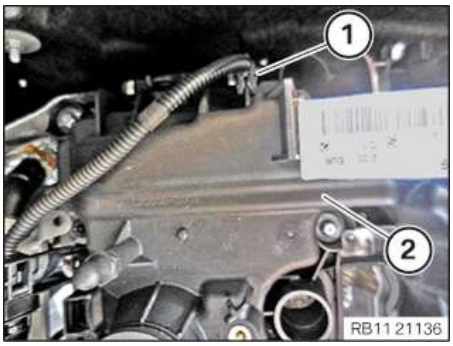
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

6X18	Tightening torque	6 Nm

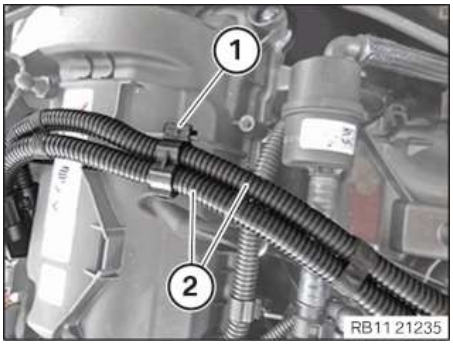


- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.



- Secure clamps (1).

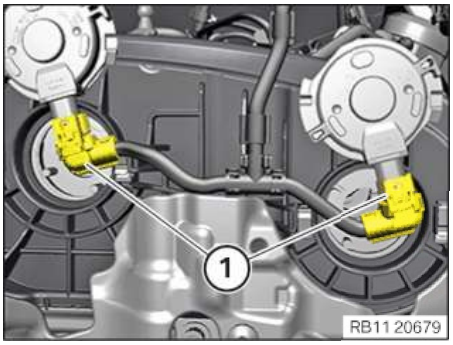
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- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

POSTPROCESSES

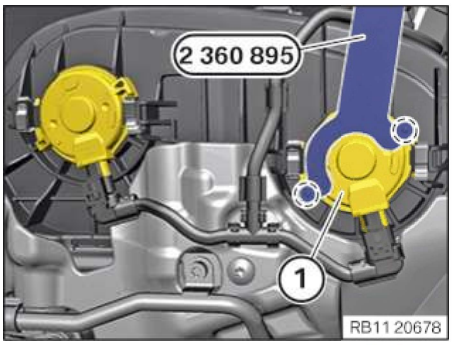
24 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

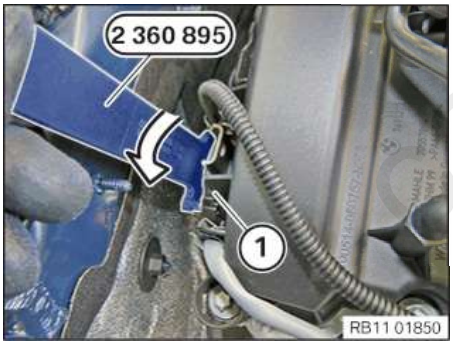
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



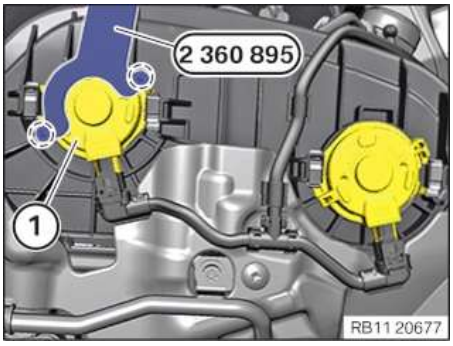
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

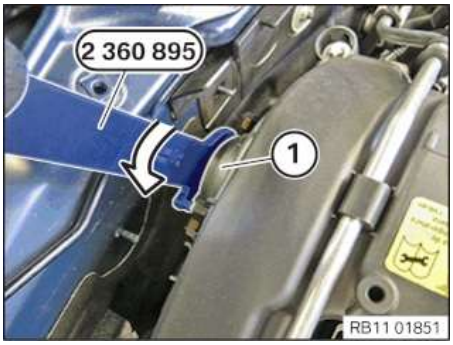


NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.

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- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

25 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

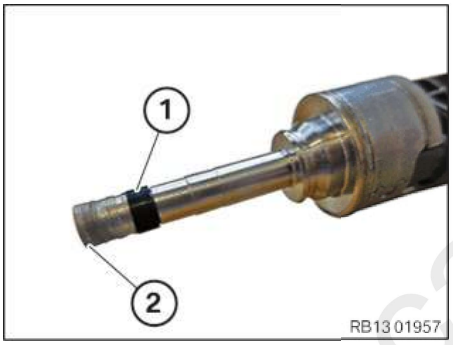
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

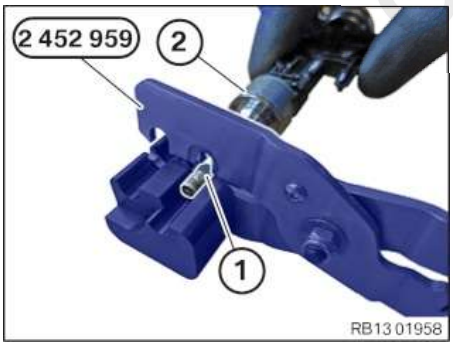
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.



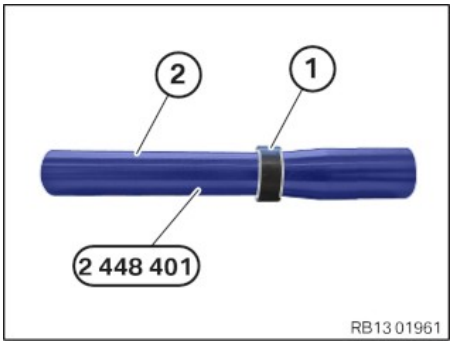
- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

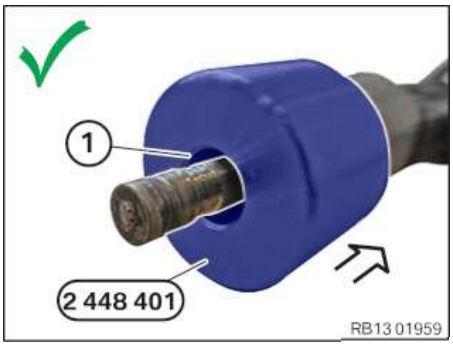
  (2) Sliding sleeve

  (3) Assembly sleeve

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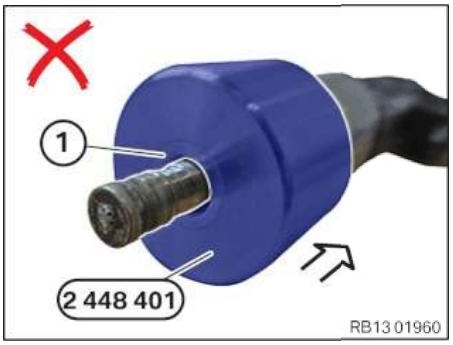


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



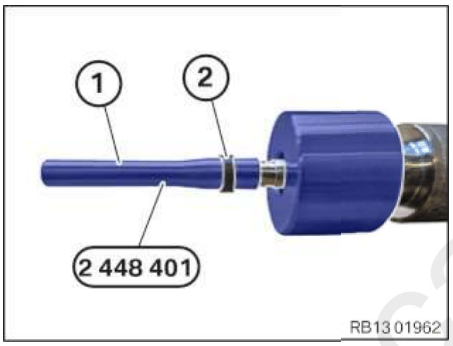
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

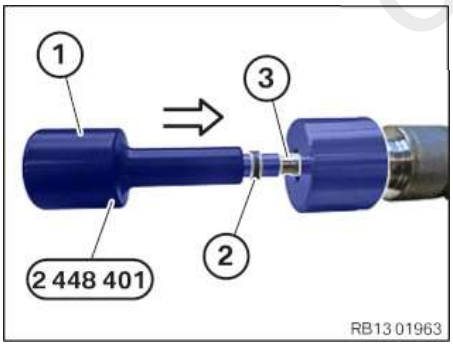


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

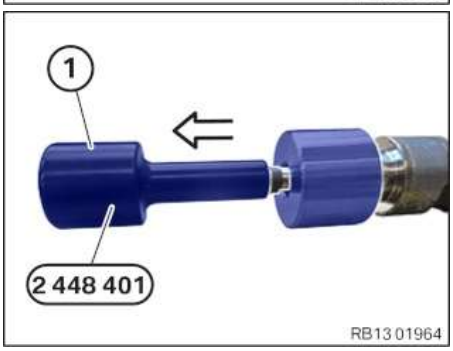
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

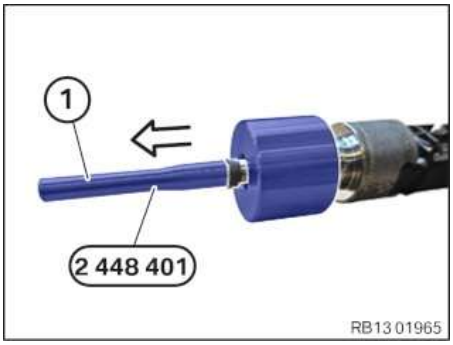


- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

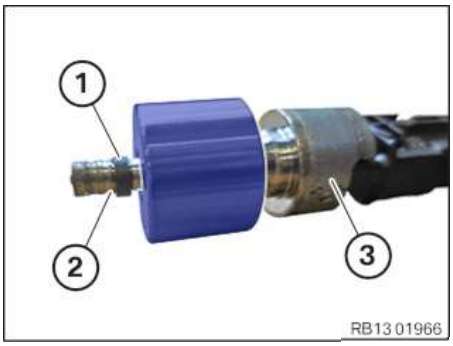


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

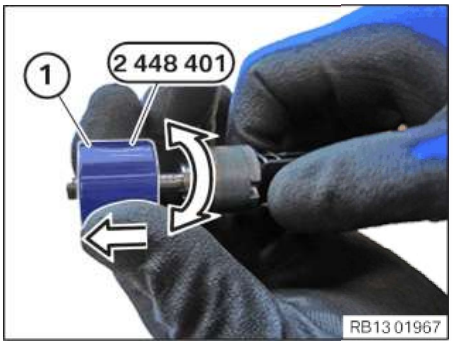
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- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

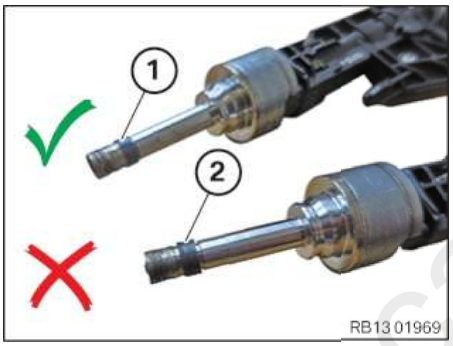


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

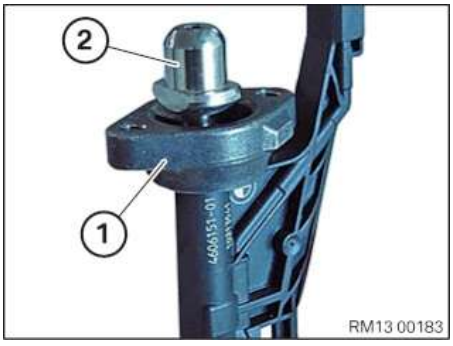


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

26 – Installing the rail with injectors

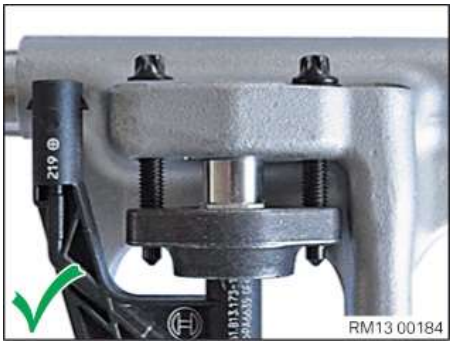
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



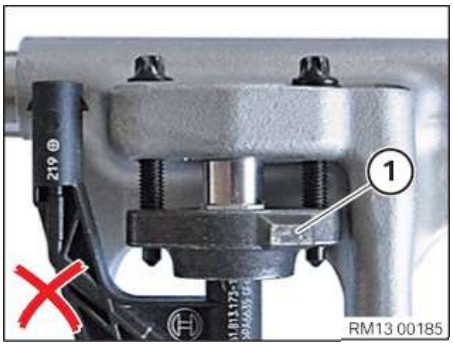
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.

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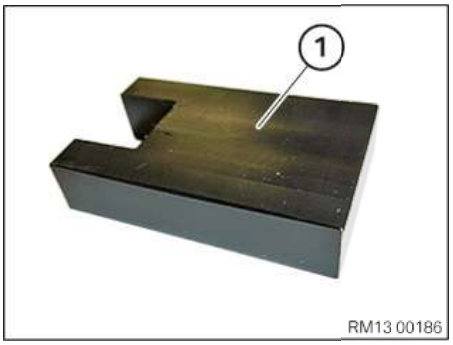
- If applicable, note the position of the cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



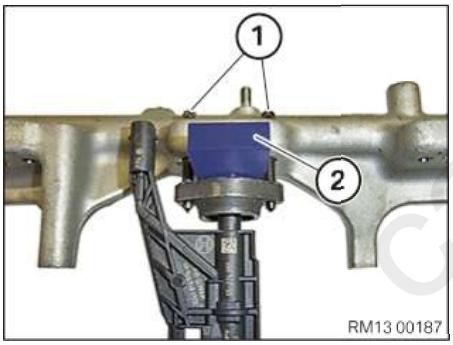
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

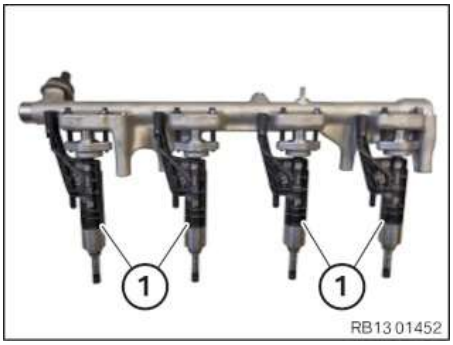
  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



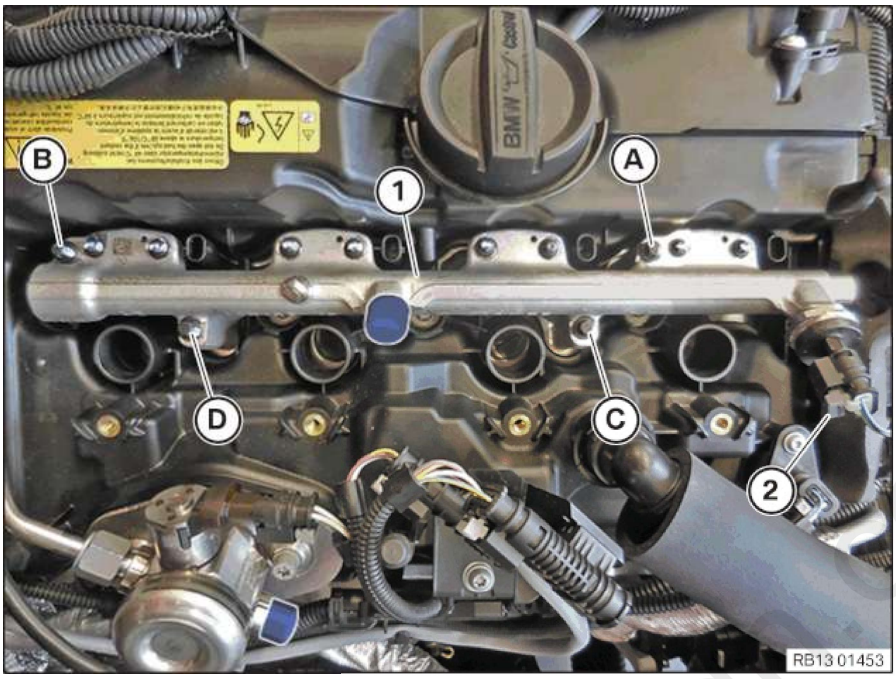
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

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- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.



- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

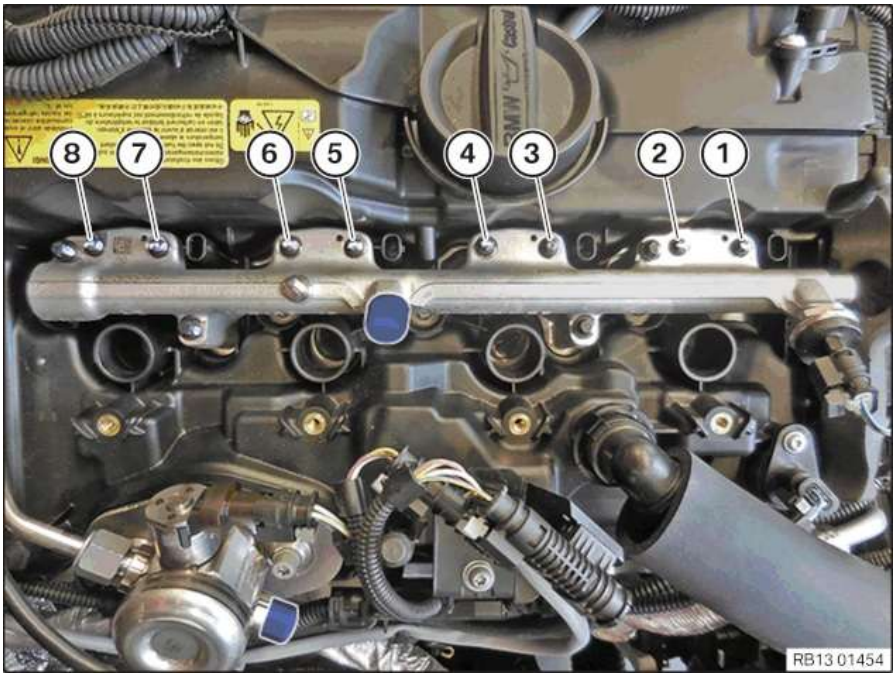
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

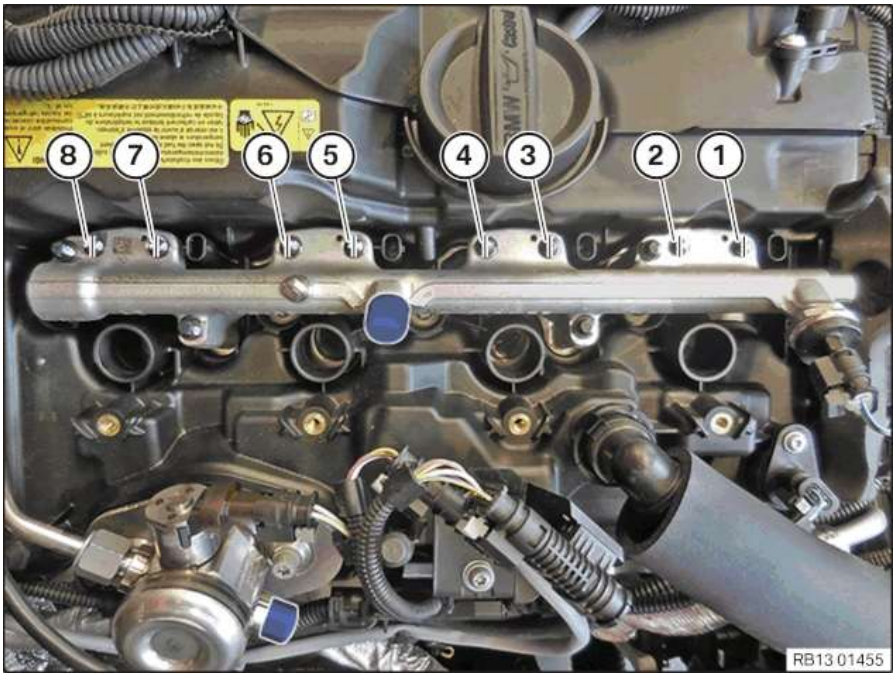
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

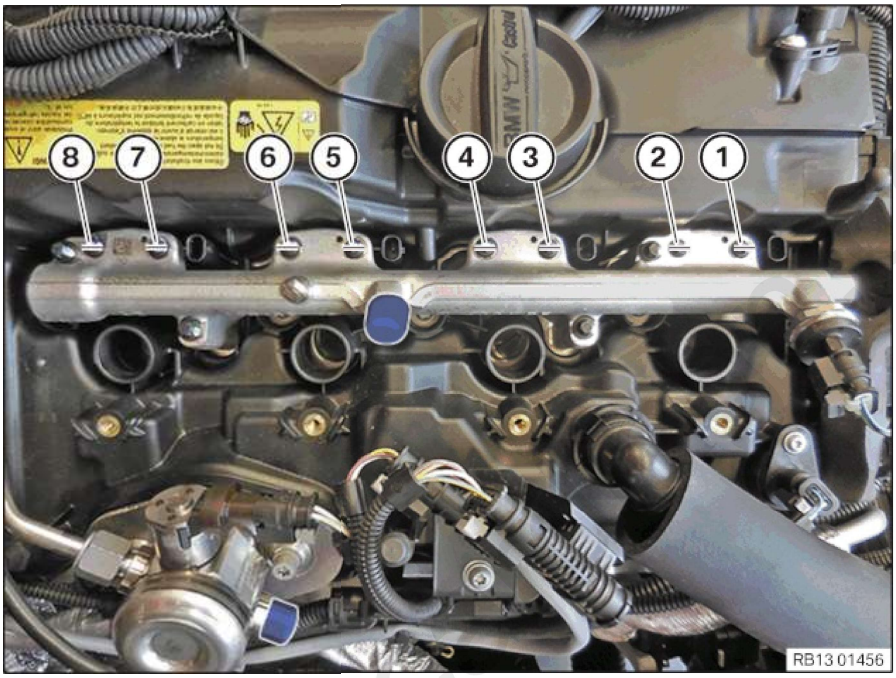
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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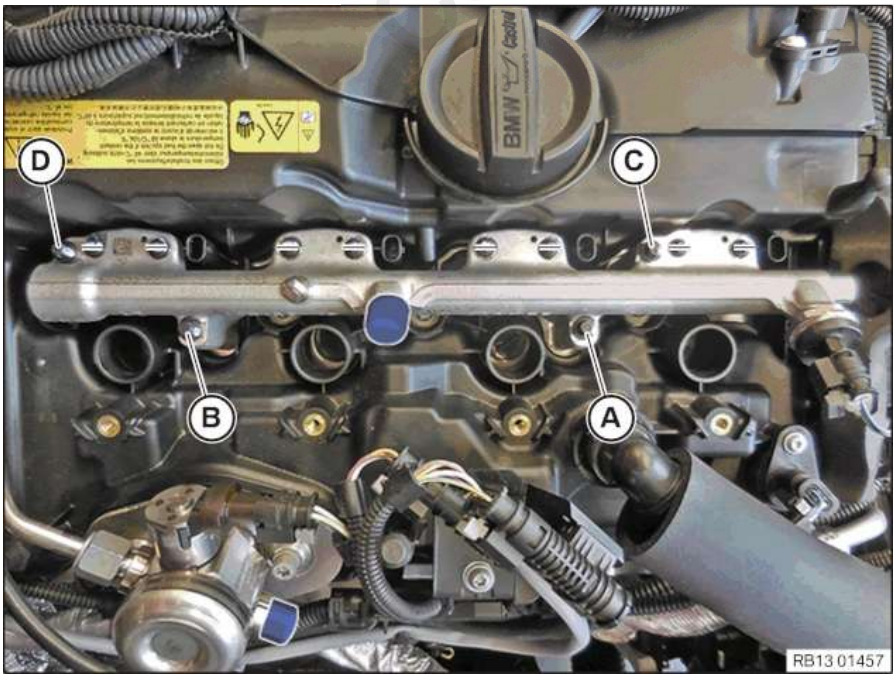


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

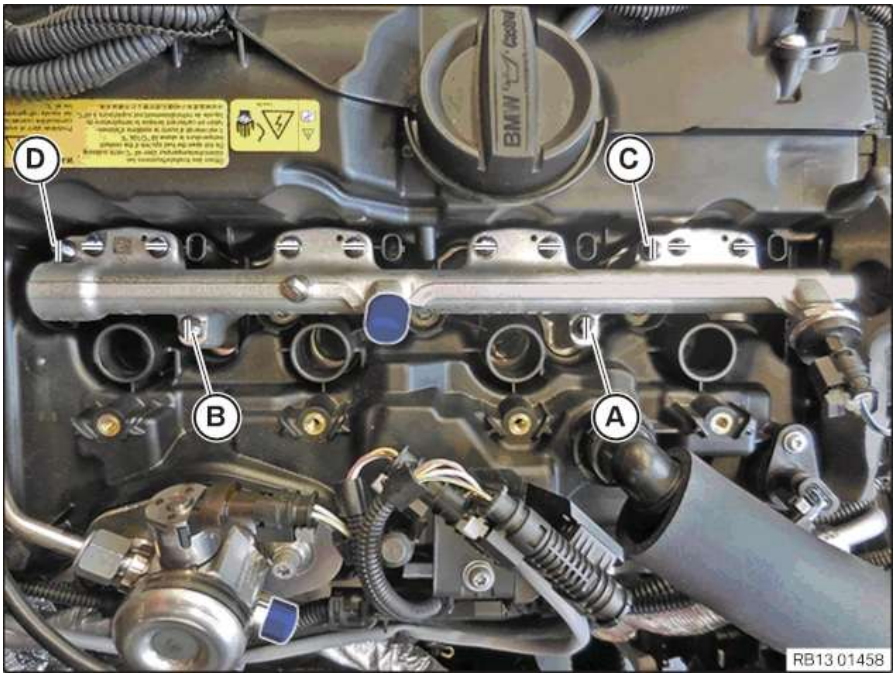
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

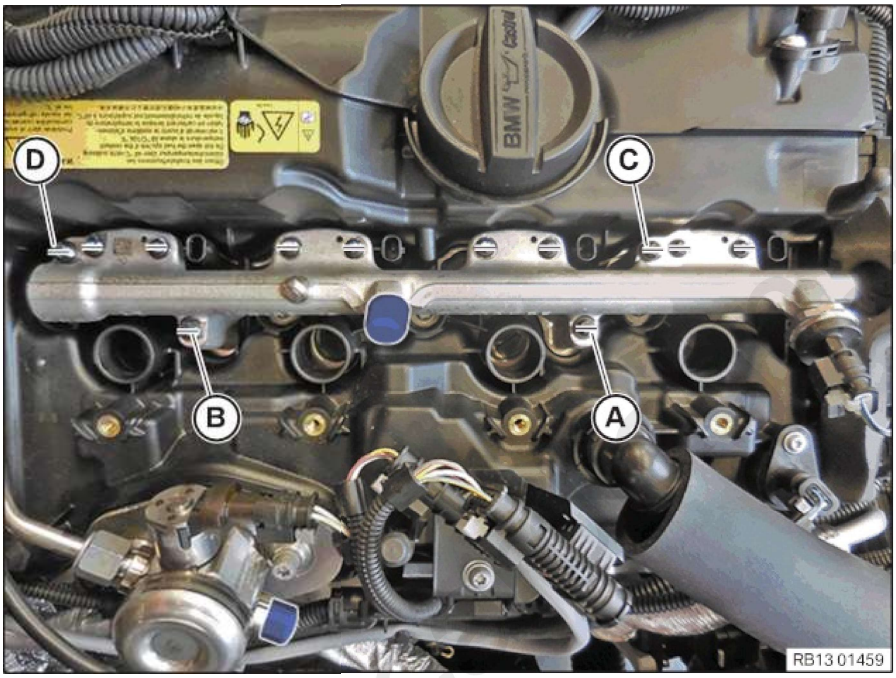
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

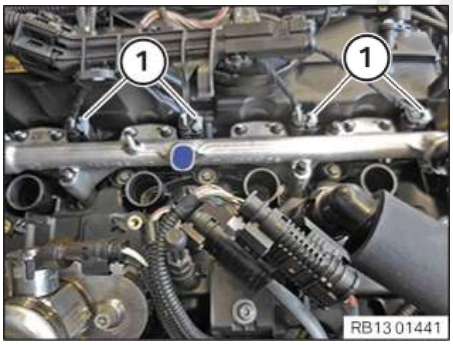


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



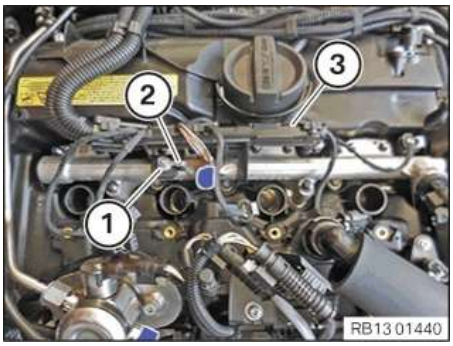
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

27 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

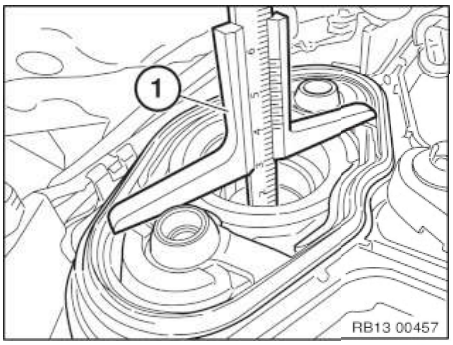
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

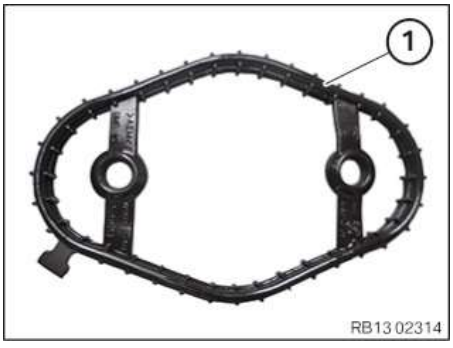
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

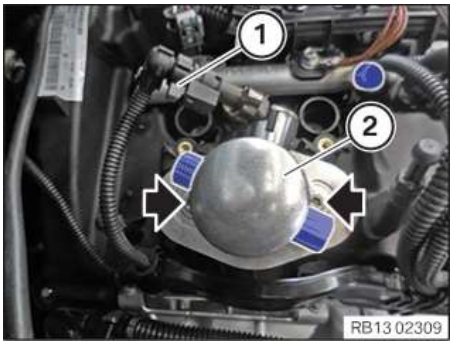
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

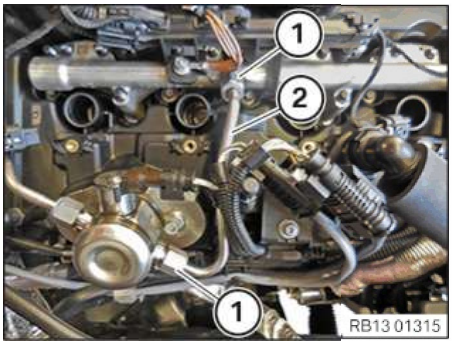
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

28 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

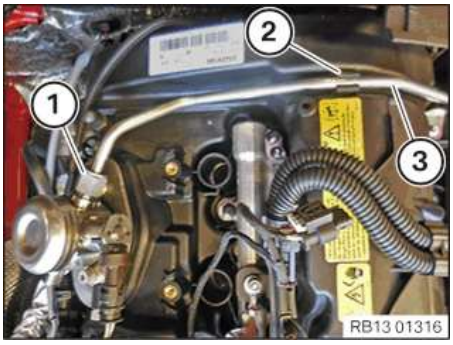
29 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

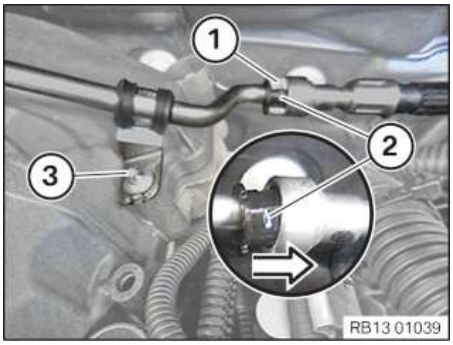


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

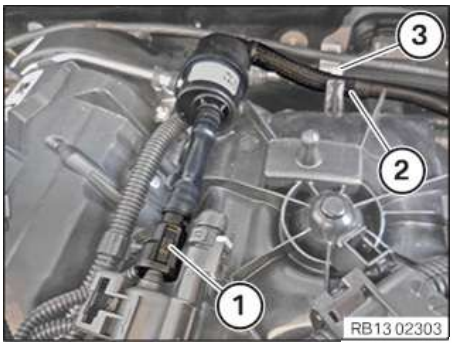
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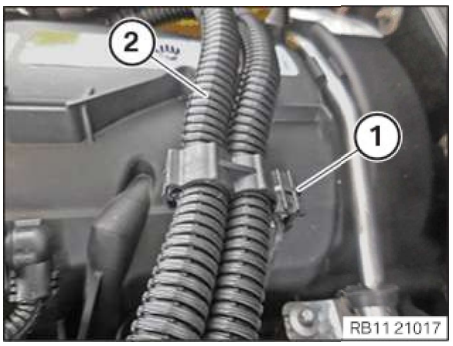
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

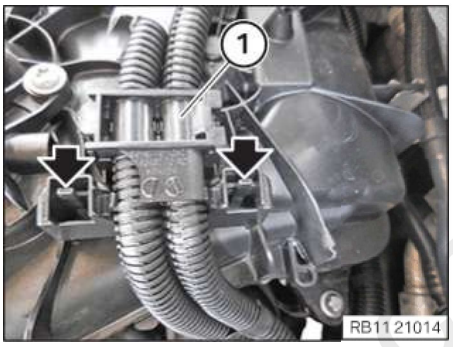
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).



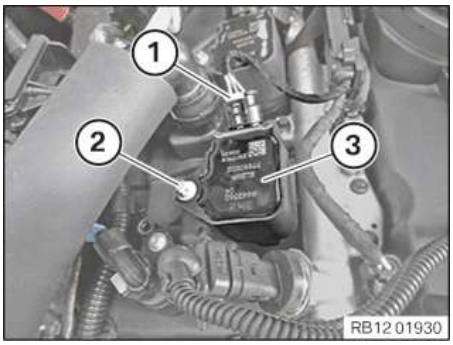
- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

30 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



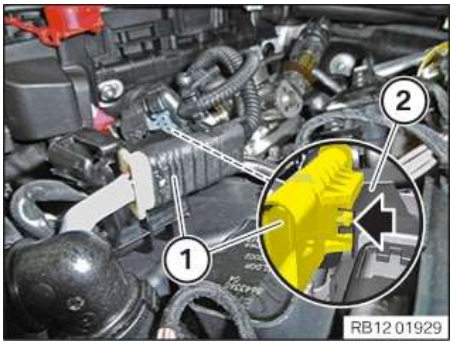
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.
  The connector (1) must engage audibly.

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- Connect and lock connector (1) with holder (2) (arrow).

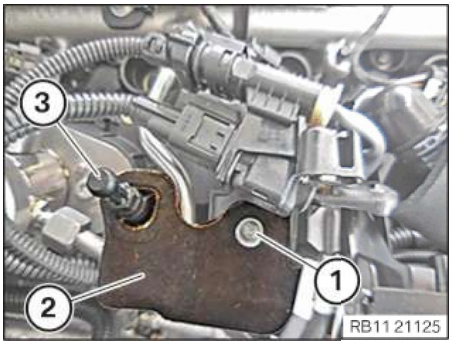
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

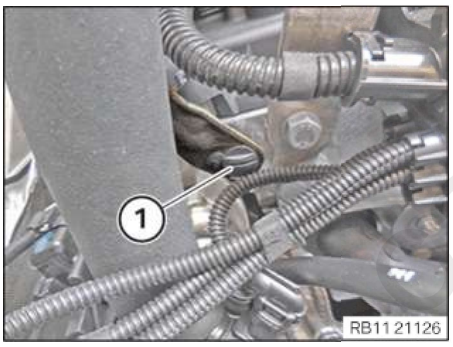
  The connector (1) must engage audibly.

31 – Install the cylinder head cover acoustic cover



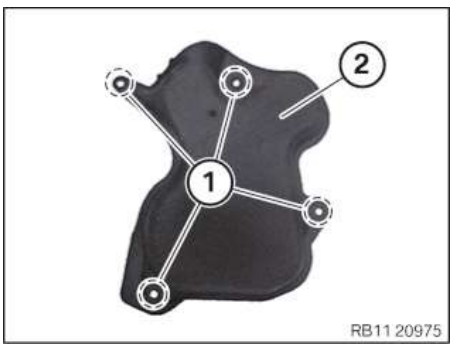
- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

Acoustic cover (side) to cylinder head cover		
TS6 x 20		8 Nm



- Secure the clip (1).

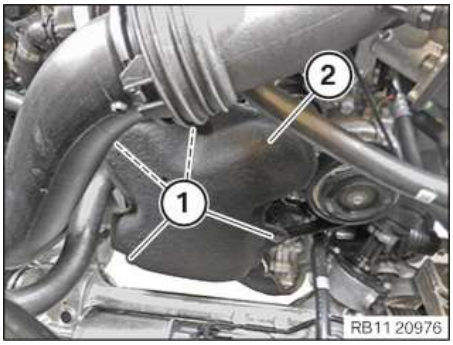
32 – Install the acoustic cover for the engine at the front



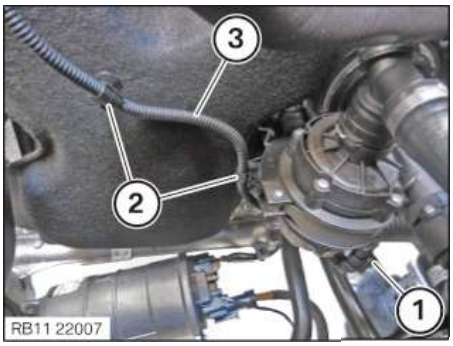
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

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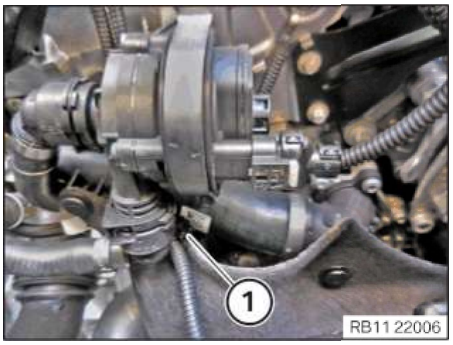


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

33 – Installing the clean air pipe with resonator

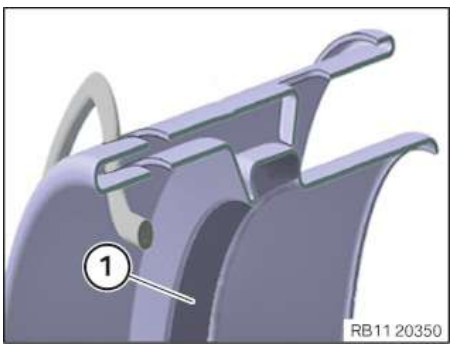


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

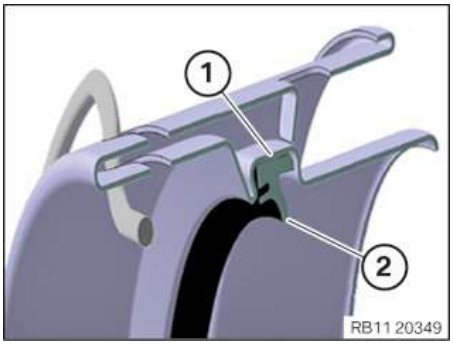
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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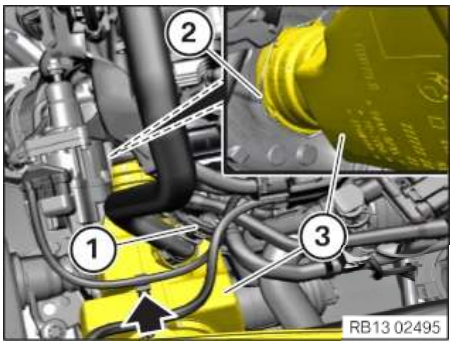
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

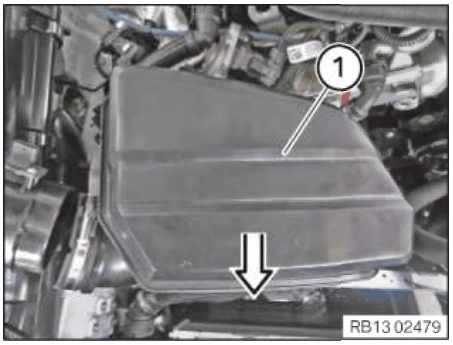
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



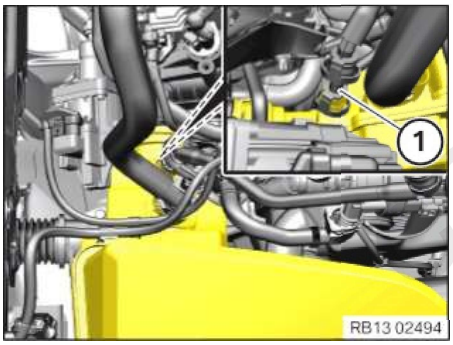
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

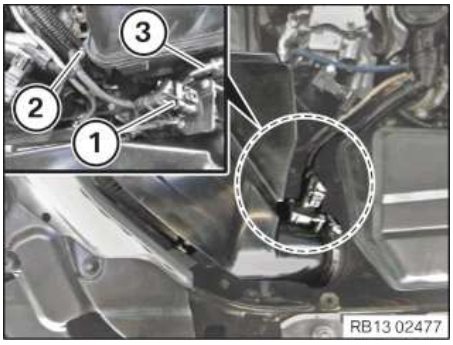
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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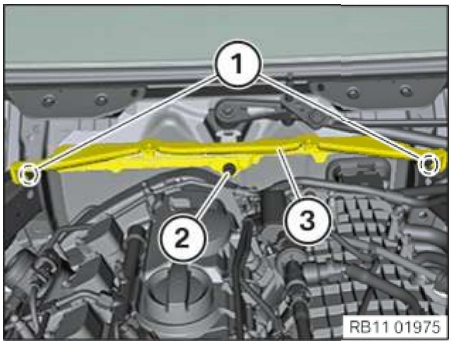
- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

34 – Disconnecting all battery earth leads



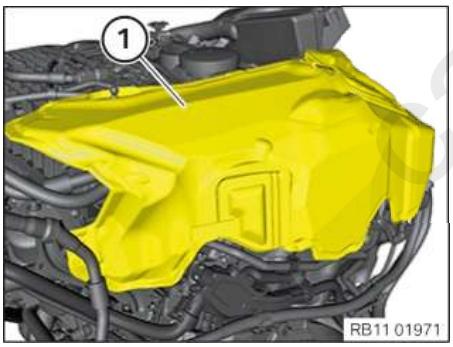
- See additional information.

35 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

36 – Installing acoustic cover at rear



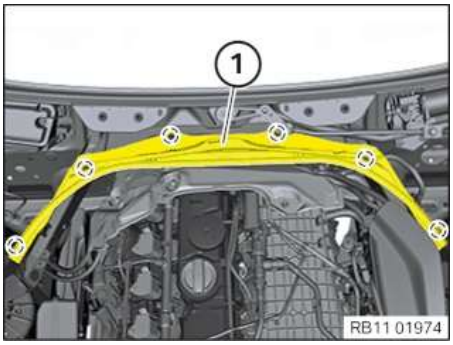
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

37 – Installing the centre bulkhead upper part

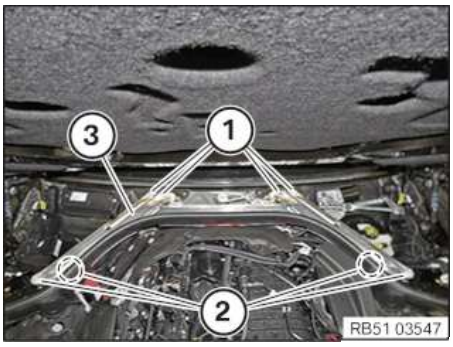
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- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

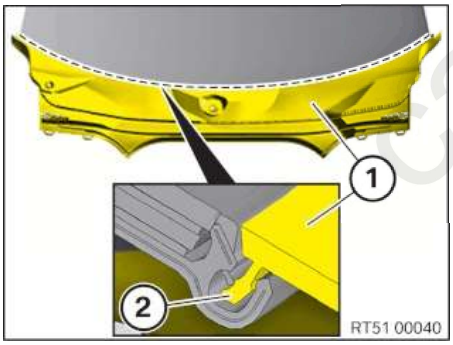
38 – Installing cowl panel cover

RISK OF DAMAGE

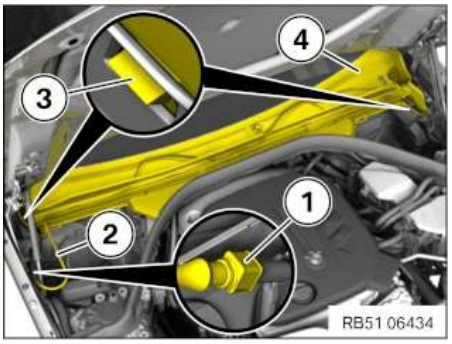
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

39 – Installing both wiper arms

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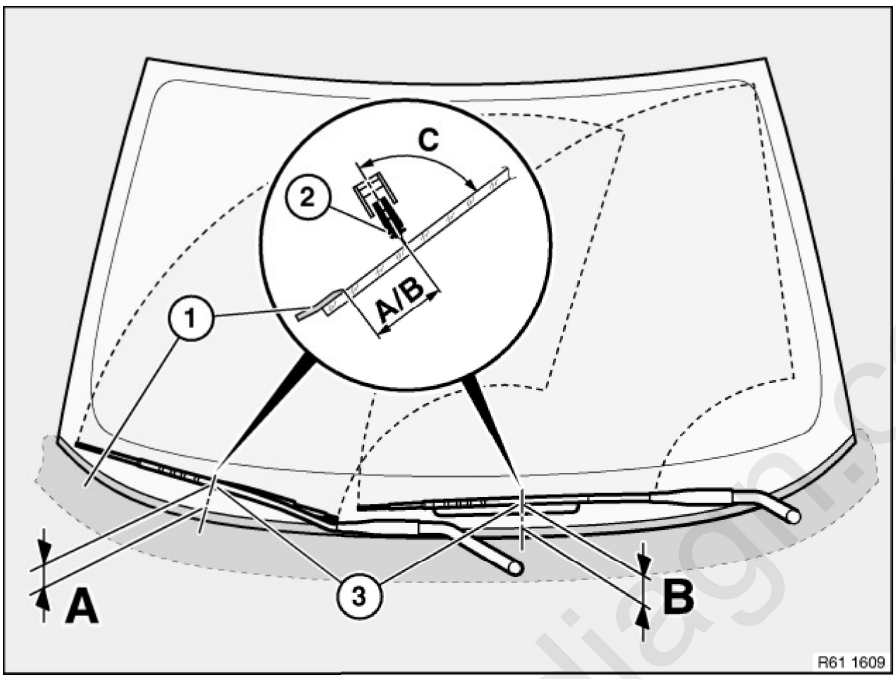
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

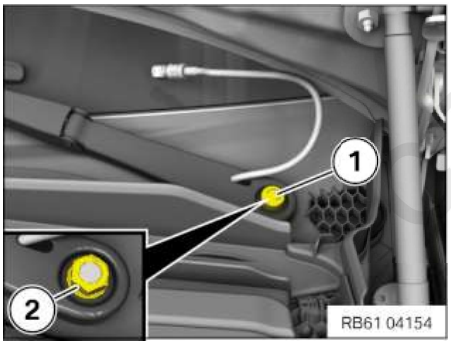
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

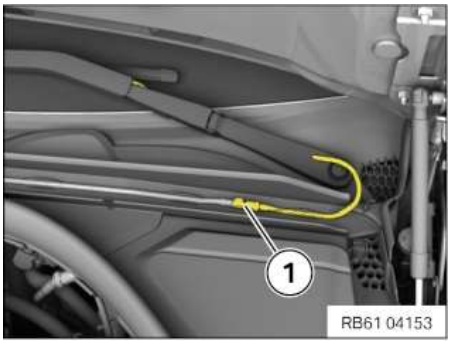


- Tighten nut (2).

Windscreen wiper arm

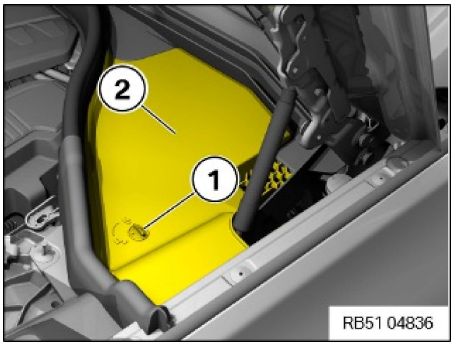
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



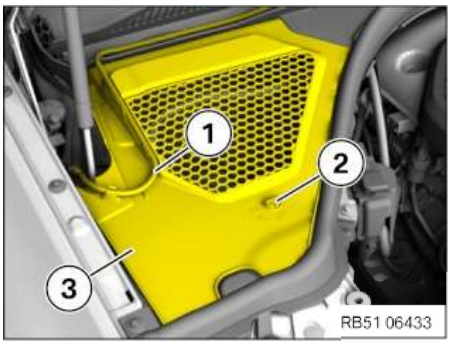
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

40 – Install the cover of the engine compartment on the rear left



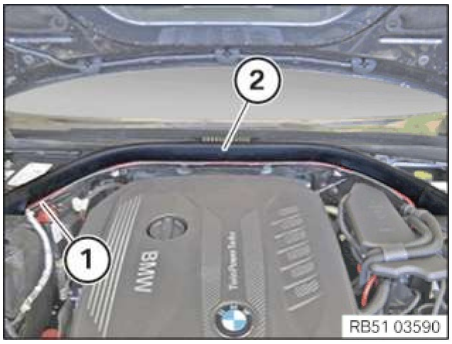
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

41 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

42 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

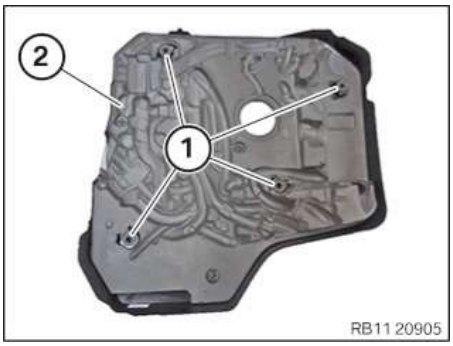
43 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

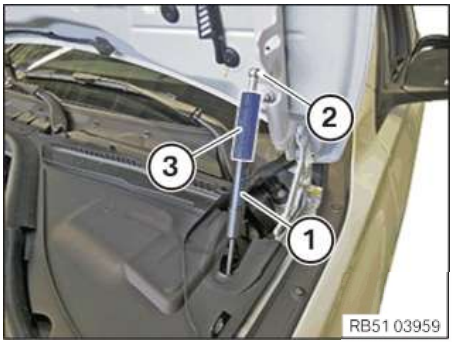
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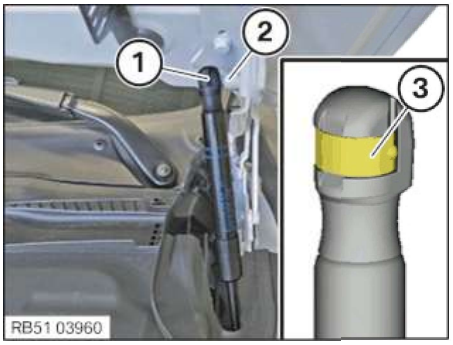
- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

44 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Exhaust camshaft sensor to cylinder head cover — Used in step 22

TS5x20		Tightening torque	4 Nm

Intake camshaft sensor to cylinder head cover — Used in step 22

TS5x20		Tightening torque	4 Nm

Cylinder head cover to cylinder head — Used in step 23

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 23

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 23

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 26

M6		Tightening torque	5 Nm

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High pressure pump to high pressure pump flange			Used in step 27
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail			Used in step 28
M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump			Used in step 29
M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover			Used in step 29
M6 screw		Tightening torque	6,5 Nm

Ignition coil			Used in step 30
Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover			Used in step 31
TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 33
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 37
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 37
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 37
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 39
Combination hexagon nut		Tightening torque	35 Nm

Overview of Special Tools

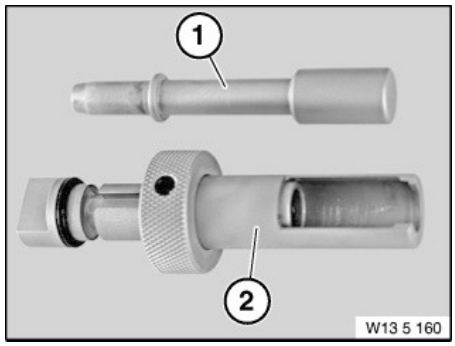
2 360 895 Pin wrench



Common	Used in step 1224
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

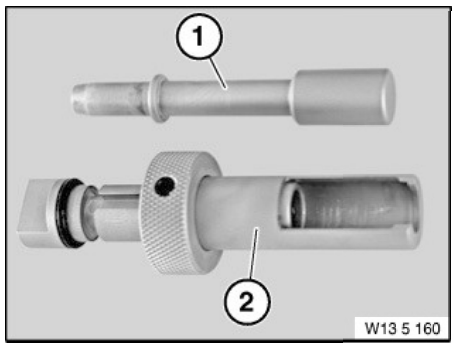
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0 496 567 (13 5 161) Fastener



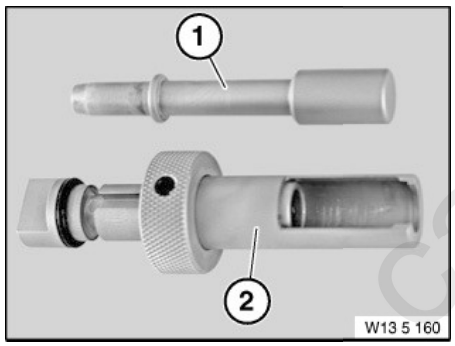
Common	Used in step 18
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 568 (13 5 162) Fastener



Common	Used in step 18
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener



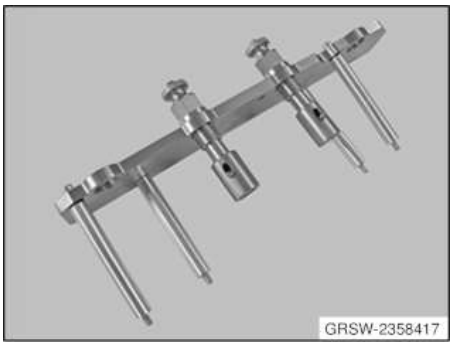
Common	Used in step 18
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

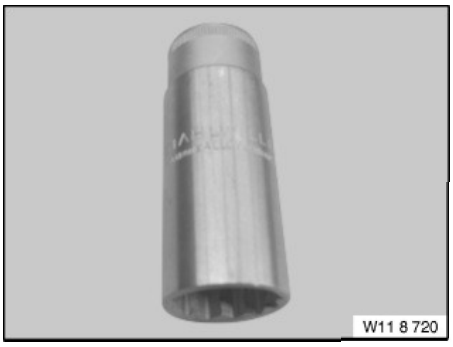
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2 358 417 Device



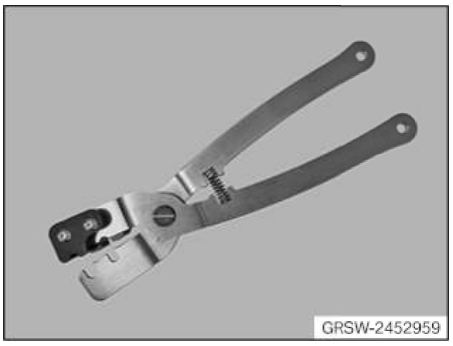
Common	Used in step 19
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 19
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 452 959 Pliers



Common	Used in step 25
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 448 401 Fitting aid



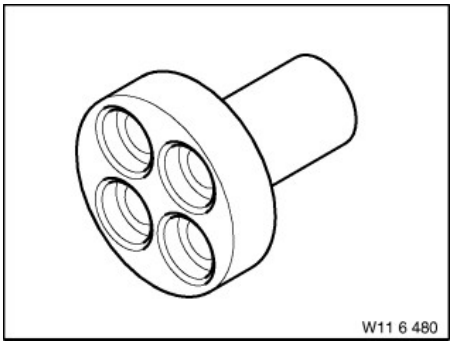
Common	Used in step 25
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 26
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



Common	Used in step 27
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 39
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

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Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	134
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	134
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
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61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 35 ... Notes on ESD protection (Electro Static Discharge)	1222
61 35 ... Notes on ESD protection (Electro Static Discharge)	121519
13 53 ... Clean the cylinder head around the injectors due to grit / dust	19
61 13 ... Unlocking and disconnecting different plug connections	192123

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11 14 295 Remove and install / replace the acoustic cover for the oil sump

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WARNING

Motor vehicle may slip off the vehicle hoist where components are supported.

Danger! Life-threatening injuries!

- Secure the vehicle hoist against lowering and lifting.

WARNING

Vehicle may slip off the vehicle hoist if the vehicle hoist is handled incorrectly.

Danger! Life-threatening injuries!

- Observe safety information on raising the vehicle using a vehicle hoist.
- For additional information see: 00 ... Raising the vehicle using a vehicle hoist.

WARNING

Motor vehicle may slip off the vehicle hoist if the weight is distributed unevenly.

Danger! Life-threatening injuries!

- Ensure there is a specific weight compensation on the motor vehicle.

WARNING

Falling or tipping of a heavy component.

Danger! Life-threatening injuries!

- Before lowering or removing the front axle: Secure the engine in mounting orientation.
- For additional information see: 11 00 670 Securing engine in installation position.

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

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1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

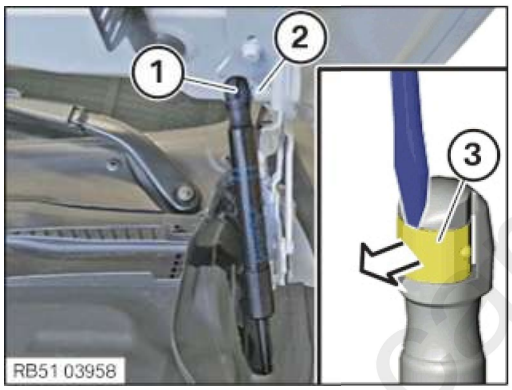
Engine compartment lid is open.

CAUTION

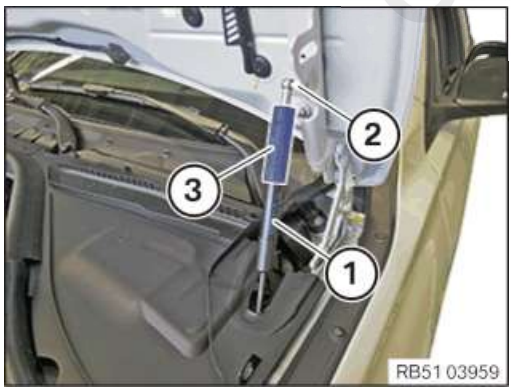
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



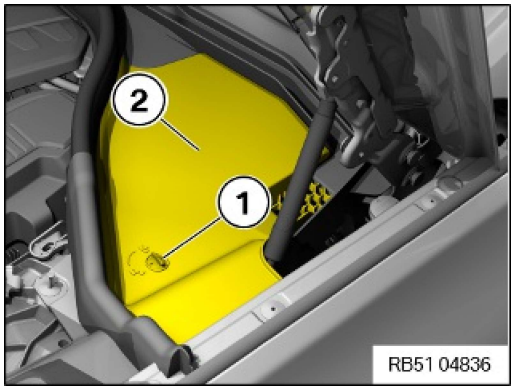
TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

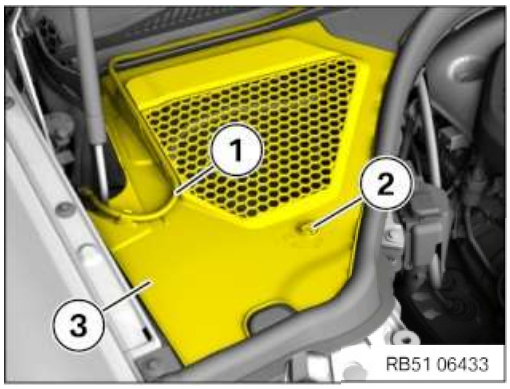
3 – Remove the cover of the engine compartment at the rear left

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- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

4 – Remove the cover of the rear right engine compartment

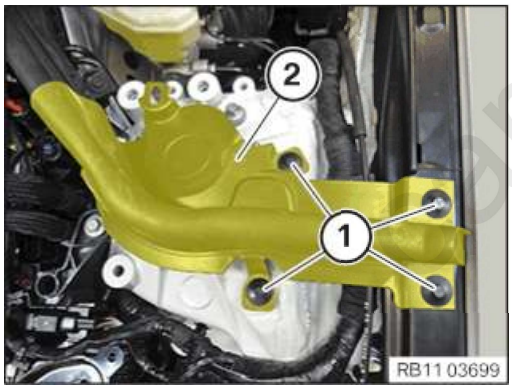


- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

5 – Removing side bonnet gaskets

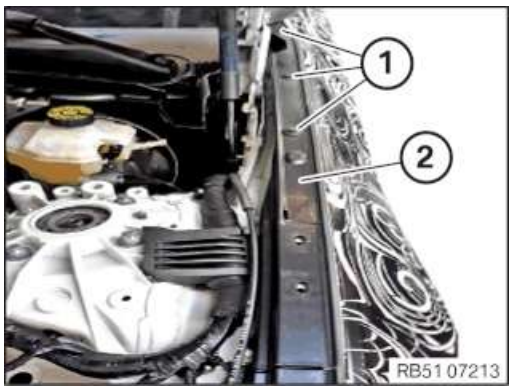
NOTICE

Perform the operations on the left and right side.



- Loosen the rivet (1).
- Remove side bonnet seal (2) from spring strut dome.

6 – Remove sealing of the side panel



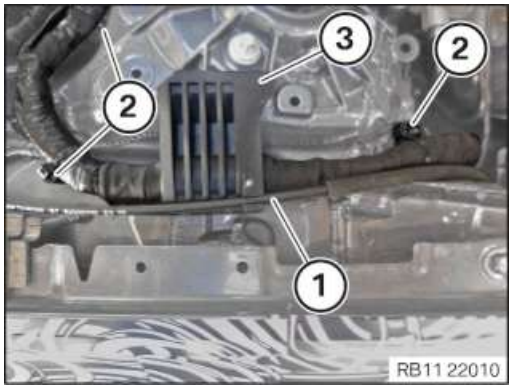
NOTICE

Description is for left component only. Procedure on the right side is identical.

- Loosen the expanding rivet (1).
- Guide out seal (2) and remove.

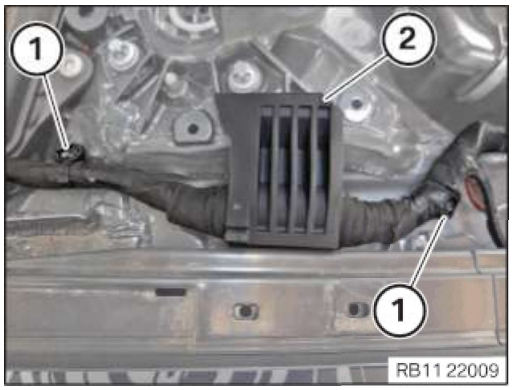
7 – Partially loosen the wiring harness section on the spring strut dome

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- Feed out the cable (1) of the front flap and set it aside.
- Loosen clamps (2).
- Feed out wiring harness section (3) on the spring strut dome on left and set it aside.

8 – Releasing the wiring harness section on the right spring strut dome



- Loosen clamps (1).
- Guide out wiring harness section (2) on the right spring strut dome and set it aside.

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing the clean air pipe with the resonator

WARNING

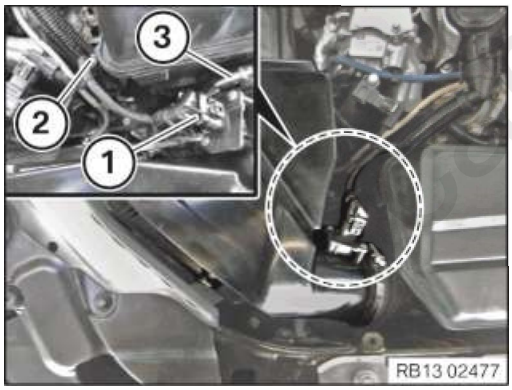
Hot surfaces.

Risk of burning!

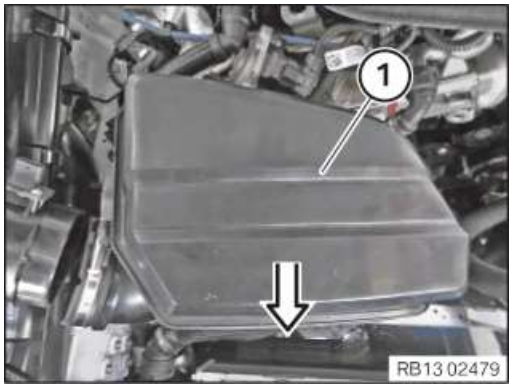
- Perform all work only on components that have cooled down.



- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

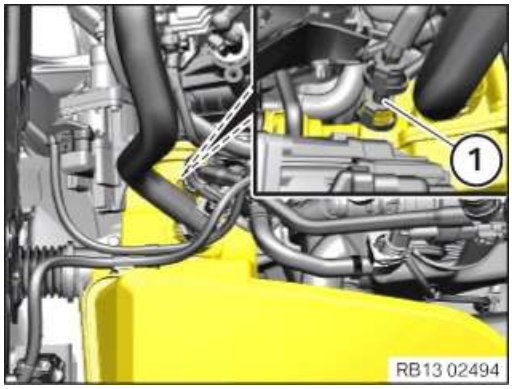


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

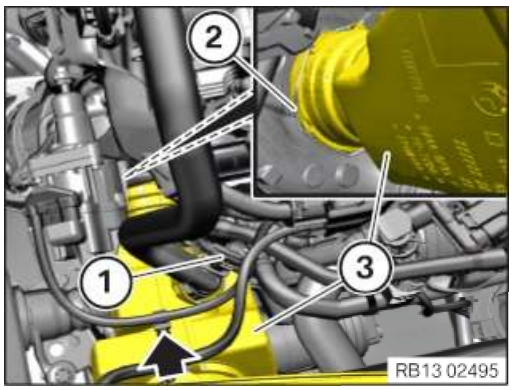


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

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- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

11 – Removing both front wheels

▸ **Removing the wheel**



- In vehicles with M Carbon ceramic brake: The wheel assembly jack must be used to remove the wheel (see workshop equipment).

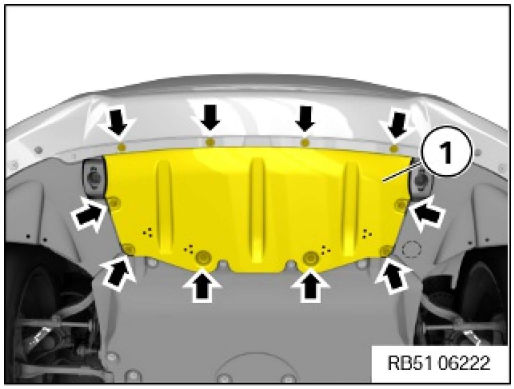
  This process is intended to prevent damage to the brake disc.



- If several wheels are removed simultaneously: Use a piece of chalk to mark on each tyre the axle and side on which the corresponding wheel is fitted.
- Release the wheel bolts (arrows) crosswise and remove the wheel.
- To release and tighten wheel bolts with a security code: Use a suitable adapter from the tool set .

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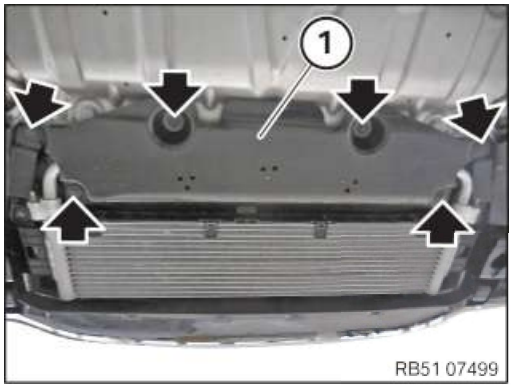
12 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

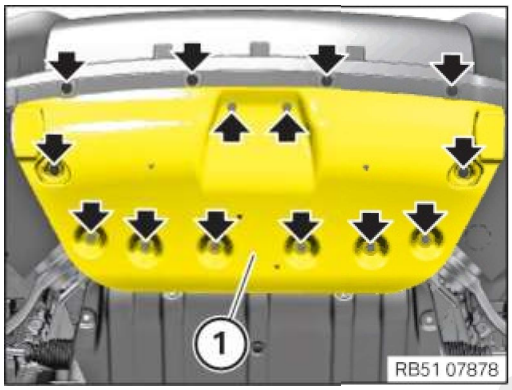
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

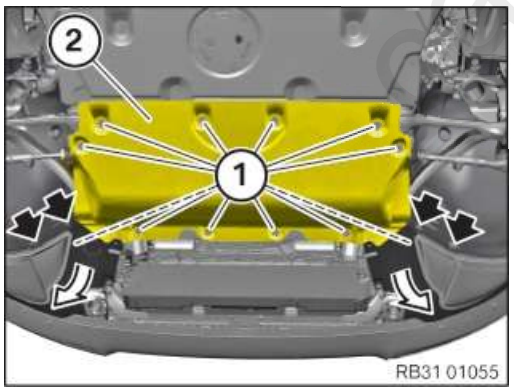


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

13 – Remove the underbody protection of the steering gear



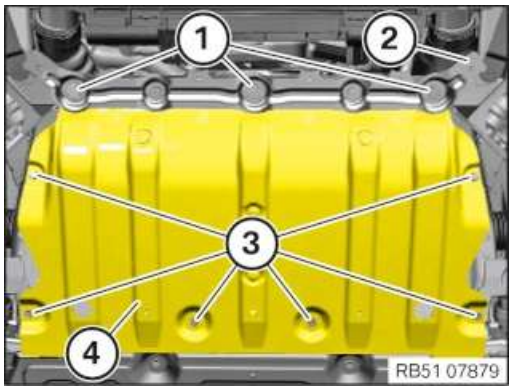
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

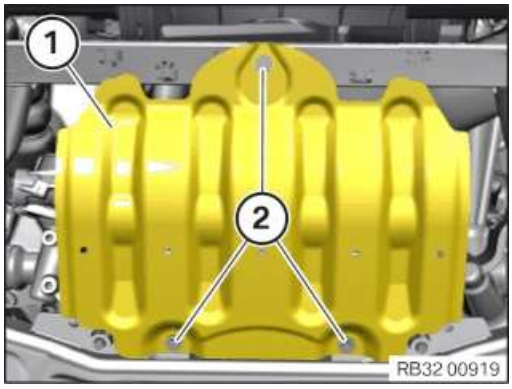
  Slide the steering gear underbody protection (4) out and remove.

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14 – If installed: Removing the steering start protection

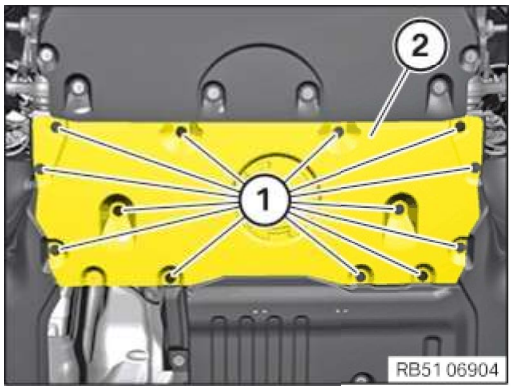
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

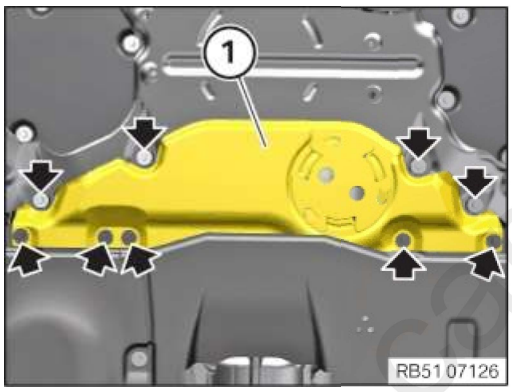
15 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

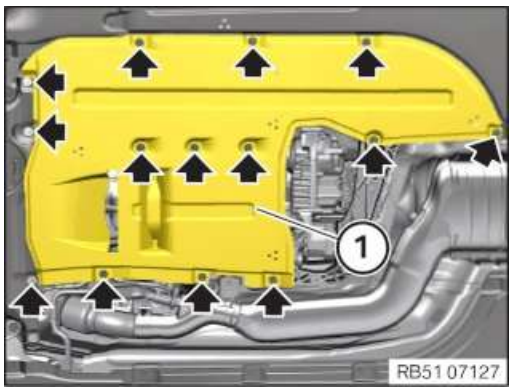


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

16 – Remove rear underbody protection

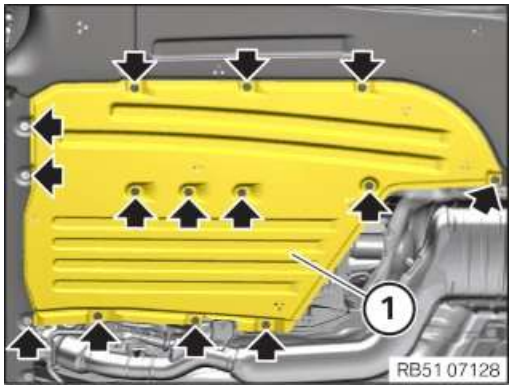


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

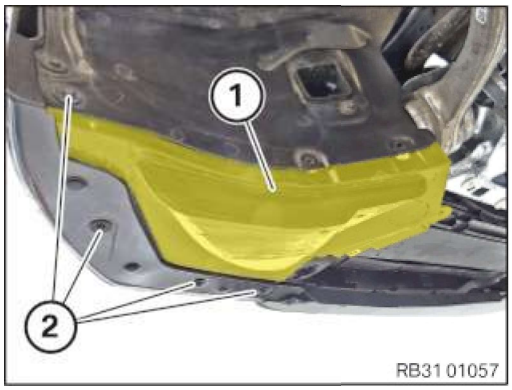
  Guide out rear underbody protection (1) and remove it.

17 – Removing the bottom left and right wheel arch cover

NOTICE

Description is for left component only. Procedure on the right side is identical.

▶ **Remove bottom wheel arch cover**

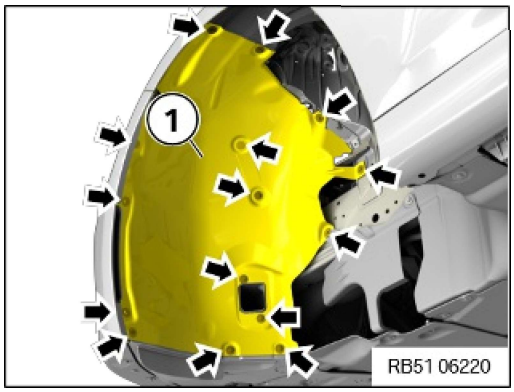


- Loosen screws (2).
- Remove bottom wheel arch cover (1)

18 – Removing the front section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.



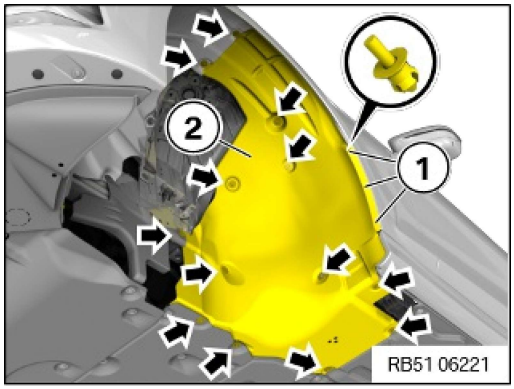
- Remove screws (arrows).
- Remove front section of the front wheel arch cover (1).

19 – Removing the rear section of the front wheel arch cover front

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.

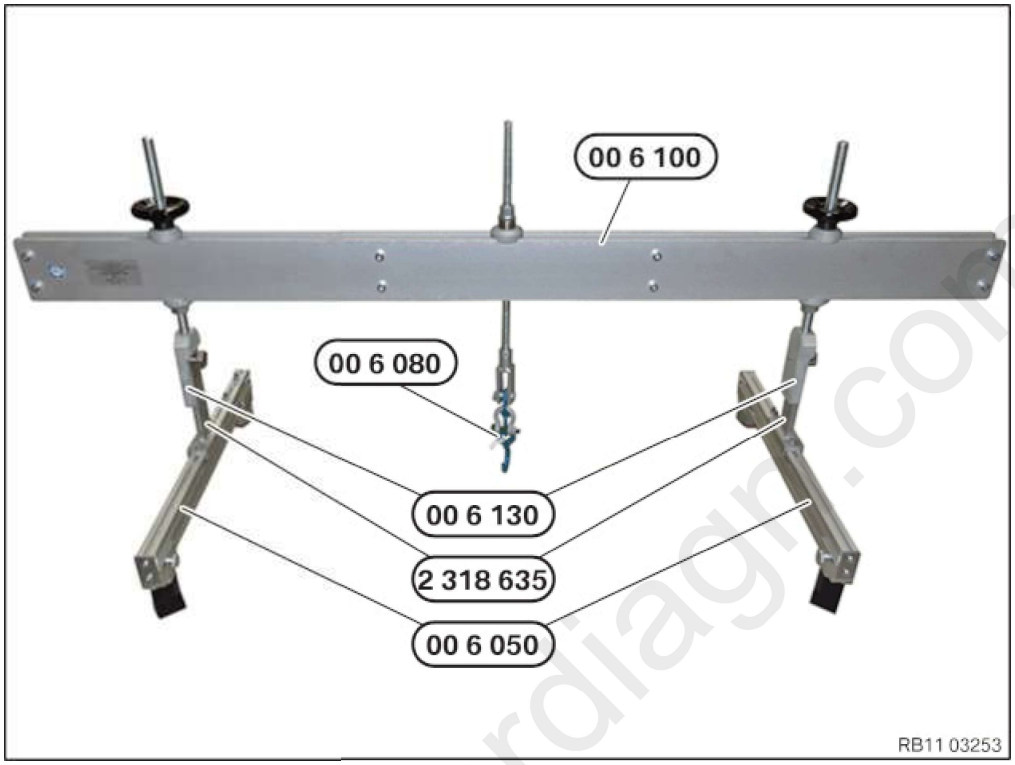
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- Loosen the expanding rivet (1).
- Remove screws (arrows).
- Remove the rear section of the front wheel arch cover (2).

20 – Securing engine in installation position

Overview: Prepared engine bridge



CAUTION

Components connected to the engine joint or cross member.

Danger of injury!

- Check lifting eyes and engine mounting brackets for damage, e.g. cracks.
- Attach the component to correctly mounted engine joints or cross members only.
- Exclusively lift the component, do not move it forwards, backwards or in transverse direction.



- Guide in and position special tool 2 459 012 on cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm

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- **Carefully** position engine bridge (1) with help from an auxiliary person.



- Make sure that special tool on the left is correctly positioned on the lock support.
- Make sure that special tool from the set of special tools , left, rests correctly on the spring strut dome.



- Make sure that special tool on the right is correctly positioned on the lock support.
- Make sure that special tool from the set of special tools , right, rests correctly on the spring strut dome.



- Align the engine bridge by moving it on the profile strips of the special tool above the engine mounting bracket (1) and screw it down.
- Align the hook above the engine mounting bracket (1).
- Connect the hook to the engine mounting bracket (1).



- Check whether the special tool on the right is correctly positioned on the lock support.

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- Check whether the special tool from the special tool kit , right, rests correctly on the spring strut dome.



- Check whether the special tool on the left is correctly positioned on the lock support.



- Check whether the special tool from the special tool kit , left, rests correctly on the spring strut dome.



- Release screw (1) on the left engine mount from the top with a commercially available tool.



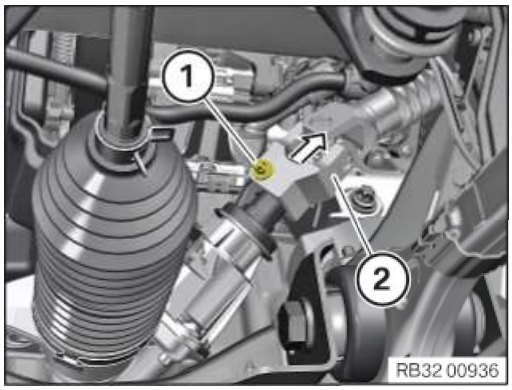
- Release screw (1) on the right engine mount from the top with a commercially available tool.

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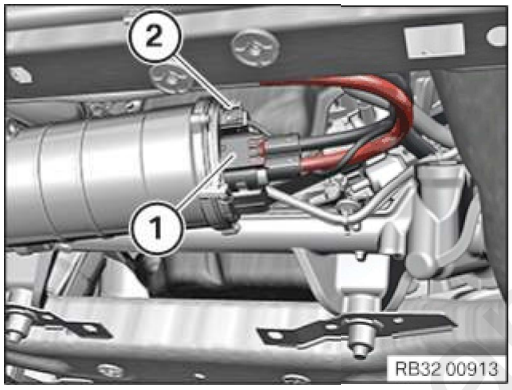
- Raise the engine by turning the special tool 2 361 506 (00 6 103) (spindle) by 10 mm.

21 – Releasing lower steering shaft from steering gear

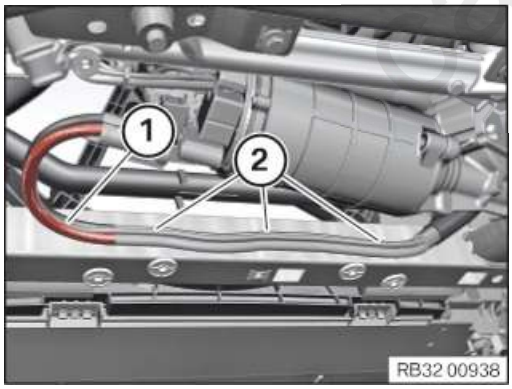


- Loosen screw (1).
- Pull off lower steering shaft (2) from steering gear in direction of arrow.

22 – Detach the wiring harness of the EPS from the front axle support

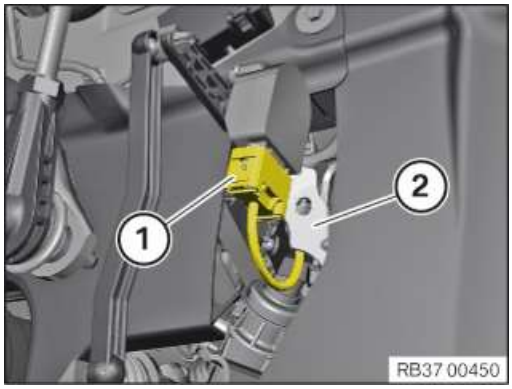


- Unlock and disconnect the plug connections (1) and (2).



- Loosen the holder (2).
- Place wiring harness (1) to one side.

23 – Detach the line connection of the ride height sensor



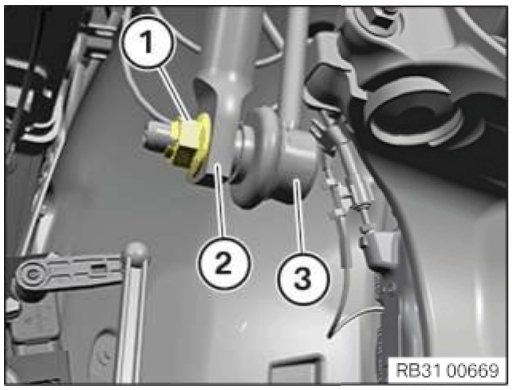
- Unlock plug connection (1) and disconnect.
- Unclip the line from holder (2).

24 – Release the left and right anti-roll bar link from the anti-roll bar

NOTICE

Perform the operations on the left and right side.

▸ **Loosening the anti-roll bar link from the anti-roll bar**



- Loosen nut (1).

Note: Use the Torx socket for counter support.

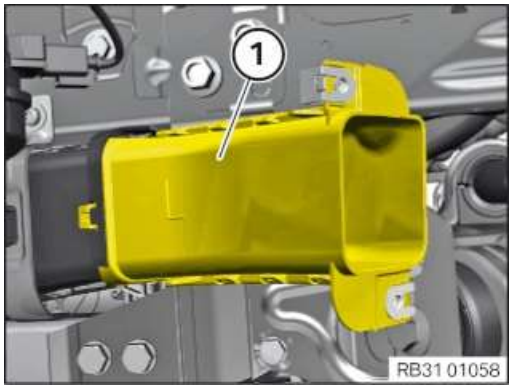
- Loosen the anti-roll bar link (3) from the anti-roll bar (2).

25 – Removing the left and right brake air duct partially

NOTICE

Perform the operations on the left and right side.

▸ **Removing brake air duct partially**



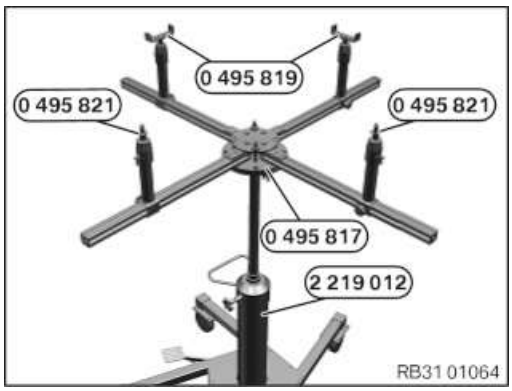
- Unclip and remove air duct (1).

26 – Preparing the special tool

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TECHNICAL INFORMATION

In a profile rail pair, two profile rails are connected to one another by gearing.



- Fit the special tool completely on the universal jack 2 219 012 with the help of an auxiliary person.
- Insert special tools in telescopic supports of a profile rail pair.
- Insert special tools in telescopic supports of other profile rail pair.

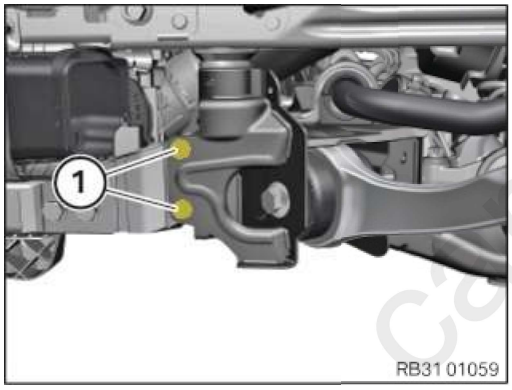
27 – Lower front axle support

WARNING

Falling or tipping of a heavy component.

Danger! Life-threatening injuries!

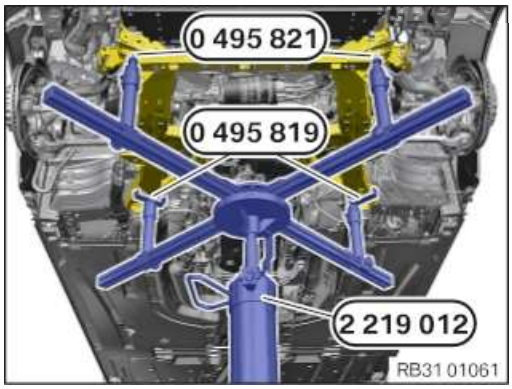
- Before lowering or removing the front axle: Secure the engine in mounting orientation.
- For additional information see: 11 00 670 Securing engine in installation position.



NOTICE

Perform the operations on the left and right side.

- Loosen screws (1).

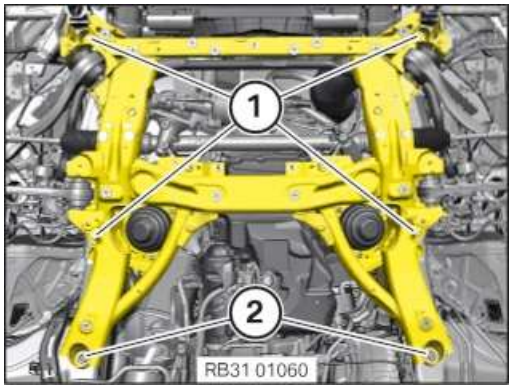


- Position the universal jack 2 219 012 with the special tools and on the front axle support.

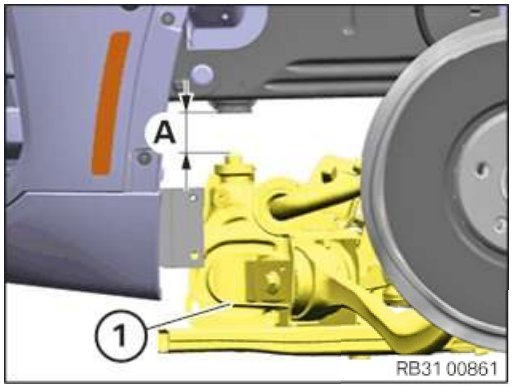
  The centre of gravity of the front axle must be centred over the universal jack 2 219 012 !

- Support the front axle support with the universal jack 2 219 012.

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- Loosen screws (1) and (2).



- Lower the front axle support (1) with the universal jack by dimension (A).

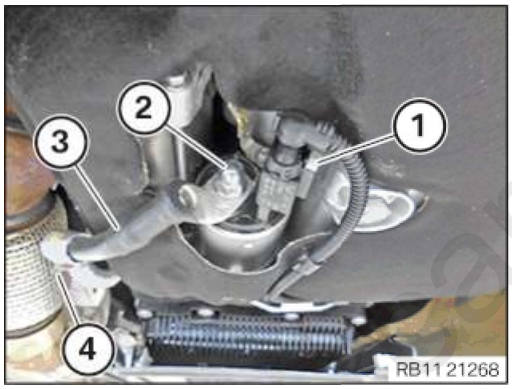
  Dimensions (A) = maximum 15 cm

MAIN WORK

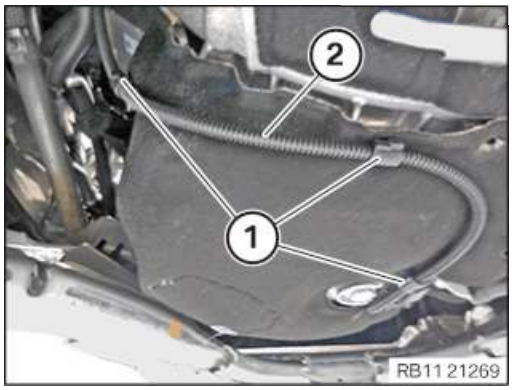
28 – Removing the acoustic cover of the oil sump

Prerequisite

Disconnect all negative battery cables.

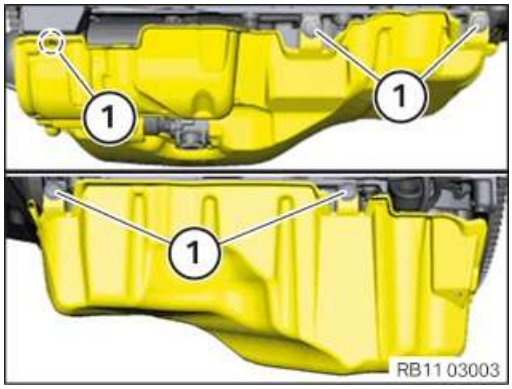


- Unlock and loosen connector (1).
- Loosen nut (2).
- Guide the positive battery cable (3) out of the clamp (4) and lay to one side.



- Unlock and loosen the clamps (1).
- Guide out the wiring harness section of automatic transmission (2) and set it aside.

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- Detach all expanding rivets (1).

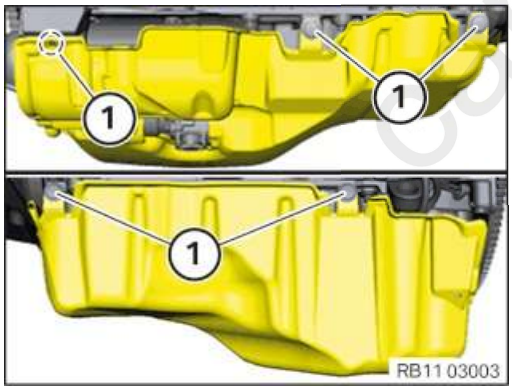


- Guide out acoustic cover (1) downwards to the rear and remove it.

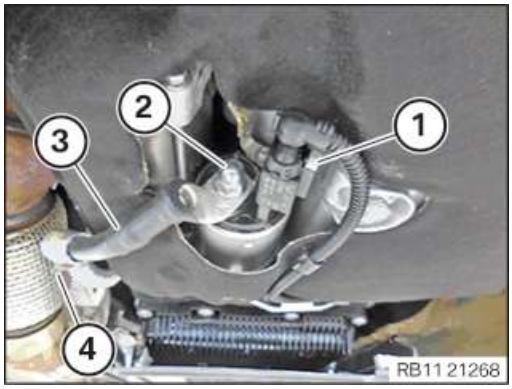
29 – Installing the acoustic cover for the oil sump



- Install acoustic cover (1) to the top front.

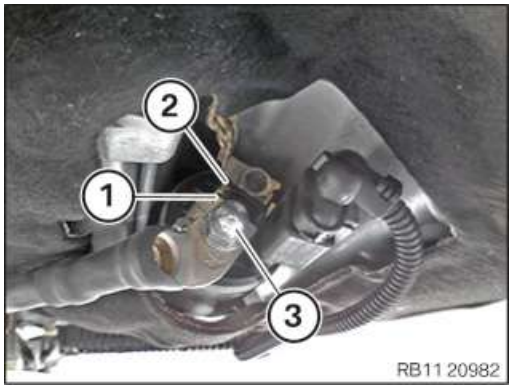


- Secure all expanding rivets (1).



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.
- Insert and install the positive battery cable (3).
- Secure positive battery cable (3) at the clamp (4).
- Tighten the nut (2) hand-tight.

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CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

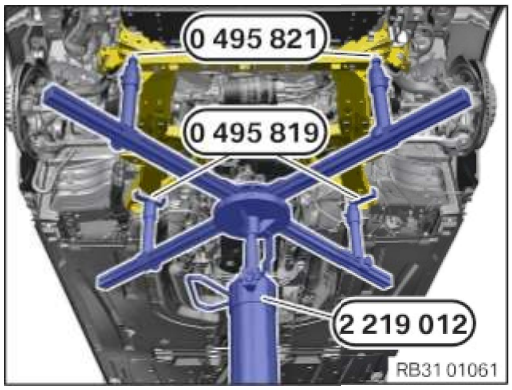
- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

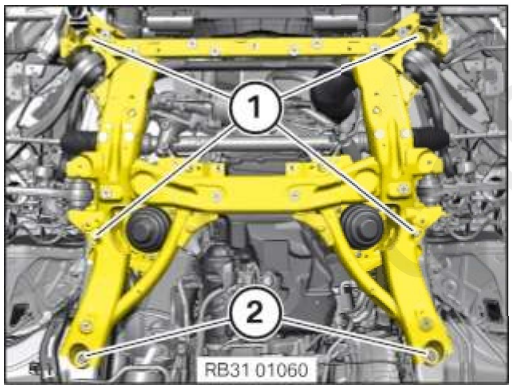
M8		Tightening torque	13,5 Nm

POSTPROCESSES

30 – Lift front axle support and fasten.



- Carefully lift the front axle support with the universal jack 2 219 012 and position on the body.



- Replace the screws (1).

  Parts: Bolts
- Tighten the screws (1).

Front axle support to front/centre of body

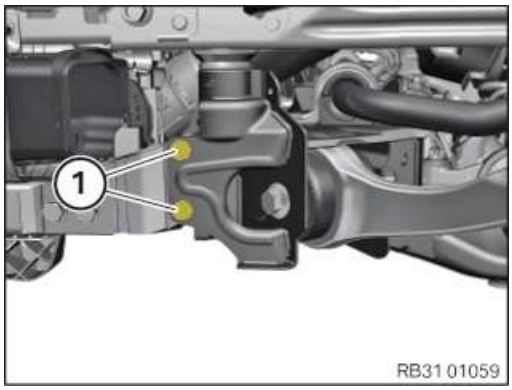
M12	Renew screws.	Jointing torque	108 Nm

- Replace the screws (2).

  Parts: Bolts
- Tighten the screws (2).

Front axle carrier to body, rear

M14	Renew screws.	Tightening torque	175 Nm

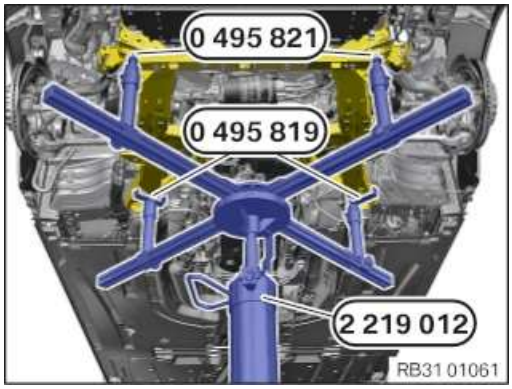


- Position the adapter for the front axle support on the front axle support .
- Tighten the screws (1).

Adapter, front axle support to front axle support

M8x70		Tightening torque	19 Nm

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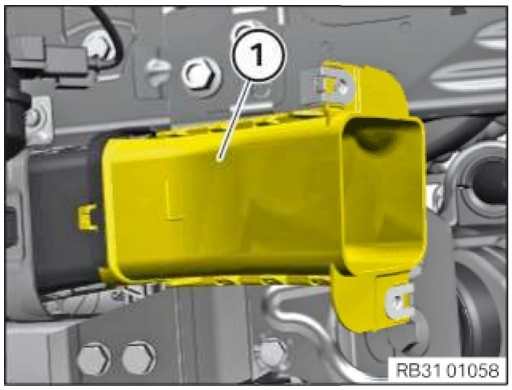
- Lower the universal jack 2 219 012 and place to one side.

31 – Partially installing the left and right brake air duct

NOTICE

Perform the operations on the left and right side.

▸ **Installing the brake air duct partially**



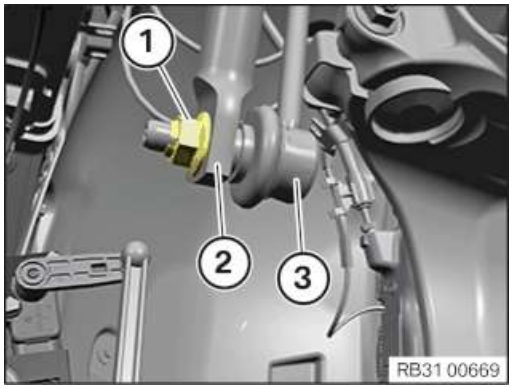
- Position and clip in air duct (1).

32 – Securing the anti-roll bar link to the left and right anti-roll bar

NOTICE

Perform the operations on the left and right side.

▸ **Securing the anti-roll bar link to the anti-roll bar**



- Position the anti-roll bar link (3) on the anti-roll bar (2).
- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

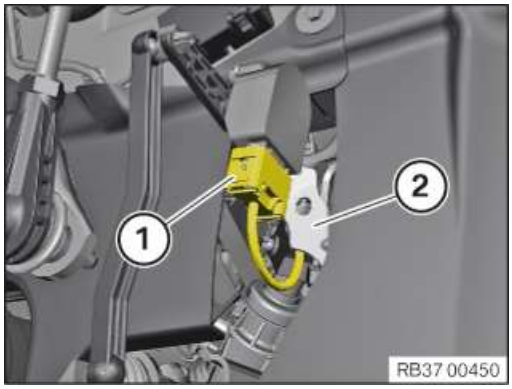
Note: Use the Torx socket for counter support.

Front anti-roll bar link to anti-roll bar/spring strut

M10	Renew nut.	Tightening torque	56 Nm

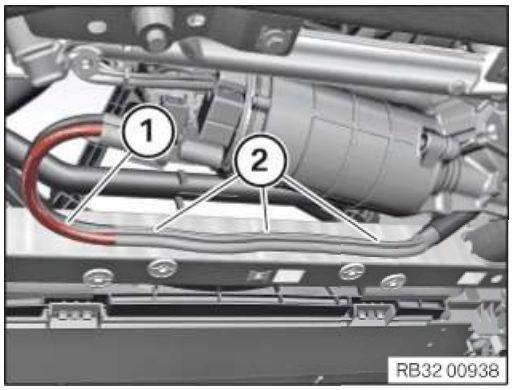
33 – Attach the line connection of the ride height sensor

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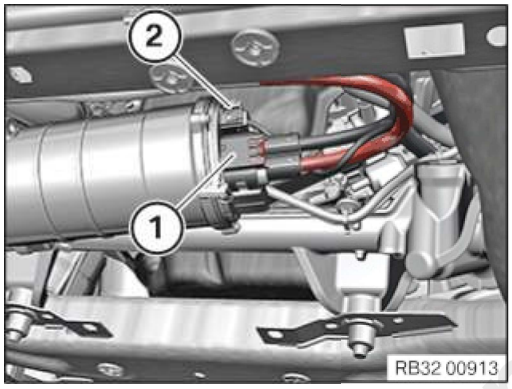


- Position the line .
- Clip in line on holder (2) .
- Connect connectors (1) and lock.

34 – Secure the wiring harness for the EPS on the front axle support



- Position the EPS wiring harness (1) from the front axle support.
- Secure the holder (2).

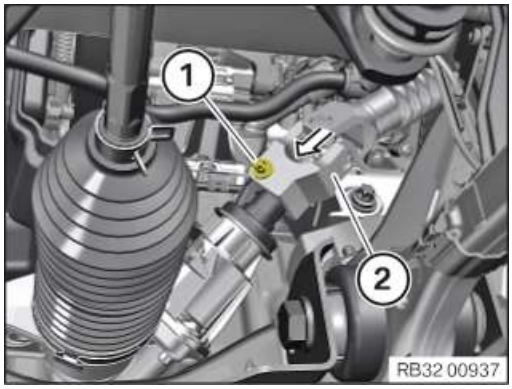


- Connect connectors (1) and (2) lock.

35 – Securing the steering shaft at the bottom on the steering gear

TECHNICAL INFORMATION

The universal joint can only be installed in one position.
The universal joint and the bottom steering gear and/or steering shaft are encoded with each other.
The clamping bolt must e positioned in the groove of the steering gear groove or the steering shaft.



- Clean the screw threads to remove all remnants of screw locking adhesive.
- Slide the lower steering shaft (2) onto the steering gear in the direction of the arrow.
- Renew the clamping bolt (1).

  Parts: Clamping bolt
- Tighten the clamping bolt (1).

Universal joint to steering box

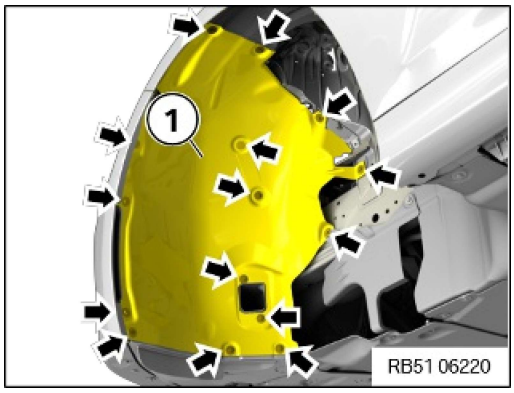
M8	Recut screw thread. Renew clamping bolt. No retorquing permitted!	Tightening torque	28 Nm

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36 – Install the front section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.



- Install the front section of the front wheel arch cover (1).
- Tighten screws (arrows).

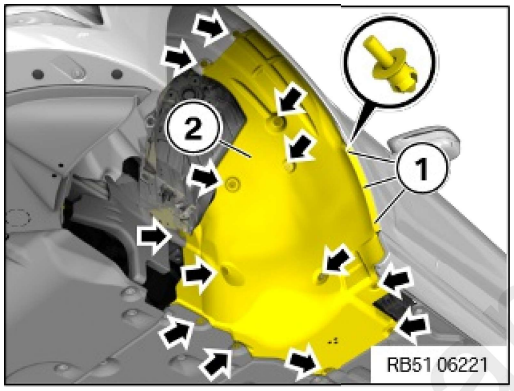
Wheel arch trim panel, front

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

37 – Install the rear section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.



- Install the rear section of the front wheel arch cover(2) .
- Tighten screws (arrows).

Wheel arch trim panel, front

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

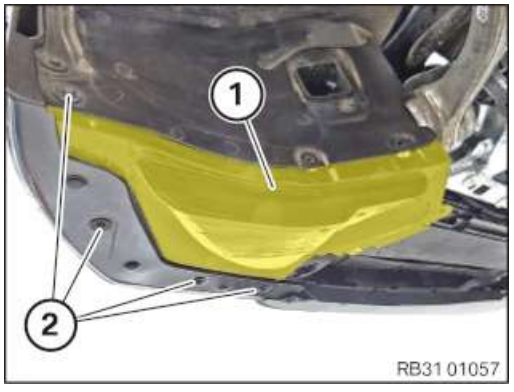
- Secure expanding rivet (1).

38 – Installing the bottom left and right wheel arch cover

NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Installing the bottom wheel arch cover**



- Position the bottom wheel arch cover (1).
- Tighten the screws (2).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

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▶ **Mounting the wheel**



TECHNICAL INFORMATION

The contact surface between the brake disc and the wheel rim must be clean and free from oil and grease. There is otherwise a risk of the wheel becoming loose at a later time.

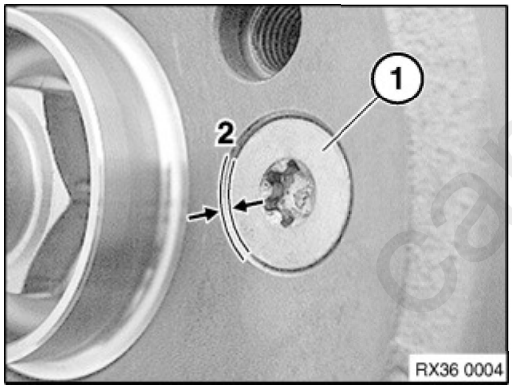
- Remove dirt, grease residues and corrosion from the contact surface with a drill and the special tool 2 344 011.

  Do not operate special tool 2 344 011 with an impact screwdriver.
- Degrease the contact surfaces with the universal cleaner (see BMW Group Parts).
- In the event of grease residue in the area of the wheel bolt holes, remove and clean the brake disc.



- Remove dirt, grease residues and corrosion from the contact surface with a drill and the special tool 2 344 011.

  Do not operate special tool 2 344 011 with an impact screwdriver.
- Degrease the contact surfaces with the universal cleaner (see BMW Group Parts).



- Check that the mounting bolt (1) for the brake disc is securely seated.

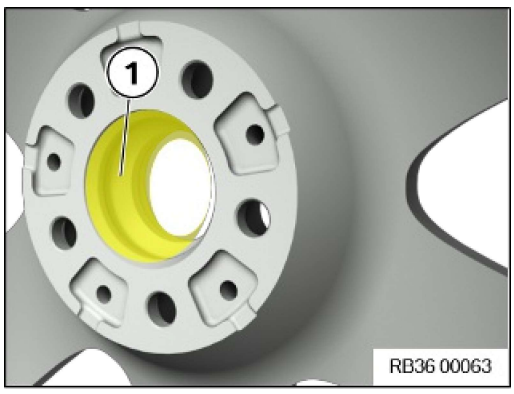
  The mounting bolt (1) for the brake disc may not protrude under any circumstances on the contact surface (2) between the brake disc and the wheel rim.

Brake disc to front wheel hub

M8	Renew screw.	Tightening torque	16 Nm

Brake disc to rear wheel hub

M8	Renew screw.	Tightening torque	16 Nm



- Thinly grease the wheel centring (1) in the wheel rim.

Expendable materials

Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233

carsagn.com



- Lightly grease the front and rear wheel hubs in this area (1) to protect from corrosion.

Expendable materials

Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233



- In vehicles with M Carbon ceramic brake: The wheel assembly jack must be used to install the wheel (see workshop equipment).

  This process is intended to prevent damage to the brake disc.

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TECHNICAL INFORMATION

Never use impact screwdrivers or electric screwdrivers to screw in and tighten the wheel bolts.

The wheel rim must rest uniformly against the brake disc.

In the case of non-original BMW wheel bolts/wheel rims, it may be necessary to retighten the wheel bolts on account of setting properties (refer to the documentation from the manufacturer).

Do not apply oil to new wheel bolts.

- Renew corroded wheel bolts.

  Parts: Wheel bolts
- Clean the wheel bolts.
- Check wheel bolts and threads for damage, renew the wheel bolts if necessary.
- Join and tighten the wheel bolts (arrows).

Wheel bolts

M14 / SW17	Screw in wheel bolts and evenly tighten crosswise by hand in order to centre the wheel rim. Tighten wheel bolts to the prescribed tightening torque with a calibrated torque wrench in a crosswise sequence. Check all the wheel bolts in the same order or retighten to the prescribed tightening torque again.	Tightening torque Check	140 Nm 140 Nm

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40 – Loosen the attachment of the engine in installation position



- Lower engine by turning the spindle 2 361 506 (00 6 103) until the engine lies completely on the engine supports.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the engine bridge (1) with an auxiliary person.



- Tighten bolt (1) of the left engine mount from the bottom using a standard tool.

Engine mount to engine mounting bracket

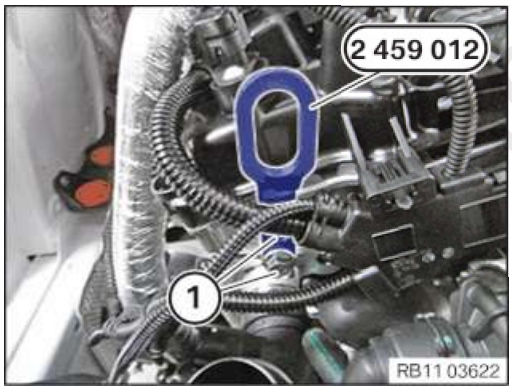
M12		Tightening torque	100 Nm



- Tighten bolt (1) of the right engine mount from the top using a standard tool.

Engine mount to engine mounting bracket

M12		Tightening torque	100 Nm



- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

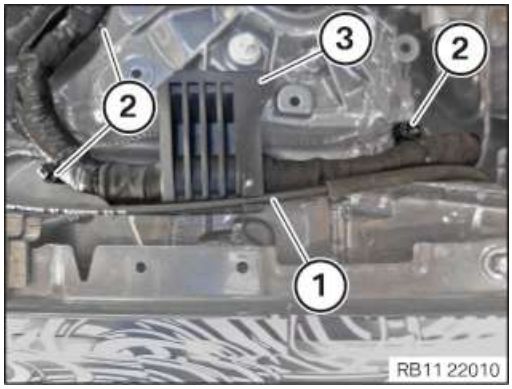
41 – Securing the wiring harness section to the left spring strut dome

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in and position wiring harness section (3) on the left spring strut dome.
- Secure clamps (2).
- Guide in and install cable (1) of the front flap.

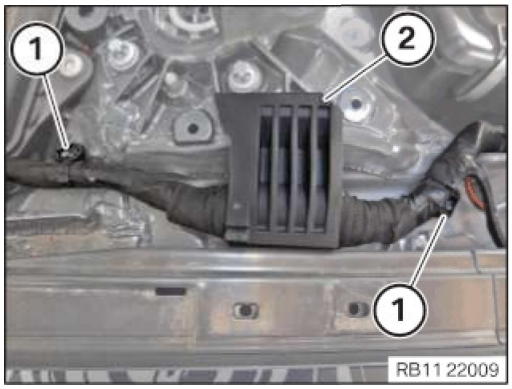
42 – Secure wiring harness section on right spring strut dome

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

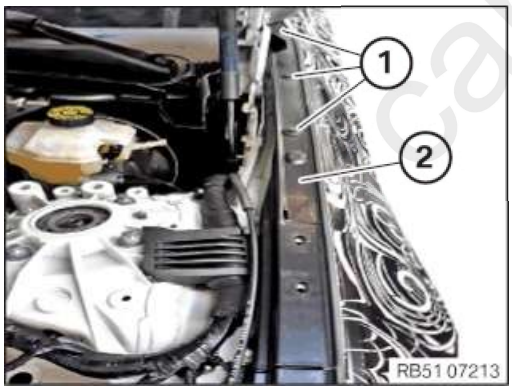
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in and position the wiring harness section (2) of right spring strut dome.
- Secure clamps (1).

43 – Installation of side panel sealing.



NOTICE

Description is for left component only. Procedure on the right side is identical.

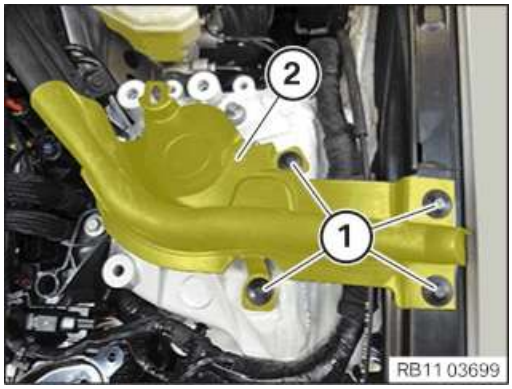
- Guide the sealing (2) in and install it.
- Mount the expanding rivets (1).

44 – Install side bonnet seals

NOTICE

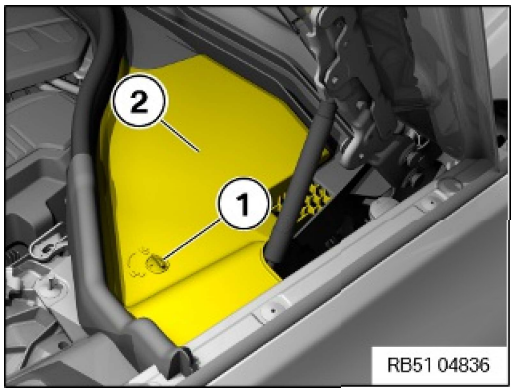
Perform the operations on the left and right side.

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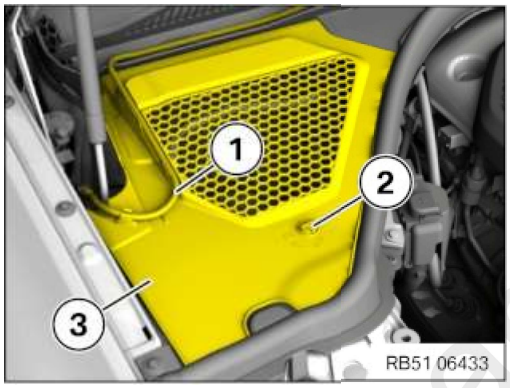
- Position the side bonnet seal (2) on the spring strut dome.
- Secure the rivet (1).

45 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

46 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

47 – Installing the clean air pipe with resonator



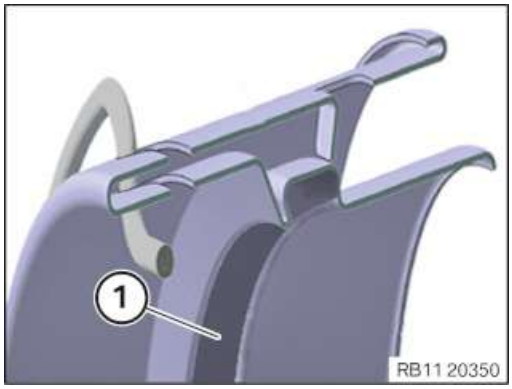
- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

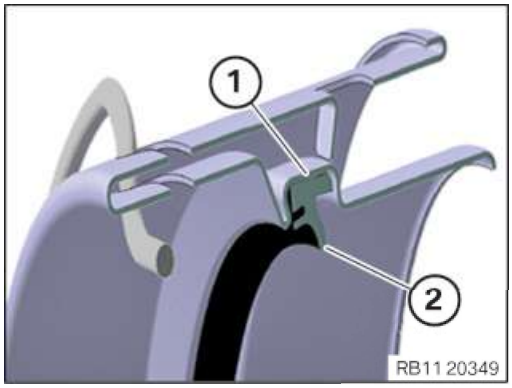
Do not use pointed or sharp-edged tools for the installation and/or removal.

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- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



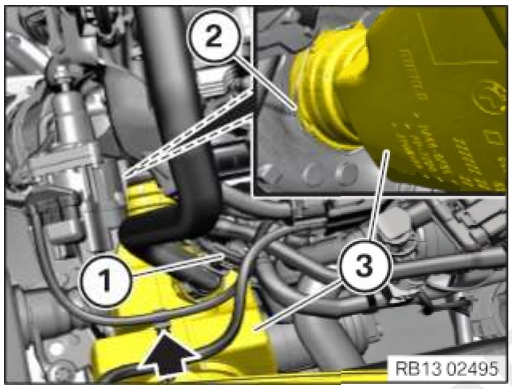
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

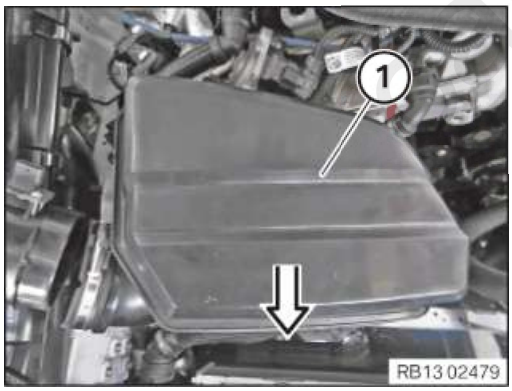
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



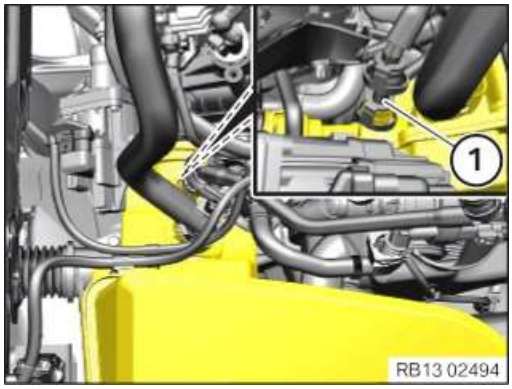
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Secure clamp (arrow).

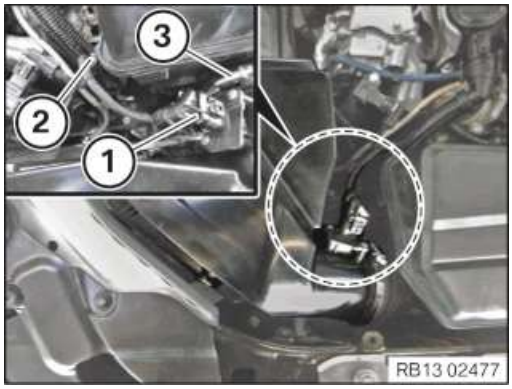


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).

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- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

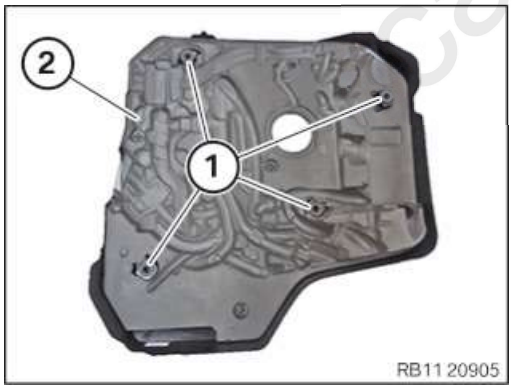
48 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



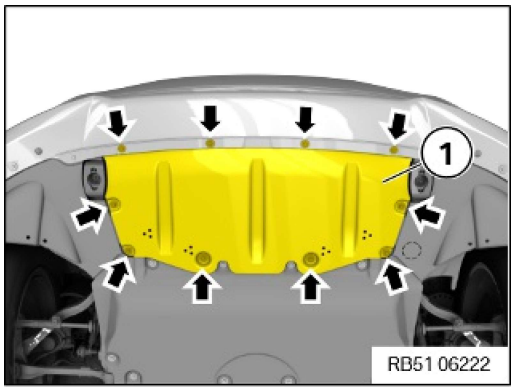
- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

49 – Installing the front underbody protection



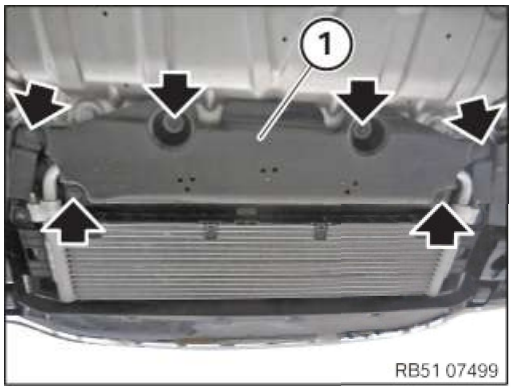
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



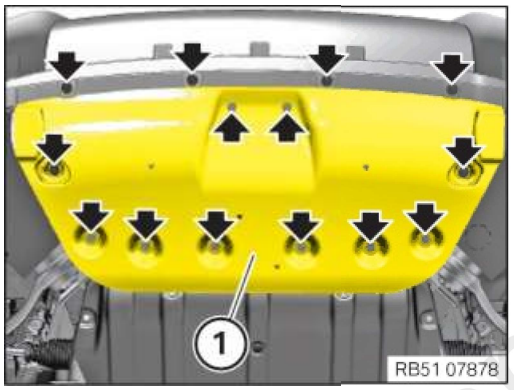
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

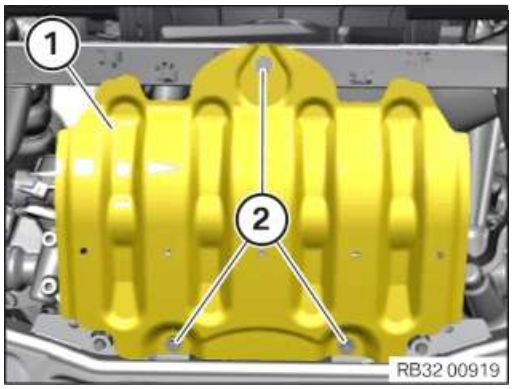
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

50 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



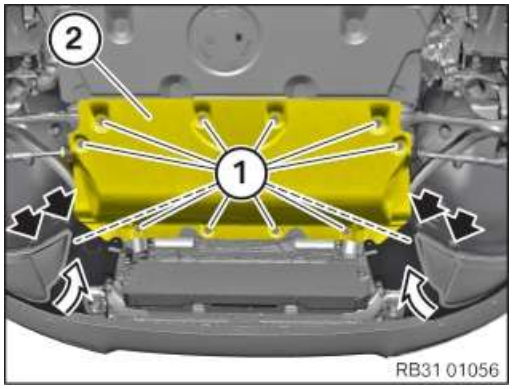
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

51 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

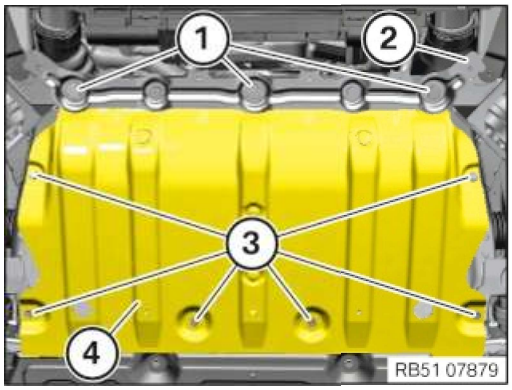
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

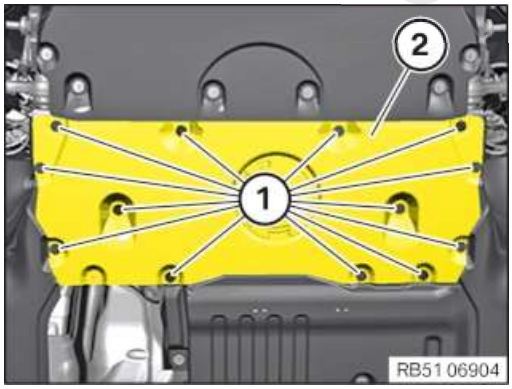
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

52 – Installing the centre underbody protection



- **Version with rear-wheel drive:**

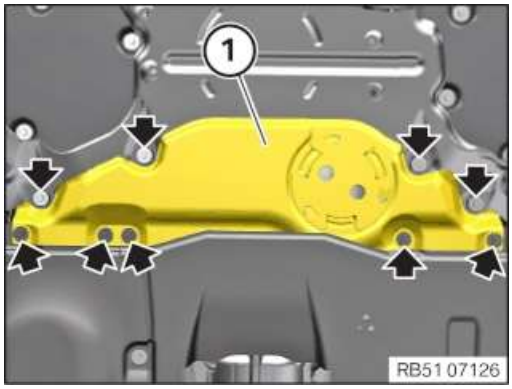
  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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- **Version with all-wheel drive:**

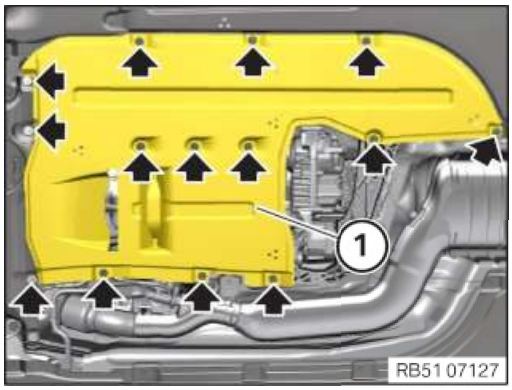
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

53 – Installing underbody protection at rear



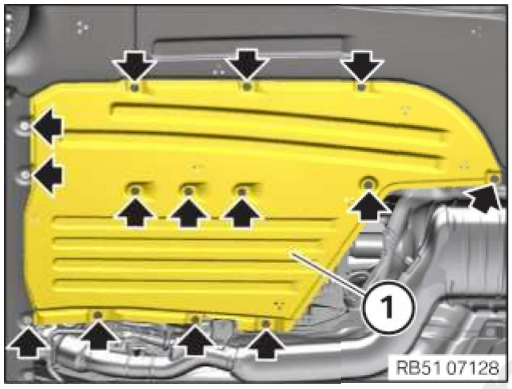
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

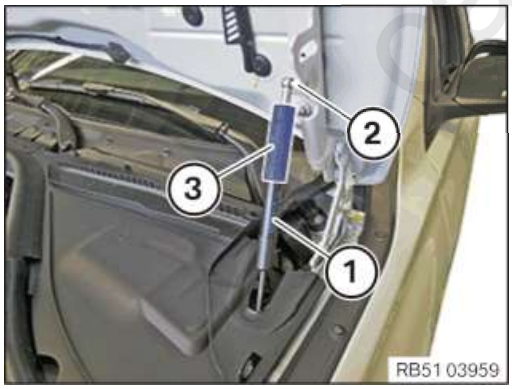
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

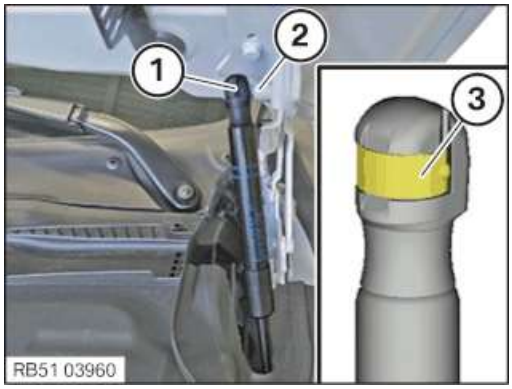
Hexagon screw		Tightening torque	3 Nm

54 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

55 – Disconnecting all battery earth leads



- See additional information.

Additional Information

Overview of Tightening Torques

Special tool to cylinder head			Used in step 20
M8		Tightening torque	21,5 Nm

Battery positive lead to starter			Used in step 29
M8		Tightening torque	13,5 Nm

Front axle support to front/centre of body			Used in step 30
M12	Renew screws.	Jointing torque	108 Nm

Front axle carrier to body, rear			Used in step 30
M14	Renew screws.	Tightening torque	175 Nm

Adapter, front axle support to front axle support			Used in step 30
M8x70		Tightening torque	19 Nm

Front anti-roll bar link to anti-roll bar/spring strut			Used in step 32
M10	Renew nut.	Tightening torque	56 Nm

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Universal joint to steering box — Used in step 35

M8	Recut screw thread. Renew clamping bolt. No retorquing permitted!	Tightening torque	28 Nm

Wheel arch trim panel, front — Used in step 3637

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

Cover, front bottom on side — Used in step 38

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Brake disc to front wheel hub — Used in step 39

M8	Renew screw.	Tightening torque	16 Nm

Brake disc to rear wheel hub — Used in step 39

M8	Renew screw.	Tightening torque	16 Nm

Wheel bolts — Used in step 39

M14 / SW17	Screw in wheel bolts and evenly tighten crosswise by hand in order to centre the wheel rim. Tighten wheel bolts to the prescribed tightening torque with a calibrated torque wrench in a crosswise sequence. Check all the wheel bolts in the same order or retighten to the prescribed tightening torque again.	Tightening torque Check	140 Nm 140 Nm

Engine mount to engine mounting bracket — Used in step 40

M12		Tightening torque	100 Nm

Clean air pipe to upper section of intake filter housing — Used in step 47

Clamp		Tightening torque	3 Nm

Underbody protection front — Used in step 49

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Bumper buffer device steering on front axle support — Used in step 50

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 51

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 51

Thermoplastic hexagon screw		Tightening torque	3 Nm

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Holder underride guard to front axle support			Used in step 51
M10		Tightening torque	56 Nm

Underbody protection			Used in step 5253
Hexagon screw		Tightening torque	3 Nm

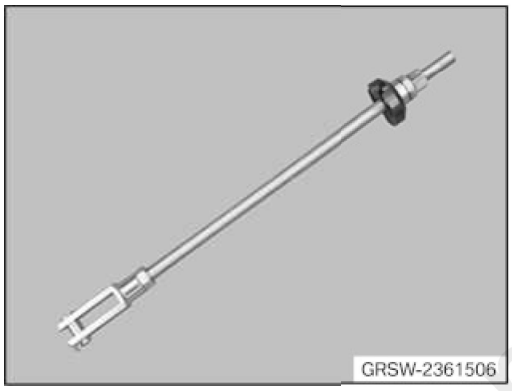
Overview of Special Tools

2 459 012 Holder



Common	Used in step 2040
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 361 506 (00 6 103) Spindle



Common	Used in step 2040
Usage	Spindle (central spindle) for Traverse 00 6 100.
Included in the tool or work	0 496 852
Storage location	
Replaced by	
In connection with	
SI-Number	01 17 10 (659)

2 219 012 Hydraulic lifter



Common	Used in step 262730
Usage	For raising and lowering various vehicle components.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 90 (207)

carorgn.com

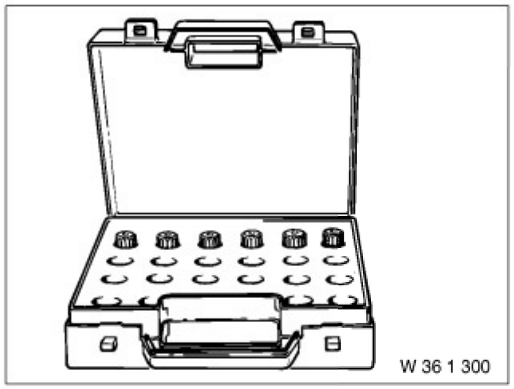
2 344 011 Tool



Common	Used in step 39
Usage	Tool (wheel hub grinder) for cleaning the connection of the wheel rim (wheel contact face) to the wheel hub.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	08 08 12 (872)

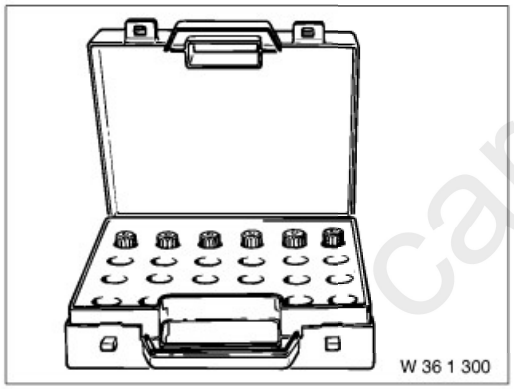
Replacement tools:

0 495 221 (36 1 323) Wheel stud



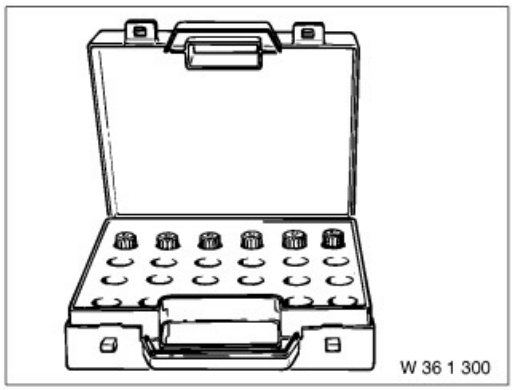
Common	Used in step 11
Usage	(Code 30) Code 39 available separately, (see EPC) under 36 13 1 181 259
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 224 (36 1 326) Wheel stud



Common	Used in step 11
Usage	(Code 33) With centring bore available separately, (see EPC) under 36 13 6 765 546
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 225 (36 1 327) Wheel stud



Common	Used in step 11
Usage	(Code 34) With centring bore available separately (see EPC) under 36 13 6 765 547
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

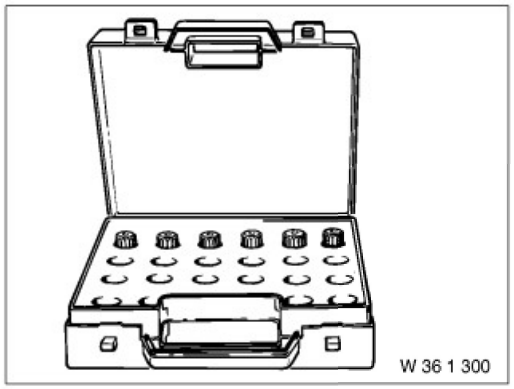
cardiagn.com

0 495 226 (36 1 328) Wheel stud



Common	Used in step 11
Usage	(Code 35) With centring bore available separately, (see EPC) under 36 13 6 762 340
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 227 (36 1 329) Wheel stud



Common	Used in step 11
Usage	(Code 36) With centring bore available separately (see EPC) under 36 13 6 762 341
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 228 (36 1 331) Wheel stud



Common	Used in step 11
Usage	(Code 37) With centring bore available separately (see EPC) under 36 13 6 762 342
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

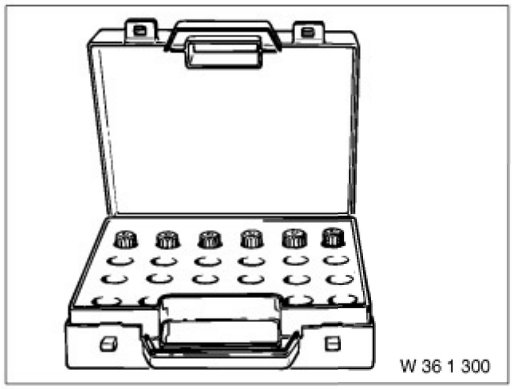
cardiagn.com

0 495 229 (36 1 332) Wheel stud



Common	Used in step 11
Usage	(Code 38) With centring bore available separately (see EPC) under 36 13 6 762 343
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 230 (36 1 333) Wheel stud



Common	Used in step 11
Usage	(Code 40) With centring bore available separately (see EPC) under 36 13 6 762 344
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

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Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	155
61 20 900 Disconnecting and connecting battery earth lead	155
61 20 900 Disconnecting and connecting battery earth lead	155
61 20 900 Disconnecting and connecting battery earth lead	155
61 20 900 Disconnecting and connecting battery earth lead	155
61 20 900 Disconnecting and connecting battery earth lead	155
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	155
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	155

61 20 900 Disconnecting and connecting battery earth lead 155
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads) 155
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle) 155
61 20 900 Disconnecting and connecting battery earth lead 155
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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads) 155
61 20 900 Disconnecting and connecting battery earth lead 155
61 20 900 Disconnecting and connecting battery earth lead 155
61 20 900 Disconnecting and connecting battery earth lead 155
61 20 900 Disconnecting and connecting battery earth lead 155
61 20 900 Disconnecting and connecting battery earth lead 155
61 20 900 Disconnecting and connecting battery earth lead 155
61 20 900 Disconnecting and connecting battery earth lead 155
00 02 001 Raising the vehicle using a vehicle lift

cardiagn.com

11 14 290 Removing and installing/renewing front engine acoustic cover

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Removing the clean air pipe with the resonator

WARNING

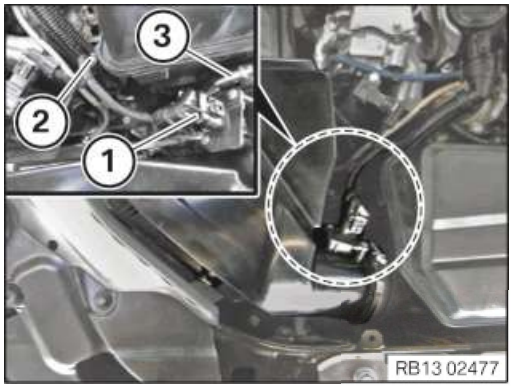
Hot surfaces.

Risk of burning!

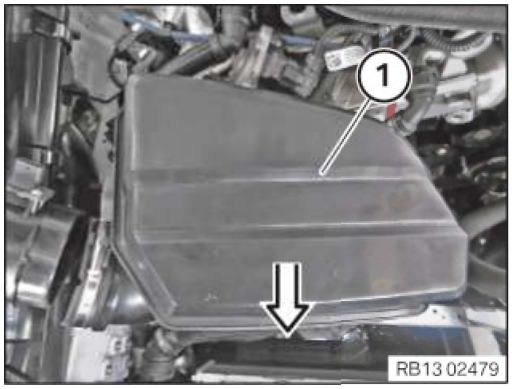
- Perform all work only on components that have cooled down.



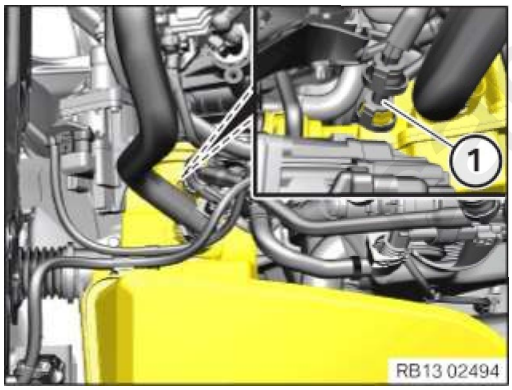
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



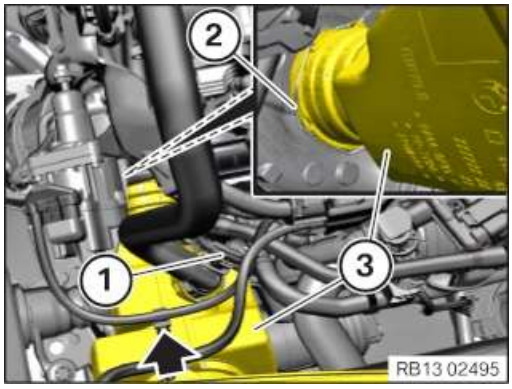
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).

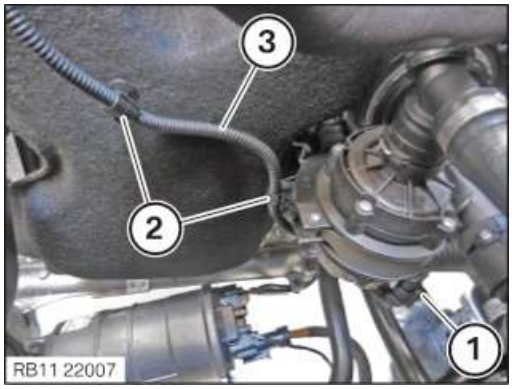


- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

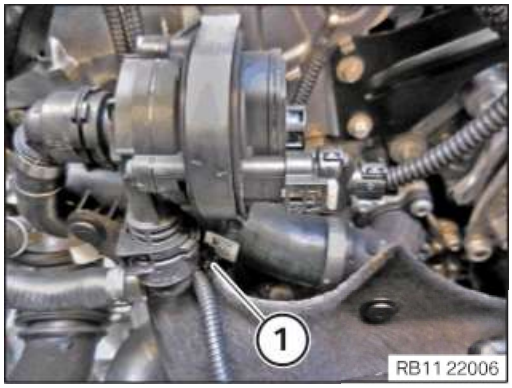
MAIN WORK

3 – Removing the acoustic cover for the engine at the front

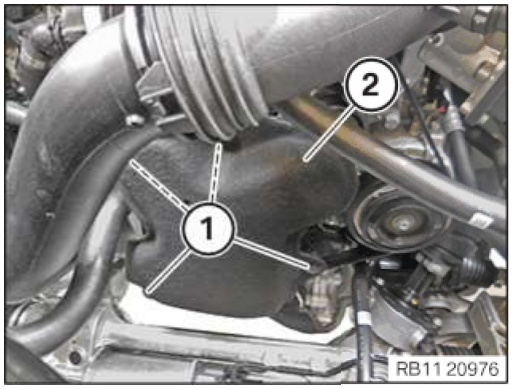
rdiagn.com



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

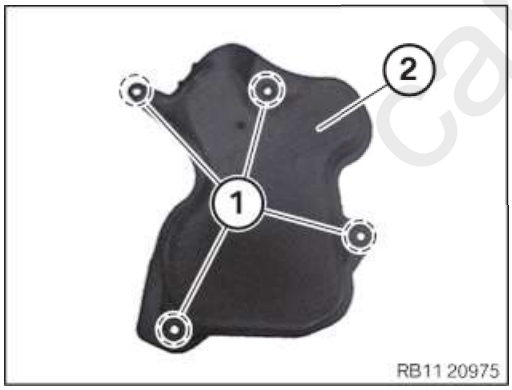


- Loosen clamp (1).



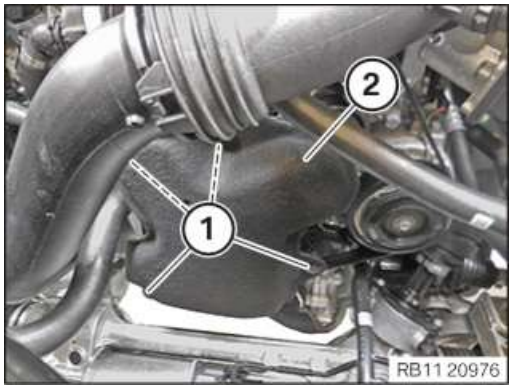
- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

4 – Install the acoustic cover for the engine at the front



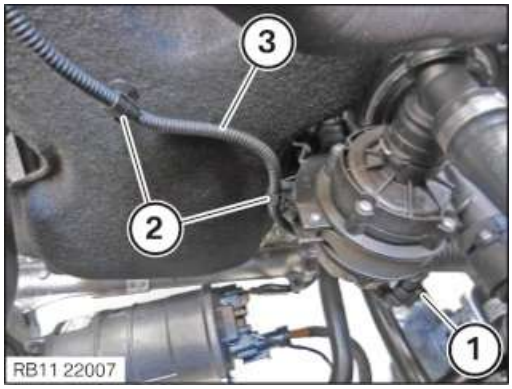
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



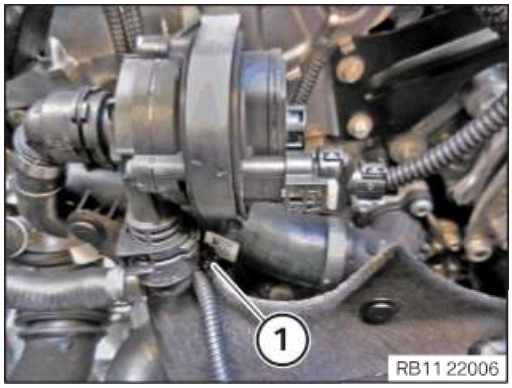
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

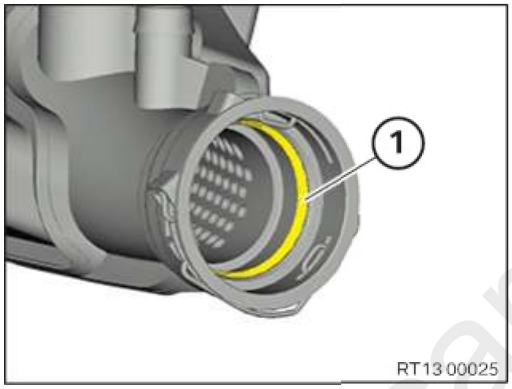
  The connector (1) must engage audibly.



- Secure clamps (1).

POSTPROCESSES

5 – Installing the clean air pipe with resonator

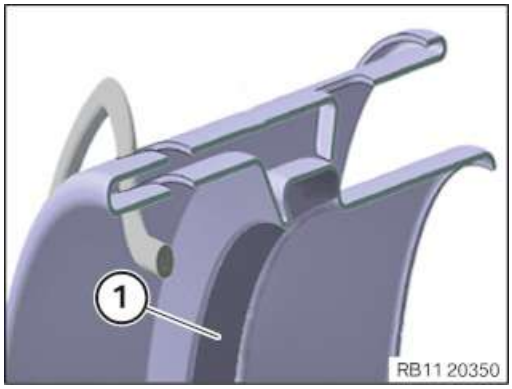


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

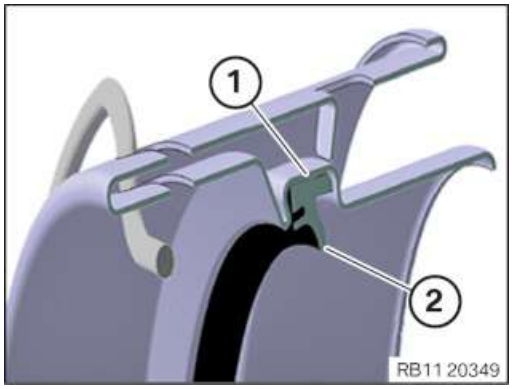
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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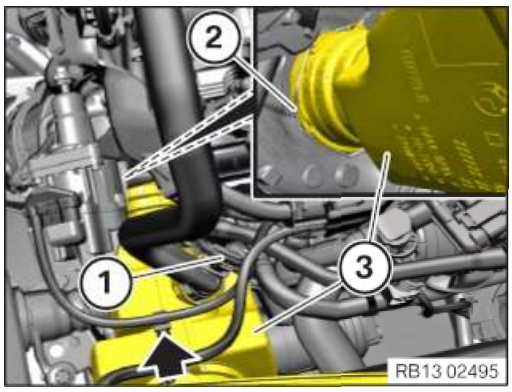
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

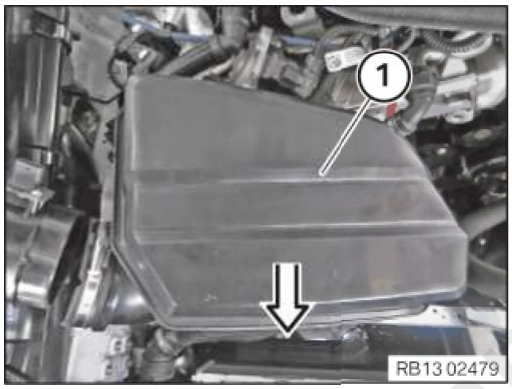
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



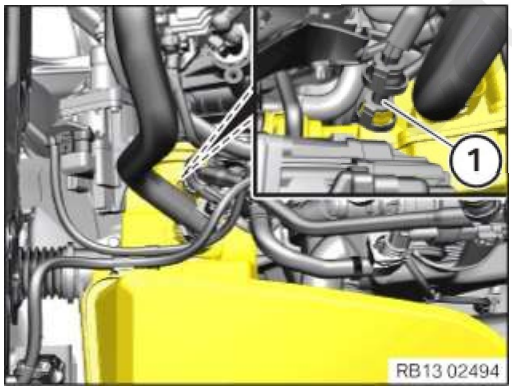
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

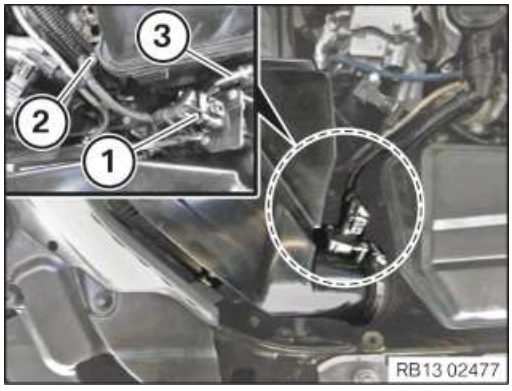
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

diag.com



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

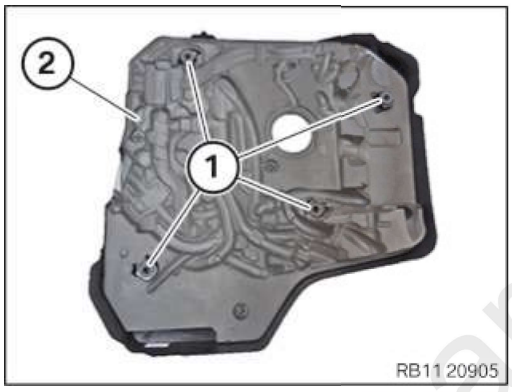
6 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

Additional Information

Overview of Tightening Torques

Clean air pipe to upper section of intake filter housing Used in step 5

Clamp		Tightening torque	3 Nm

11 14 307 Removing and installing/replacing engine encapsulation on the hot side

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

PRELIMINARY WORK

1 – Bring front compartment lid in the service position

Prerequisite

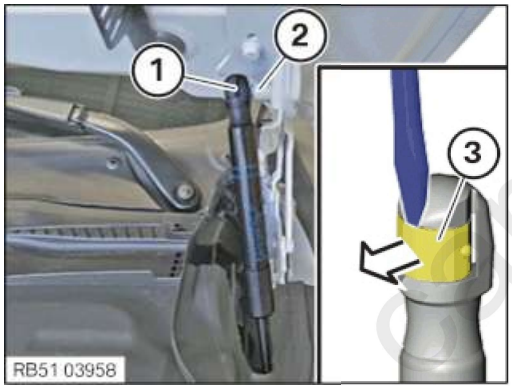
Engine compartment lid is open.

CAUTION

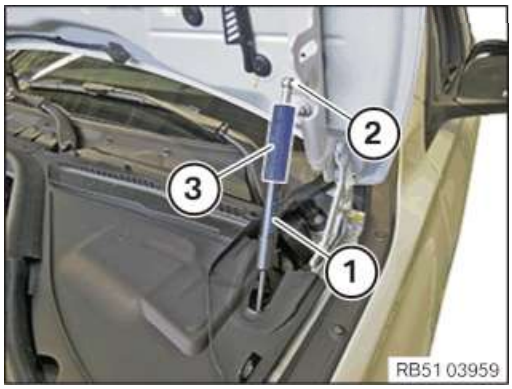
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

2 – Removing the acoustic cover

carsdiagn.com

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

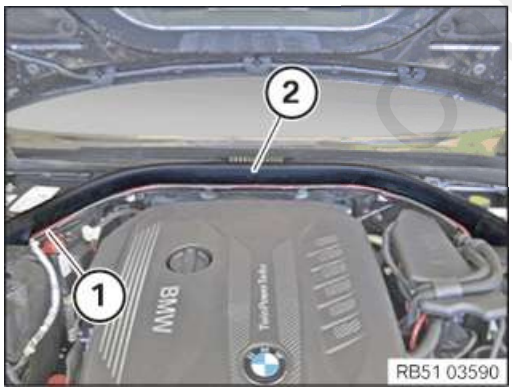
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

4 – Removing acoustic cover at rear

ordiagn.com



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

5 – Removing the clean air pipe with the resonator

WARNING

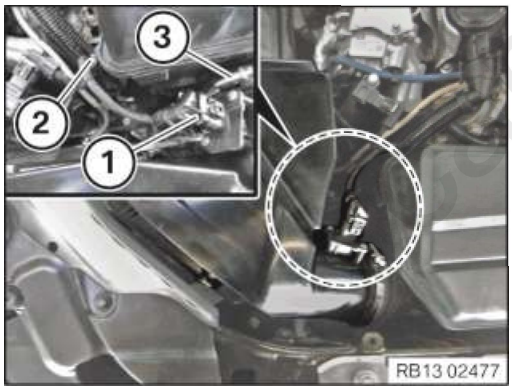
Hot surfaces.

Risk of burning!

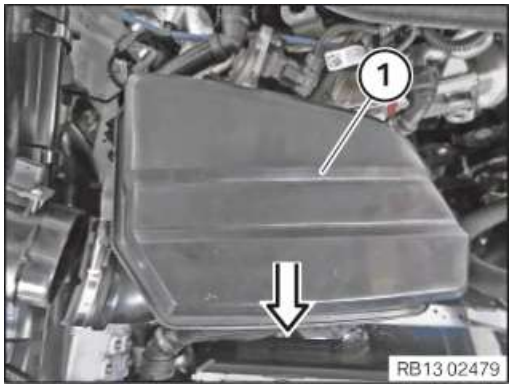
- Perform all work only on components that have cooled down.



- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

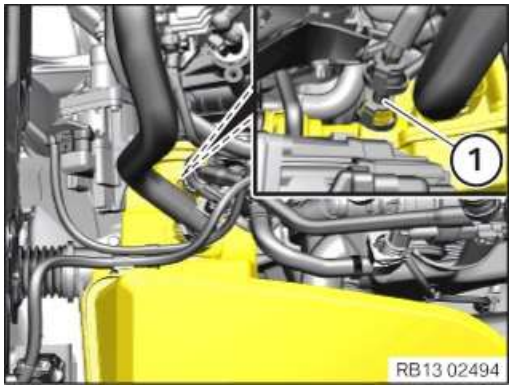


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

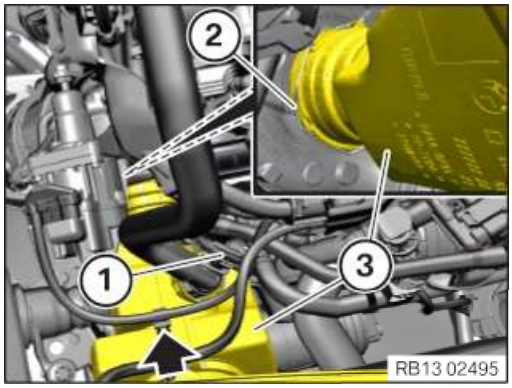


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

partdiagn.com



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

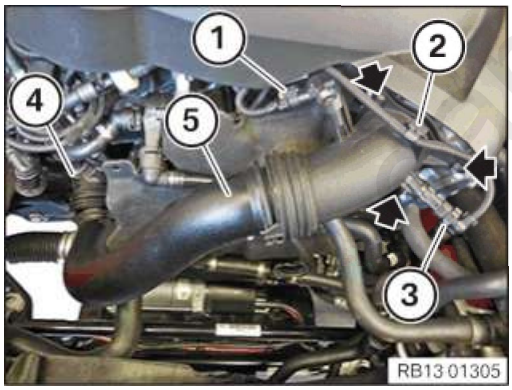
6 – Remove charge air line

WARNING

Hot surfaces.

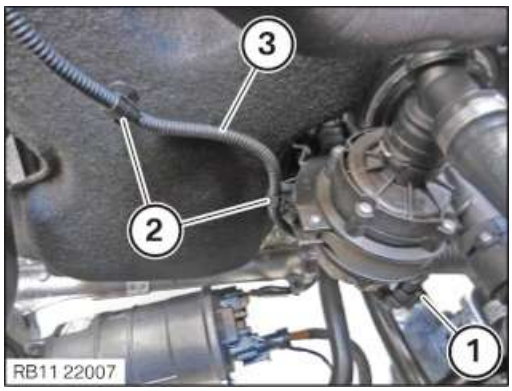
Risk of burning!

- Perform all work only on components that have cooled down.



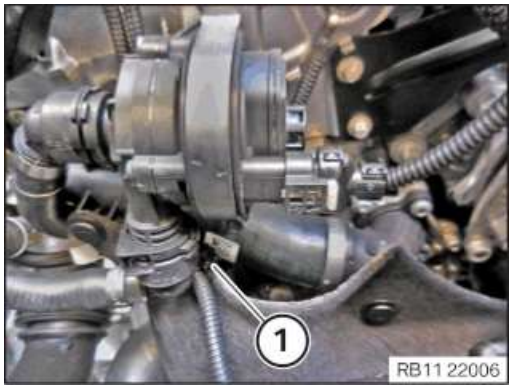
- Unlock and loosen the connector (1) on the charging pressure sensor.
- Unlock and loosen clamp (2).
- Unlock and disconnect the connector (3) from the charge-air temperature sensor.
- Remove screws (arrows).
- Unlock and loosen the clamp (4) on the exhaust turbocharger.
- Guide out and remove charge air line (5).

7 – Removing the acoustic cover for the engine at the front

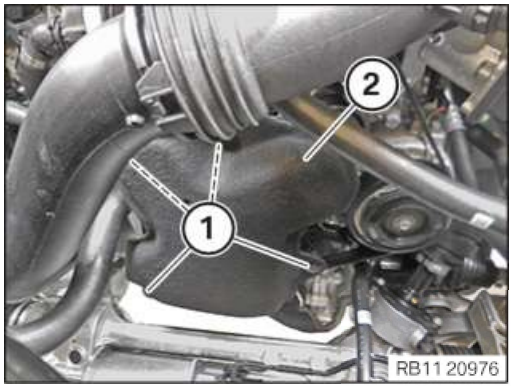


- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

erdiagn.com



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

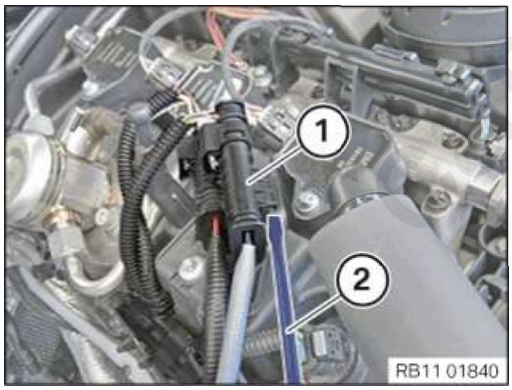
8 – Remove the control sensor

WARNING

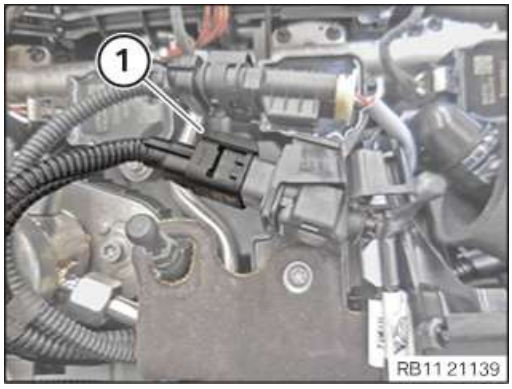
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

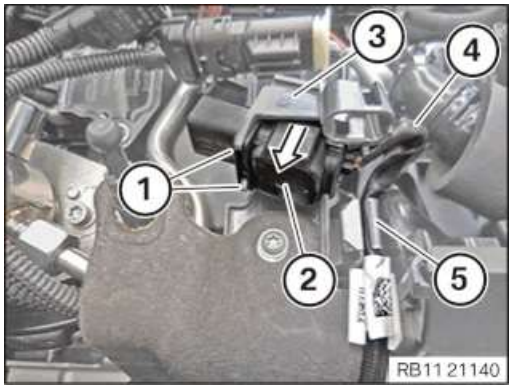


- Unlock connector (1) with screwdriver (2) and remove from the carrier plate.
- Unlock and loosen connector (1).

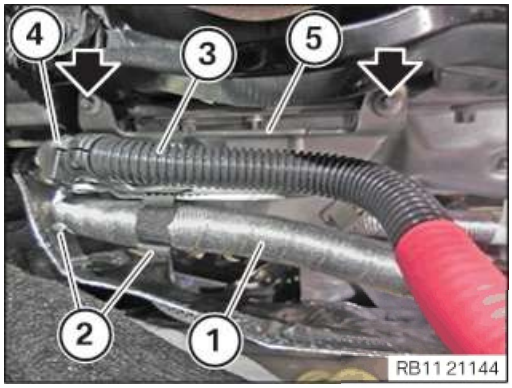


- Unlock and loosen connector (1).

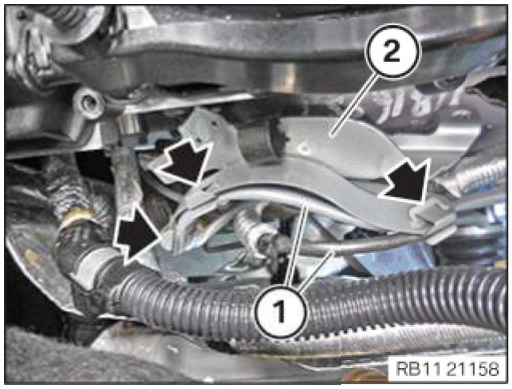
carldiagn.com



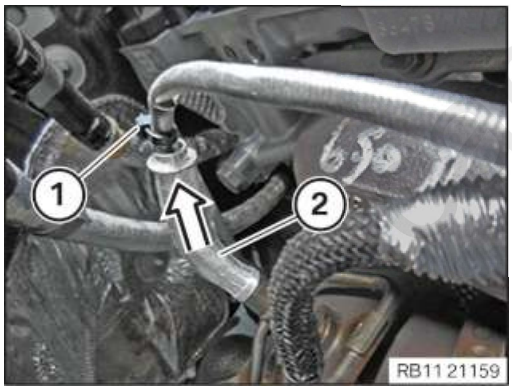
- Unlock the locks (1).
- Guide the connector (2) out of the bracket (3)in the **direction of the arrow** and set it aside.
- Release the cable (4) from the clamp (5).



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.



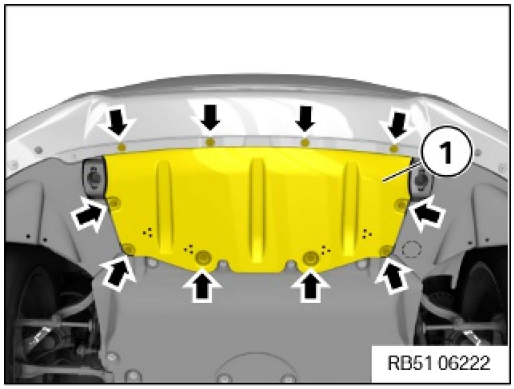
- Unfasten cable strap (1).
- Feed out the heat shield (2) **in direction of arrow** and set it aside.



- Release and remove the control sensor (1) with the special tool 0 491 074 (11 7 020).

9 – Removing the front underbody protection

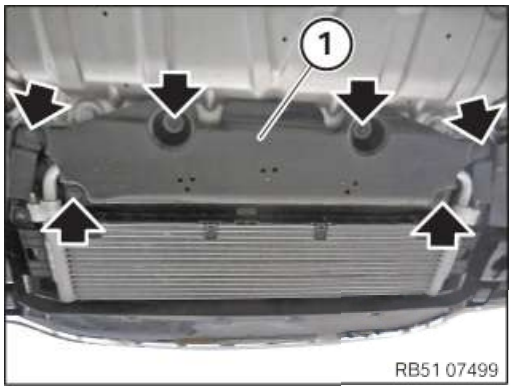
rdiagn.com



- **Version 1:**

  Remove screws (arrows).

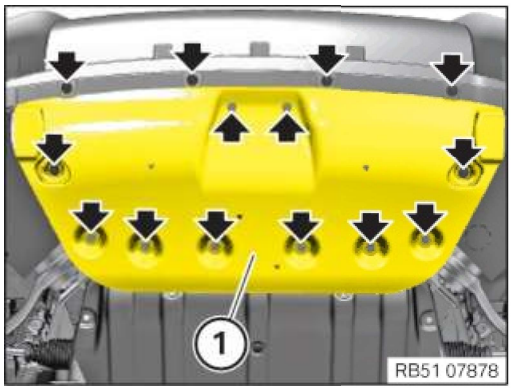
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

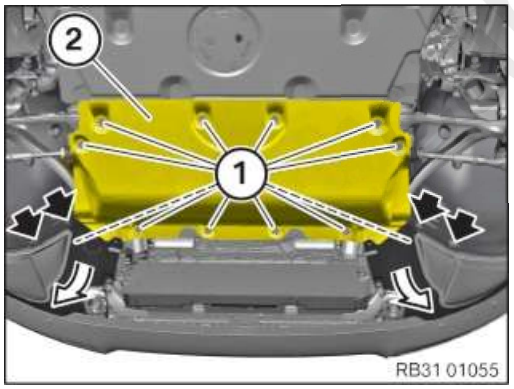


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

10 – Remove the underbody protection of the steering gear



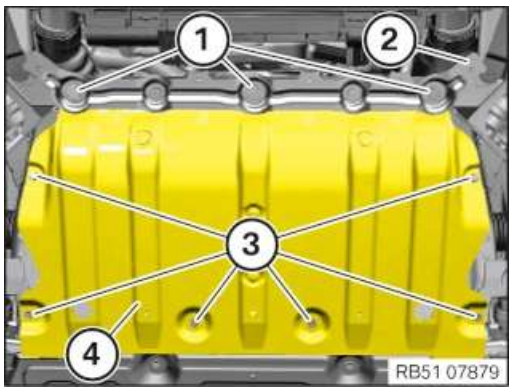
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

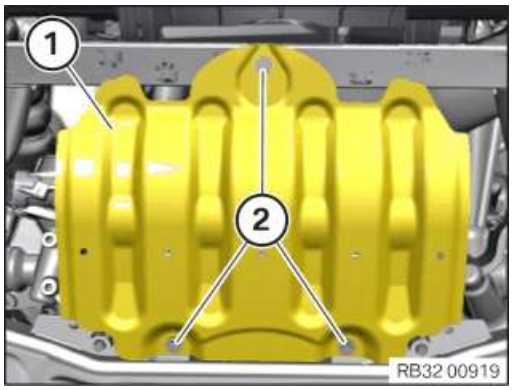
  Slide the steering gear underbody protection (4) out and remove.

11 – If installed: Removing the steering start protection

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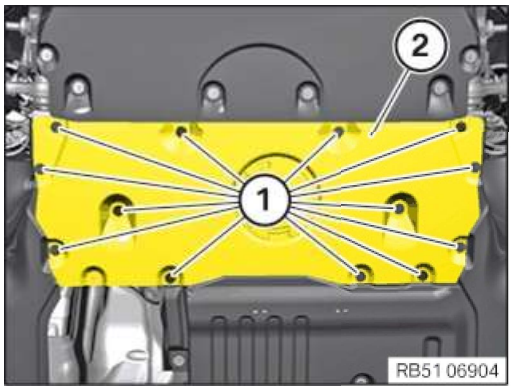
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

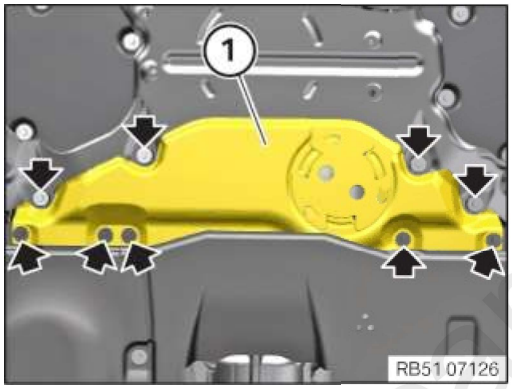
12 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



- **Version with all-wheel drive:**

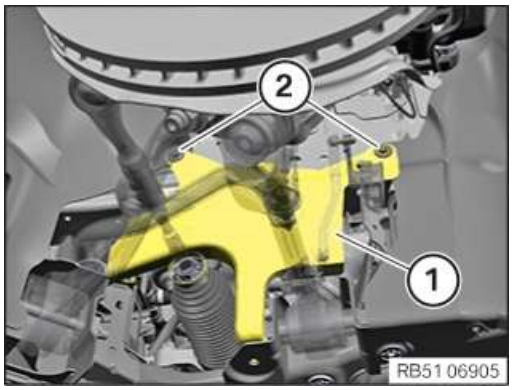
  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

13 – Remove the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.



- Loosen screws (2).
- Remove the cover (1).

14 – Draining the coolant from the high-temperature cooling system

cardiagn.com

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

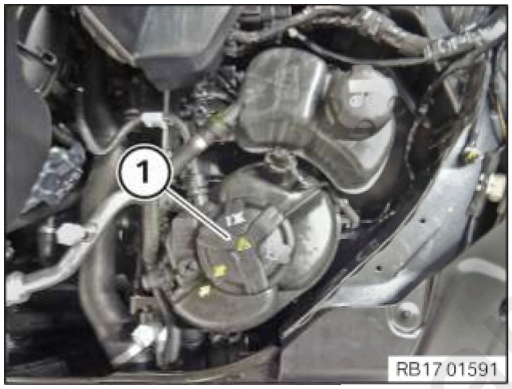
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

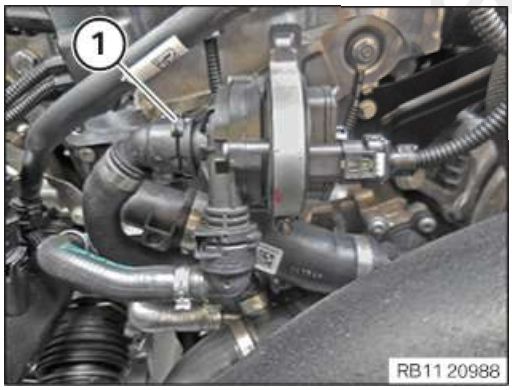
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

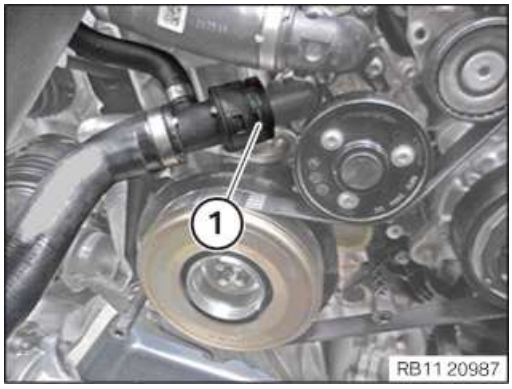
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



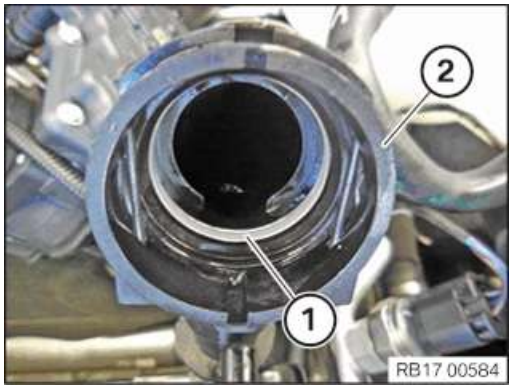
- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

.diagn.com

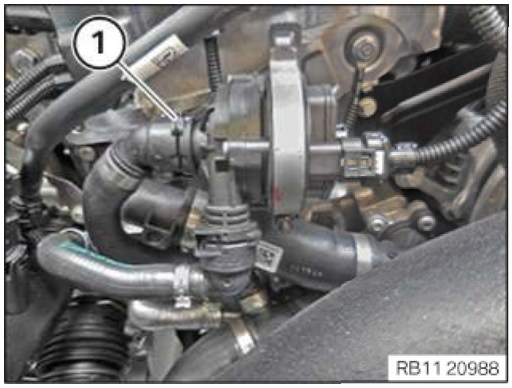
15 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

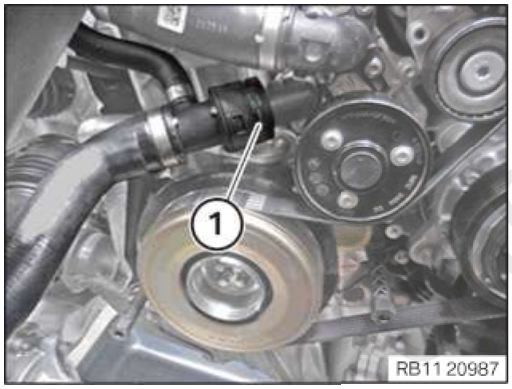


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

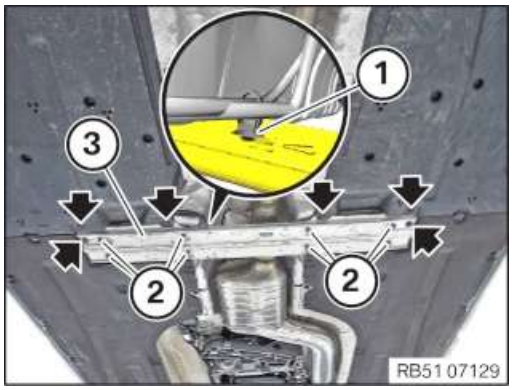
  Coolant line (1) must audibly engage.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

16 – Remove the connecting support from the tunnel



- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

17 – Remove complete exhaust system

mdiagn.com

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

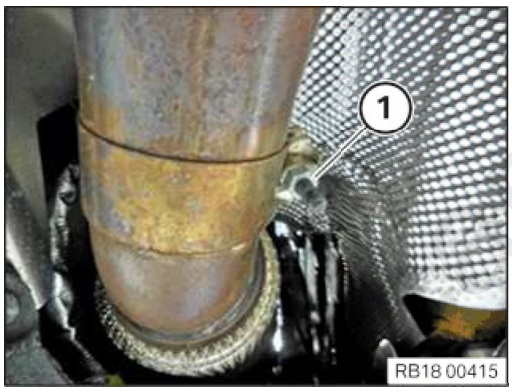
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

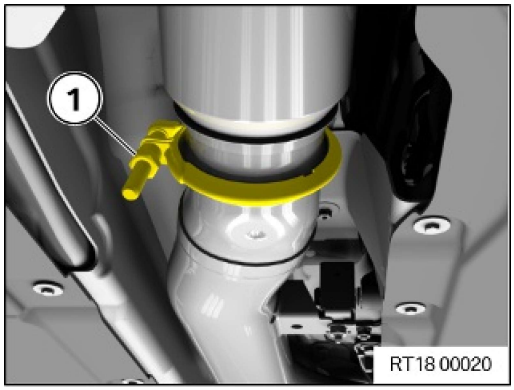
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).



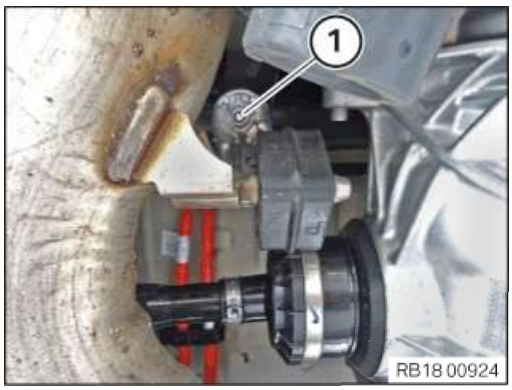
- **Equipment specification 2 (V-clips)**

  Unfasten clamp (1).

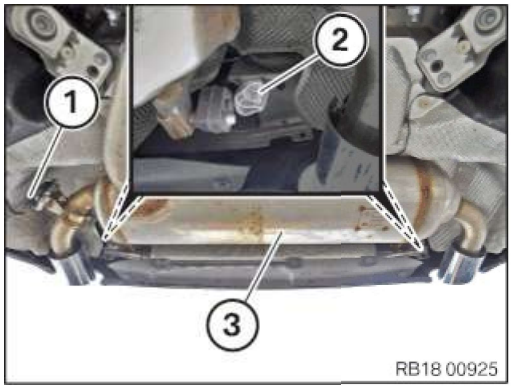
tdiag.com



- Loosen nut (1).



- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

18 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

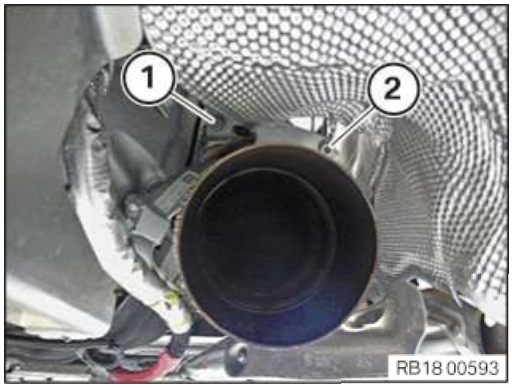
cardiagn.com

CAUTION

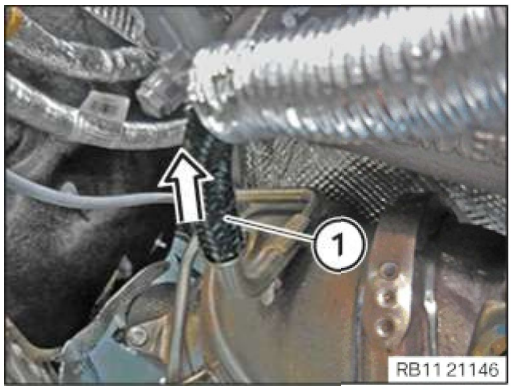
Component with heavy weight.

Danger of injury!

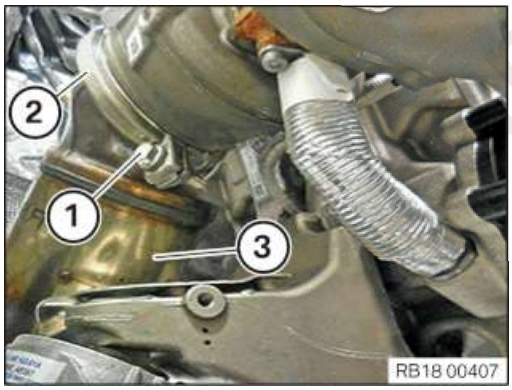
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.



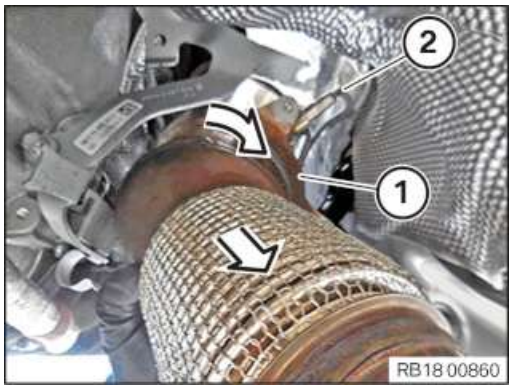
- Loosen screw (1).
- Loosen nut (2).



- Pull off pressure hose (1) in direction of arrow and set it aside.



- Loosen screw (1).
- Feed out V-clip (2) on catalytic converter (3) and remove.



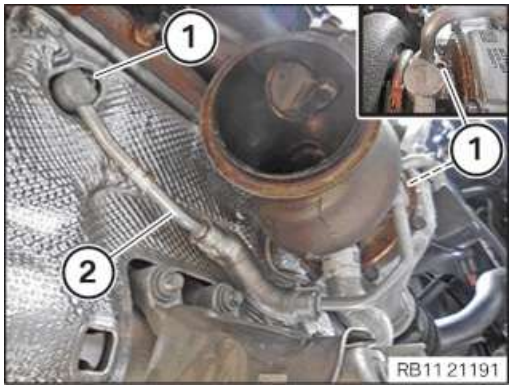
- Guide out catalytic converter (1) in direction of arrow and remove.
- Ensure that monitoring oxygen sensor (2) is**not** damaged.

19 – Remove the coolant feed line for the exhaust turbocharger

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TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

20 – Remove the coolant return line for the exhaust turbocharger

WARNING

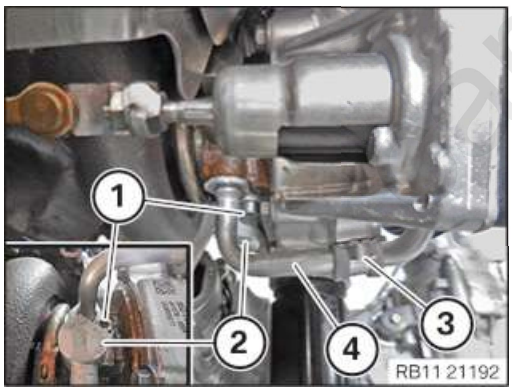
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

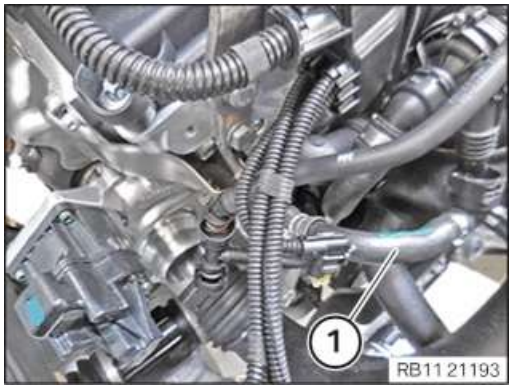
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

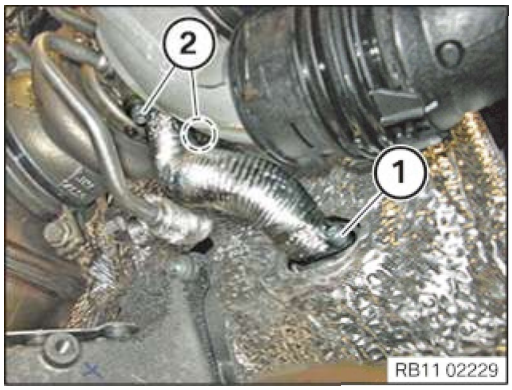


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

21 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

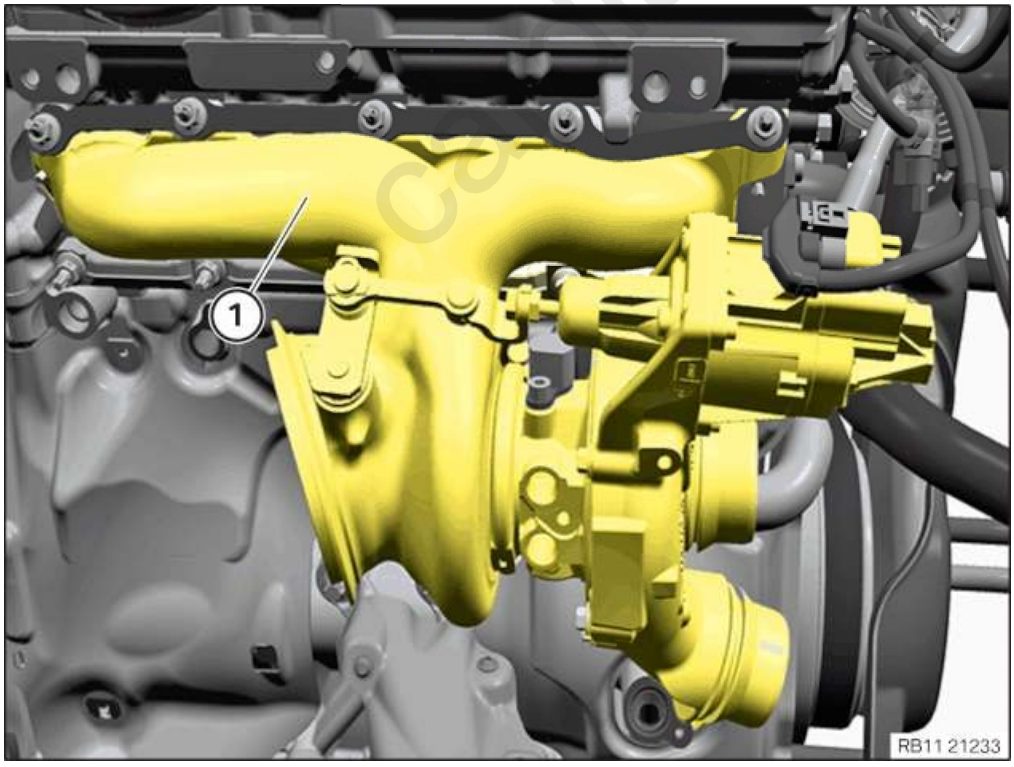
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

22 – Remove exhaust turbocharger

Exhaust turbocharger



1 Exhaust turbocharger

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

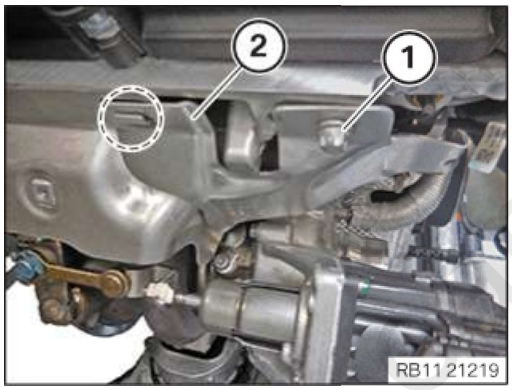
- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

TECHNICAL INFORMATION

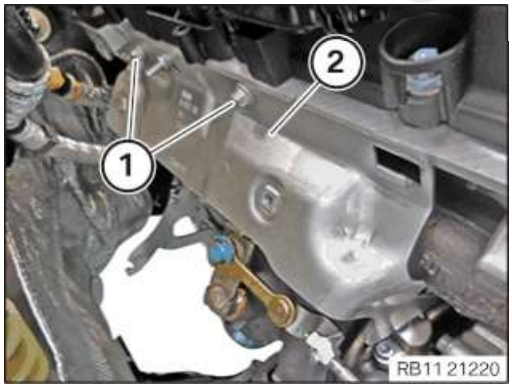
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).

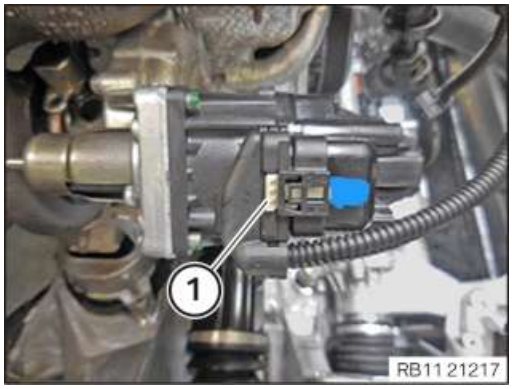


- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

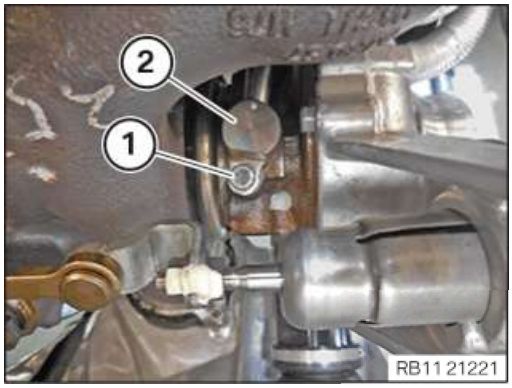


- Loosen screws (1).
- Feed out and remove the heat shield (2).

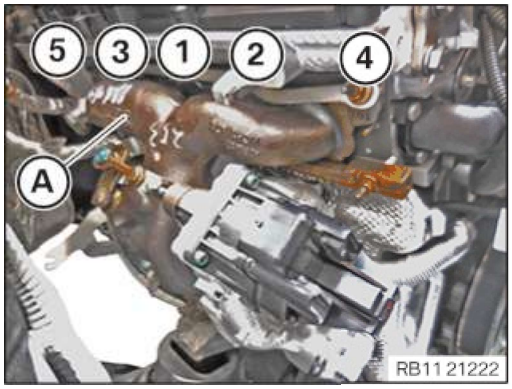
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- Unlock and loosen connector (1).



- Loosen screw (1).
- Guide out oil feed line (2) for the exhaust turbocharger and place it aside.

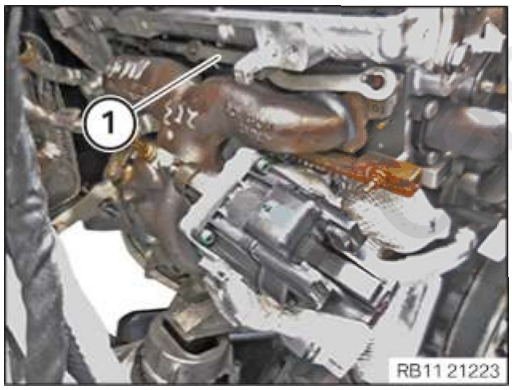


- Protect the exhaust turbocharger (A) from falling.

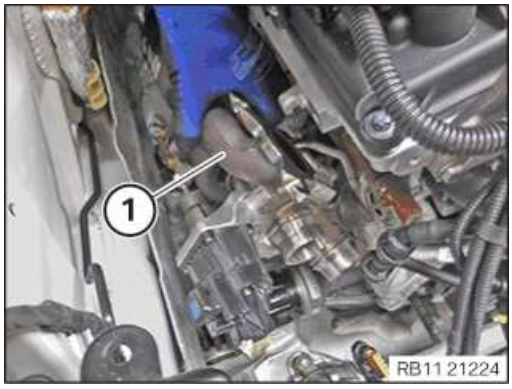
TECHNICAL INFORMATION

Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (5) to (1).



- Remove reinforcement plate (1).



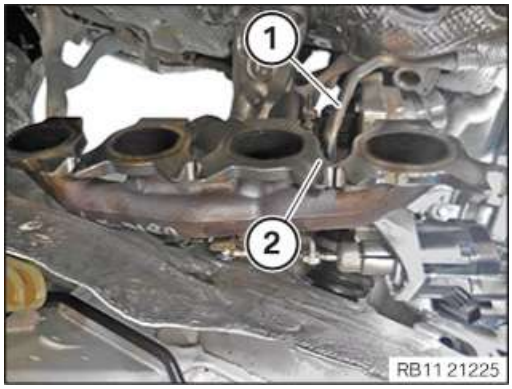
CAUTION

Heavy component.

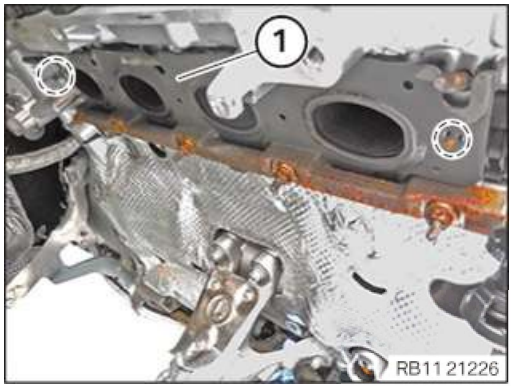
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide out exhaust turbocharger (1) and set it aside.



- Guide out oil feed line (1) for the exhaust turbocharger and place it aside.
- Thread out and remove exhaust turbocharger (2).

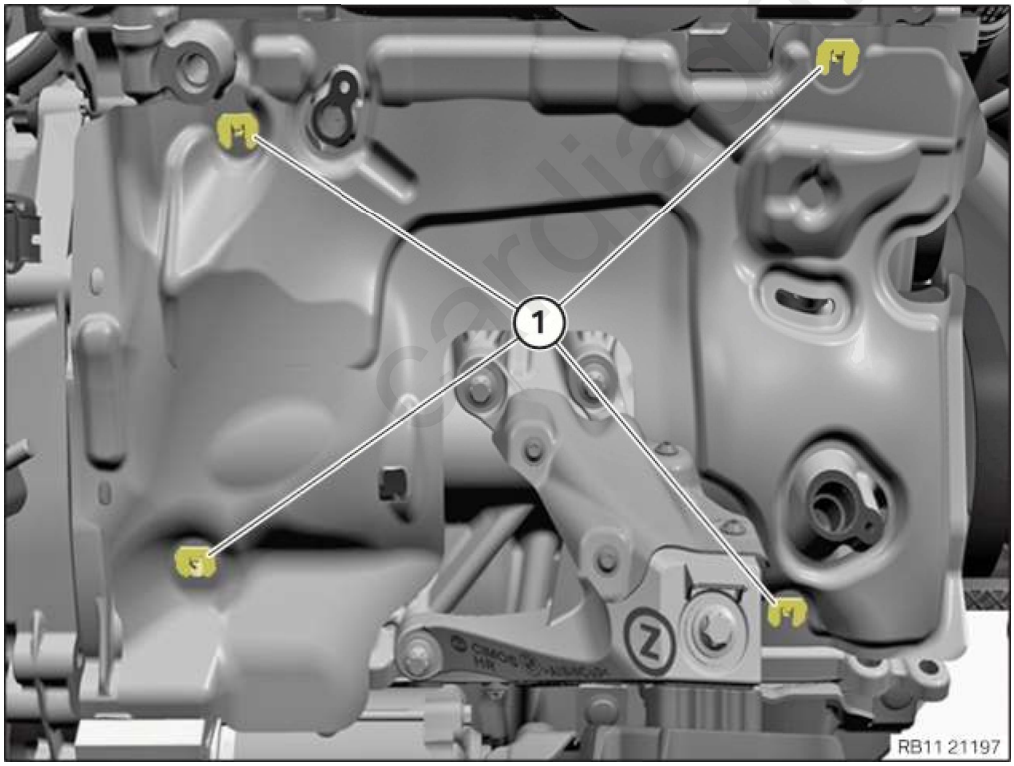


- Guide seal (1) out of the **marked** area and remove it.

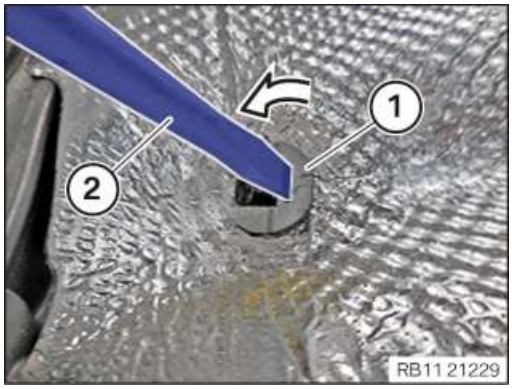
MAIN WORK

23 – Removing engine encapsulation on the hot side

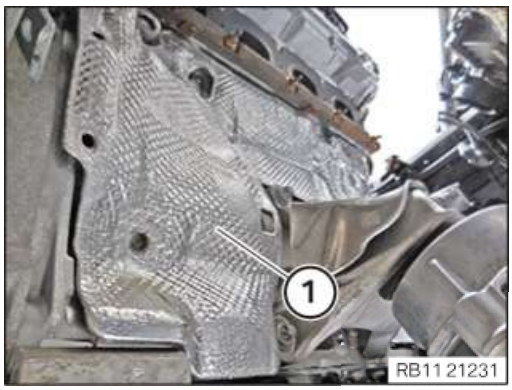
Overview of engine encapsulation clips, hot side



1. Clips for engine encapsulation, hot side

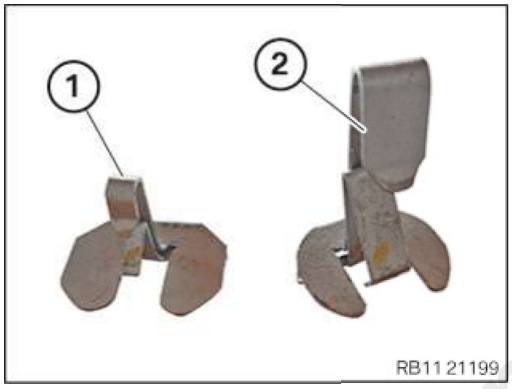


- Release clips (1) with a standard screwdriver (2) in the **direction of arrow**.



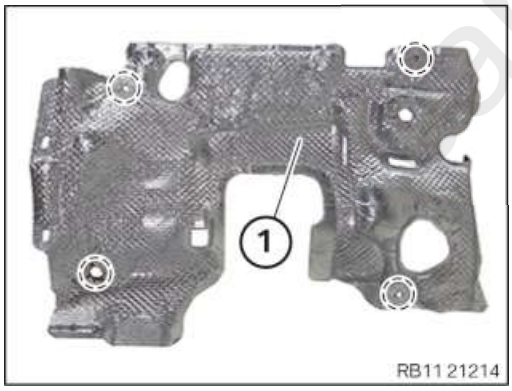
- Guide out and remove engine encapsulation (1).

24 – Installing engine encapsulation on hot side

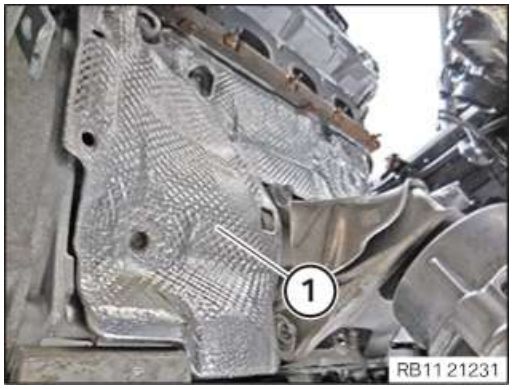


- Renew clips (1) and (2).

  Parts: Clips

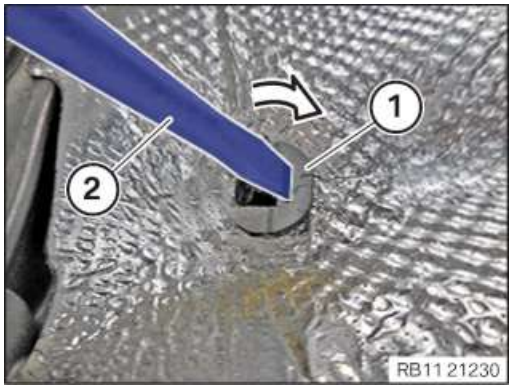


- Check engine encapsulation (1) for damage and, if necessary, renew engine encapsulation (1).



- Guide in and position engine encapsulation (1).

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- Secure clips (1) with a commercially available screwdriver (2) in the **direction of the arrow**.

POSTPROCESSES

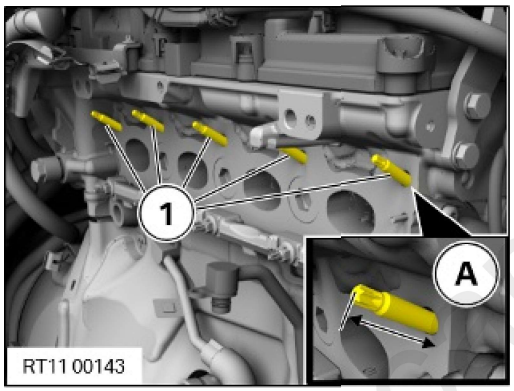
25 – Installing exhaust turbocharger

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

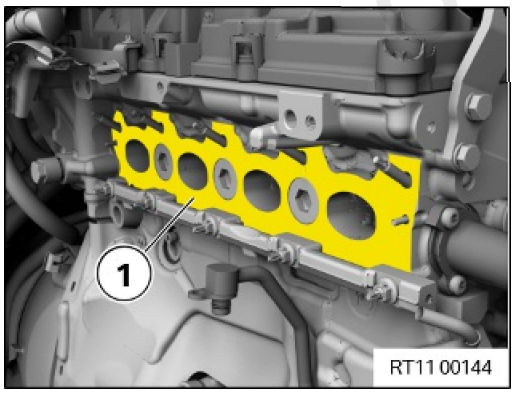


- Check stud bolt (1) for damage, renew stud bolt (1) if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1); if necessary screw in stud bolt further.

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm



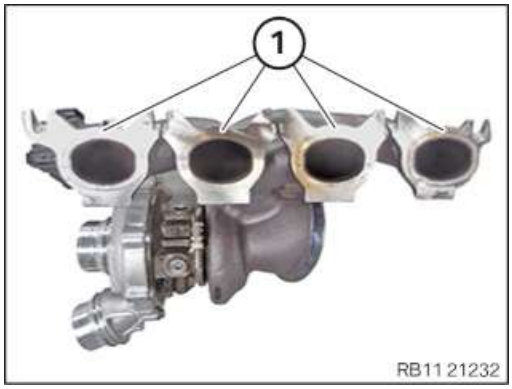
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the cylinder head (1) using the special tool 0 495 102 (11 4 470).



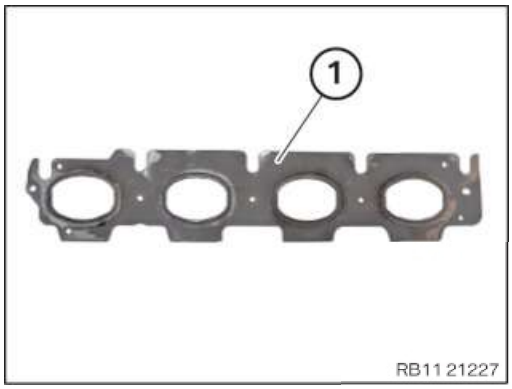
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

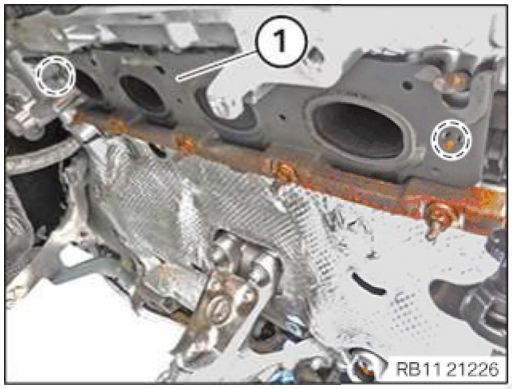
- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the exhaust turbocharger (1) using the special tool 0 495 102 (11 4 470).

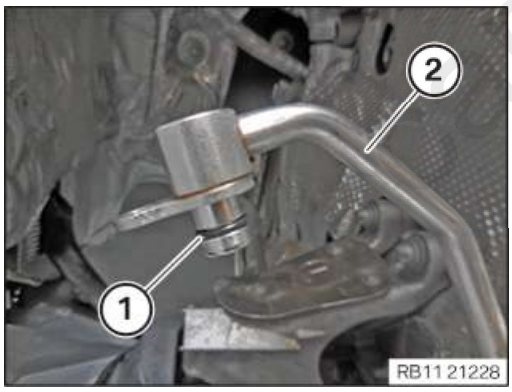


- Renew gasket (1).

  Parts: Seals



- Insert and install the gasket (1).
- Make sure the seal (1) has been **correctly** installed in the guide pins in the **marked** area.



- Renew O-rings (1) on the oil feed line (2) for the exhaust turbocharger with the special tool 0 496 714 (00 9 030).

  Parts: O-ring

TECHNICAL INFORMATION

- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

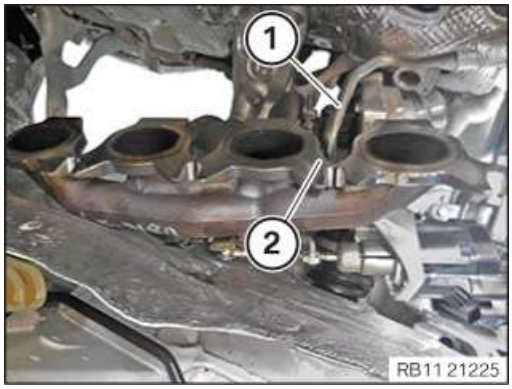
- Fill oil feed line (2) for the exhaust turbocharger with engine oil till the rim.

Engine oil

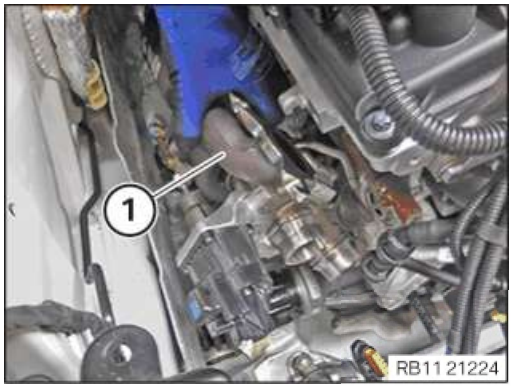
Technically suitable engine oils for BMW Group engines	

3.0 Technically appropriate engine oils for BMW Group engines

diagn.com



- Feed in and position the exhaust turbocharger (2).
- Feed in and position the oil feed line (1) for the exhaust turbocharger on the exhaust turbocharger (2).



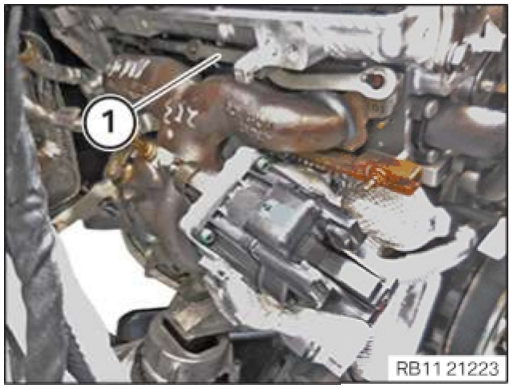
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Insert and install the exhaust turbocharger (1).

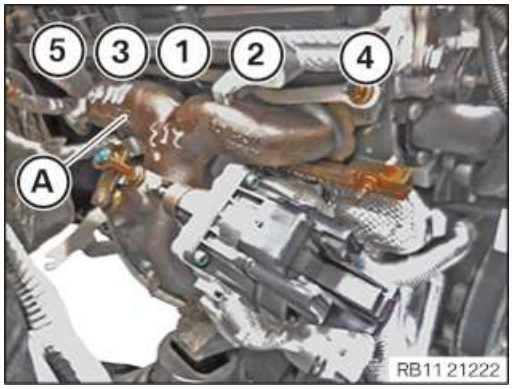


TECHNICAL INFORMATION

- Note the installation position of the component. The component may be installed in various installation positions.

- Mount sliding rail (1).
- The original BMW part number of the sliding rail (1) must be **legible** from the rear.

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

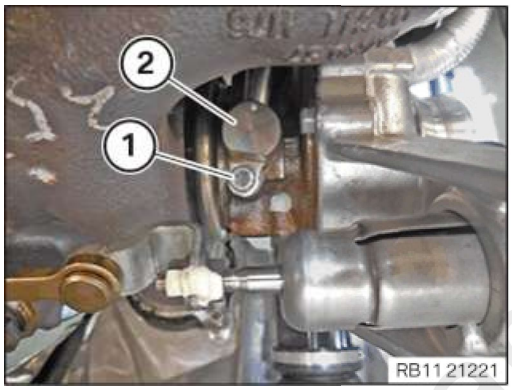
- Renew nuts (1) to (5).

  Parts: Nuts

- Tighten the nuts in sequence (1) to (5).

Exhaust turbocharger to cylinder head

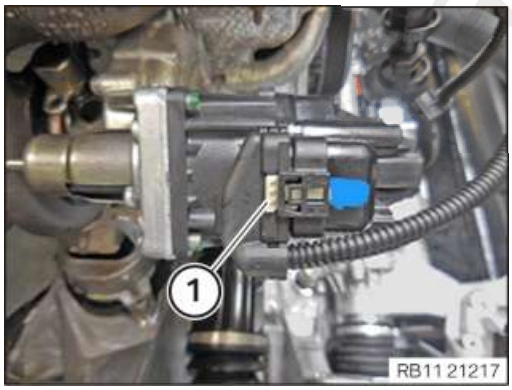
M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm



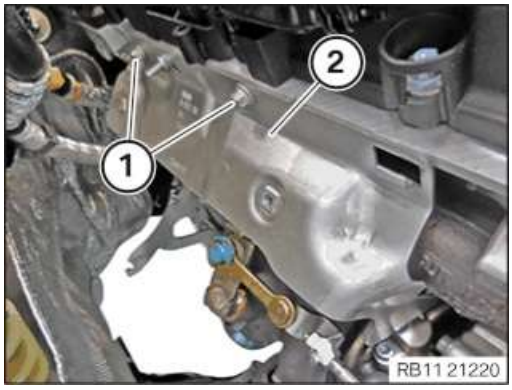
- Feed in and install the oil feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

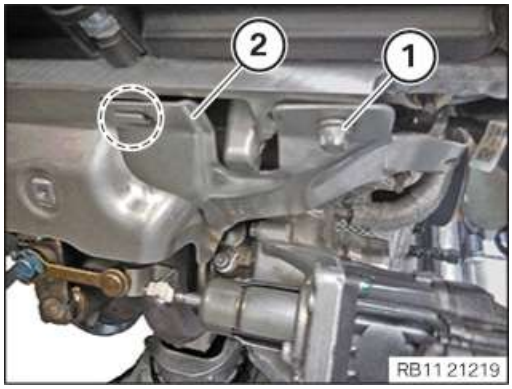


- Feed in and install the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

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- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

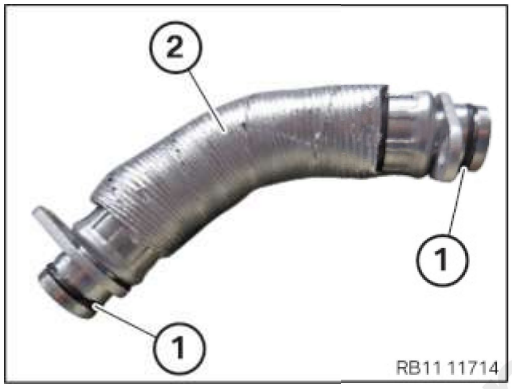


- Tighten down screw (1).

Heat shield to clamping strip

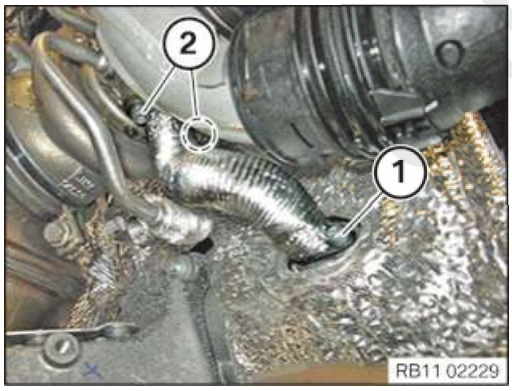
M6 x 12		Tightening torque	8 Nm

26 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

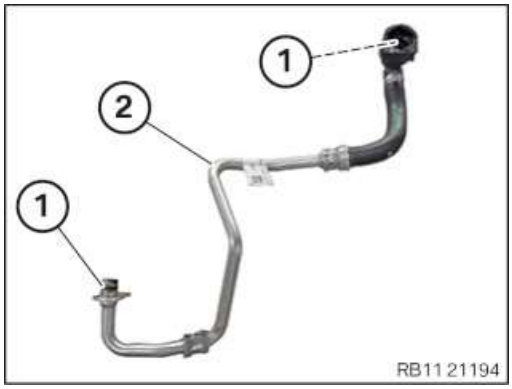
Oil return line to exhaust turbocharger/crankcase

M6x14		Tightening torque	8 Nm

27 – Install the coolant return line for the exhaust turbocharger

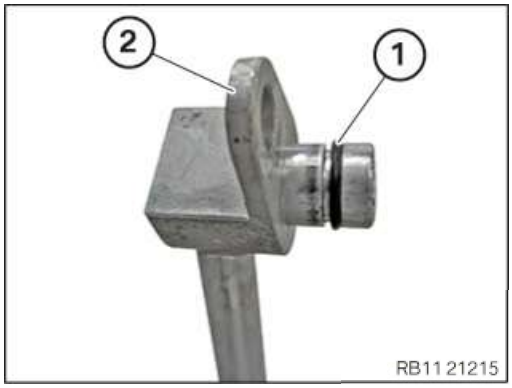
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



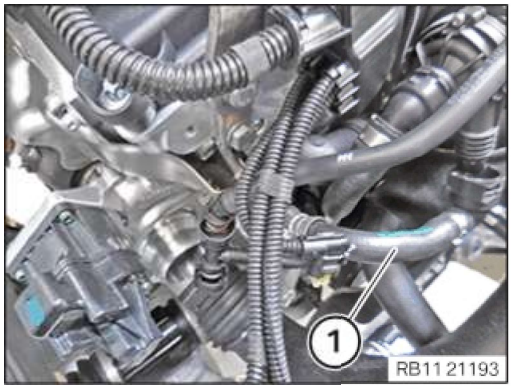
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

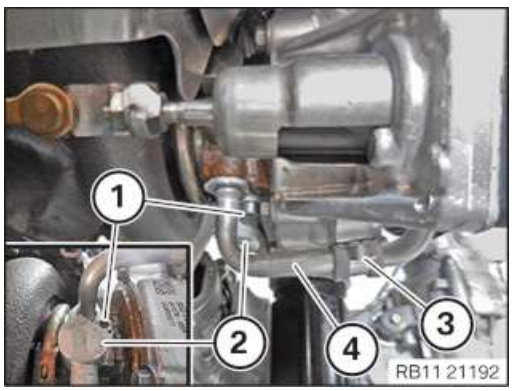
  Parts: O-ring



- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

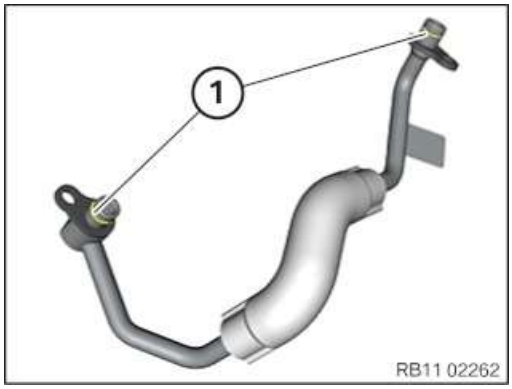
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

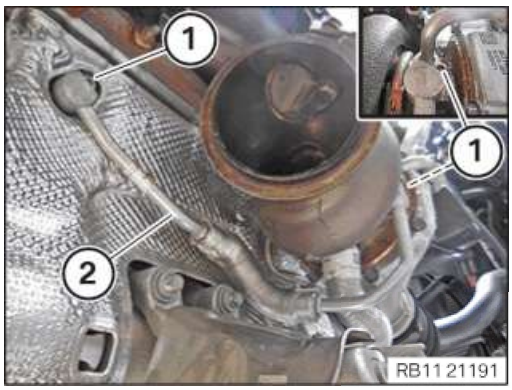
M6		Tightening torque	8 Nm

28 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

29 – Install catalytic converter



- Renew the V-clip (1).

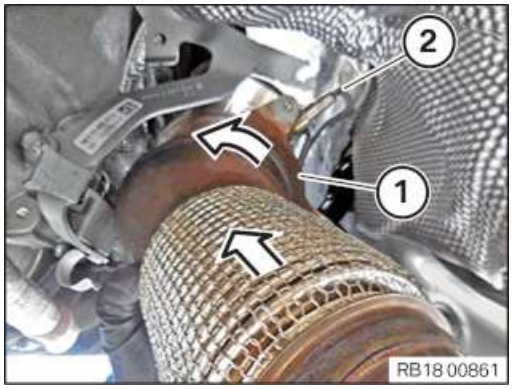
  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket

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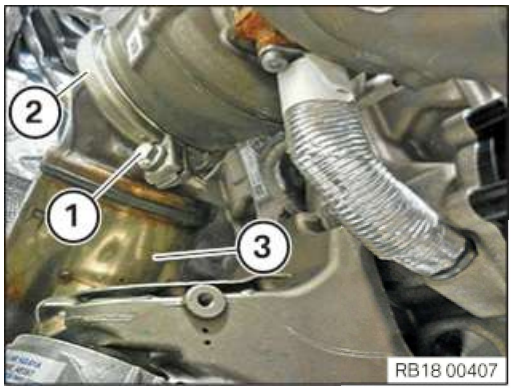
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

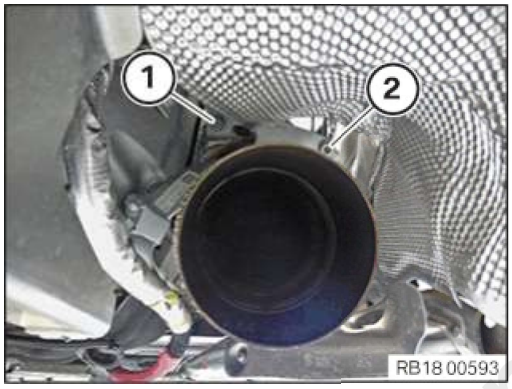
- Remove and install heavy components with the aid of another person/other persons.

- Guide in and install the catalytic converter (1) in the direction of arrow.
- Make sure that the monitoring oxygen sensor (2) **is not damaged.**



- Renew the V-clip (2).

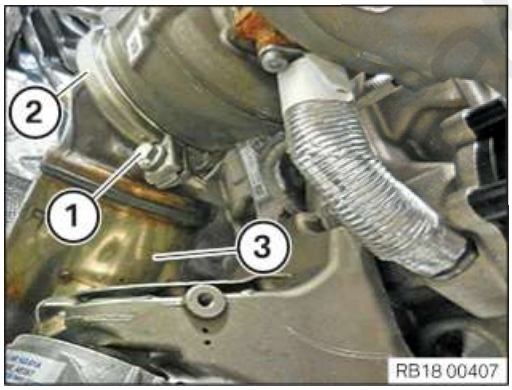
  Parts: V-band clamp
- Feed in and install V-clip (2) on the catalytic converter (3).
- Position the bolt (1).



- Renew the screw (1).

  Parts: Screw
- Position the bolt (1).
- Renew nut (2).

  Parts: Nut
- Position the nut (2).



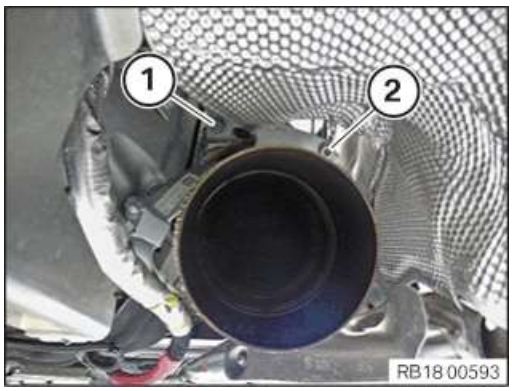
- Position the catalytic converter (3).
- Position V-clip (2).

Note: Ensure correct mounting orientation of the V-clip.

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm



- Tighten down screw (1).

Catalytic converter to holder

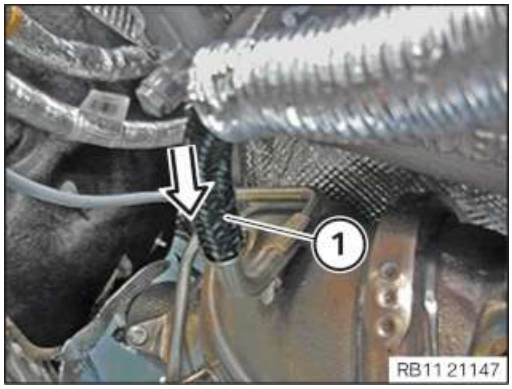
M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm

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- Check the pressure hose (1) for damage and renew hardened pressure hose (1) if necessary.
- Connect the pressure hose (1) in direction of arrow to the limit position.

30 – Installing the complete exhaust system

CAUTION

Component with heavy weight.

Danger of injury!

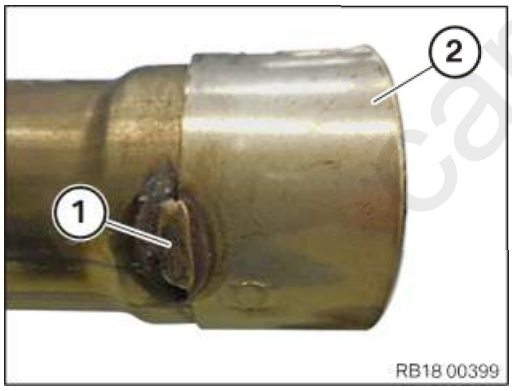
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



CAUTION

Swarf resulting from sawing or grinding components.

Danger of injury!

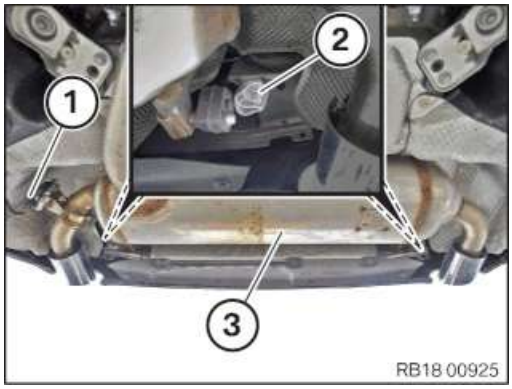
- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp

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- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

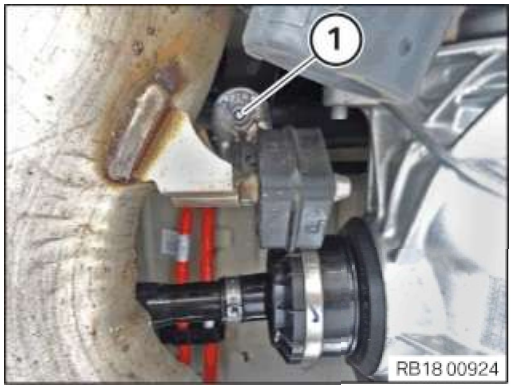
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

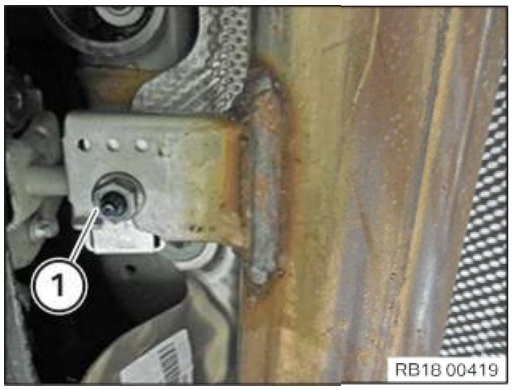


- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm

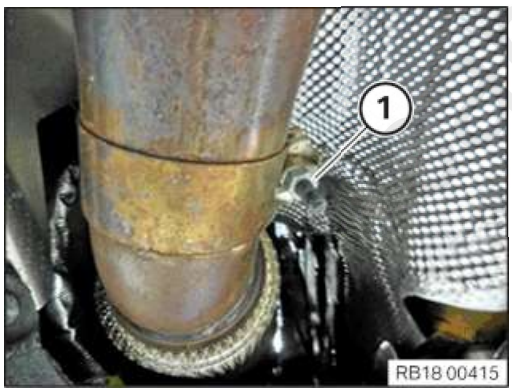


- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

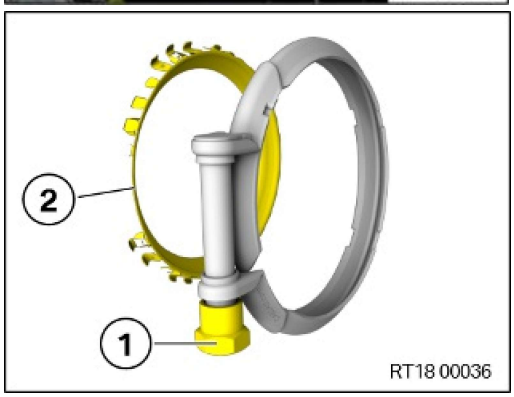
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm



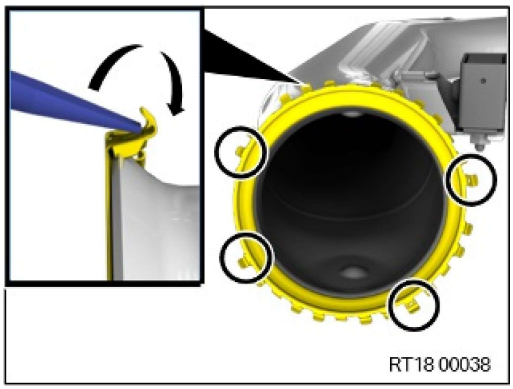
- **Equipment specification 2 (V-clips)**

  Renew V-band clamp.

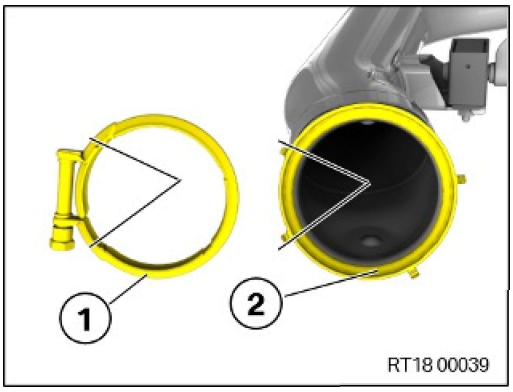
  Parts: V-band clamp

  Unscrew the nut (1) and remove the sealing ring (2).

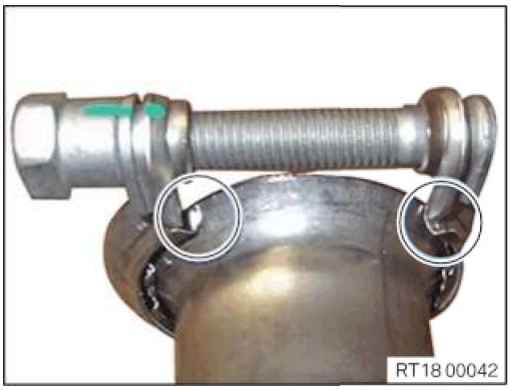
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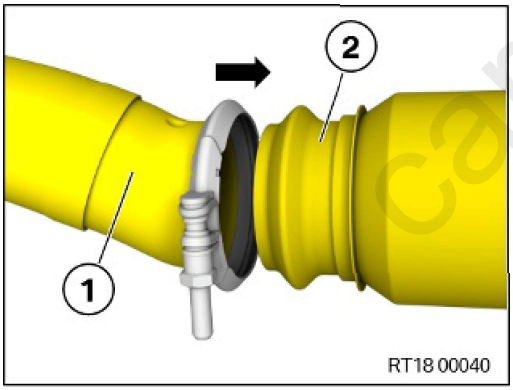
- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.



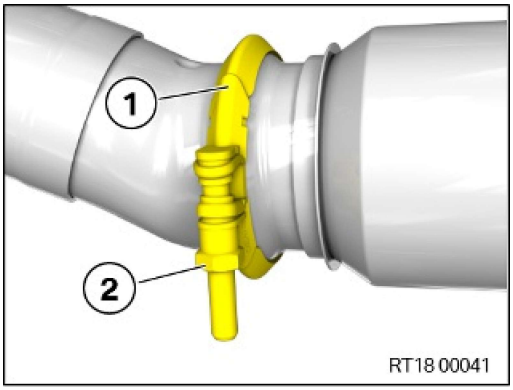
- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).



- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.



- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).



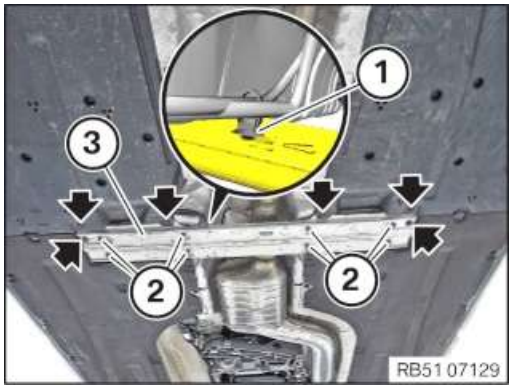
- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

31 – Install the connecting supports on the tunnel

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- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- Tighten screws (arrows).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

32 – Install the control sensor

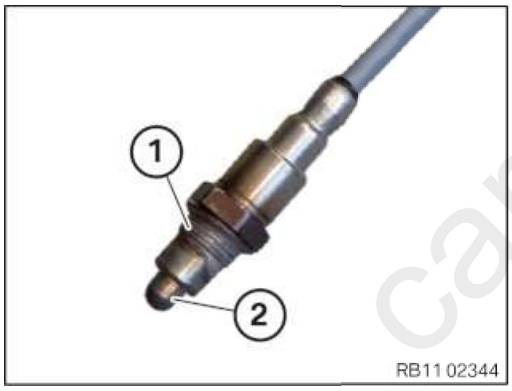
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

  (2) = Sensor ceramics

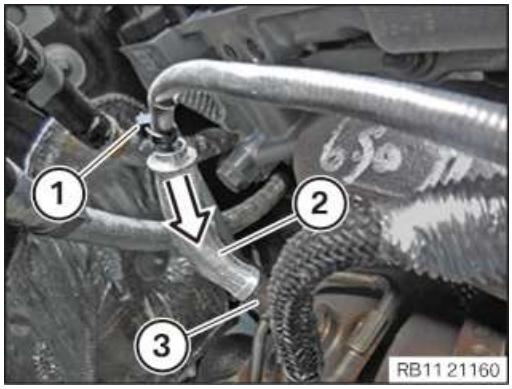


- Screw the control sensor (1) in and tighten it with the special tool 0 491 074 (11 7 020).

Control sensor

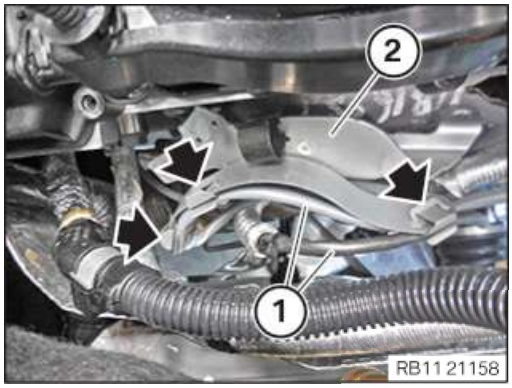
M18x1.5		Tightening torque	50 Nm

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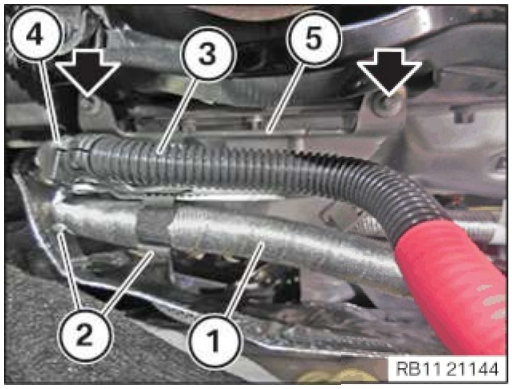


- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

  Parts: Cable strap
- Guide in and install the cable strap (1).



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

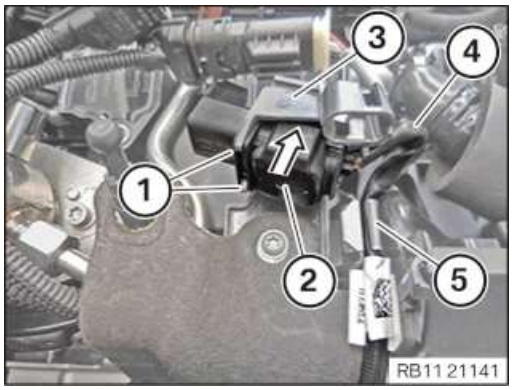
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

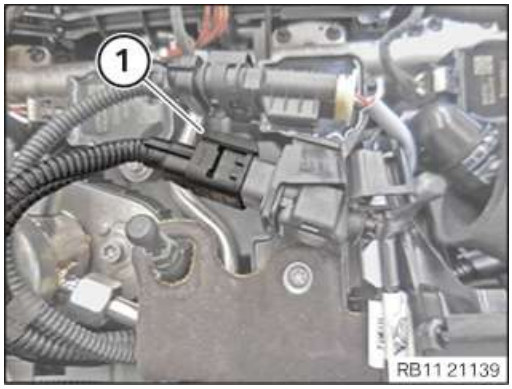
6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

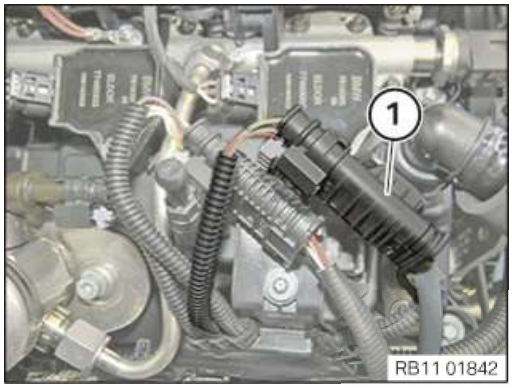


- Guide in the connector (2) in the direction of arrow at the carrier plate (3) and install.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).

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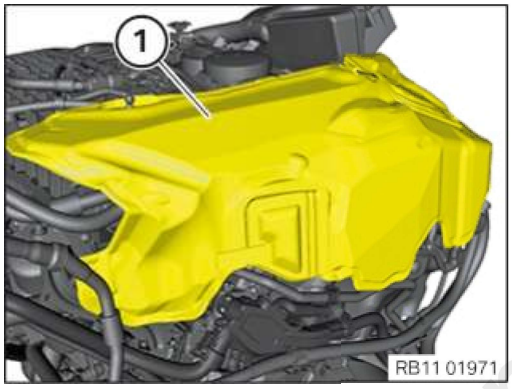


- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Connect and lock the connector (1).
- Guide the connector (1) into the carrier plate in the direction of arrow.
- Ensure the connector (1) audibly engages with the carrier plate.

33 – Installing acoustic cover at rear



- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



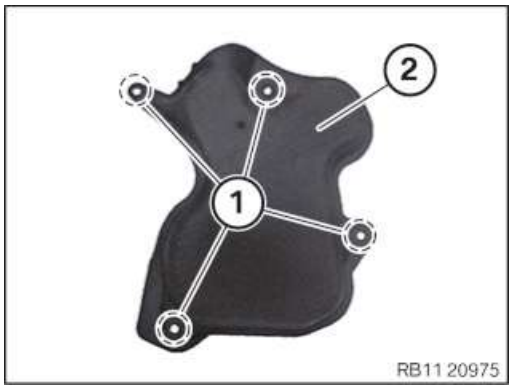
- Install the acoustic cover (1) from the top and clip it in into the marked areas.

34 – Install the seal for the bonnet



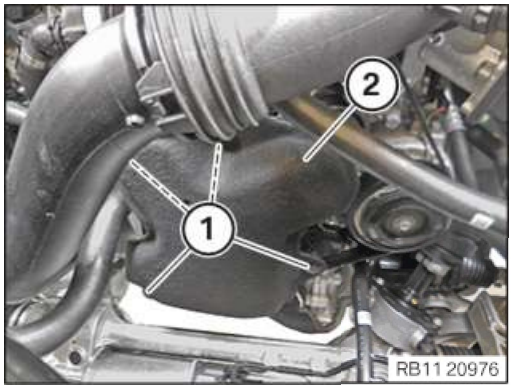
- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

35 – Install the acoustic cover for the engine at the front

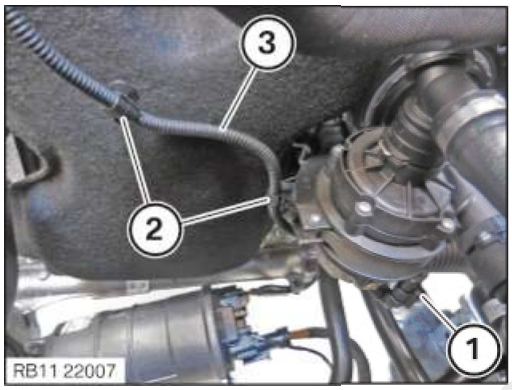


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

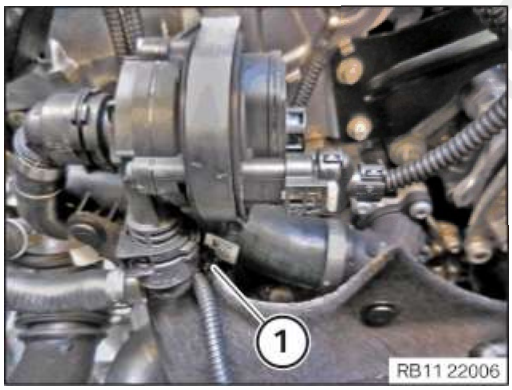


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



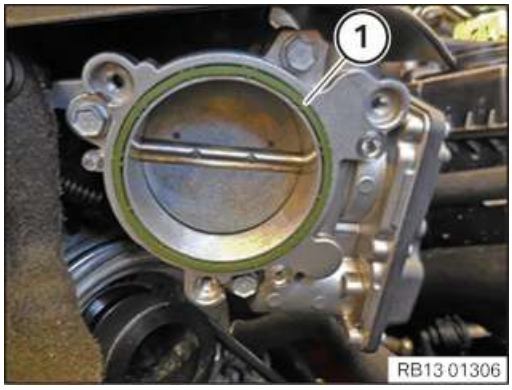
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

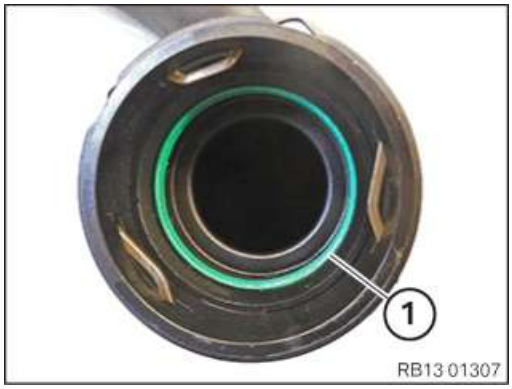
36 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring

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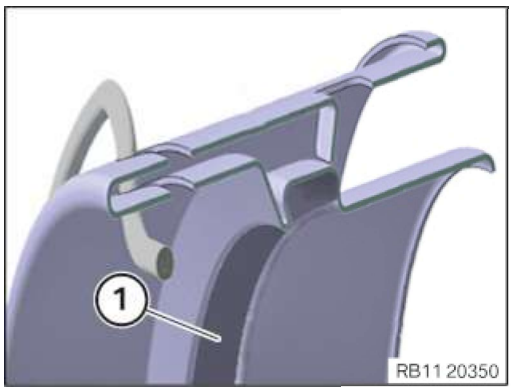


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▶ **Replace damaged gasket**

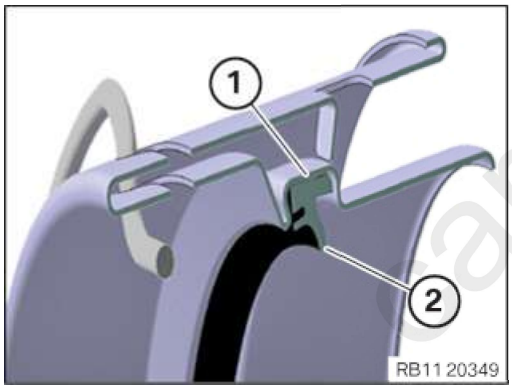
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



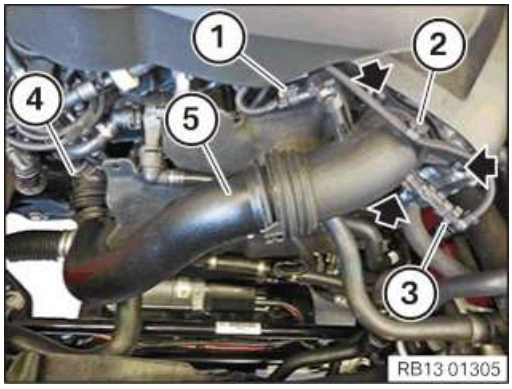
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

Charge air line to throttle body

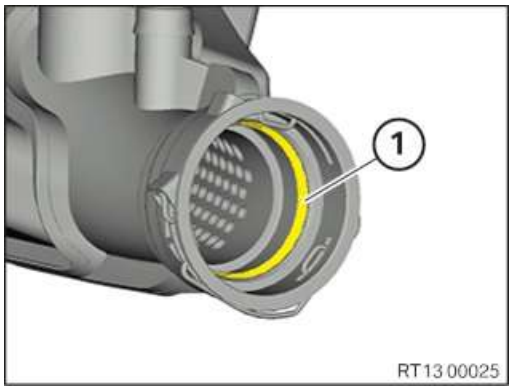
M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

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37 – Installing the clean air pipe with resonator

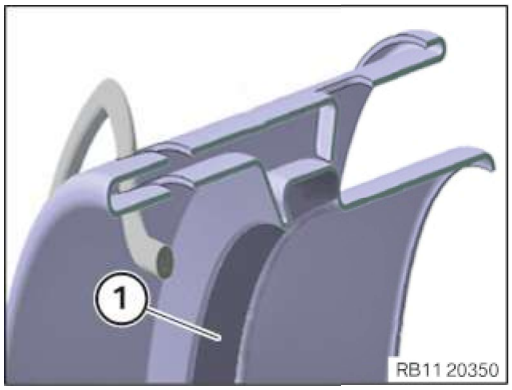


- Check the seal (1) for damages, replace if necessary.

▶ **Replace damaged gasket**

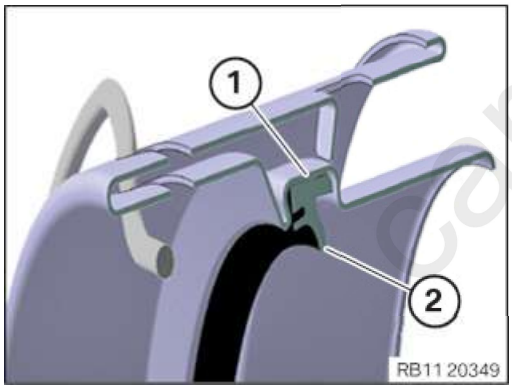
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



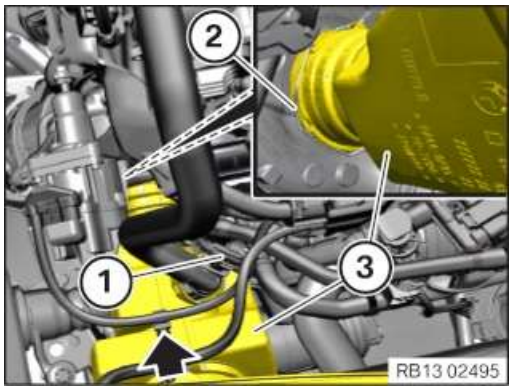
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).

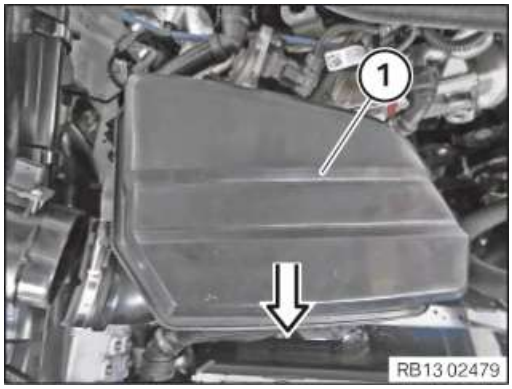


- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

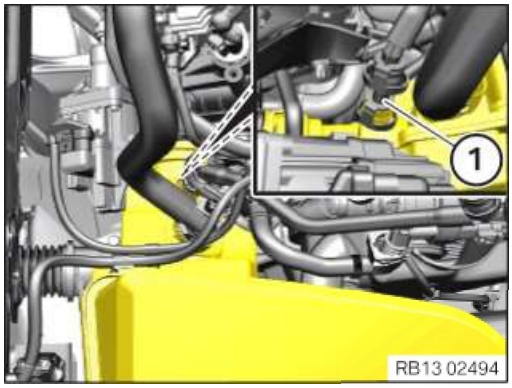
  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Secure clamp (arrow).

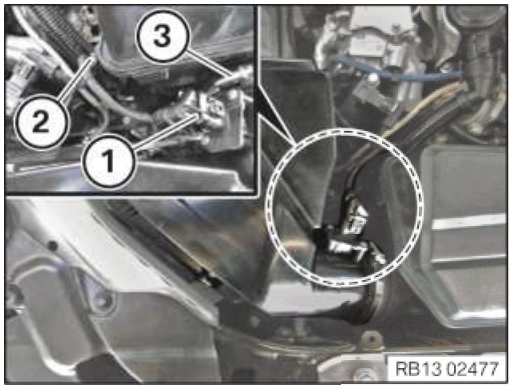
cardiagn.com



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

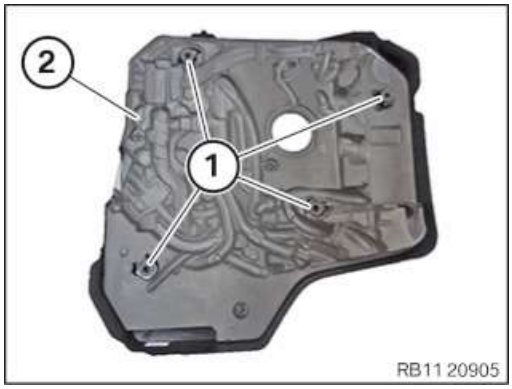
38 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



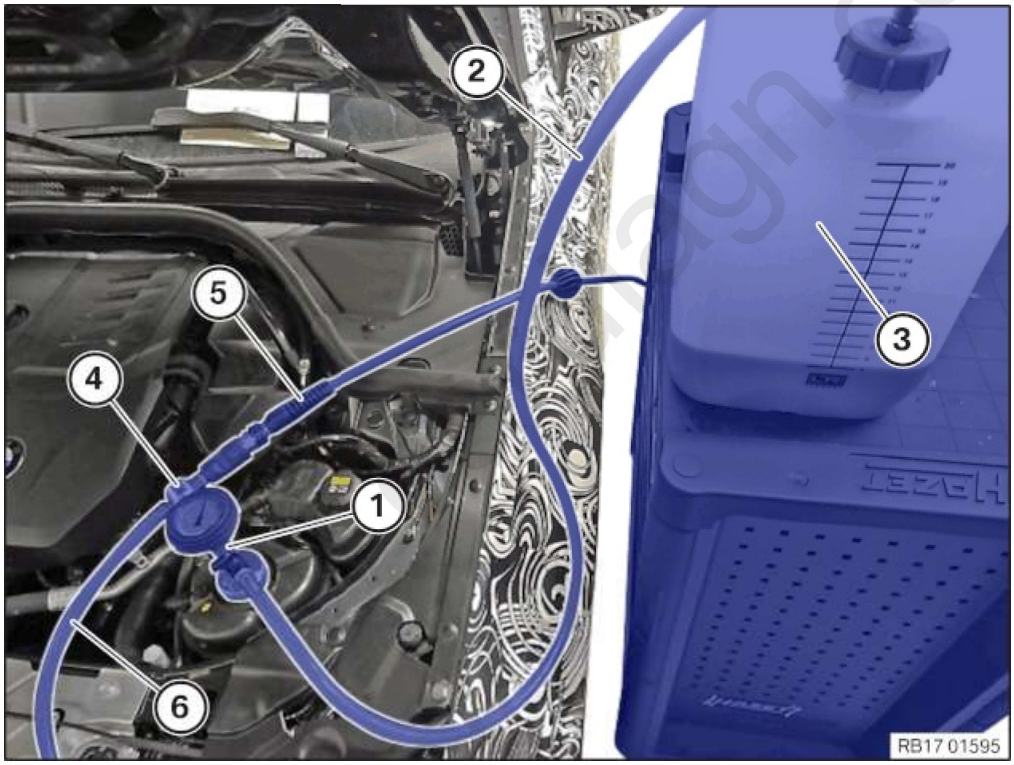
- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.
  The acoustic cover (1) must audibly engage into place.

39 – Fill the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

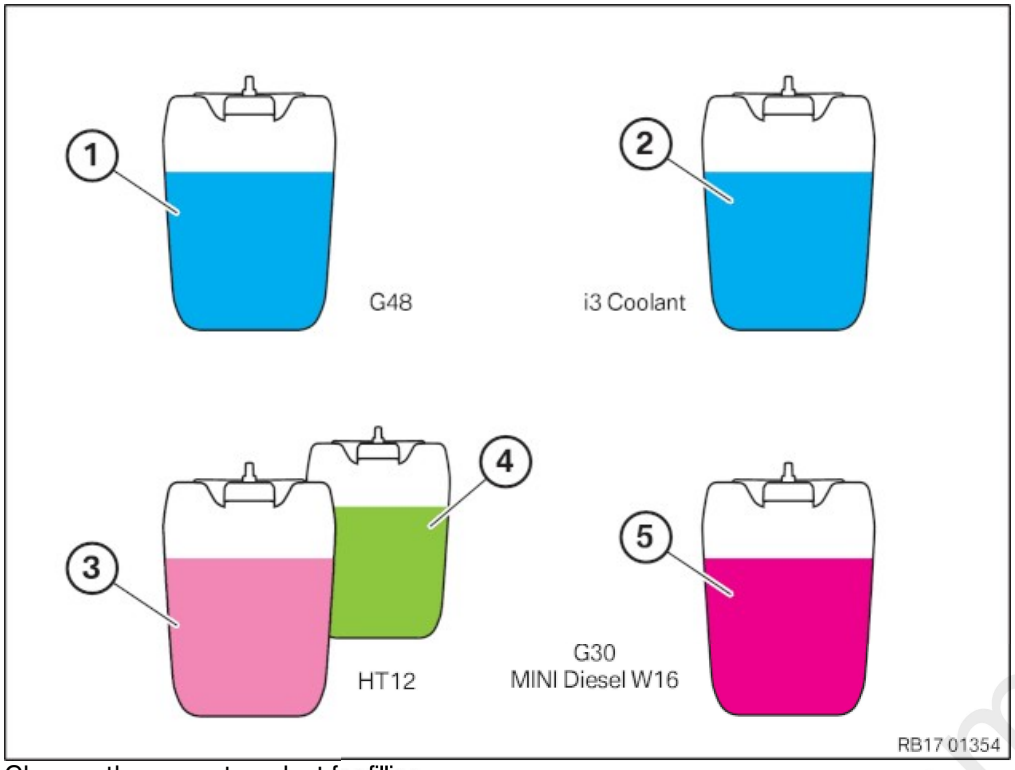
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

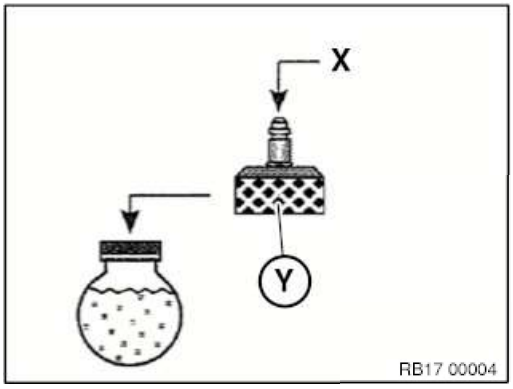
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

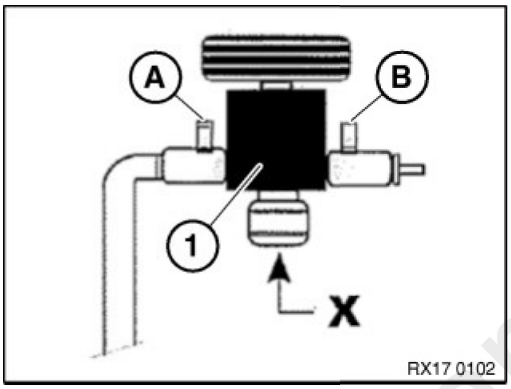
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

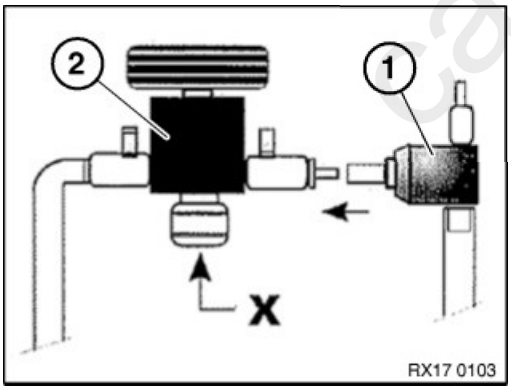
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

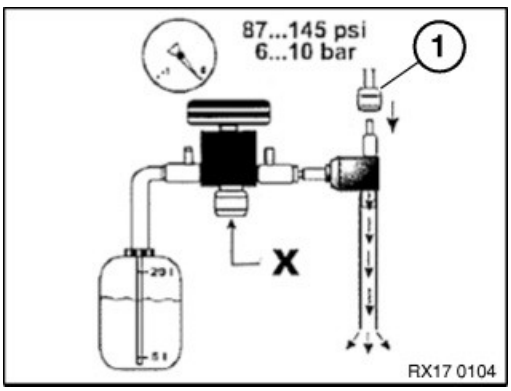


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

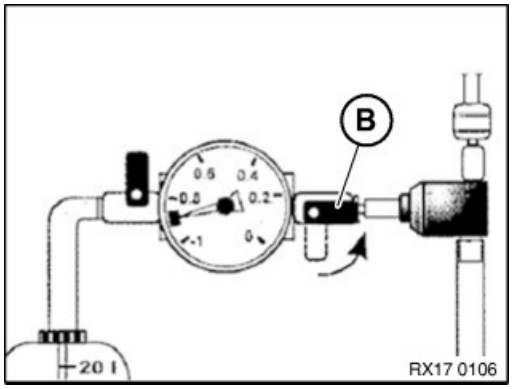
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

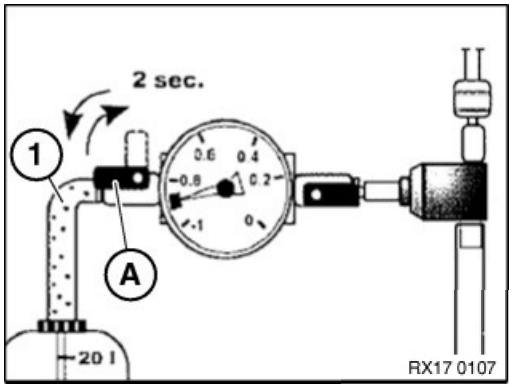
  (X)is the connection on the coolant expansion tank.

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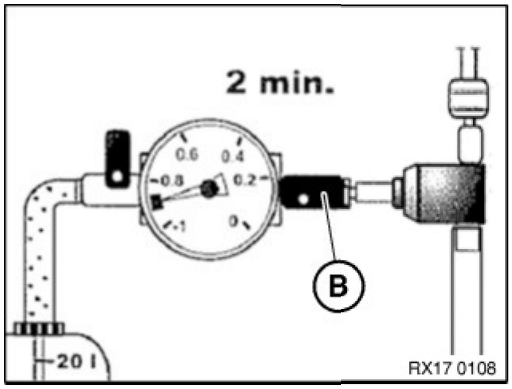
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

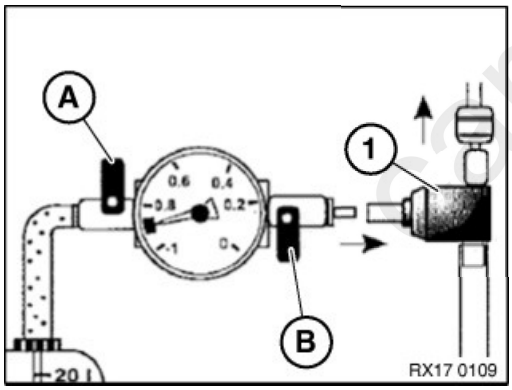


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

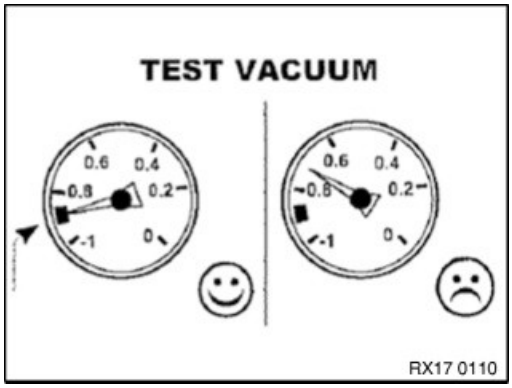
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

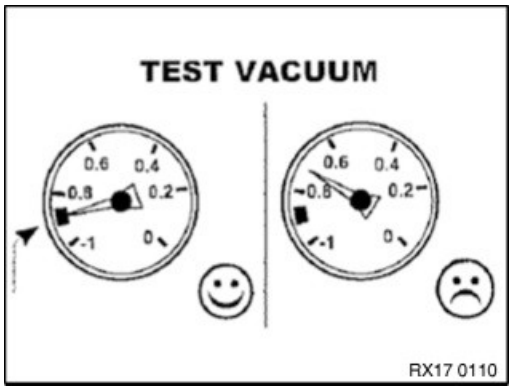
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



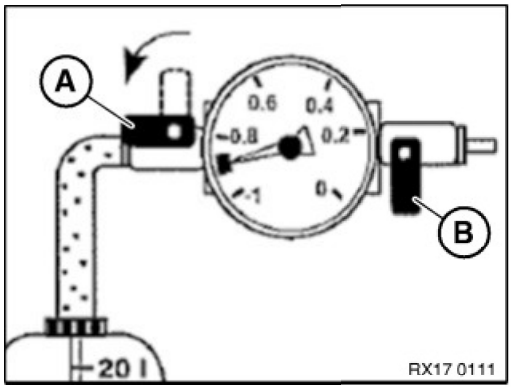
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

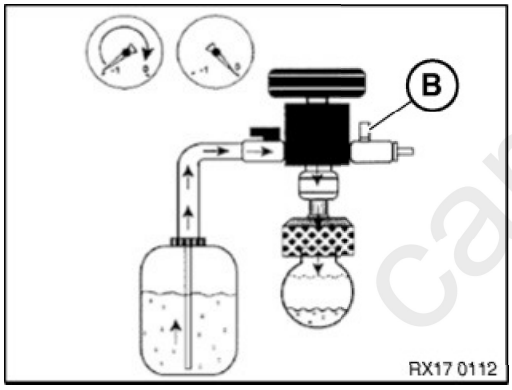
» Vacuum remains constant.

Measure

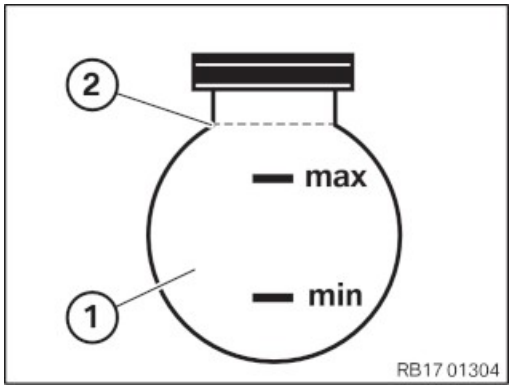
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

40 – Bleed the high-temperature coolant circuit

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

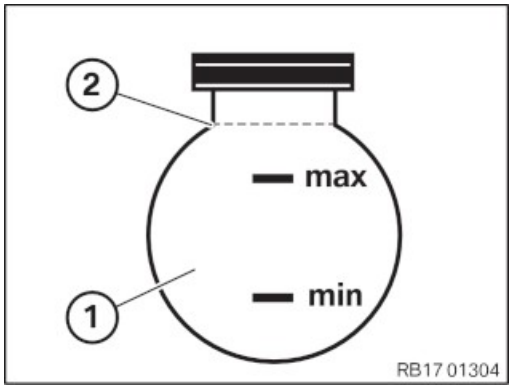
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

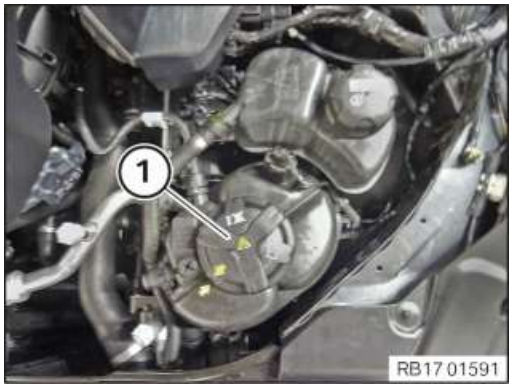
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

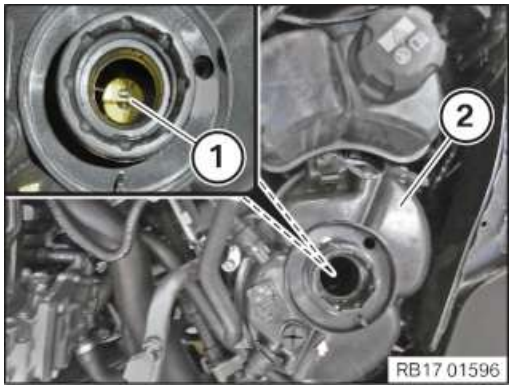
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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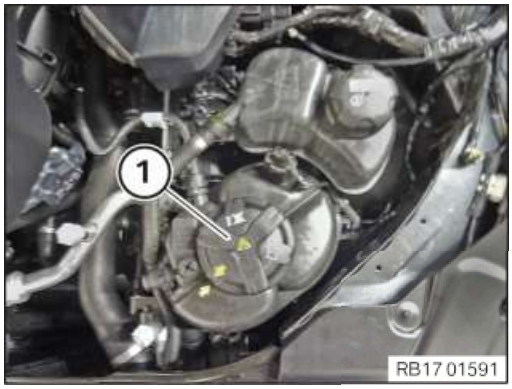
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .

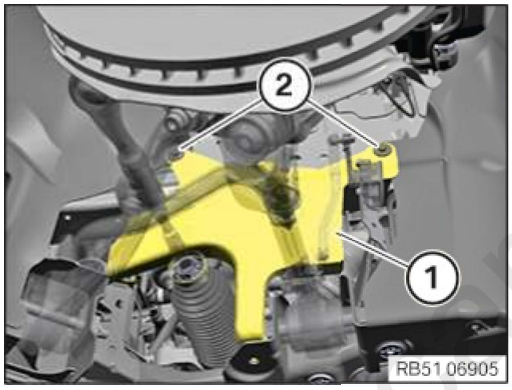


- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

41 – Install the cover of the steering assembly

Prerequisite

The underbody protection of the steering gear is removed.



- Position the cover (1).
- Tighten the screws (2).

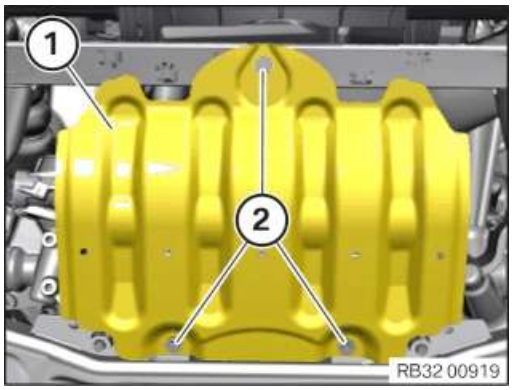
Cover, steering unit

Screw		Tightening torque	3 Nm

42 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



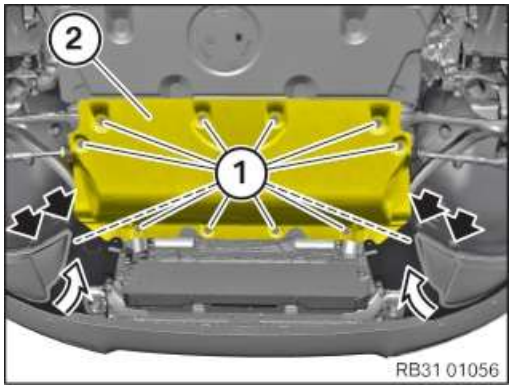
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

43 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

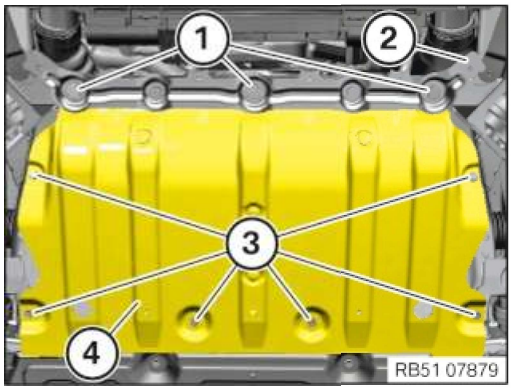
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

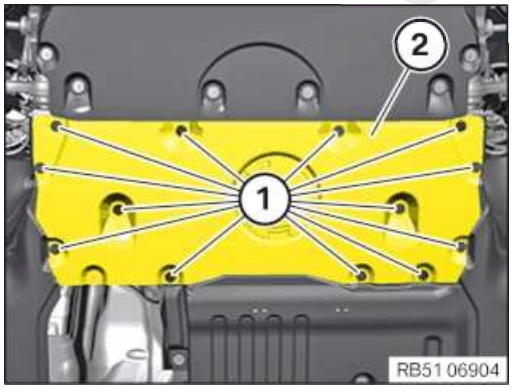
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

44 – Installing the centre underbody protection



- **Version with rear-wheel drive:**

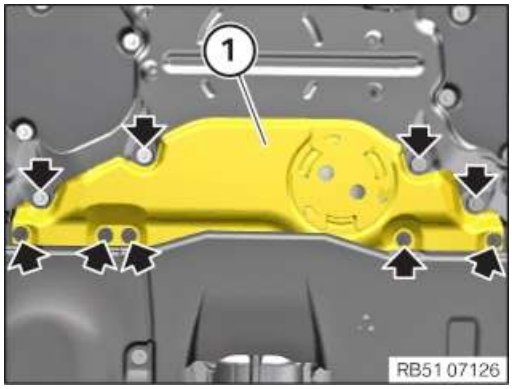
  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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- **Version with all-wheel drive:**

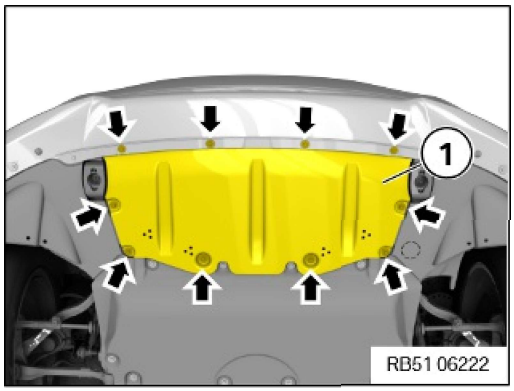
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

45 – Installing the front underbody protection



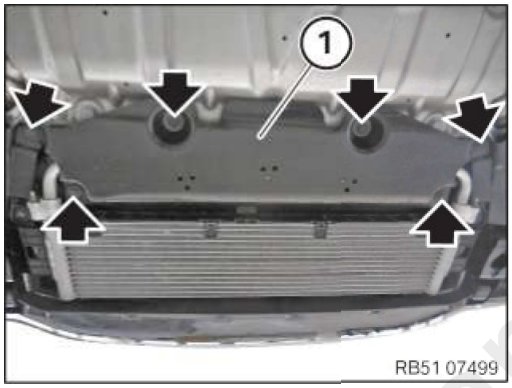
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



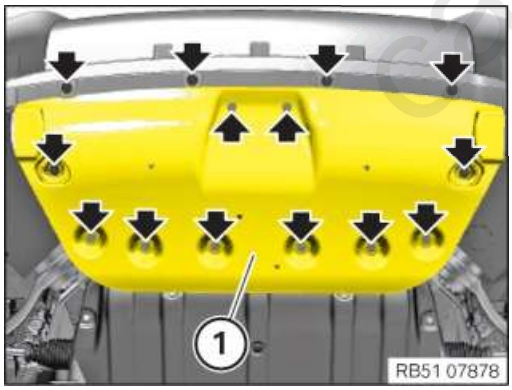
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

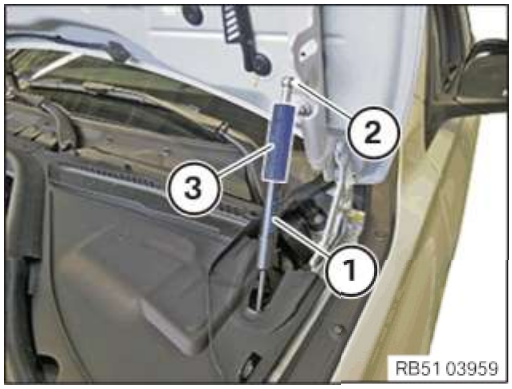
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

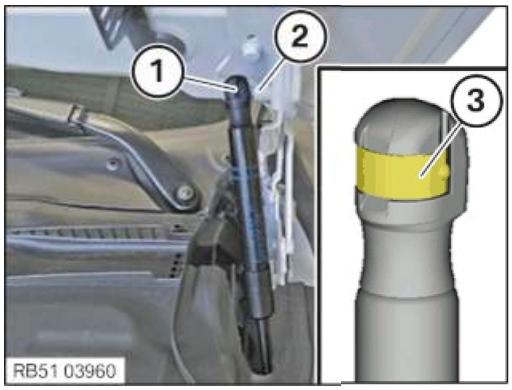
46 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

47 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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Additional Information

Overview of Tightening Torques

Exhaust turbocharger to cylinder head — Used in step 25

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 25

M6x12		Tightening torque	8 Nm

Heat shield to cylinder head — Used in step 25

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip			Used in step 25
M6 x 12		Tightening torque	8 Nm

Oil return line to exhaust turbocharger/crankcase			Used in step 26
M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger			Used in step 2728
M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger			Used in step 27
M6		Tightening torque	8 Nm

Coolant feed line to crankcase			Used in step 28
M6 x 12		Tightening torque	8 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger			Used in step 29
V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Catalytic converter to holder			Used in step 29
M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder			Used in step 29
M8	Renew nut.	Tightening torque	19 Nm

Rear silencer to body / bumper support			Used in step 30
M8	Replace nuts.	Tightening torque	19 Nm

Exhaust system to rear axle carrier			Used in step 30
Nut M8	Renew nut.	Tightening torque	19 Nm

Front silencer / petrol particulate filter on transmission bracket			Used in step 30
M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter			Used in step 30
Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter			Used in step 30
V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

Connecting support to tunnel			Used in step 31
M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Control sensor			Used in step 32
M18x1.5		Tightening torque	50 Nm

Holder, positive battery cable to cylinder head cover			Used in step 32
6X18		Tightening torque	6 Nm

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Charge air line to throttle body — Used in step 36

M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 37

Clamp		Tightening torque	3 Nm

Cover, steering unit — Used in step 41

Screw		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 42

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 43

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 43

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 43

M10		Tightening torque	56 Nm

Underbody protection — Used in step 44

Hexagon screw		Tightening torque	3 Nm

Underbody protection front — Used in step 45

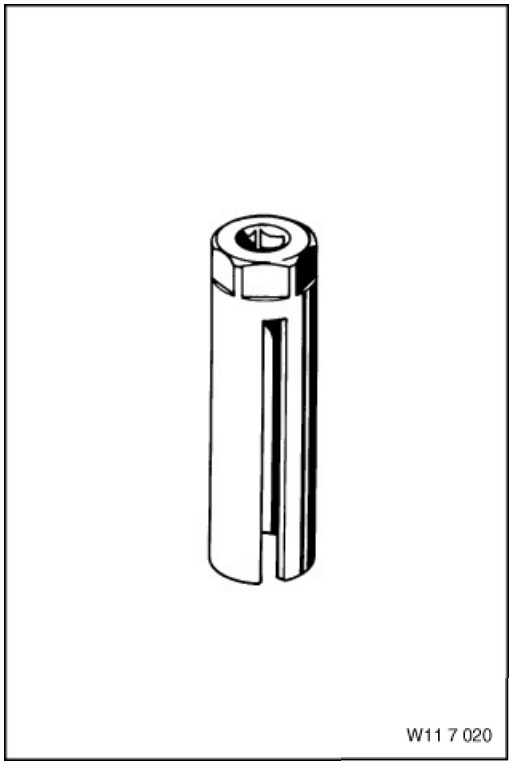
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

0 491 074 (11 7 020) Socket wrench insert

Used in step 832

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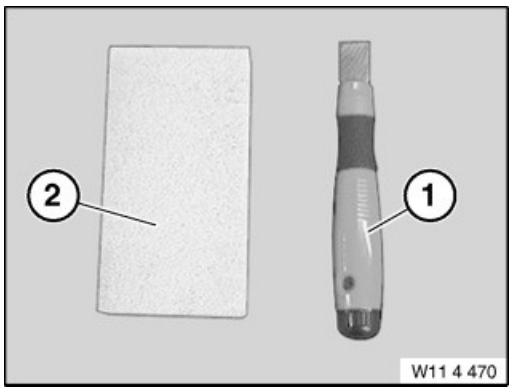


Common

Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool

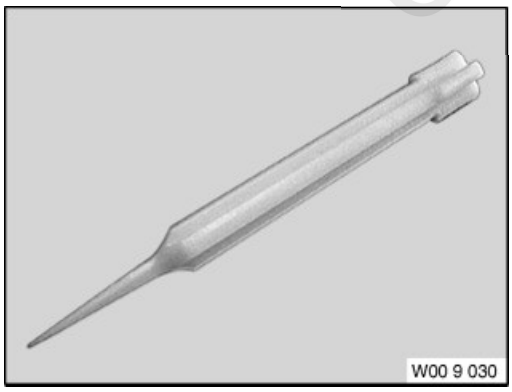


Common	Used in step 25
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

0 496 714 (00 9 030) Wedge

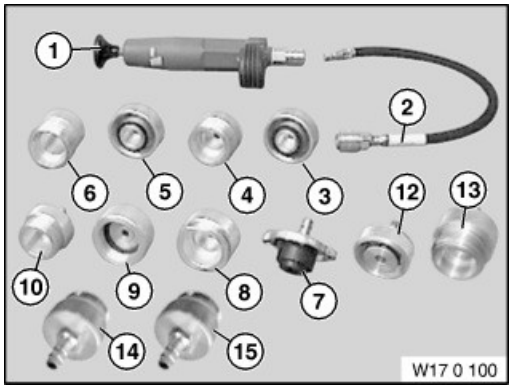


Common	Used in step 252728
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

0 494 417 (17 0 100) Tester

Common	Used in step 39
Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	

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Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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Overview Technical Data

Capacity of high-temperature coolant circuit G20	Used in step 39
B48B20O1/B46B20O1	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Screw-in depth of upper stud bolt on cylinder head	Used in step 25
Dimension A	30 mm

Links

General repair instructions	Used in step
11 00 ... Overview of consumables (Electronic Parts Catalogue)	32

Repair instructions	Used in step
17 00 ... Notes for working on cooling system.	39

Operating materials	Used in step
3.0 Technically appropriate engine oils for BMW Group engines	25

Operating materials	Used in step
Main group 17	39

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11 14 270 Removing and installing/replacing the rear acoustic cover

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Remove the seal for the rear bonnet



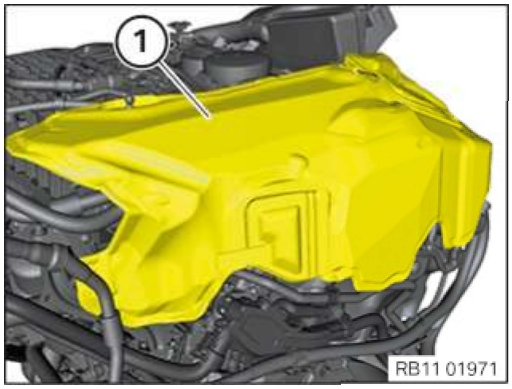
- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

3 – Removing acoustic cover at rear

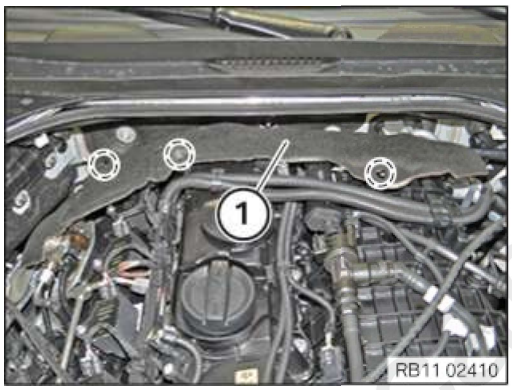


- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

4 – Installing acoustic cover at rear



- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

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5 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

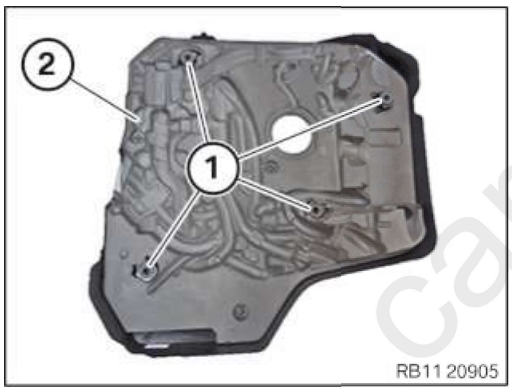
6 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

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This documentation refers to special tools that were not yet available when going to press.

11 14 110 Removing and installing/sealing or replacing bottom timing case cover

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Removing engine



- See additional information.

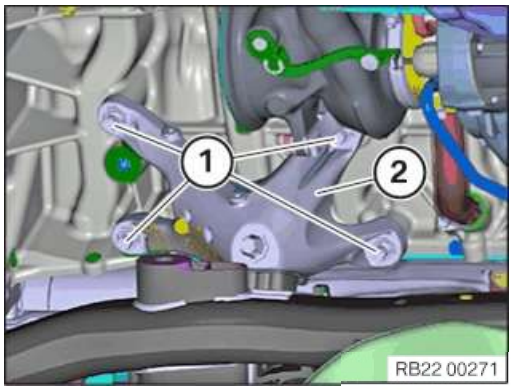
2 – Mount engine on assembly stand

CAUTION

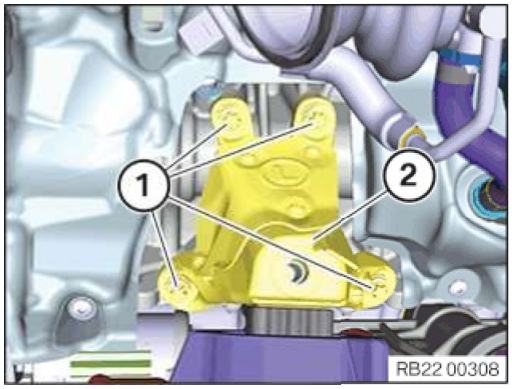
Heavy component.

Heavy components can lead to injury or damage.

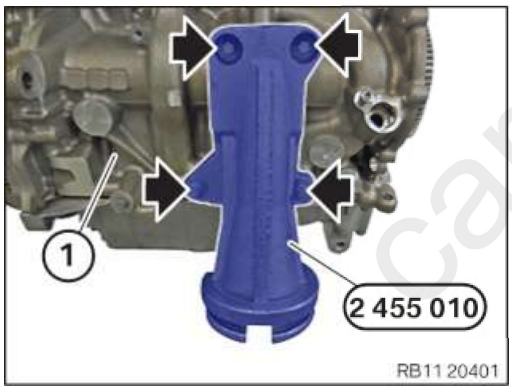
- Remove and install heavy components with the aid of another person/other persons.



- **Type: Rear-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



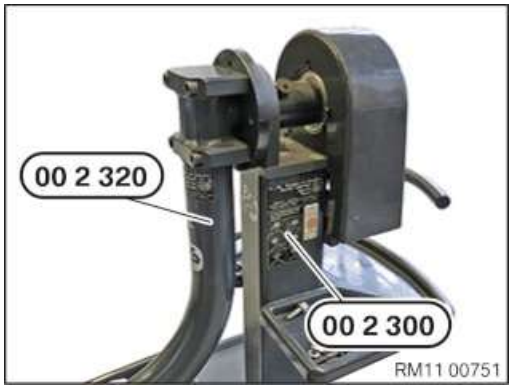
- **Type: Four-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



- Position the special tool 2 455 010 on the engine (1).
- Position the standard bolts **M10x30**.
- Tighten the standard bolts (arrows).

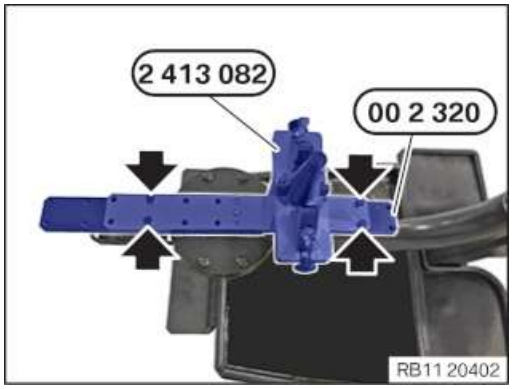
Special tool 2 455 010 to crankcase

M10x30		Tightening torque	38 Nm



- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).

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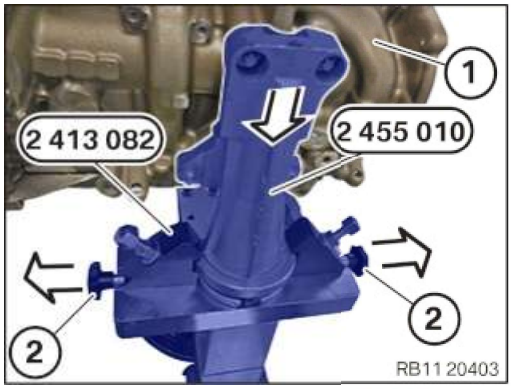
- Screw the special tool to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

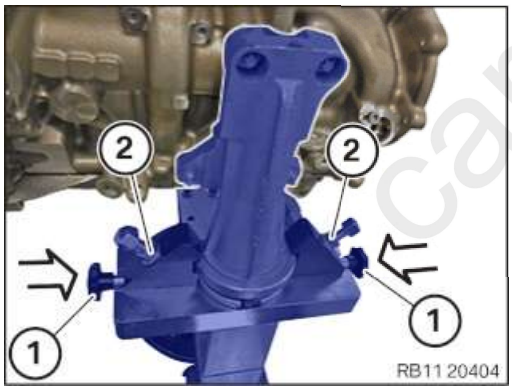
M14x35		Tightening torque	160 Nm



- Position the engine lifter with the special tool and the engine on the special tool 0 495 187 (00 2 300).



- Detach the holder (2) in the direction of the arrow.
- Position the engine (1) with the special tool 2 455 010 in the direction of the arrow on the special tool .



- Lock the holder (1) in direction of arrow.
- Tighten nuts (2).

3 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

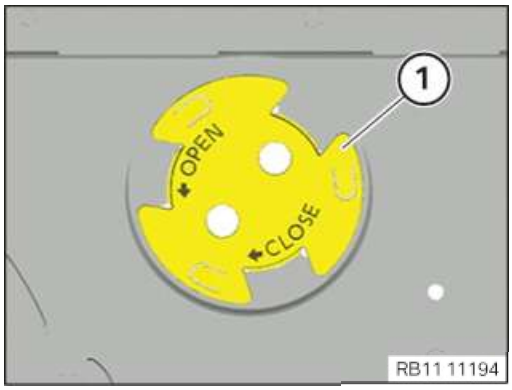
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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).



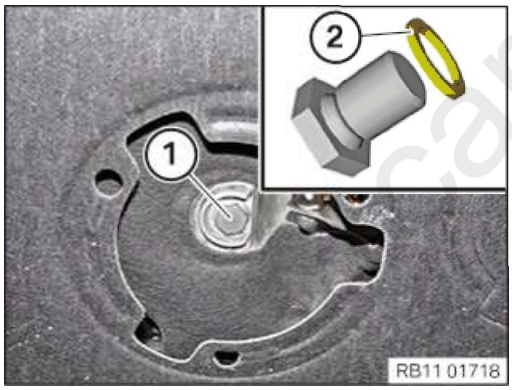
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

4 – Tightening the oil drain plug

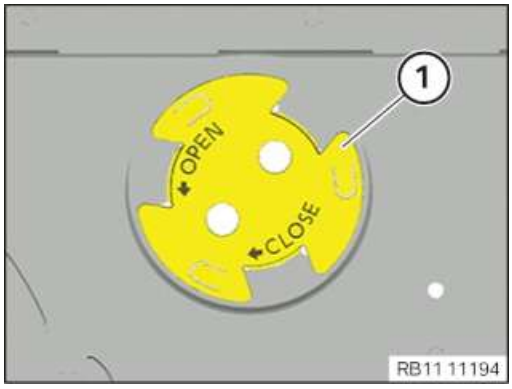


- Renew sealing ring (2).

  Parts: Sealing ring
- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

M12x16	Renew the sealing ring.	Tightening torque	25 Nm



- Install service cap (1).

5 – Removing all spark plugs

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

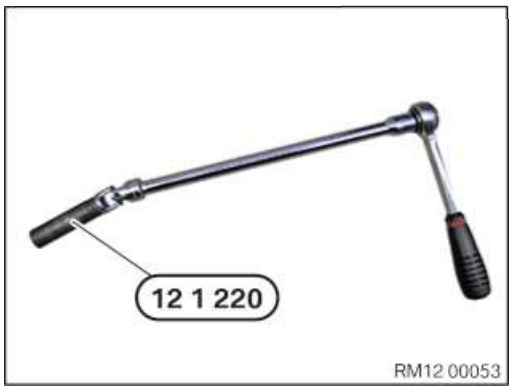
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

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- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

6 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

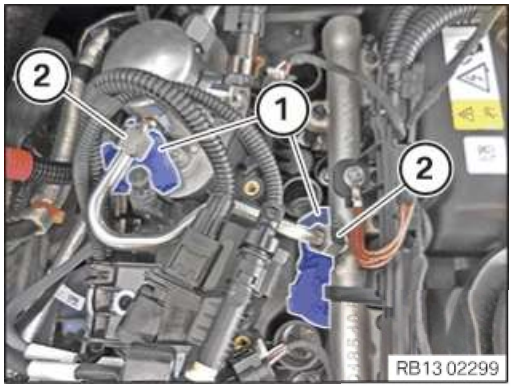
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

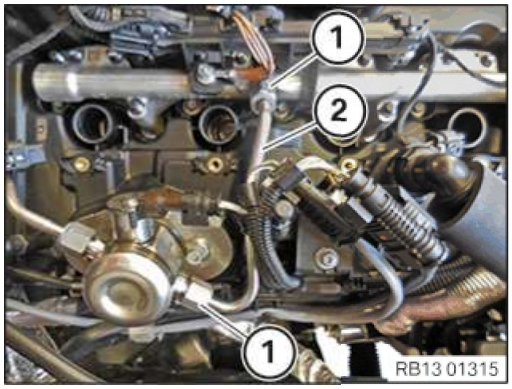
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- Have the special tool ready.



- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

7 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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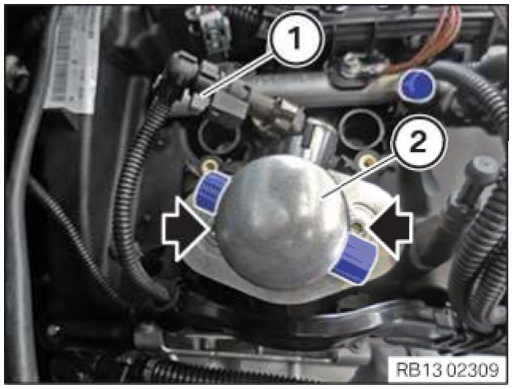
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

8 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

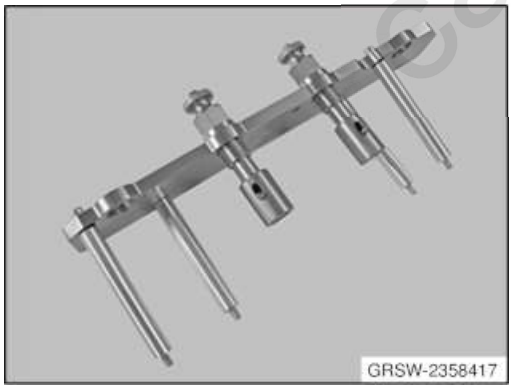
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Prepare special tool .

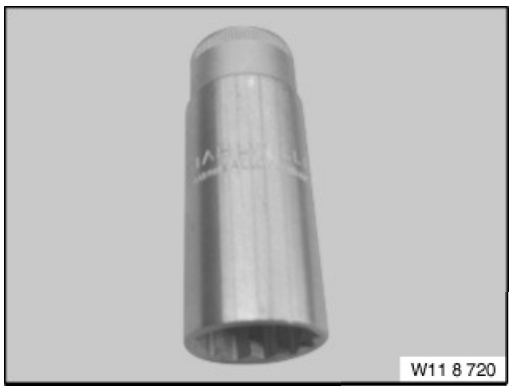


- Prepare special tool 2 358 417.

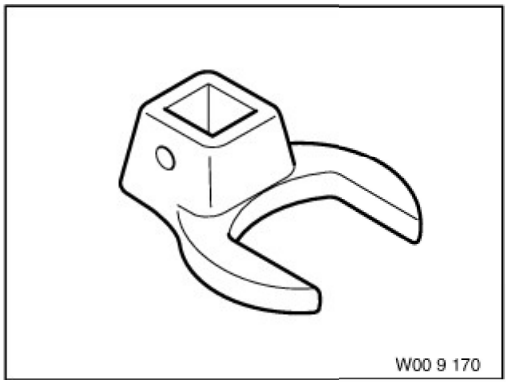
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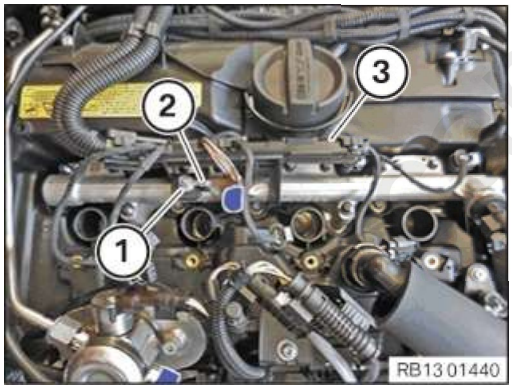
- Prepare special tool .



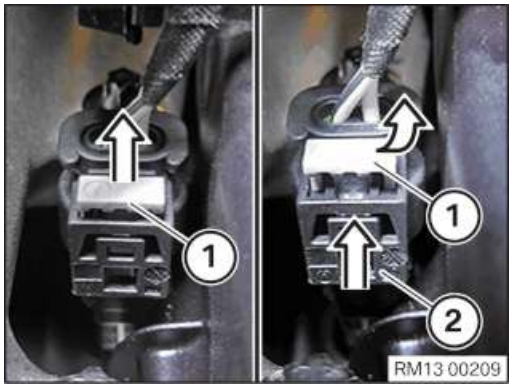
- Prepare special tool 0 496 106 (11 8 720).



- Prepare special tool .

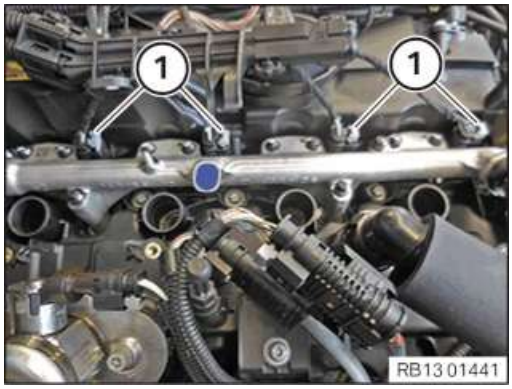


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.



- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.

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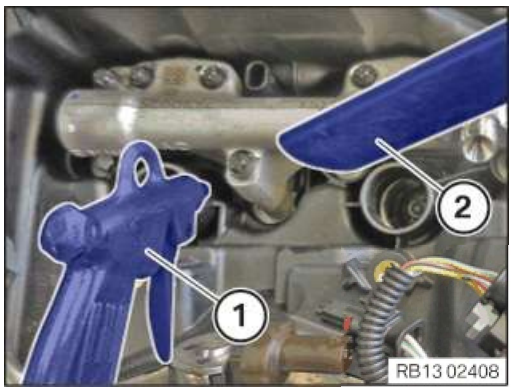
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

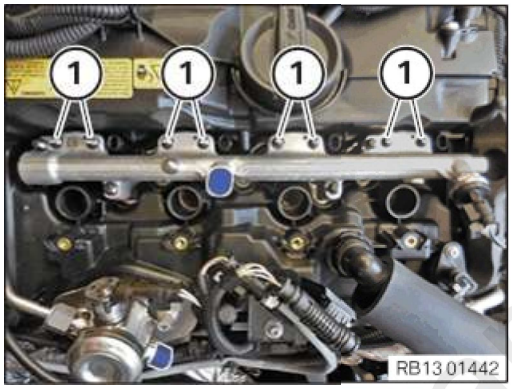


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

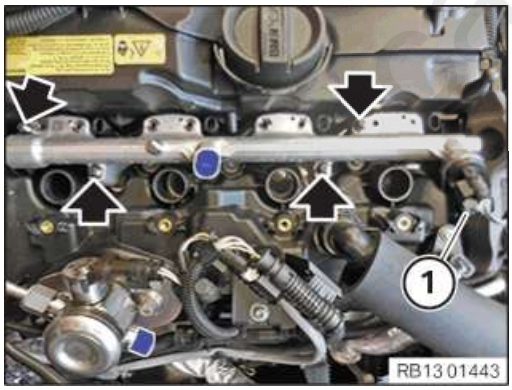
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

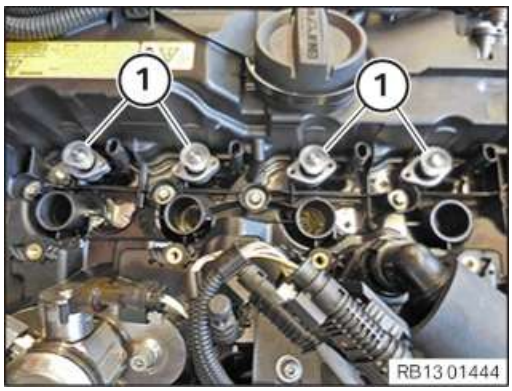


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

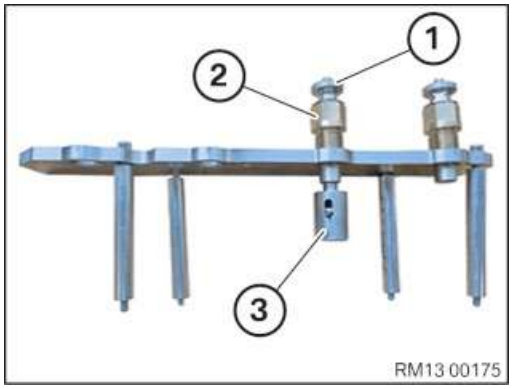
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

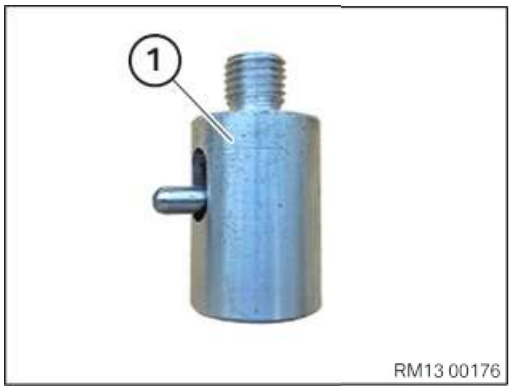
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

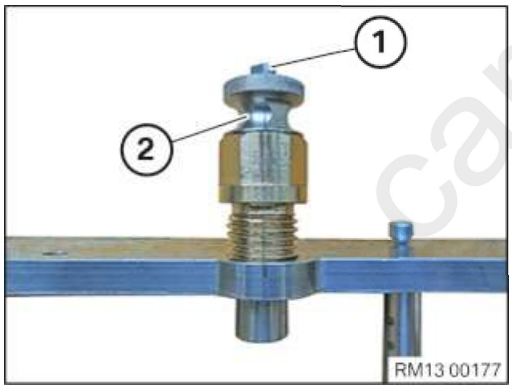
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

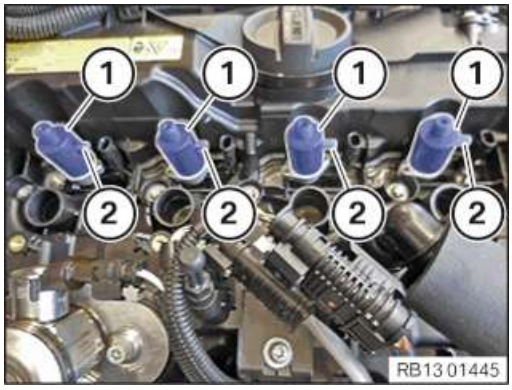
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



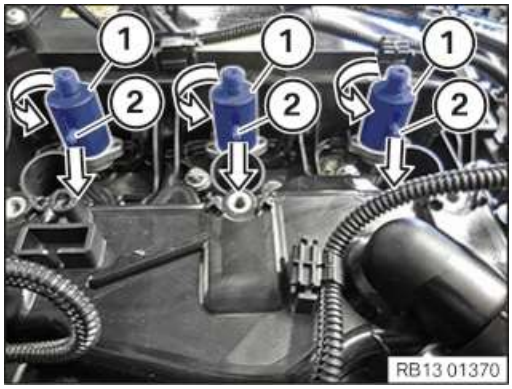
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



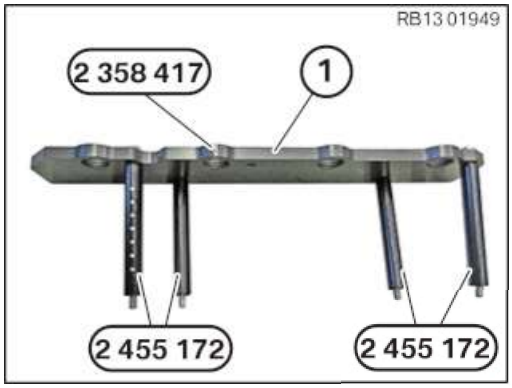
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

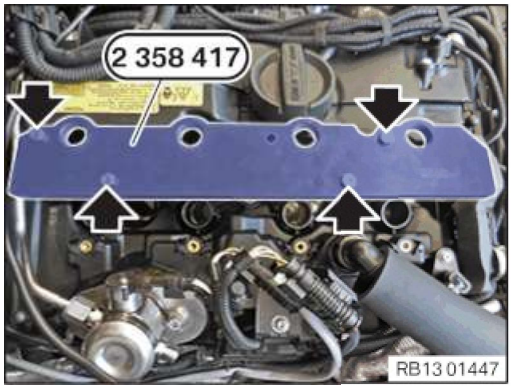
cardiagn.com



- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



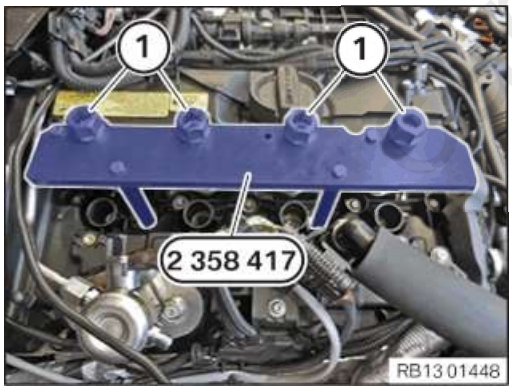
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

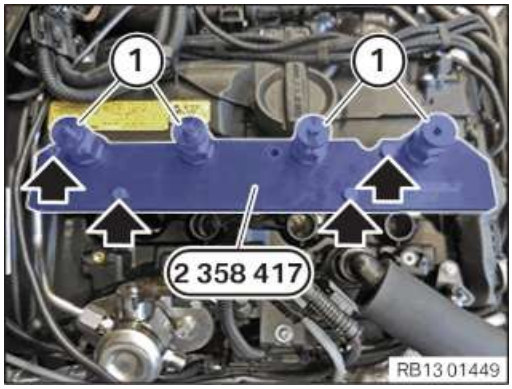
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

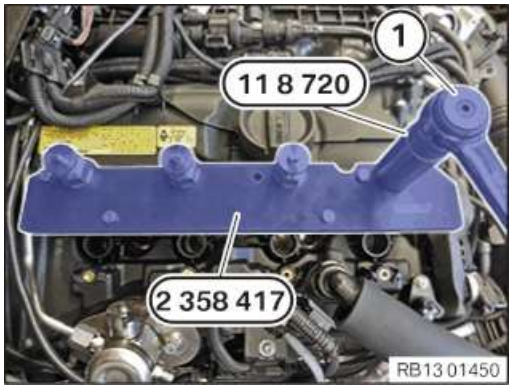
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

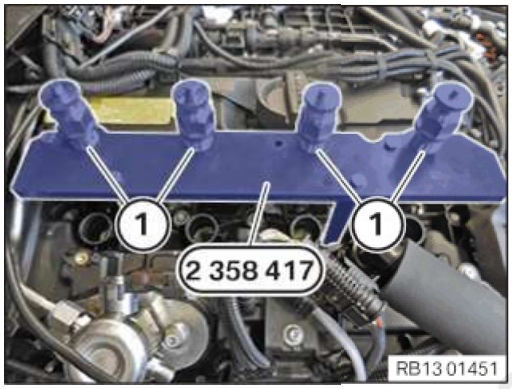


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

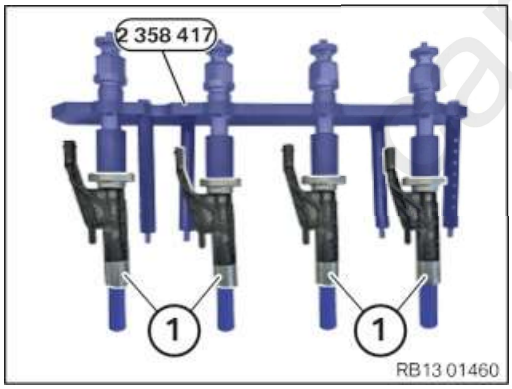
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

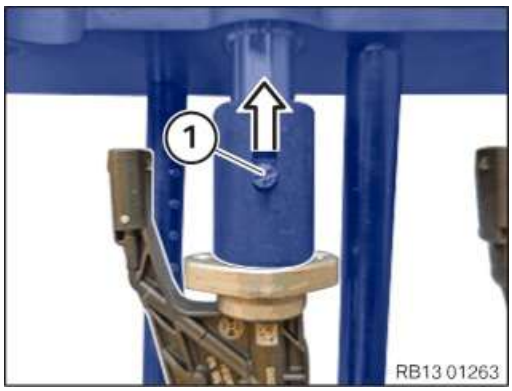


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

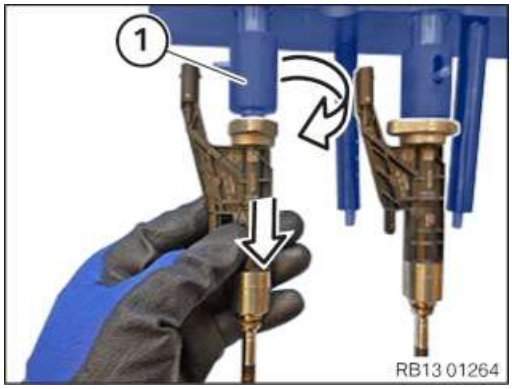


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

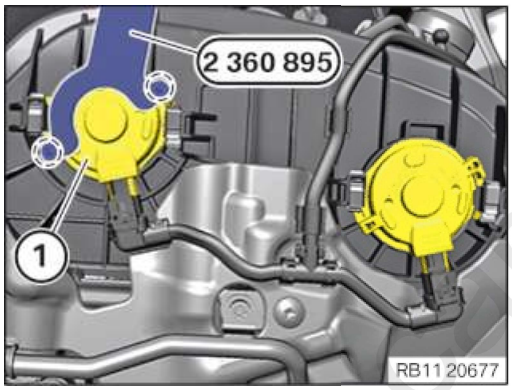
9 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

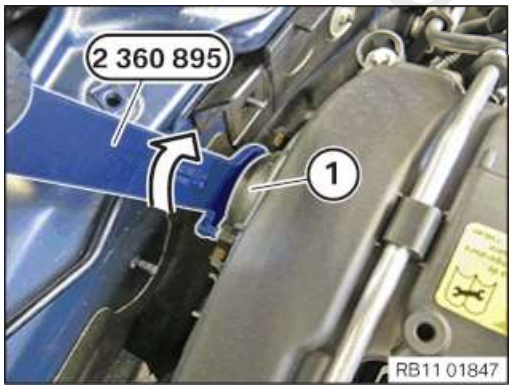
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



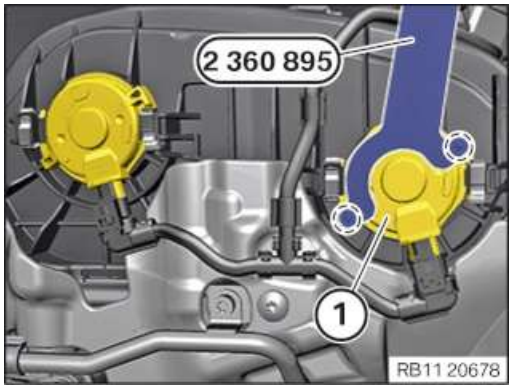
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



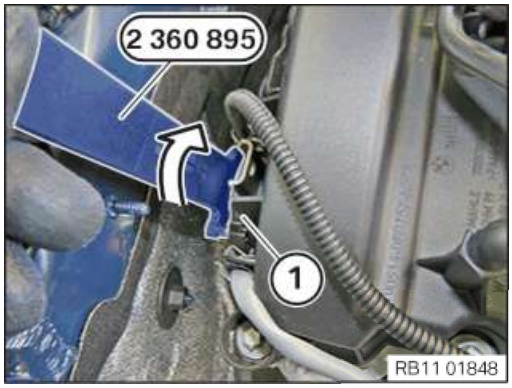
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



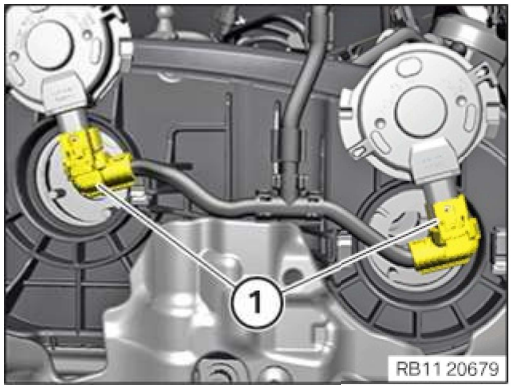
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

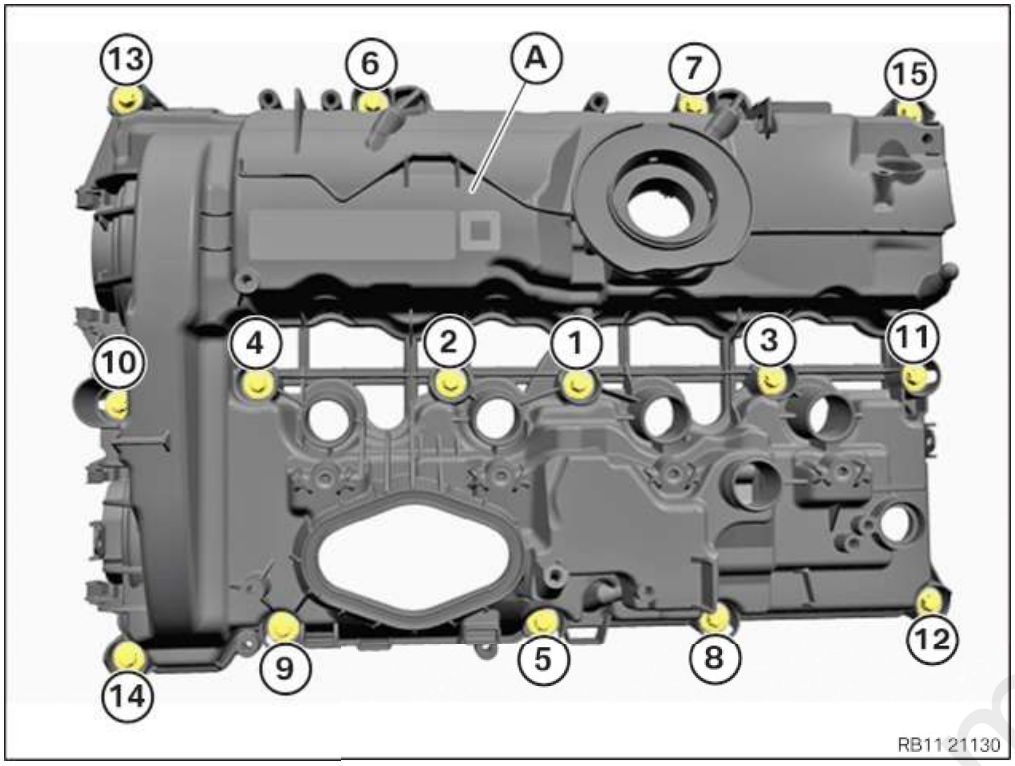
The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

10 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

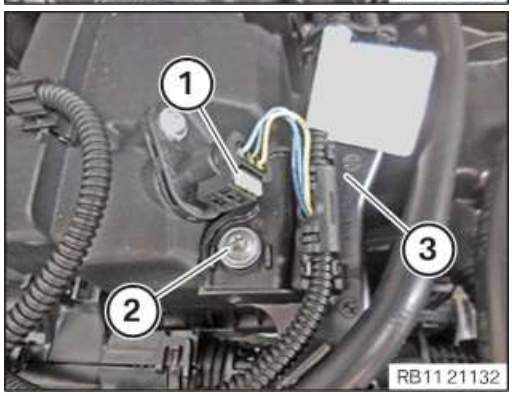
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

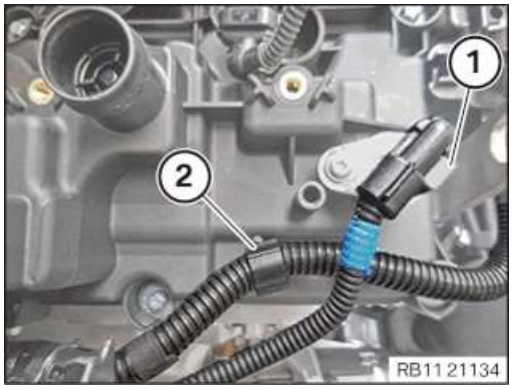
- Do not pull on the wires when disconnecting connectors and plug connections.



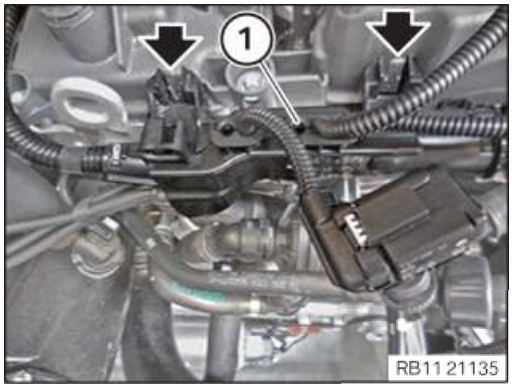
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



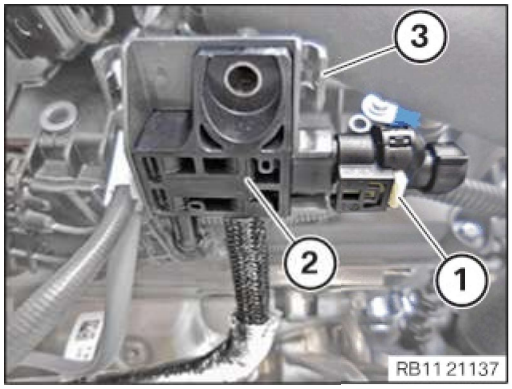
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



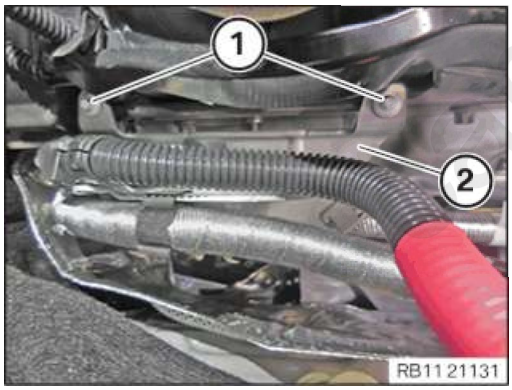
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



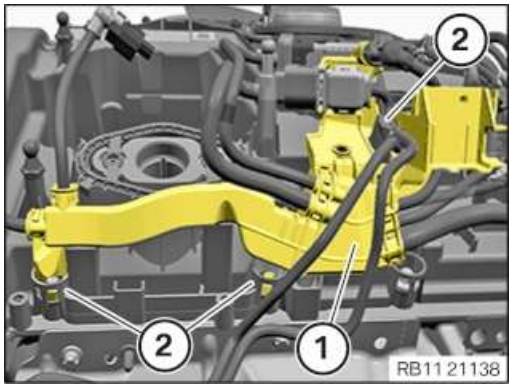
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.

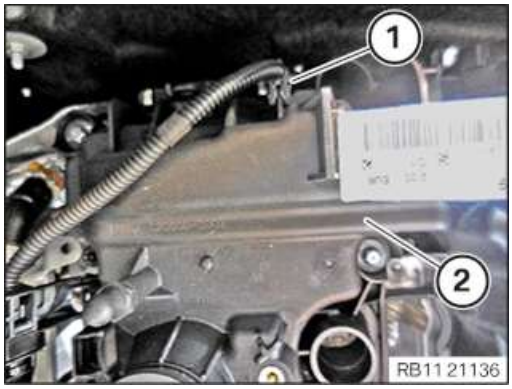


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

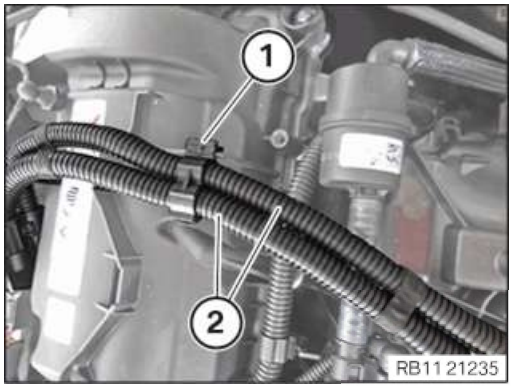


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

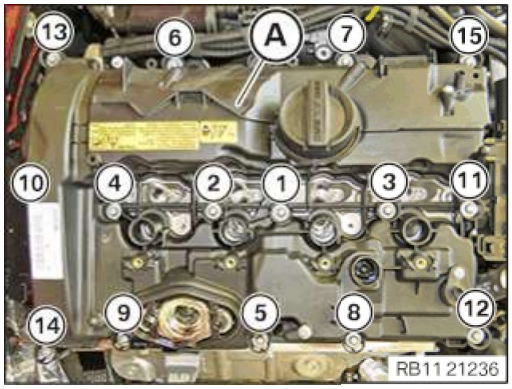
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- Loosen clamp (1).



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

11 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

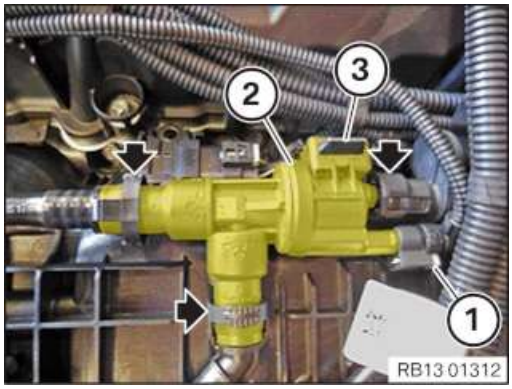
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

12 – Removing the intake plenum

RISK OF DAMAGE

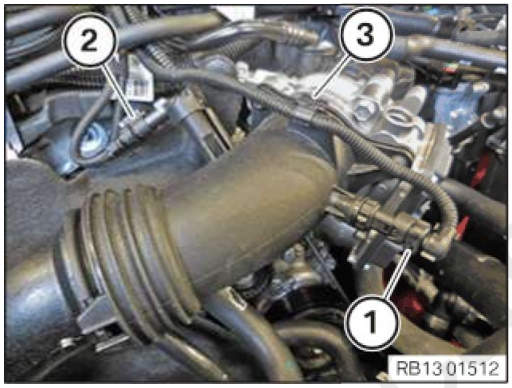
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

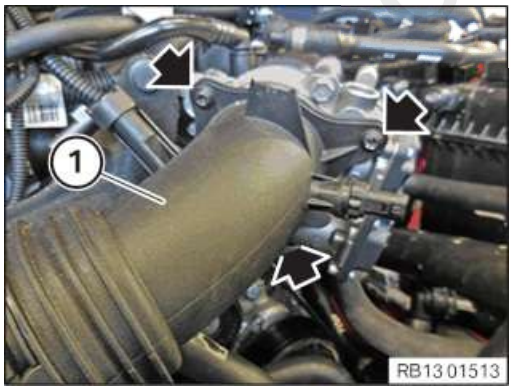
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

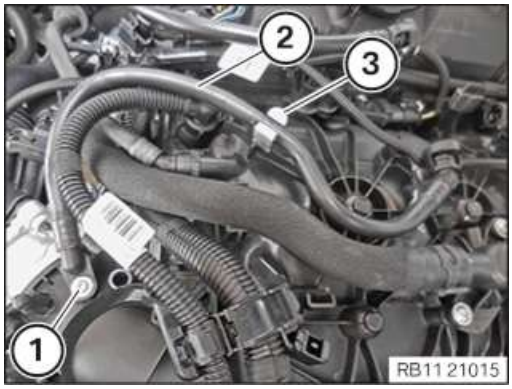
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



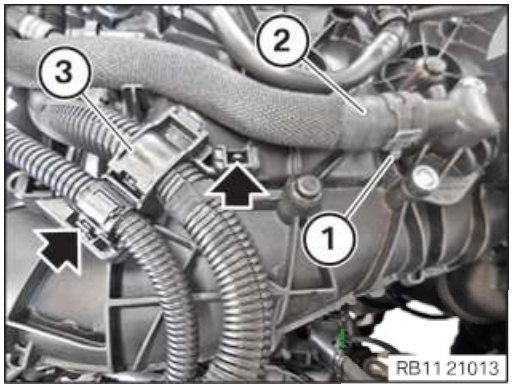
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



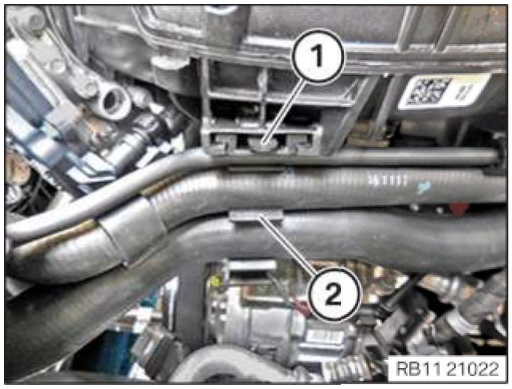
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



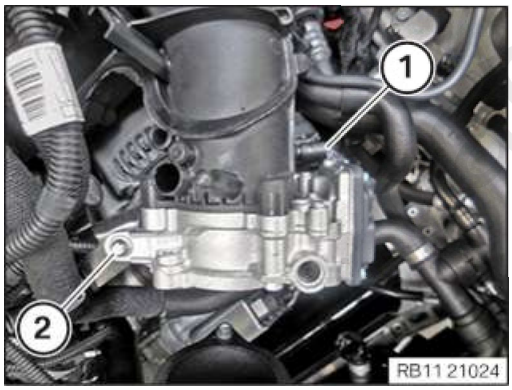
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



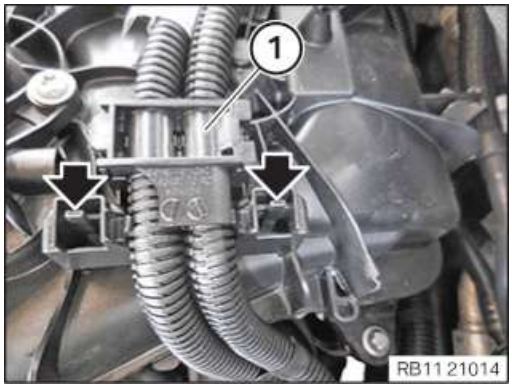
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

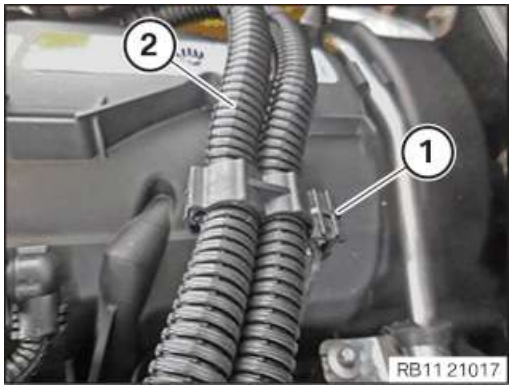


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

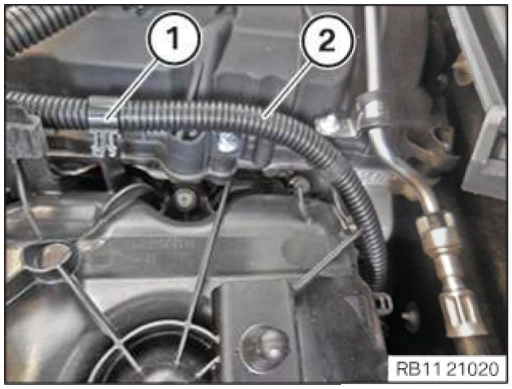
mdiagn.com



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



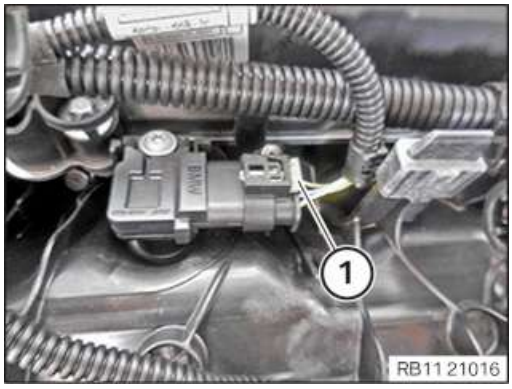
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

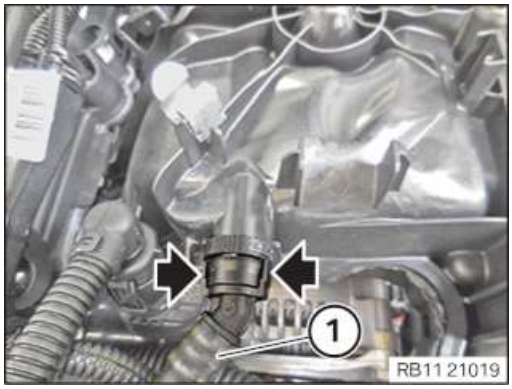


- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

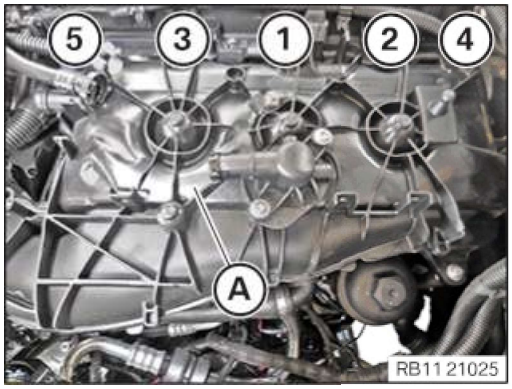
rdiagn.com



- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

13 – Remove the heat shield on the cylinder head

WARNING

Hot surfaces.

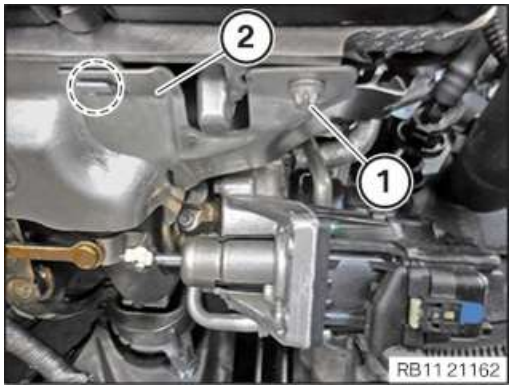
Risk of burning!

- Perform all work only on components that have cooled down.

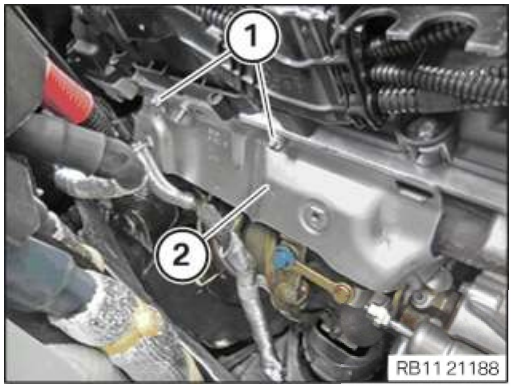


- Loosen screw (1).

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- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

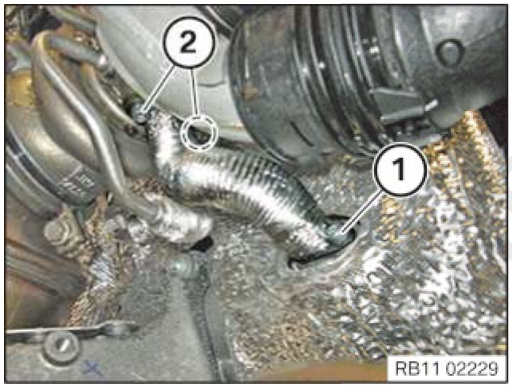


- Loosen screws (1).
- Feed out and remove the heat shield (2).

14 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

15 – Remove the coolant return line for the exhaust turbocharger

WARNING

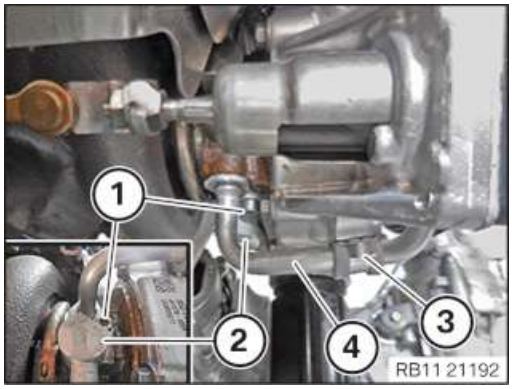
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

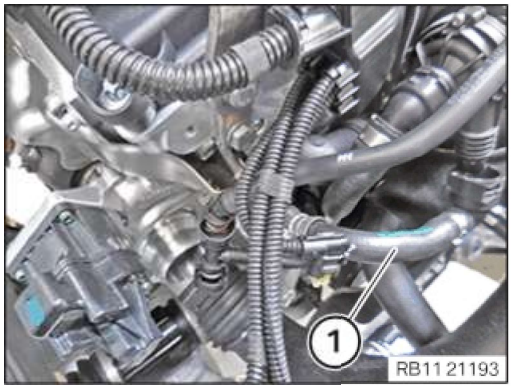
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

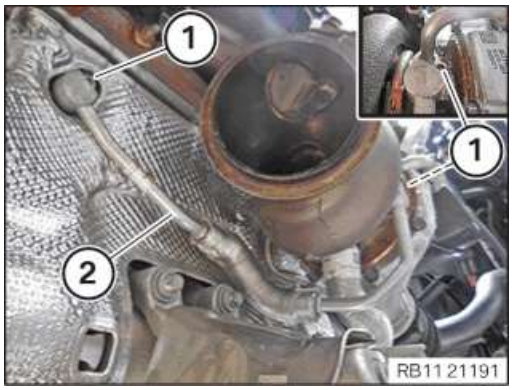


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

16 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

17 – Block the engine with the special tool in TDC firing position

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- Thread the sealing cap (1) out and remove.



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

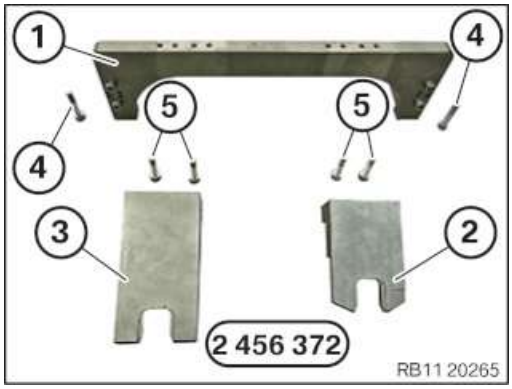


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

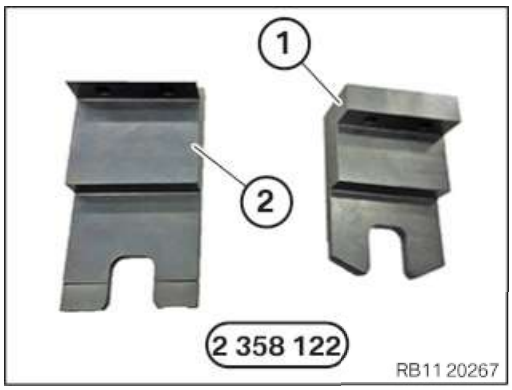
  The engine is in the TDC firing position of cylinder 1.

erdiagn.com



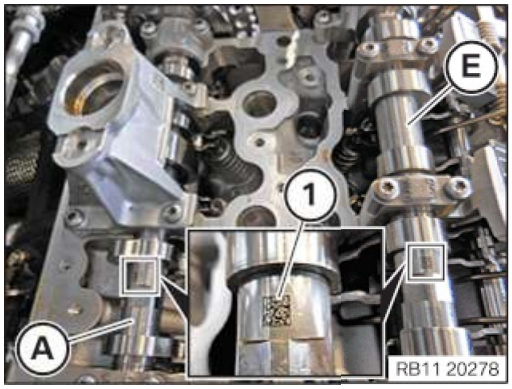
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

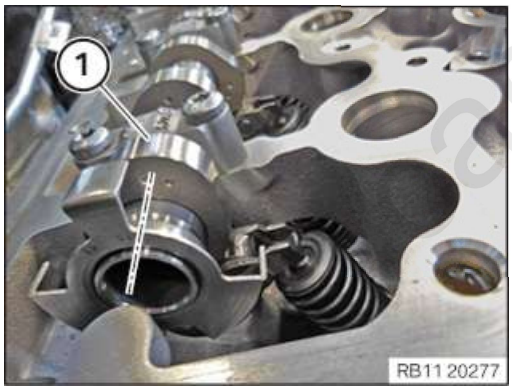


- Overview of the test gauges from the set of special tools 2 358 122:

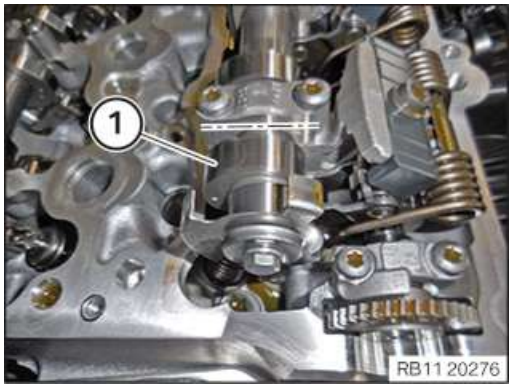
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

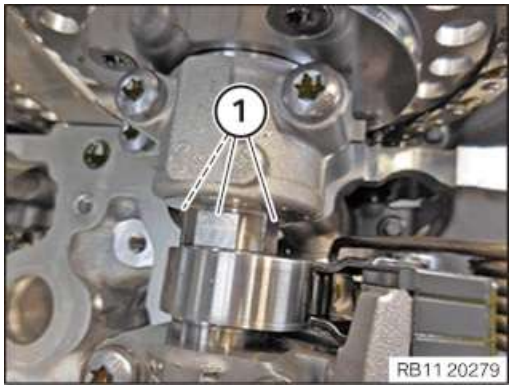


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

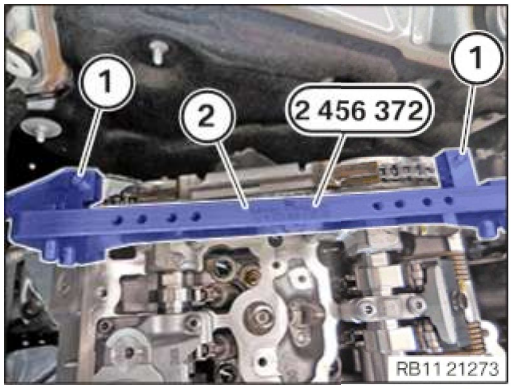
ardiagn.com



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



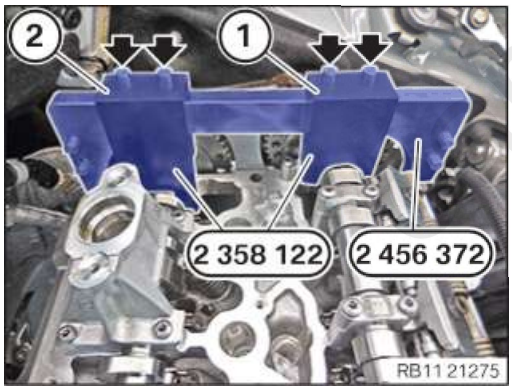
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

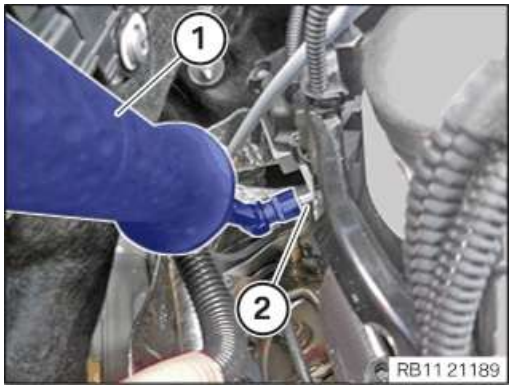
M6		Tightening torque	8 Nm

18 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

diagn.com



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

19 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

The figure shows the rear side of the engine.

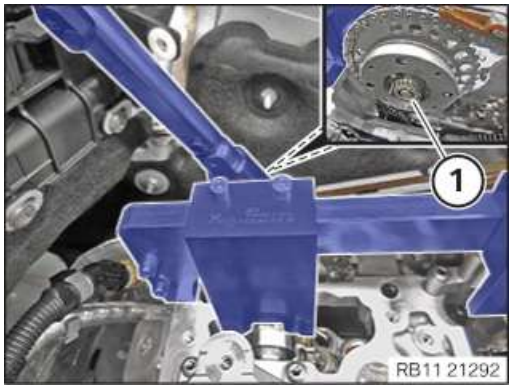
- Release the VANOS central valve (1) of the intake adjuster.

20 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

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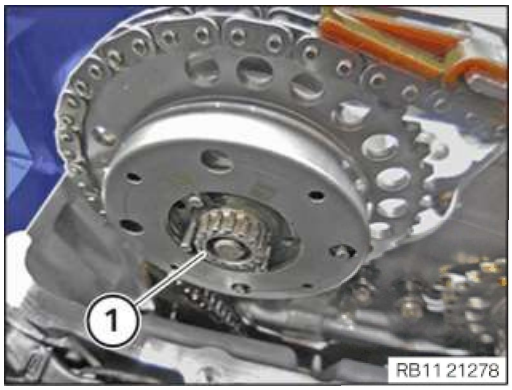


NOTICE

The figure shows the rear side of the engine.

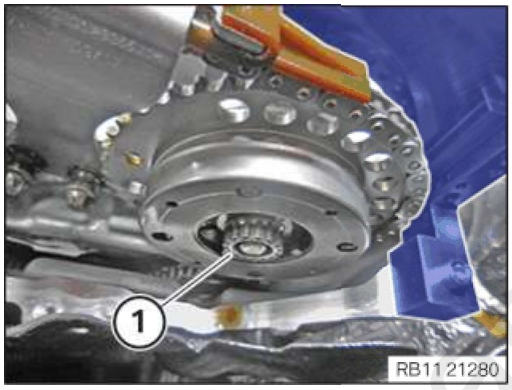
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

21 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

22 – Remove the VANOS central valve of the exhaust camshaft adjuster



- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

23 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.



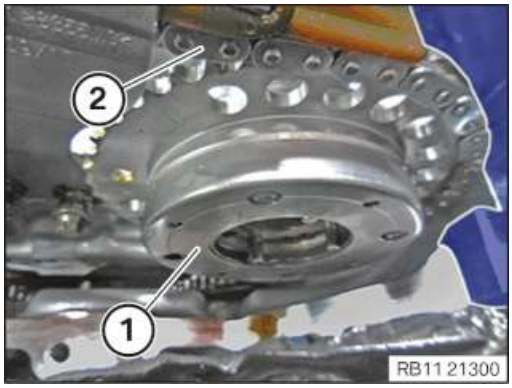
- Guide out the intake adjuster (1) from the timing chain (2) and remove.

24 – Remove exhaust camshaft adjuster

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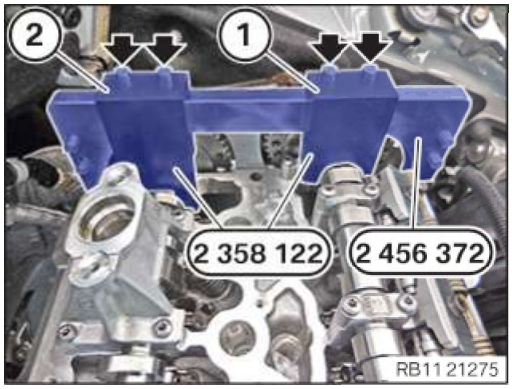
NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

25 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

26 – Remove cylinder head.

CAUTION

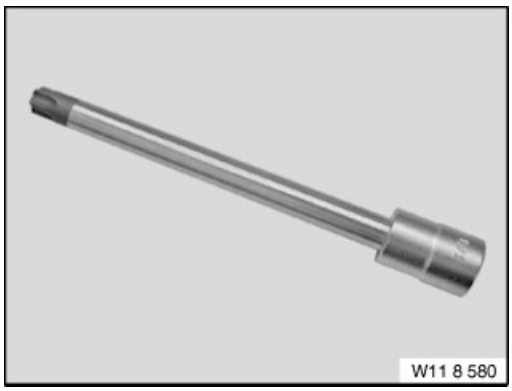
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

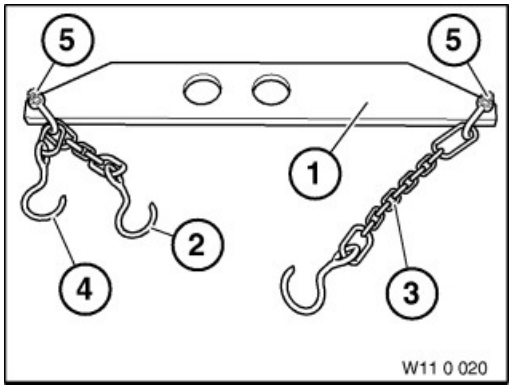
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Prepare special tool 0 495 747 (11 8 580).

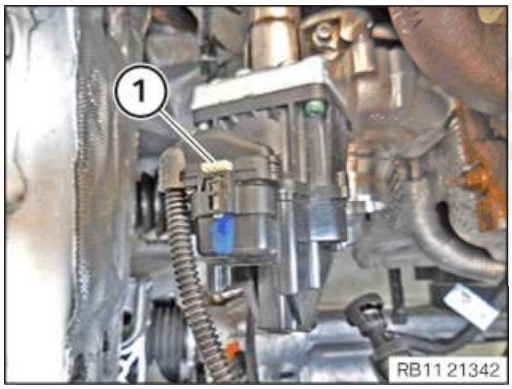
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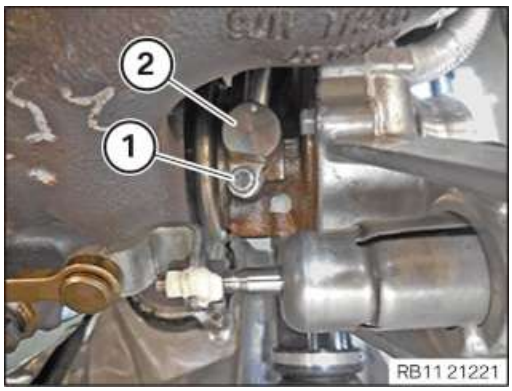
- Prepare special tool .



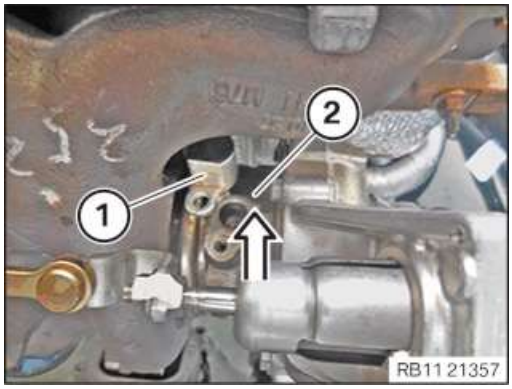
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.



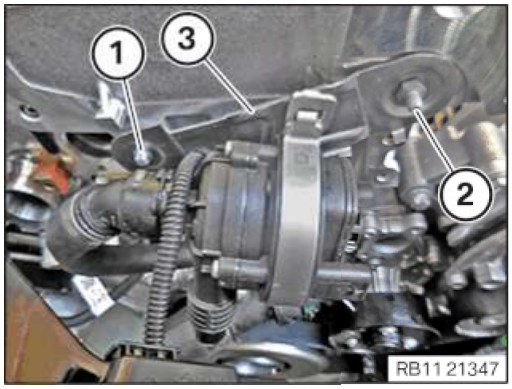
- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.



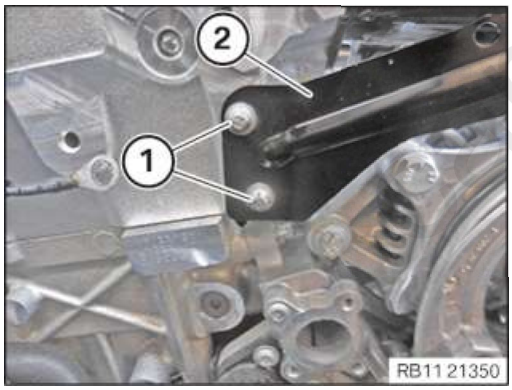
- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.

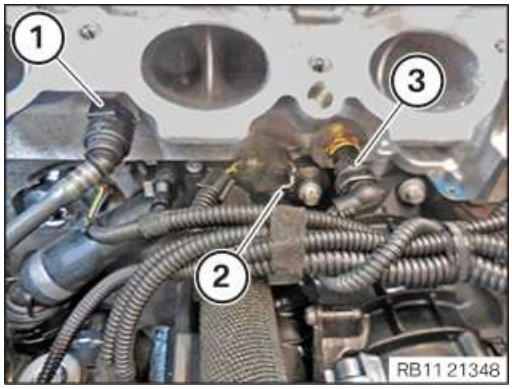


- Loosen screws (1).
- Thread out holder (2) and set aside.

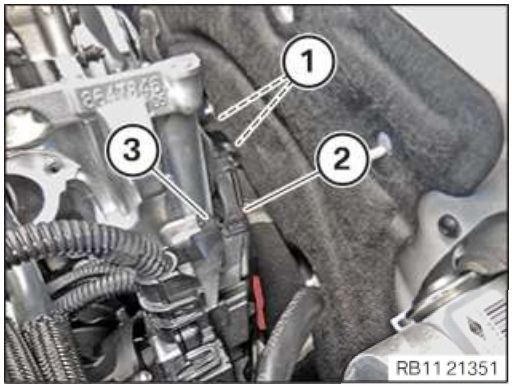


- Unlock plug connection (1) and disconnect.

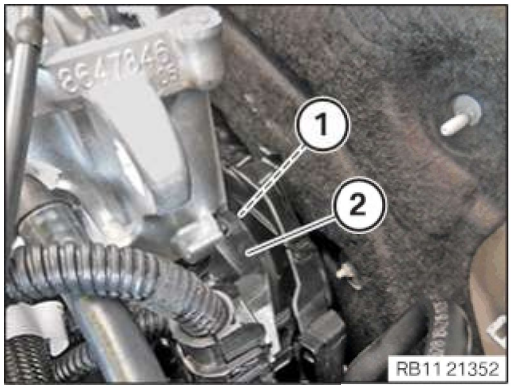
rdiagn.com



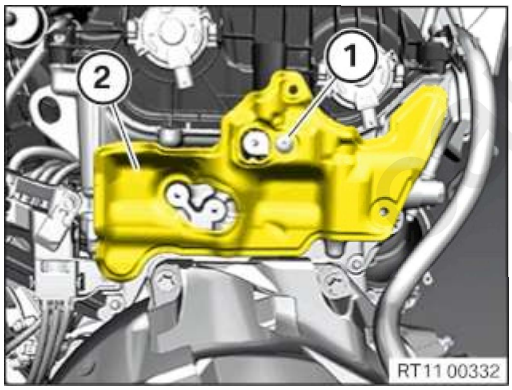
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



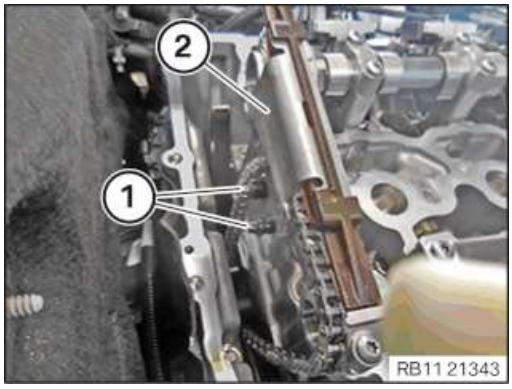
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



NOTICE

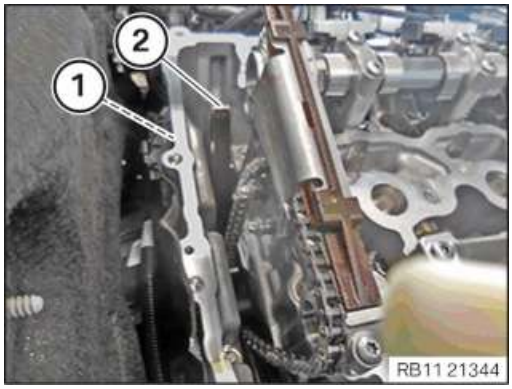
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

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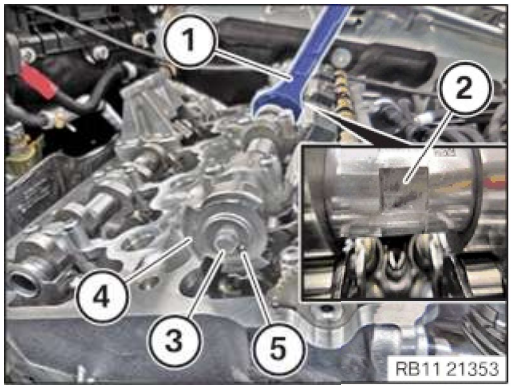
- Release the bearing journal (1) from the guide rail (2).



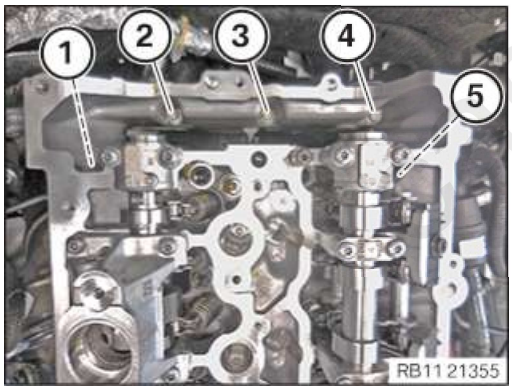
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm



- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.

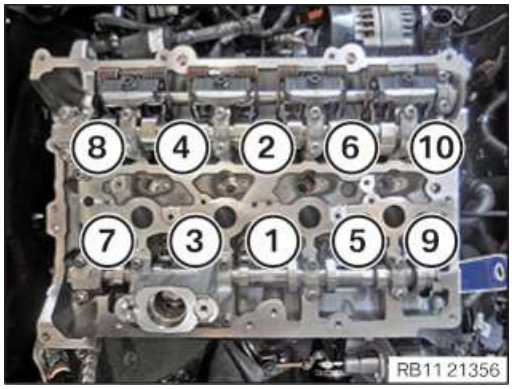


- Loosen the cylinder head bolts in the sequence from (5) to (1).

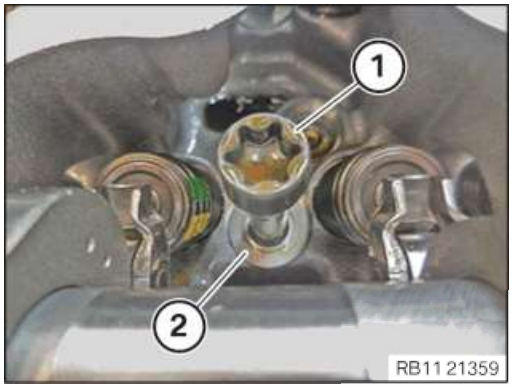


- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

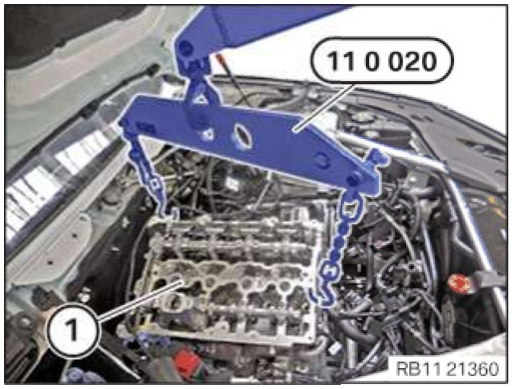
tdiagn.com



- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to the guide rails.

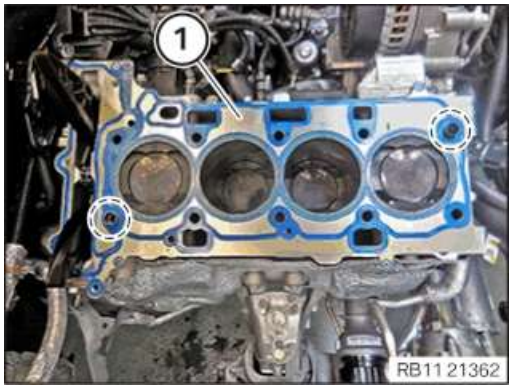
Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Attach special tool to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an **auxiliary person**, the workshop crane and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

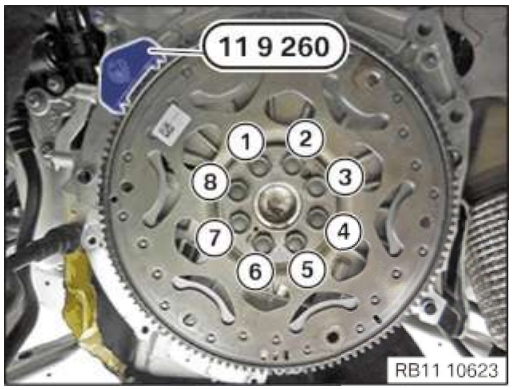
27 – Removing the cylinder head gasket

carmagn.com



- Guide out and remove cylinder head gasket (1) in the **marked** area.

28 – Removing flywheel

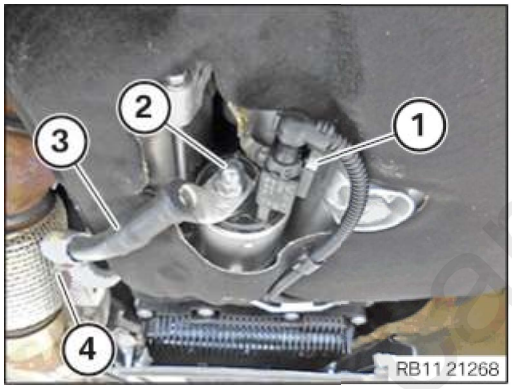


- Fasten the flywheel with the special tool 0 493 938 (11 9 260) and tighten with the special tool 0 494 130 (11 9 264).
- Loosen screws (1-8).

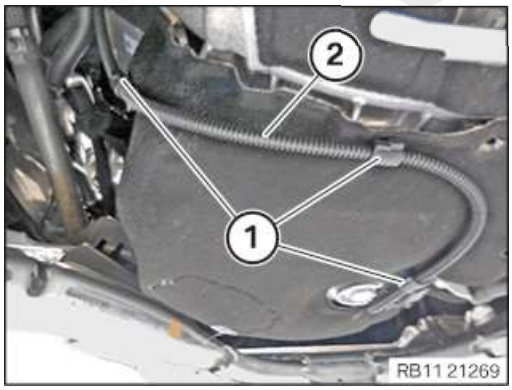
29 – Removing the acoustic cover of the oil sump

Prerequisite

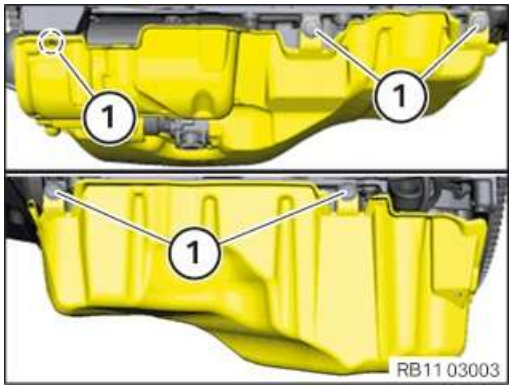
Disconnect all negative battery cables.



- Unlock and loosen connector (1).
- Loosen nut (2).
- Guide the positive battery cable (3) out of the clamp (4) and lay to one side.



- Unlock and loosen the clamps (1).
- Guide out the wiring harness section of automatic transmission (2) and set it aside.



- Detach all expanding rivets (1).



- Guide out acoustic cover (1) downwards to the rear and remove it.

30 – Remove oil sump

RISK OF DAMAGE

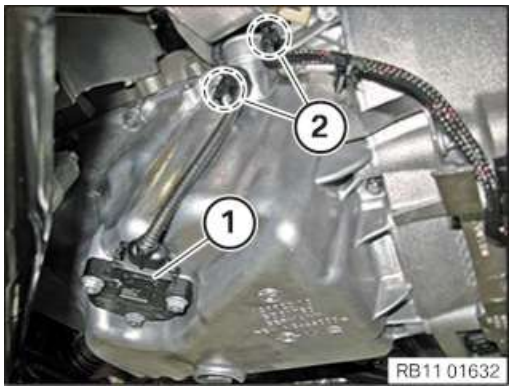
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

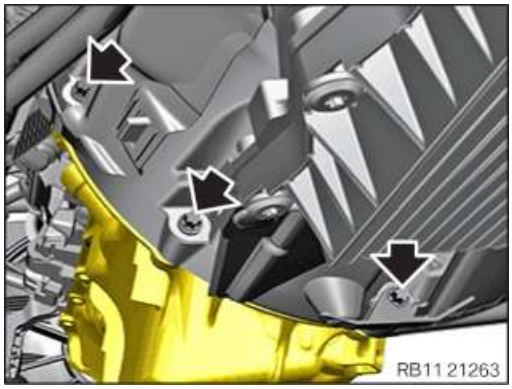
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

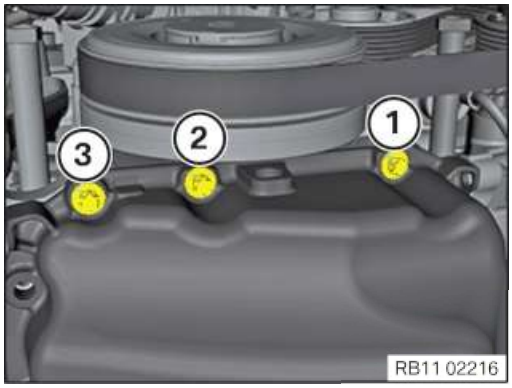


- Unlock and loosen connector (1).
- Release the cable from the clips (2) of the oil sump.

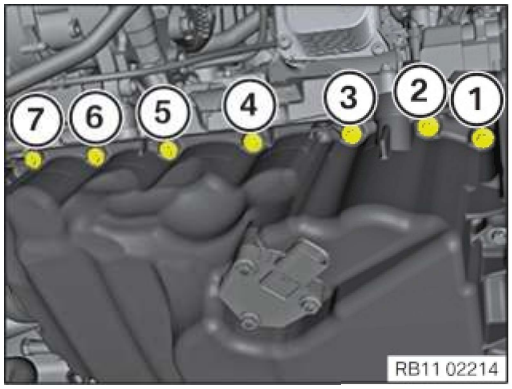
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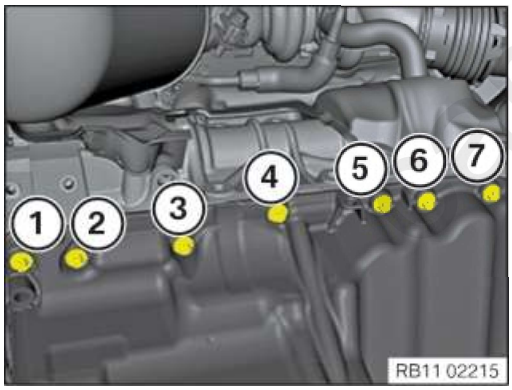
- Unscrew the transmission bolts (arrows).



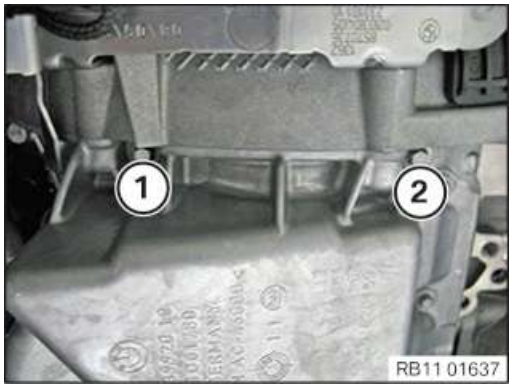
- Loosen screws (1), (2) and (3).



- Loosen screws (1) to (7).



- Loosen screws (1) to (7).



- Loosen screws (1) and (2).

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TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

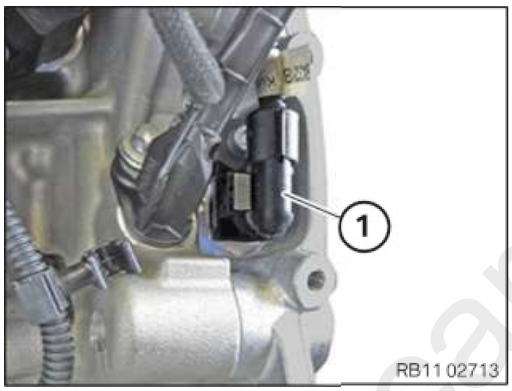
- Release the oil sump in the **marked** areas using suitable tools (1).



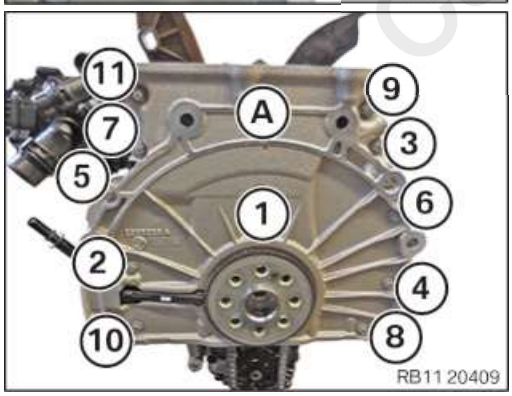
- Guide out the oil sump (1) downwards to the rear and remove.

MAIN WORK

31 – Remove rear timing case cover



- Unlock the connector (1) and pull it off the crankshaft sensor.



- Loosen screws in the order (11) to (1).

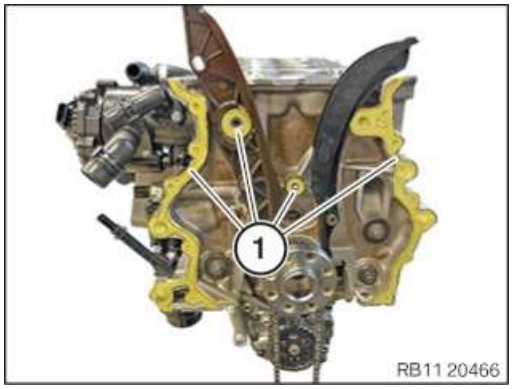
TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Carefully loosen and remove the timing case cover (A).

32 – Install the rear timing case cover

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RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

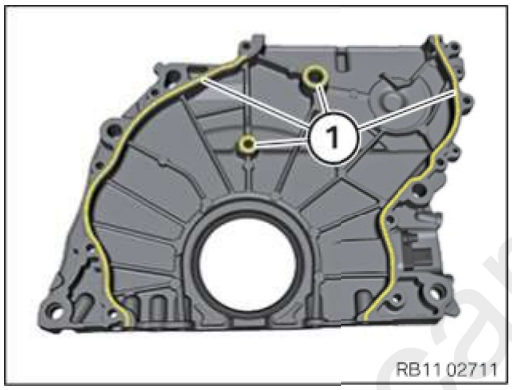
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove sealing residue in this area (1) using special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

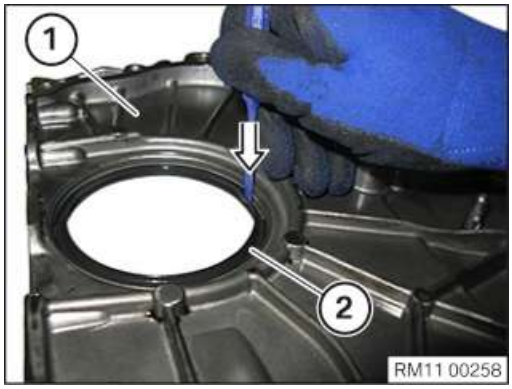
The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove sealing residue in this area (1) using special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

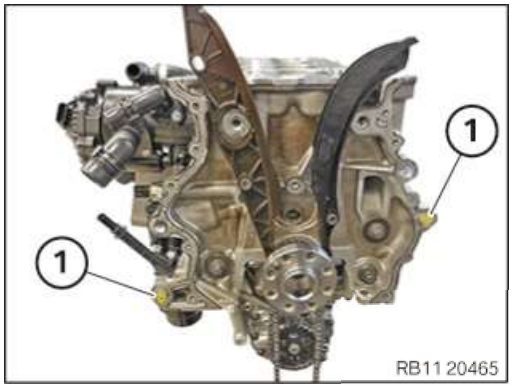
Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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- Position the timing case cover (1) underneath.
- Position the inner punch in the crankshaft sealing ring (2).
- Remove the crankshaft sealing ring (2) outward in the direction of the arrow.



- Check the fitting sleeves (1) for damage and renew, if necessary.
- Check for correct fit of fitting sleeves(1).



- Have the special tool ready.



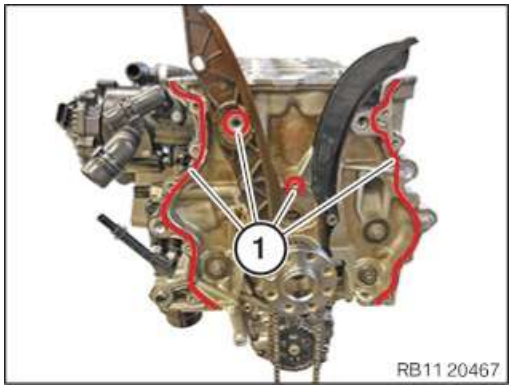
TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

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TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound in area (1)along the inner edge.

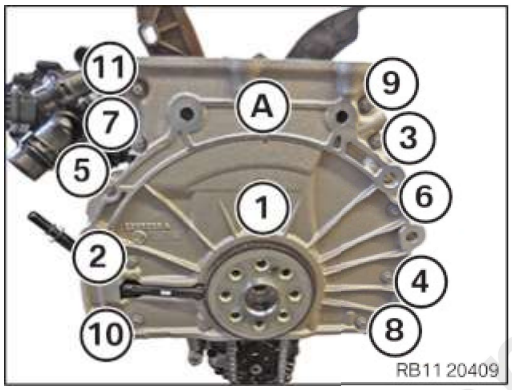
Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

2,0 mm ... 2,5 mm

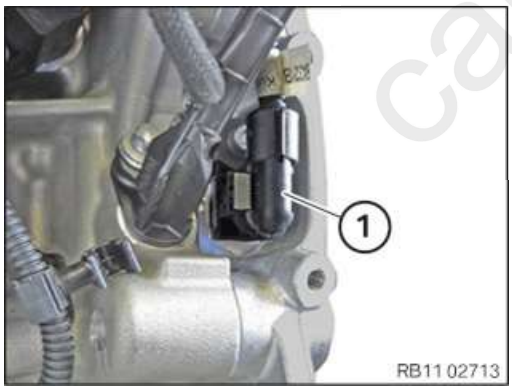


- Renew screws (1) to (11).

  Parts: Bolts
- Carefully mount the timing case cover (A).
- Tighten screws in the order (1) to (11).

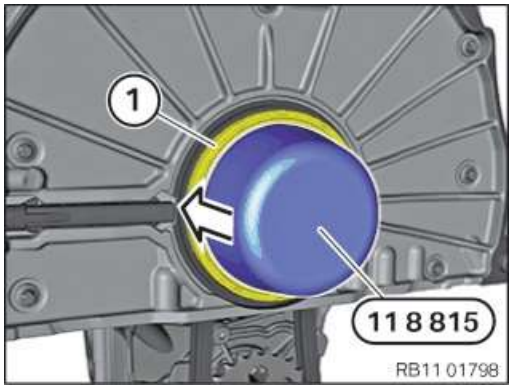
Rear timing case cover to crankcase

M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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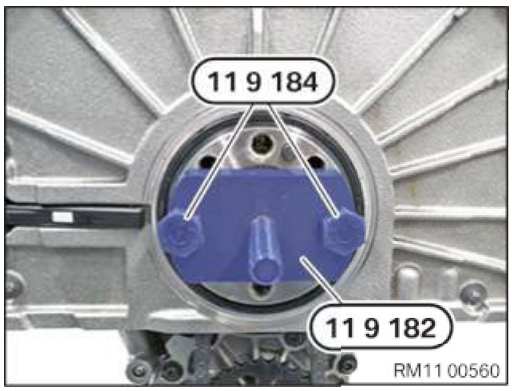
RISK OF DAMAGE

Radial shaft seal damage.

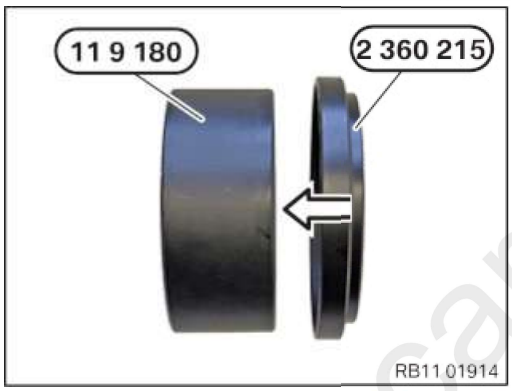
Touching the sealing lip (inner) and applying oil to the radial shaft seal will lead to its destruction.

- Do not touch the sealing lip (inner) of the radial shaft seal.
- Do not apply oil to the radial shaft seal.
- Install the radial shaft seal dry.

- Preassemble special tool 0 496 137 (11 8 815) on crankshaft.
- Carefully slide the new crankshaft sealing ring (1) straight off the special tool 0 496 137 (11 8 815) using a rotational movement until the new crankshaft sealing ring is positioned parallel on the timing case cover.



- Secure special tool 0 494 029 (11 9 182) to the crankshaft using special tool 0 494 031 (11 9 184).

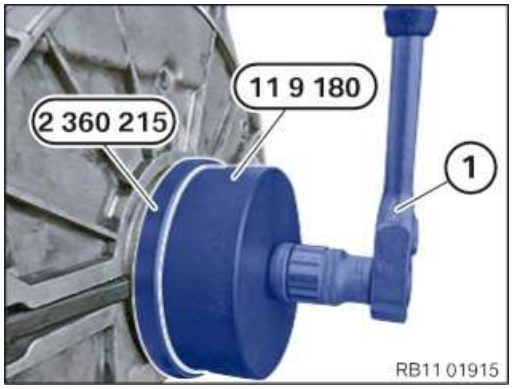


- Connect special tool 2 360 215 onto special tool 0 493 881 (11 9 180).



- Pull in the new crankshaft sealing ring with special tools 0 494 028 (11 9 181) and 2 360 215 together with the special tool 0 494 030 (11 9 183).

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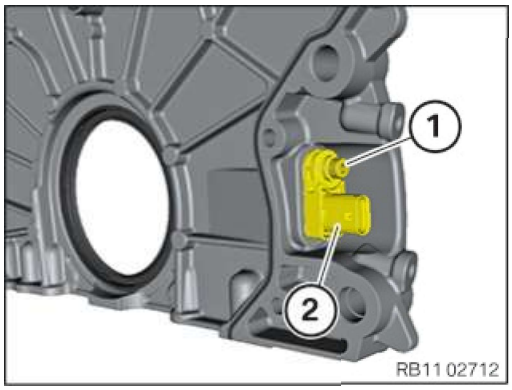
- Screw in the new crankshaft sealing ring with the tool (1) to the stop.

33 – Renew the rear timing case cover

▸ **Replacement: Remount crankshaft sensor**

- **For timing case cover replacements:**

  Remount crankshaft sensor.



RISK OF DAMAGE

Electrostatic discharge.

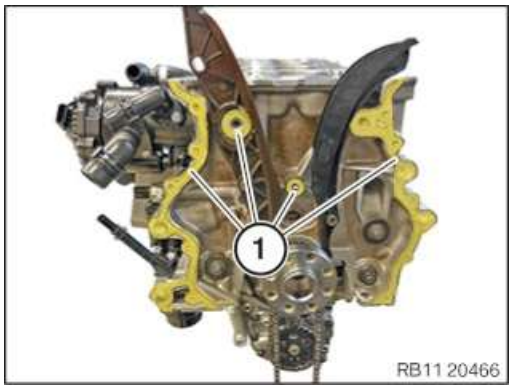
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

- Loosen the screw (1) and remount the crankshaft sensor (2).
- Tighten down screw (1).

Crankshaft sensor to timing case cover

	4.6 Nm



RISK OF DAMAGE

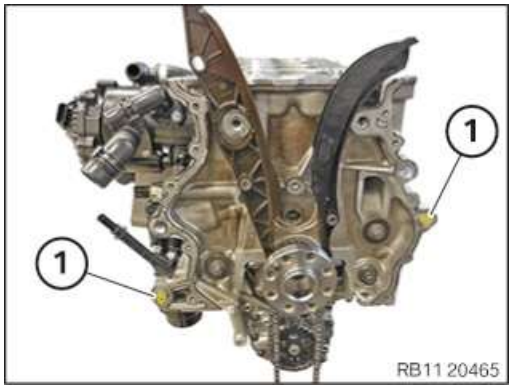
Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

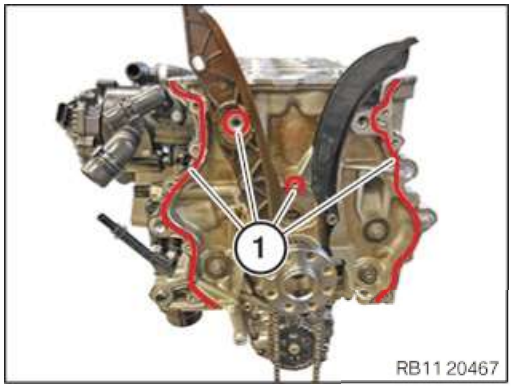
- Do not use any metal-cutting tools.

- Remove sealing residue in this area (1) using special tool 0 495 102 (11 4 470).

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- Check the fitting sleeves (1) for damage and renew, if necessary.
- Check for correct fit of fitting sleeves(1).



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound in area (1)along the inner edge.

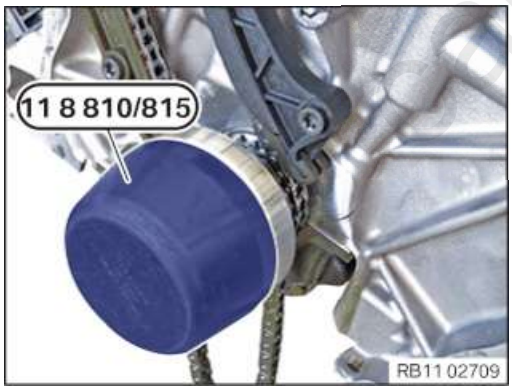
Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

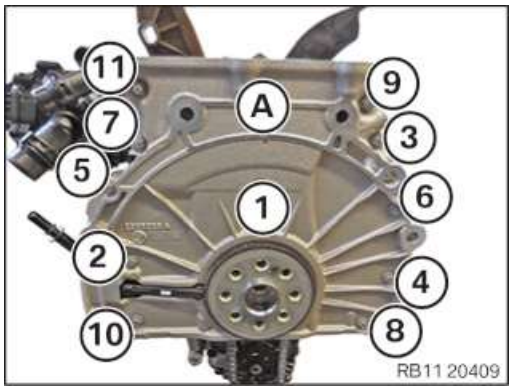
Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

2,0 mm ... 2,5 mm



- Mount special tool 0 496 137 (11 8 815) and 0 496 132 (11 8 810) on the crankshaft.



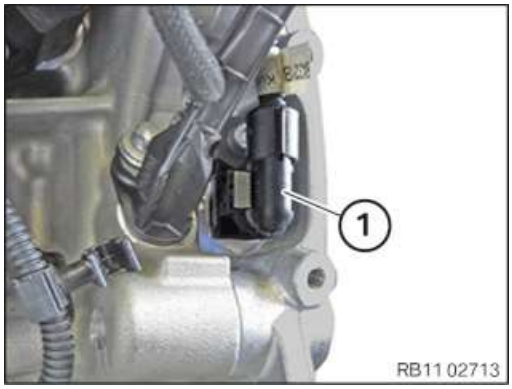
- Renew screws (1) to (11).

  Parts: Bolts
- Carefully mount the new timing case cover (A).
- Tighten screws in the order (1) to (11).

Rear timing case cover to crankcase

M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °

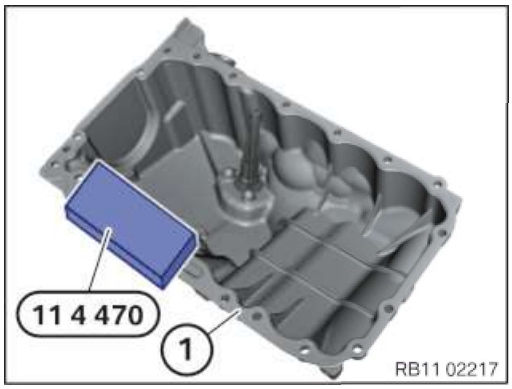
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- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

POSTPROCESSES

34 – Refitting sump



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the rough seal remains on the sealing surface (1) of the crankcase with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



- Have the special tool ready.



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

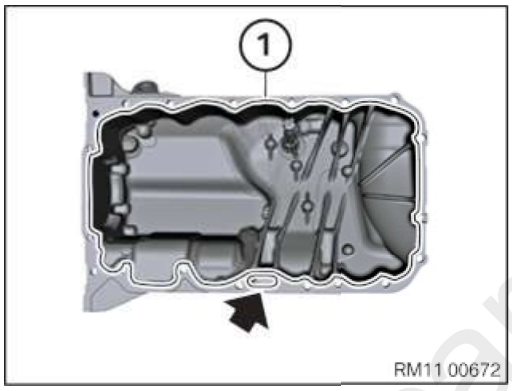
- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)



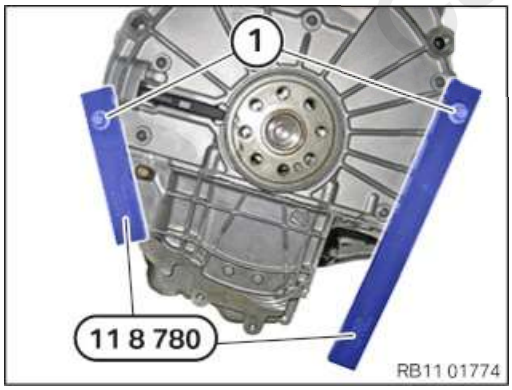
TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound along the line (1) with a thickness of 2 mm to 2.5 mm.

  Apply the sealing compound along the inner edge.

- Completely encircle the oil return orifice (arrow) with the sealing compound.

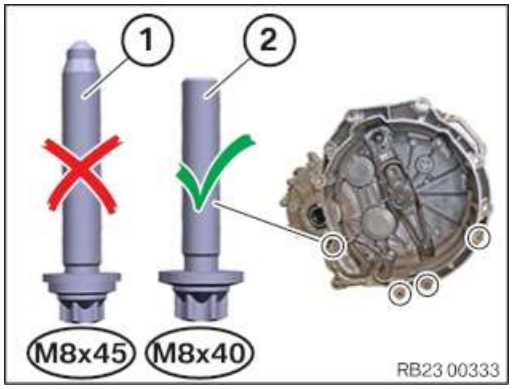


TECHNICAL INFORMATION

The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with engine block.
- If necessary, renew fitting sleeves.

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RISK OF DAMAGE

Component damage caused by incorrect screw length.

The use of screws with the incorrect screw length can damage the component.

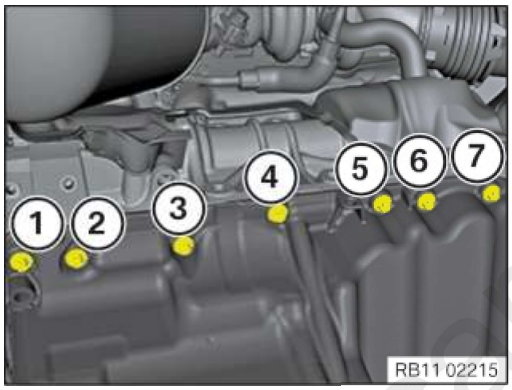
- Check for correct screw length.
- Re-install screws that correspond to the original screw length.

- Ensure that the **correct** screw (2) (M8x40) is used for mounting the oil sump on the transmission.

  The screw (1) (mounting bolt of the starter motor) may **never** be used for mounting the oil sump.



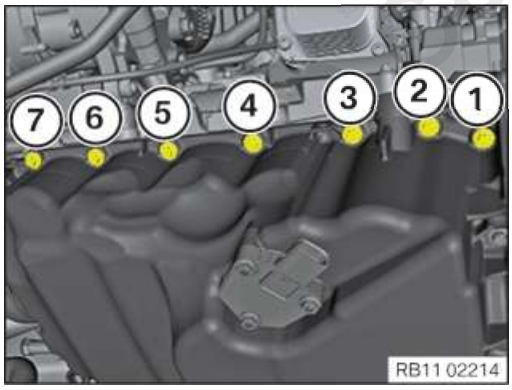
- Install oil sump (1) to top front.
- **Hand-tighten** all oil sump screws but do not tighten completely.



- Tighten the screws (1) to (7).

Oil sump to crankcase

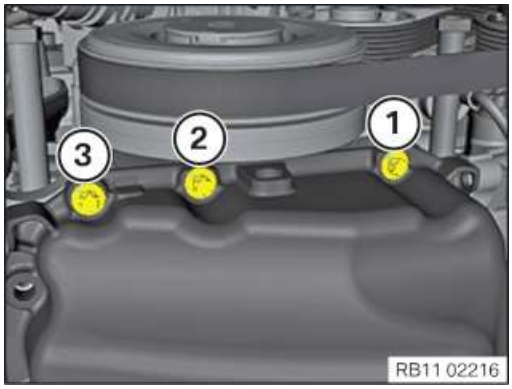
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1) to (7).

Oil sump to crankcase

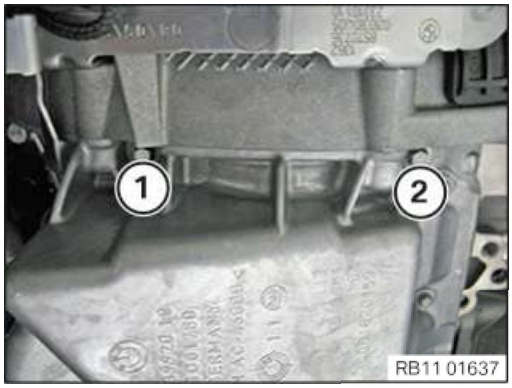
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1), (2) and (3).

Oil sump to crankcase

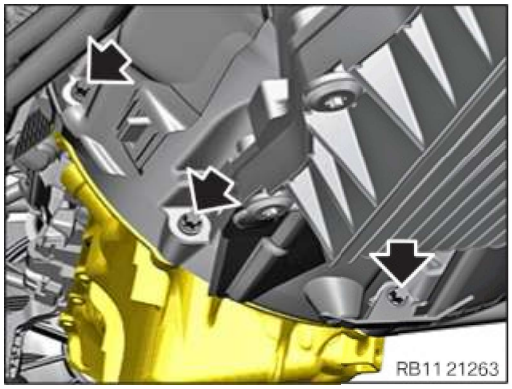
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten down screws (1) and (2).

Oil sump to crankcase

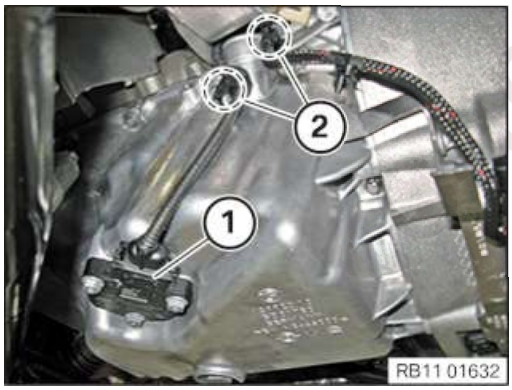
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm



- Fasten cable on the clips (2) from the oil sump.
- Connect and lock the connector (1).
- Make sure the connector 1 engages audibly.

35 – Installing the flywheel

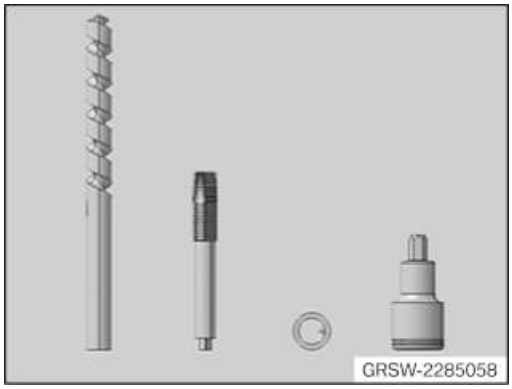


TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).

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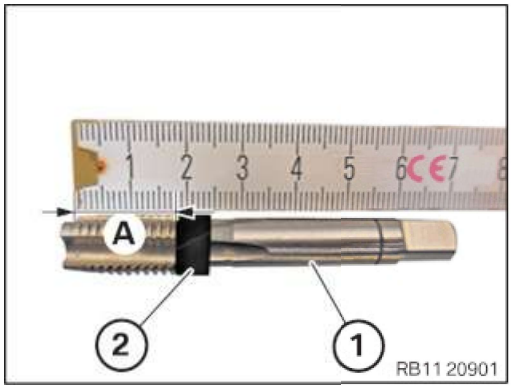
- Use the set of special tools 2 285 058.

Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool



- Assemble tool set.

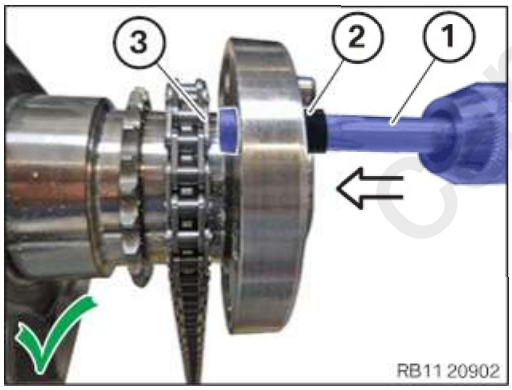
Number	Description
1	Tool holder
2	Thread cutter M12X1,5



- Mark the screw-in depth (A) on thread cutter (1) from the set of special tools 2 285 058 with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm



NOTICE

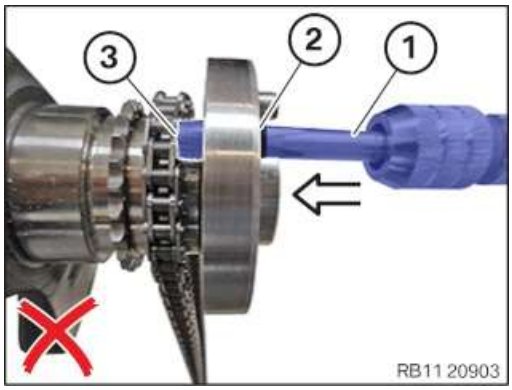
To provide a better overview: Shown with engine removed.

- Screw in the thread cutter (1) from the set of special tools 2 285 058 in direction of arrow up to the screw-in depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).



TECHNICAL INFORMATION

- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

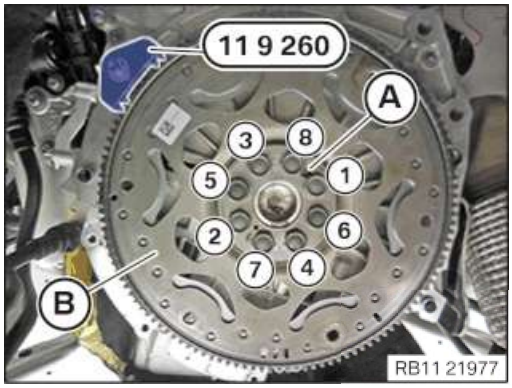
- Make sure that the screw-in depth (2) of the screw tap (1) is not exceeded.

  The thread cutter (1) may not rest on the timing chain (3).

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- Make sure the magnet wheel (1) is installed correctly.



- Renew screws (1) to (8).

  Parts: Bolts
- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool 0 494 034 (11 9 261) and screw the special tool 0 494 130 (11 9 264) tightly.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten flywheel bolts in sequence (1) to (8).

Flywheel to crankshaft

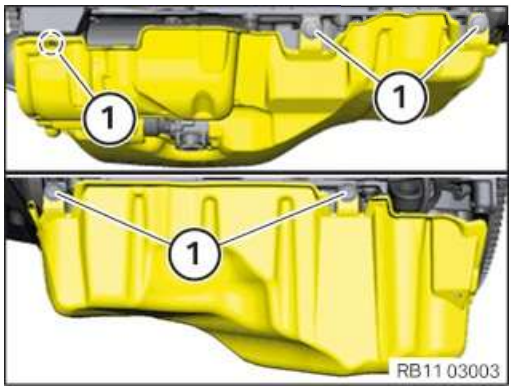
M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

- Remove special tool 0 493 938 (11 9 260).

36 – Installing the acoustic cover for the oil sump

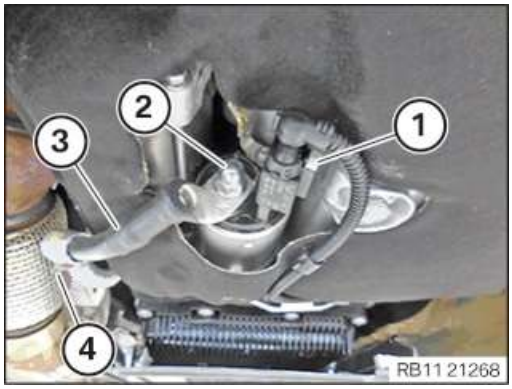


- Install acoustic cover (1) to the top front.

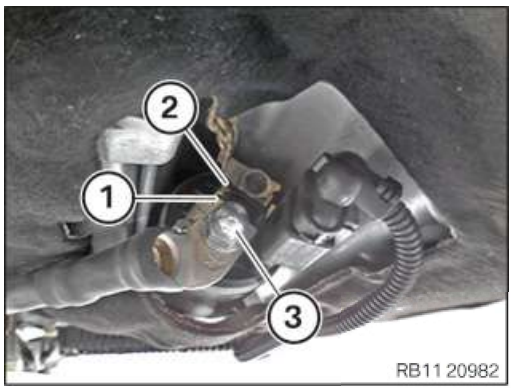


- Secure all expanding rivets (1).

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- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.
- Insert and install the positive battery cable (3).
- Secure positive battery cable (3) at the clamp (4).
- Tighten the nut (2) hand-tight.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

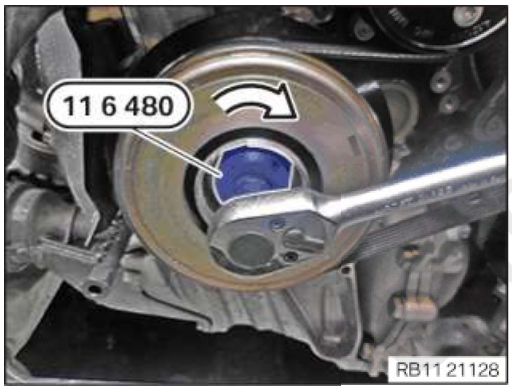
- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

37 – Block the crankshaft in he TDC firing position of cylinder 1



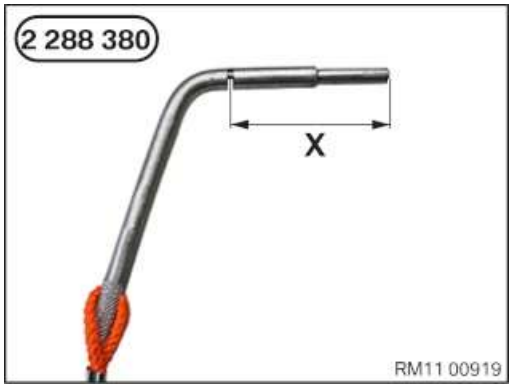
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

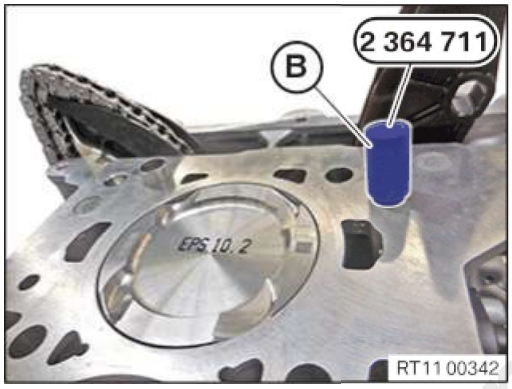


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

38 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

39 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.



- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).

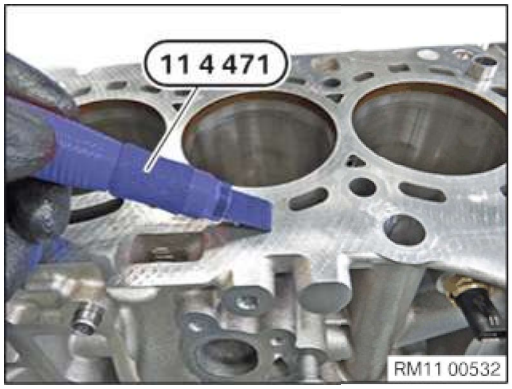
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- Remove fine backlogs from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.



CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

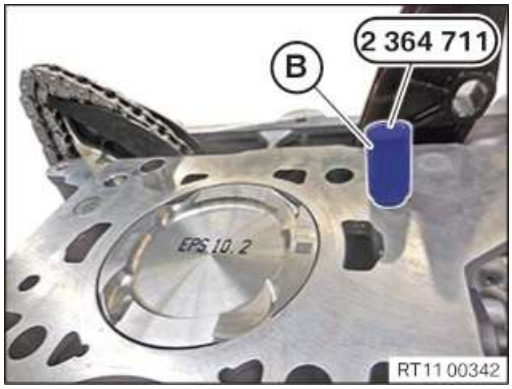
- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

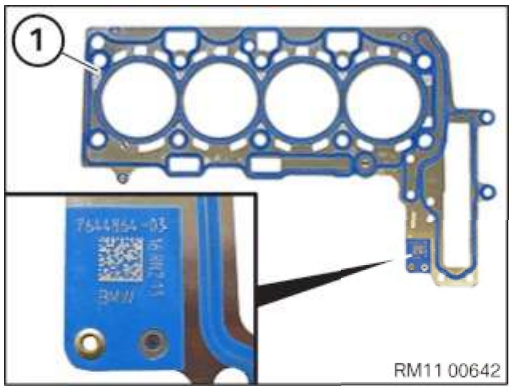
- Clean all the threaded holes in the **marked** area of the crankcase with compressed air.

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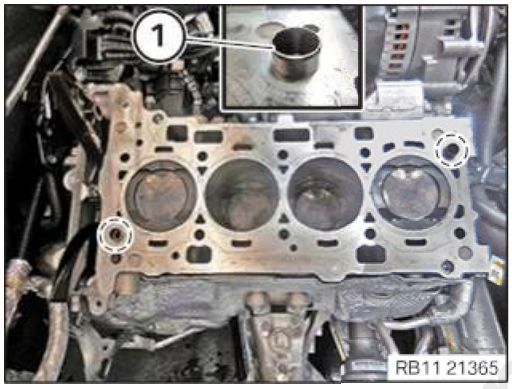
- Remove special tool (B) contained in the set of special tools 2 364 711.

40 – Renewing the cylinder head gasket

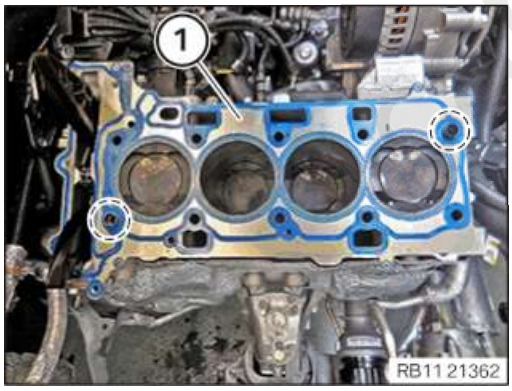


- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional thicker gasket 0.3 mm is available for service personnel.



- Check fitting sleeves (1) in the **marked** area for damage and, if necessary, renew them.



- Guide cylinder head gasket (1) into the **marked** area and install it.

41 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

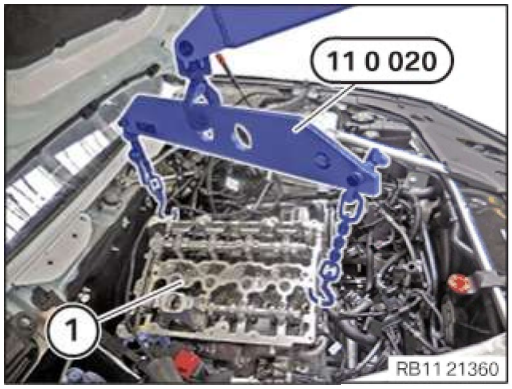
- Dry threaded holes (e.g. using compressed air).

TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



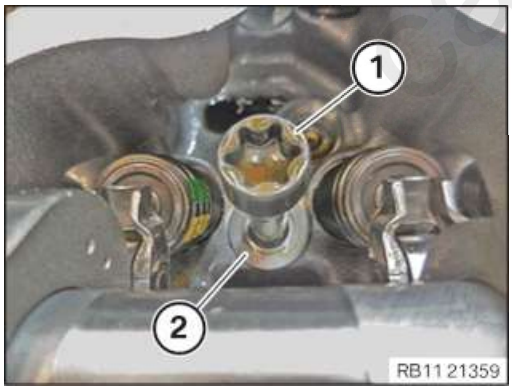
RISK OF DAMAGE

Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

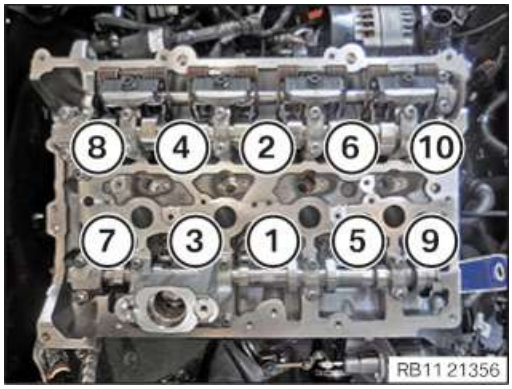
- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.



- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of engine block.
- Guide in and install cylinder head bolts (1).



TECHNICAL INFORMATION

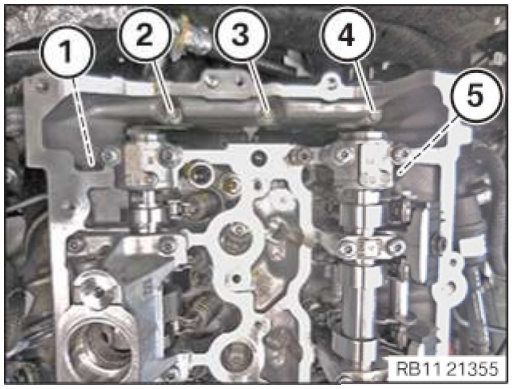
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °



- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

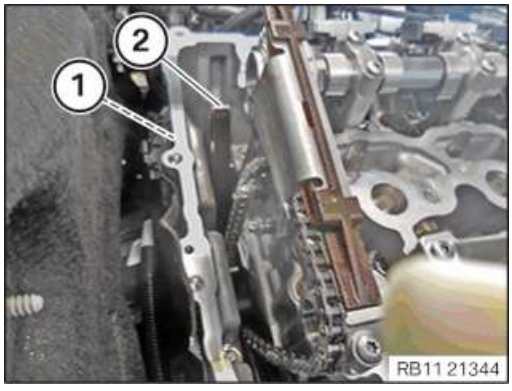
Cylinder head bolt to timing case cover

M8x40	Renew screws.	Tightening torque	19 Nm



- Renew bearing journal (1).

  Parts: Bearing journal

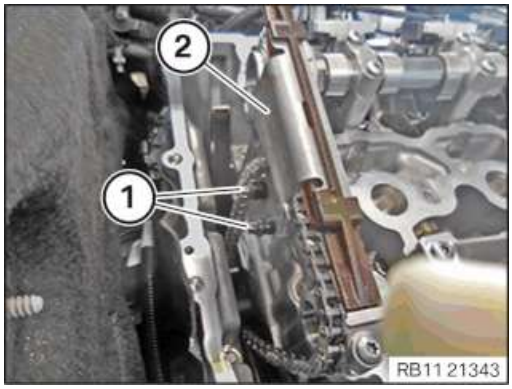


- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

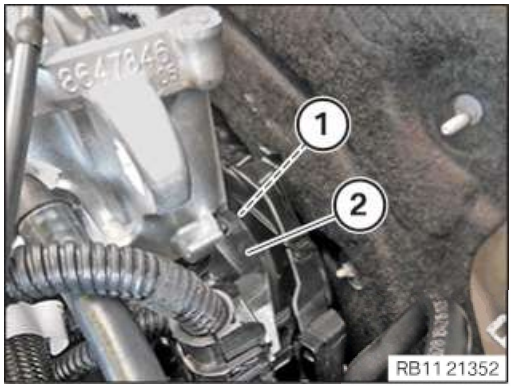
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- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

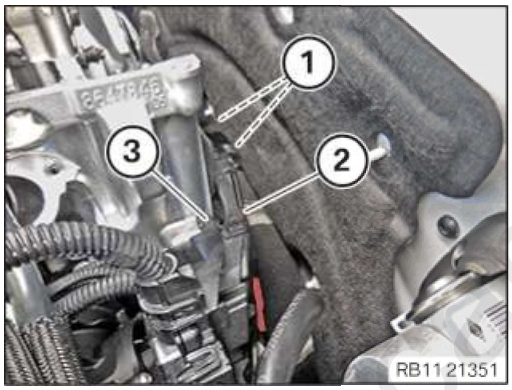
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

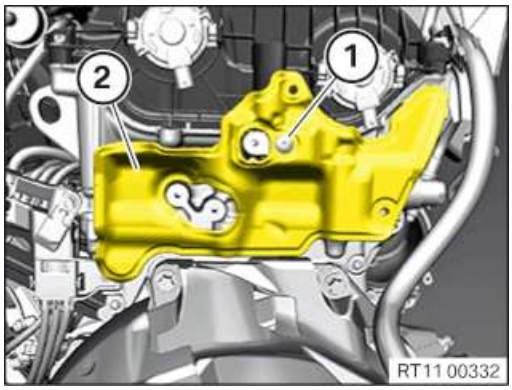
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm

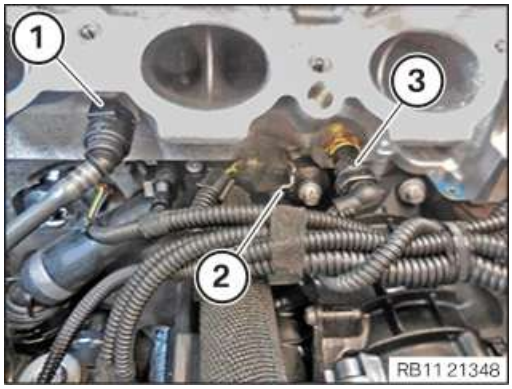


- Guide in and install cover (2).
- Tighten down screw (1).

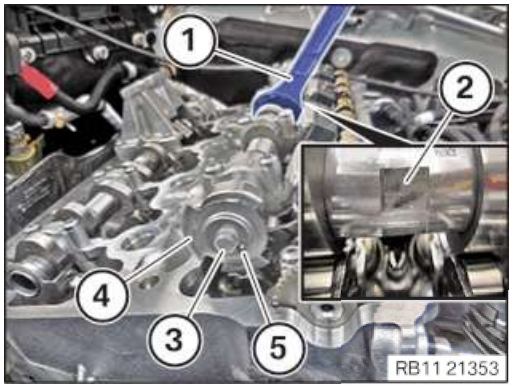
Cover on rear cylinder head

M6		Tightening torque	8 Nm

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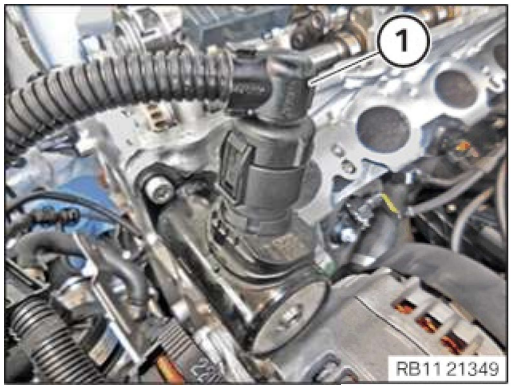
- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



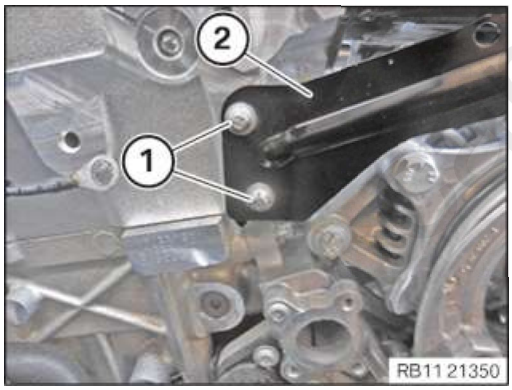
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm



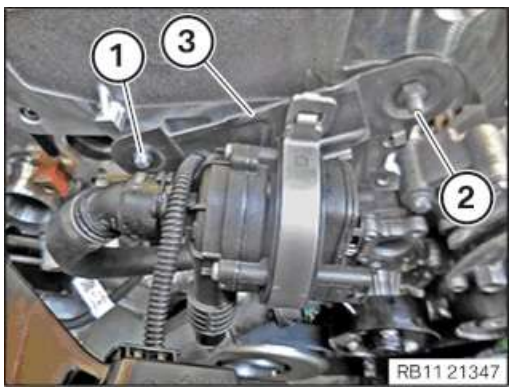
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

Holder for electrical auxiliary coolant pump on cylinder head

M6		Tightening torque	7 Nm

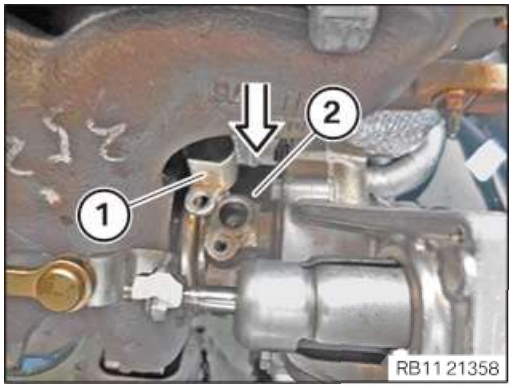
mdiagn.com



- Thread in ground cable (2) and install.
- Tighten nut (1).

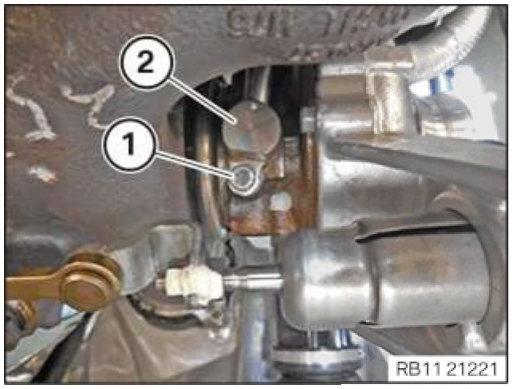
Standard screw connection M6

M6		8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

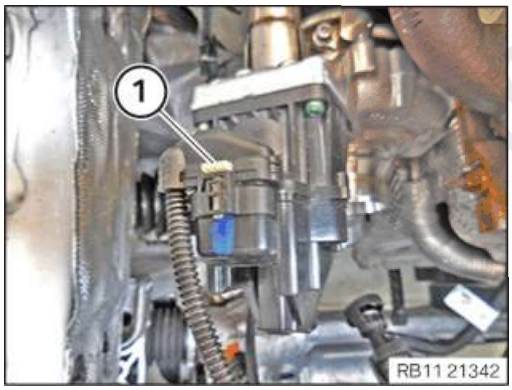
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm



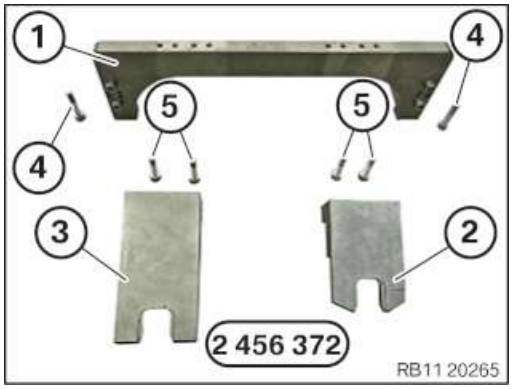
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

42 – Adjust the camshafts with the special tool

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- Overview of the set of special tools 2 456 372:

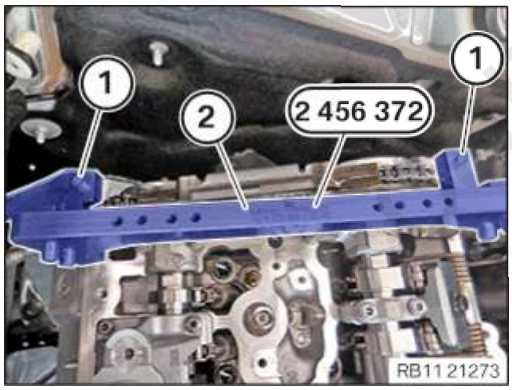
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



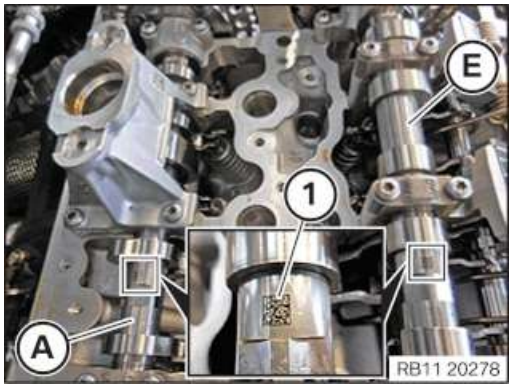
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

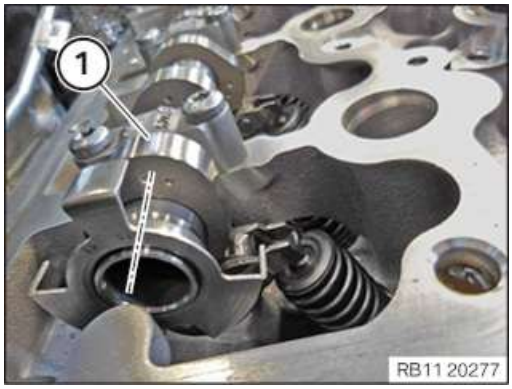
Basic carrier to cylinder head

M6		Tightening torque	8 Nm

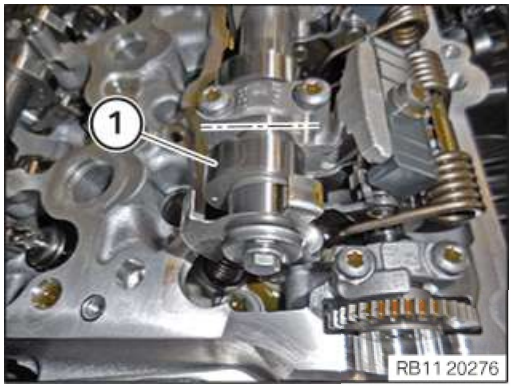


- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.

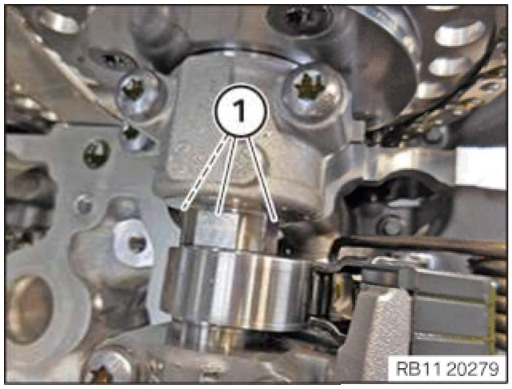
.diagn.com



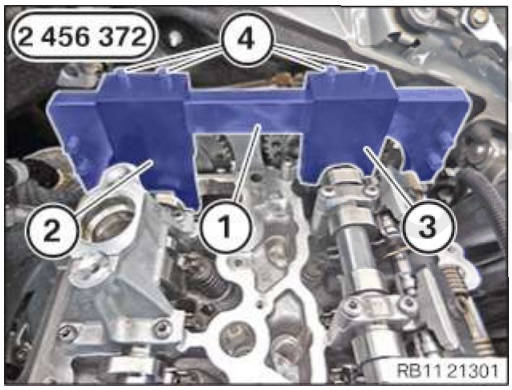
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

43 – Install exhaust camshaft adjuster

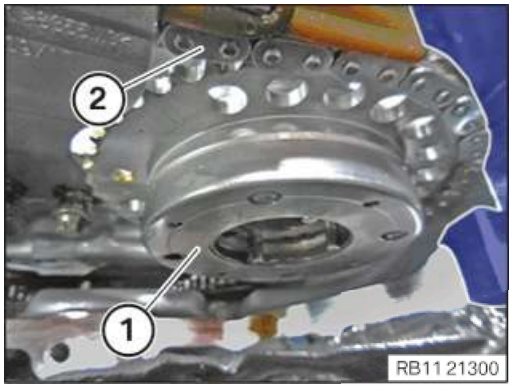
NOTICE

The figure shows the rear side of the engine.

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- Keep exhaust camshaft adjuster (1) marked EX ready.



- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

44 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.



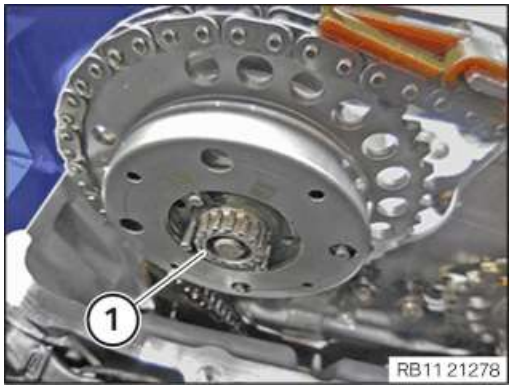
- Keep intake adjuster (1) marked IN ready.



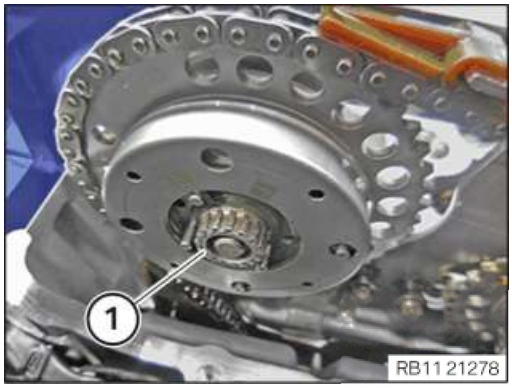
- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

45 – Install the VANOS central valve of the intake adjuster

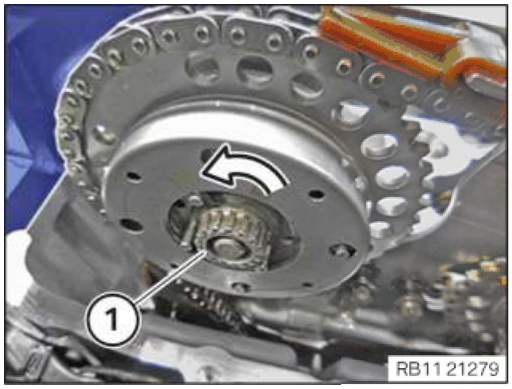
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- Guide in the VANOS central valve (1) of the intake adjuster and install.

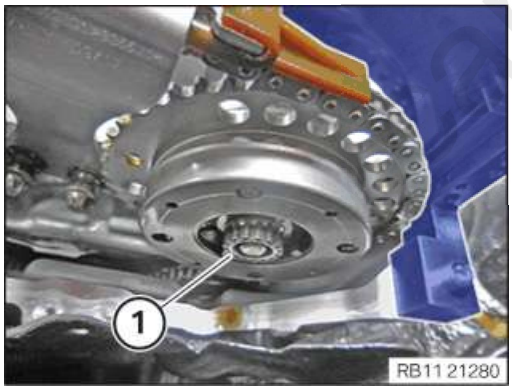


- Hand-tighten the VANOS central valve (1) of the intake adjuster.

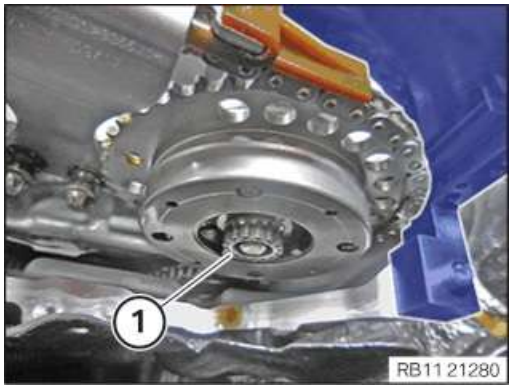


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

46 – Installing the VANOS central valve of the exhaust camshaft adjuster

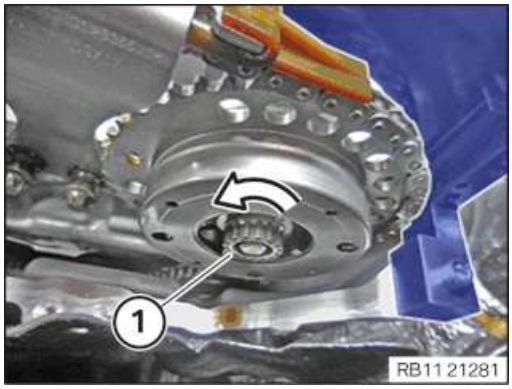


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



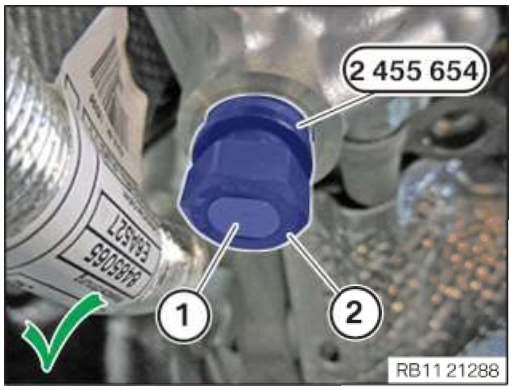
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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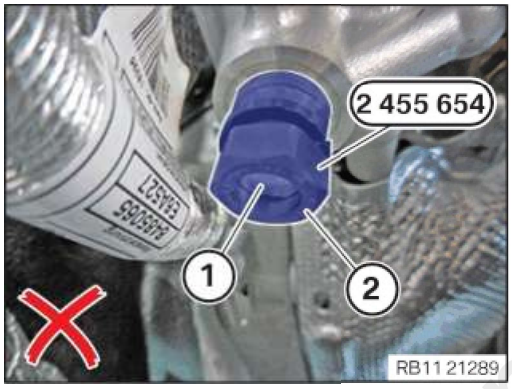
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

47 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

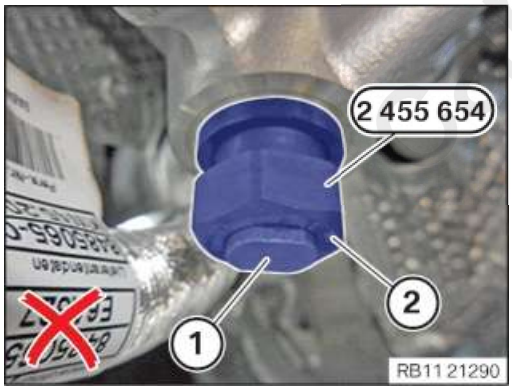
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

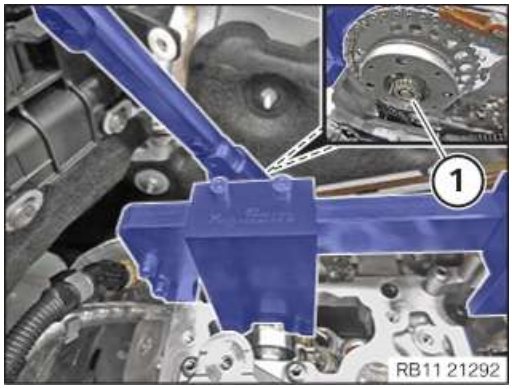
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

48 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

49 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

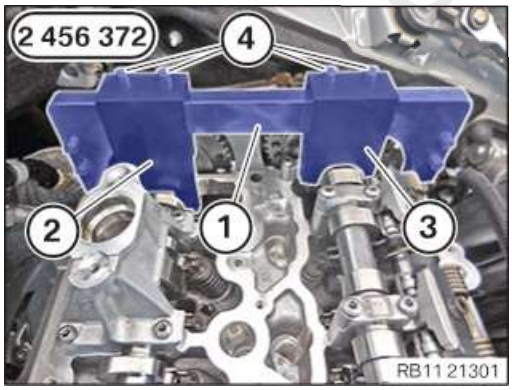


- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

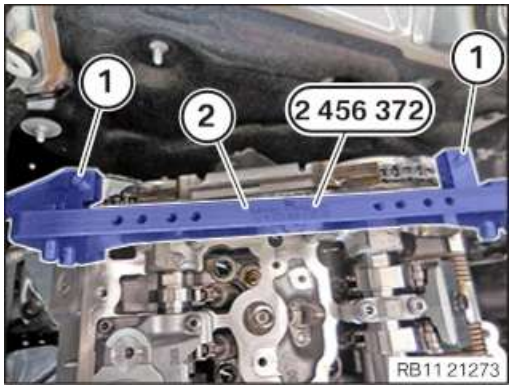
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

50 – Disassembling all special tools

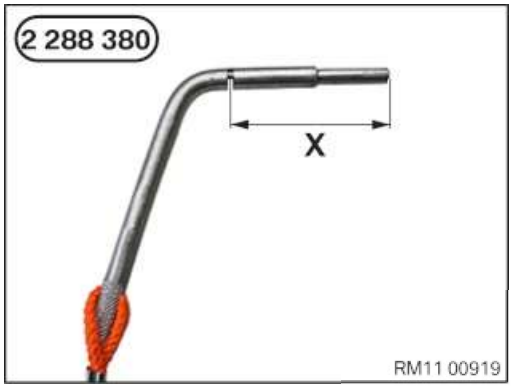


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

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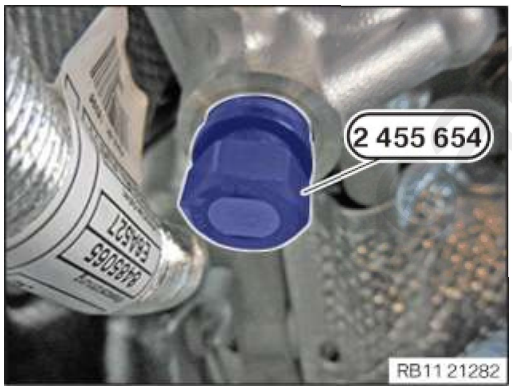
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

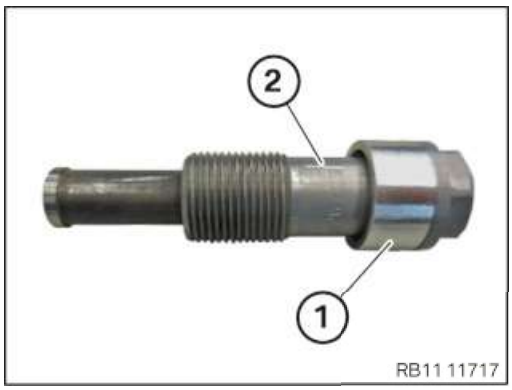
51 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

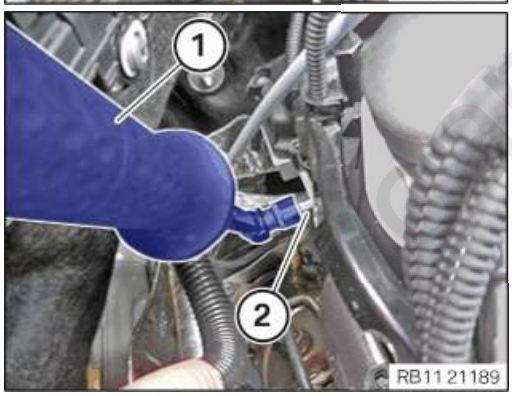


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

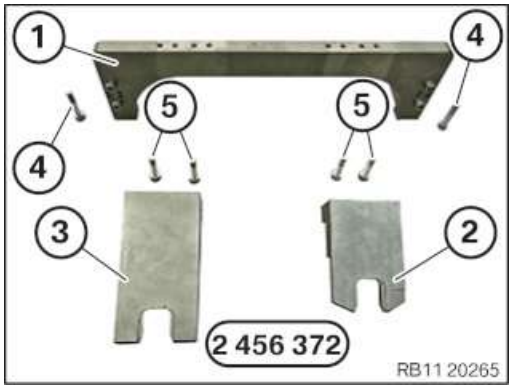


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

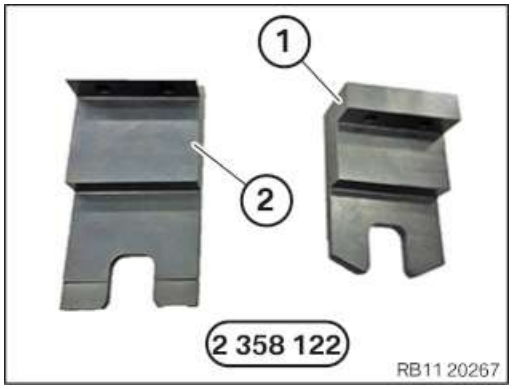
52 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



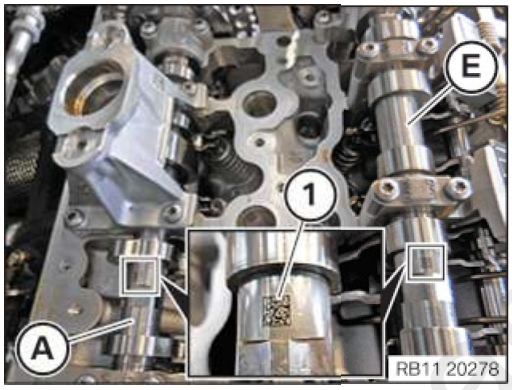
RISK OF DAMAGE

Damage to the engine.

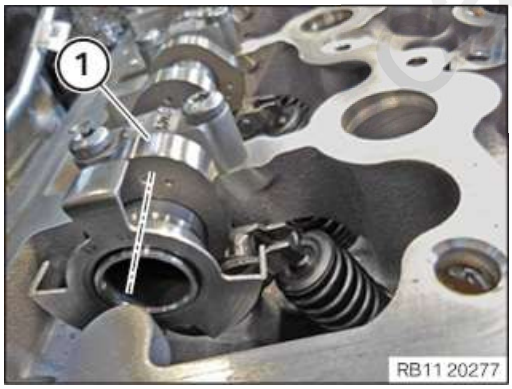
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

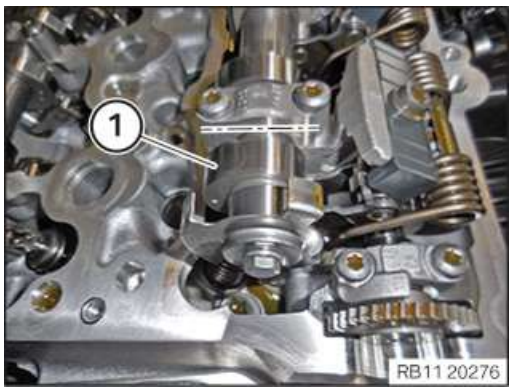
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



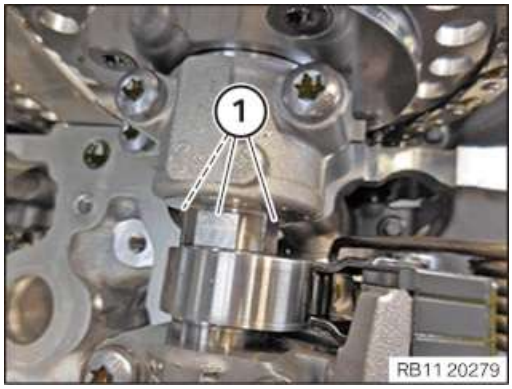
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



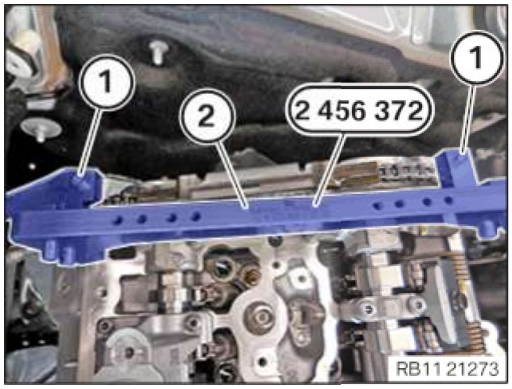
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



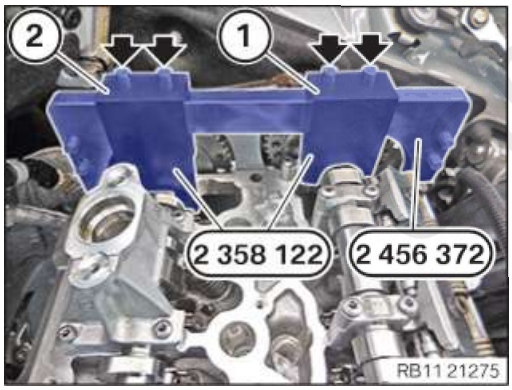
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

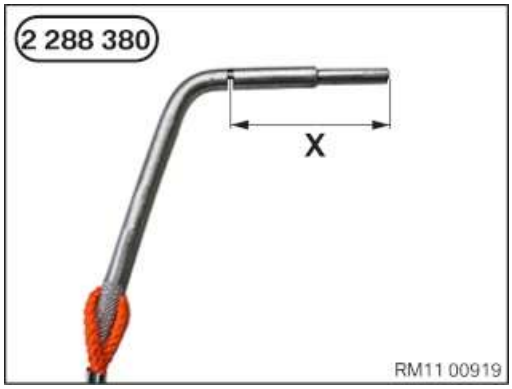
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

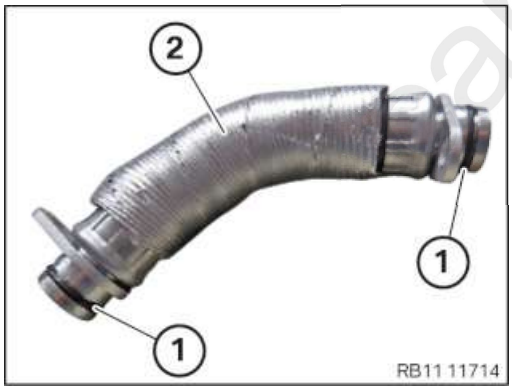


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

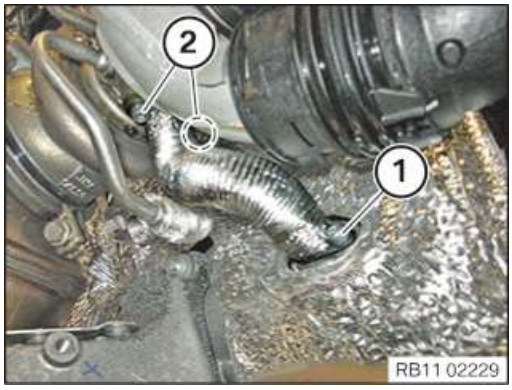
  The engine **is in the** TDC firing position of cylinder 1.

53 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

Oil return line to exhaust turbocharger/crankcase

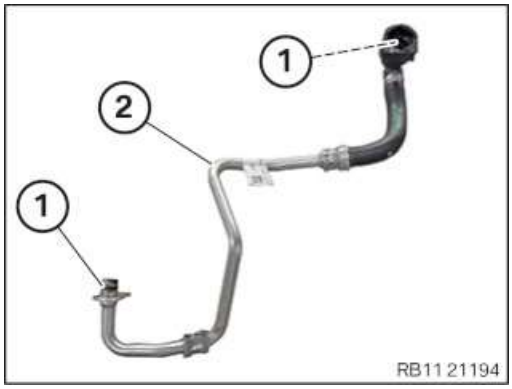
M6x14		Tightening torque	8 Nm

54 – Install the coolant return line for the exhaust turbocharger

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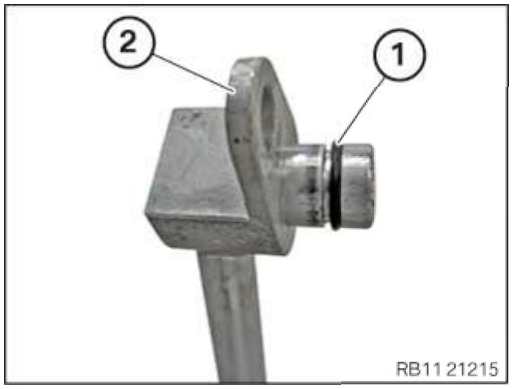
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



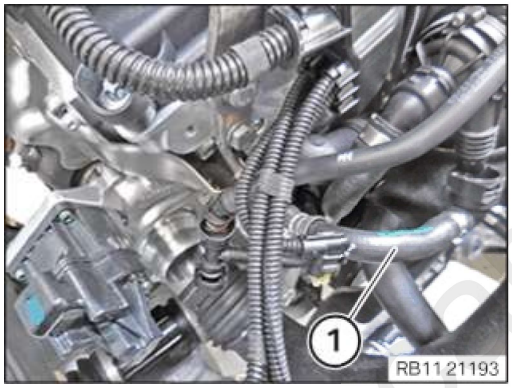
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-ring

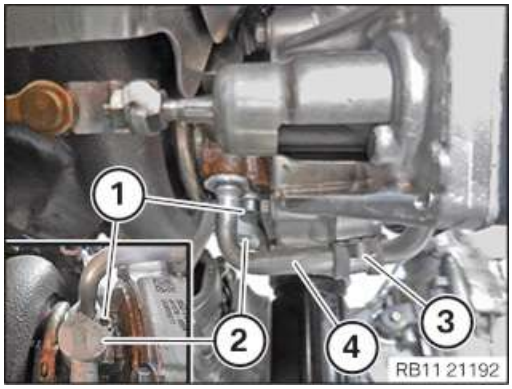


- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.

.com



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

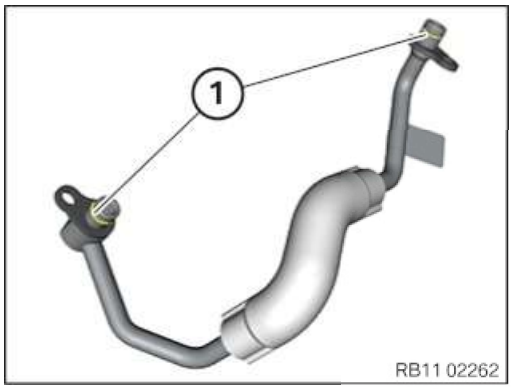
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

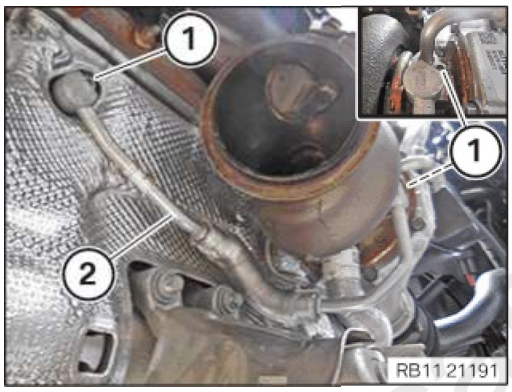
M6		Tightening torque	8 Nm

55 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

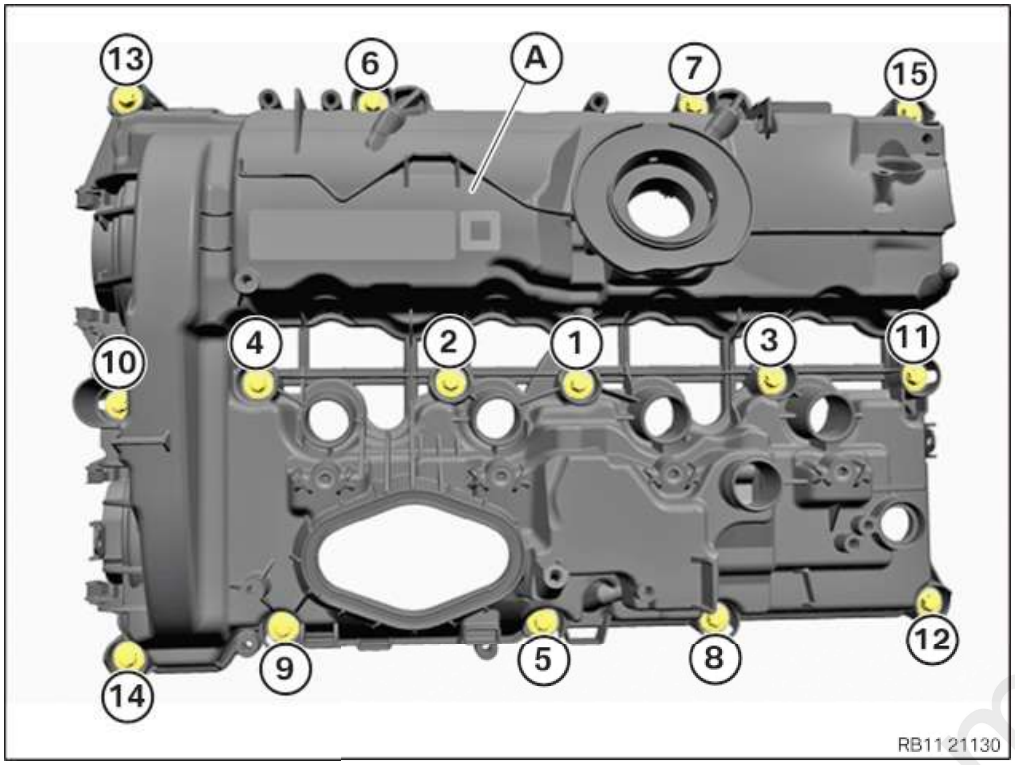
Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

56 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

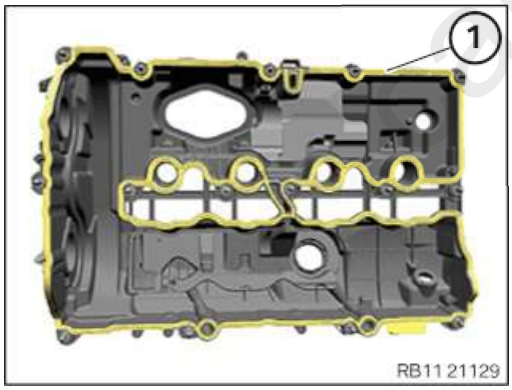
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

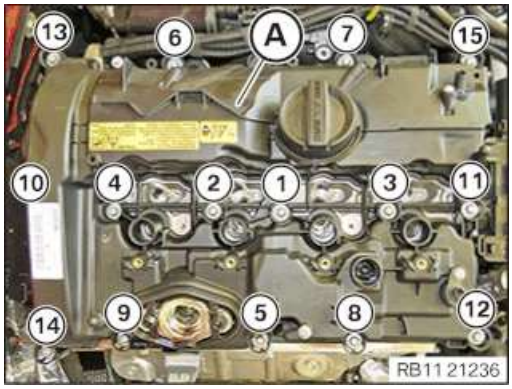
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).

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TECHNICAL INFORMATION

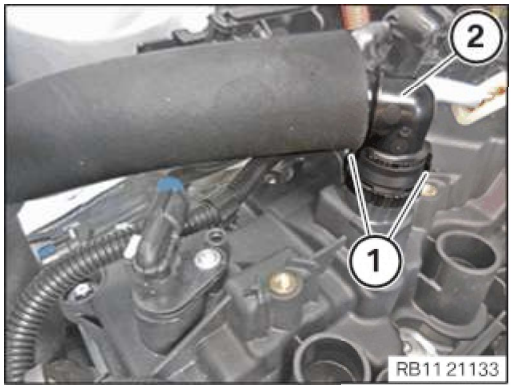
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

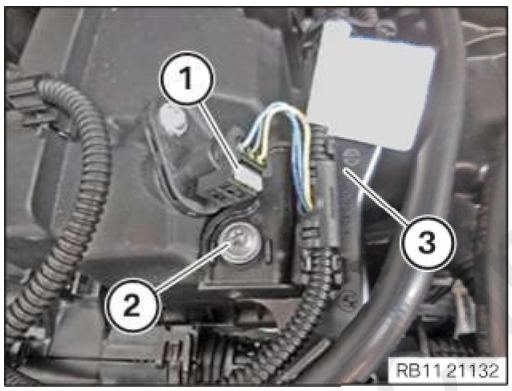
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

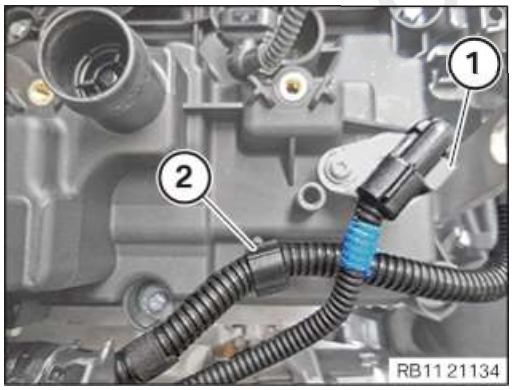


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

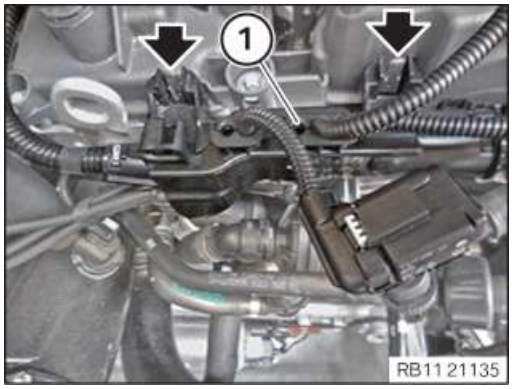
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

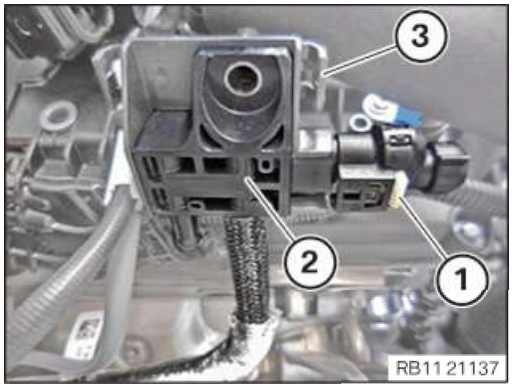


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

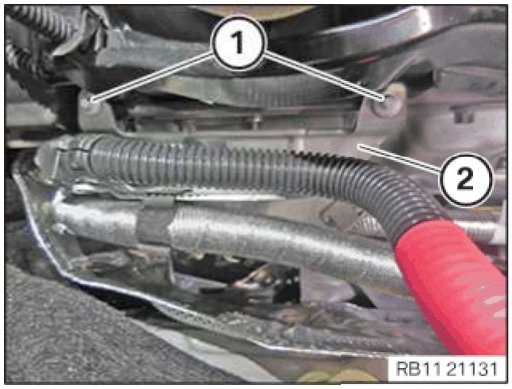
mdiagn.com



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

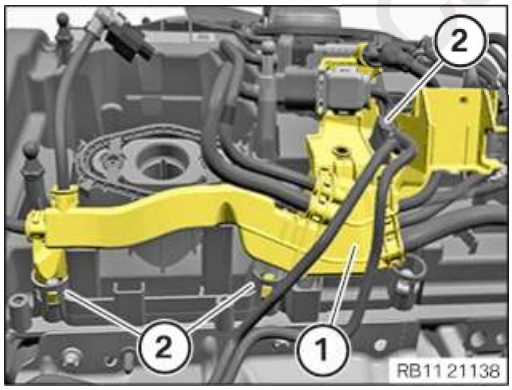
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

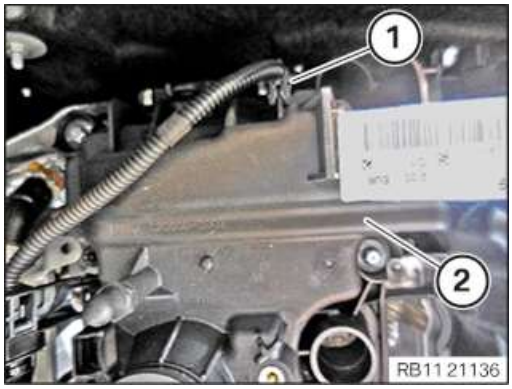
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

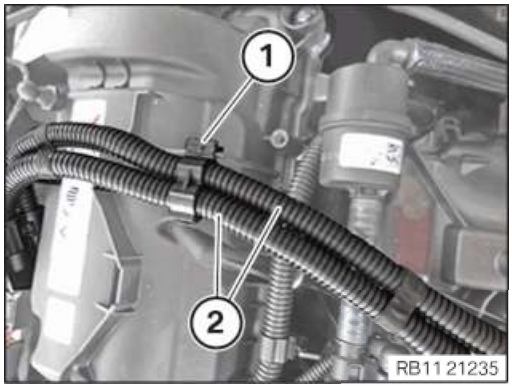


- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

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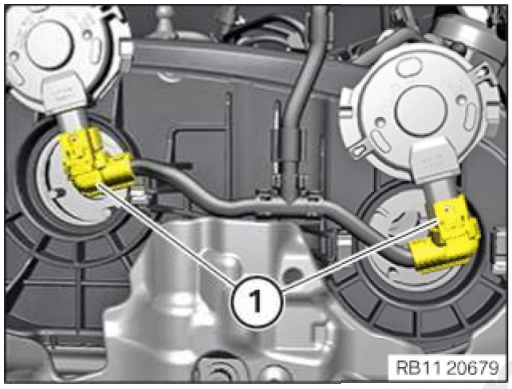


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

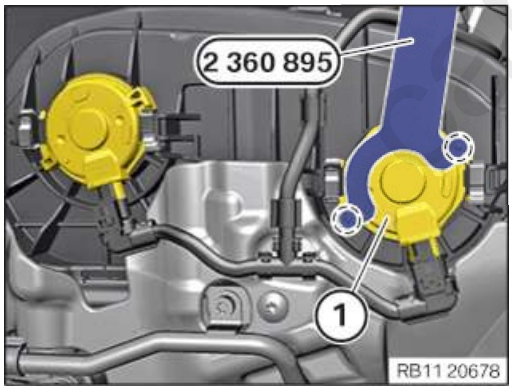
57 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

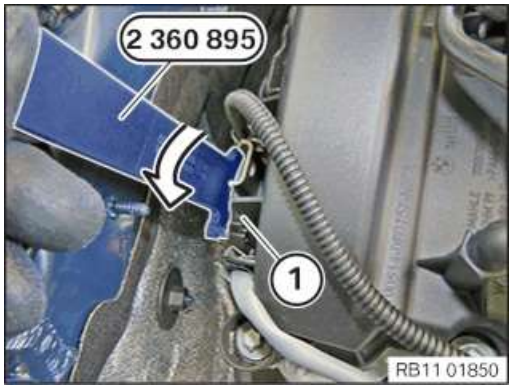
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



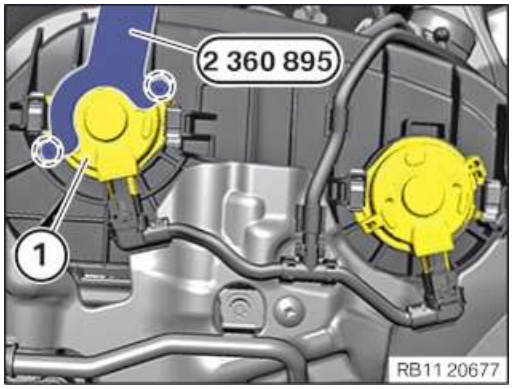
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



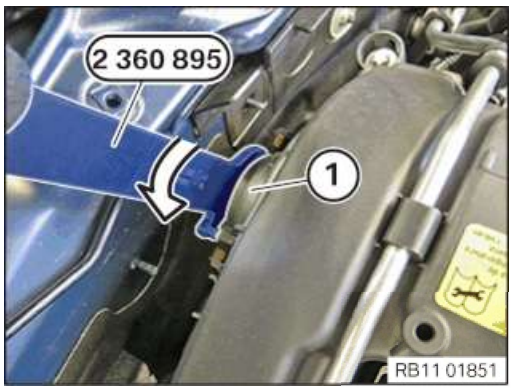
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

58 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

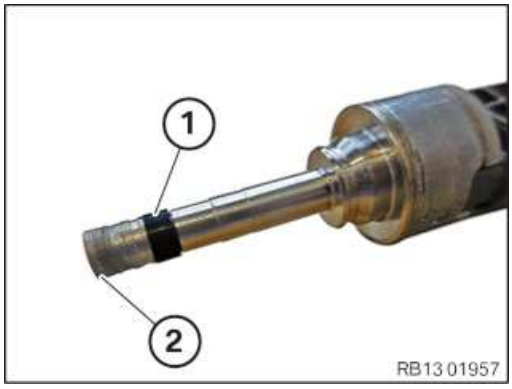
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.

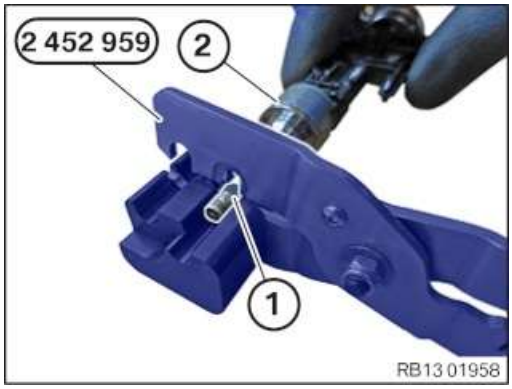


- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).

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- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

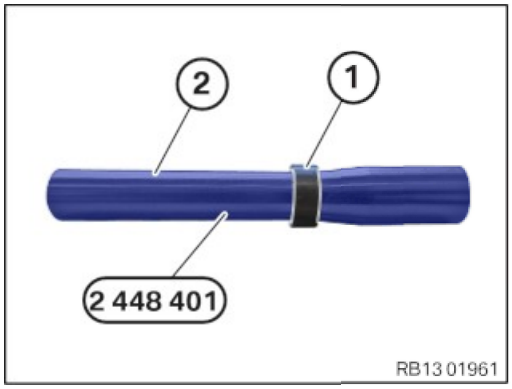


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

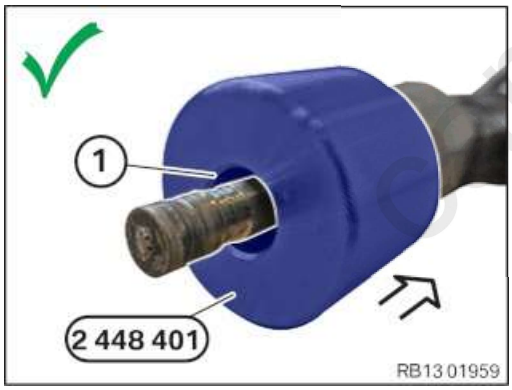
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

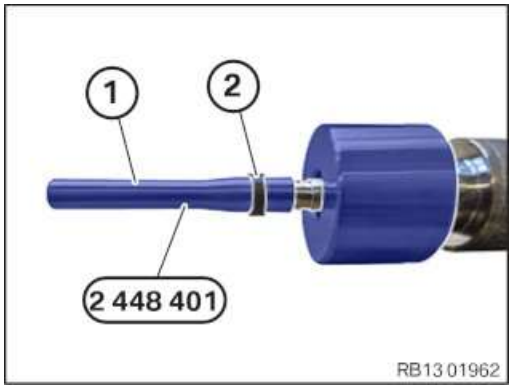
  The larger diameter of the assembly sleeve (1) must point to the injector tip.



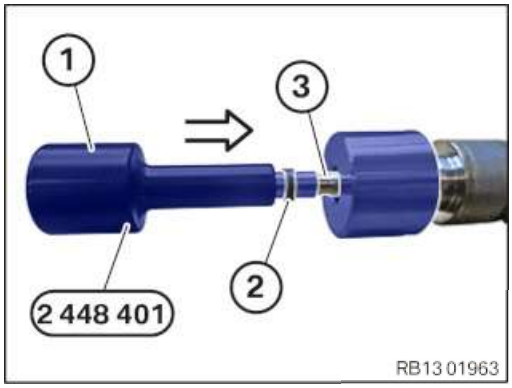
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

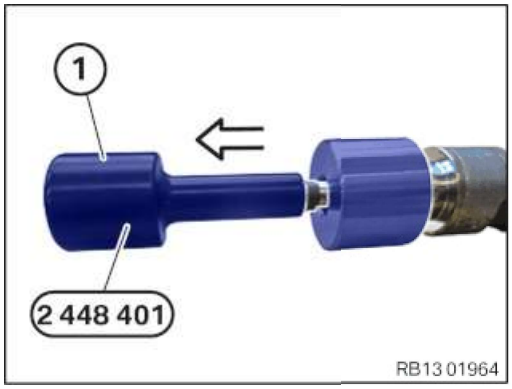
ardiagn.com



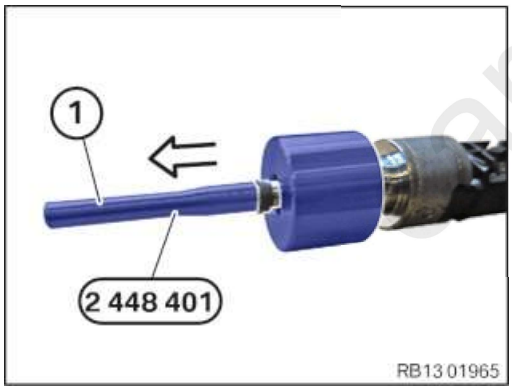
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



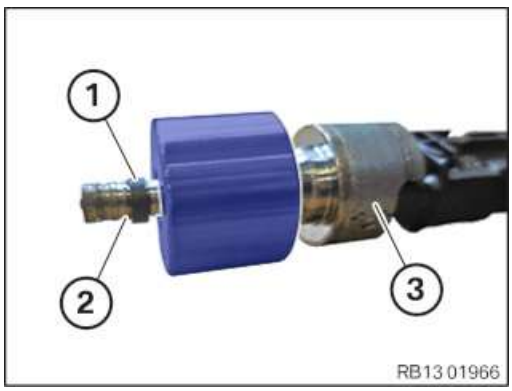
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

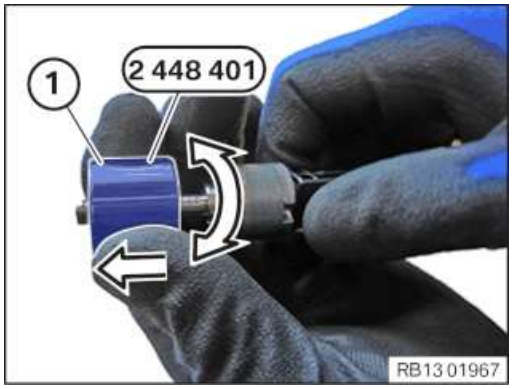


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



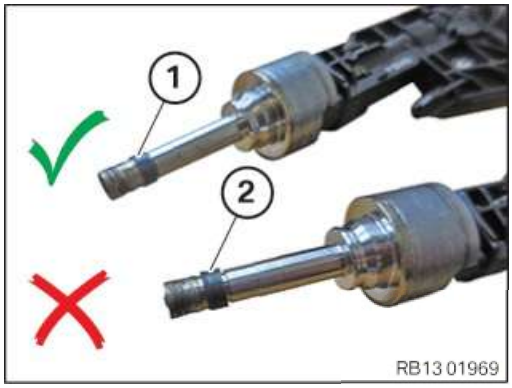
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

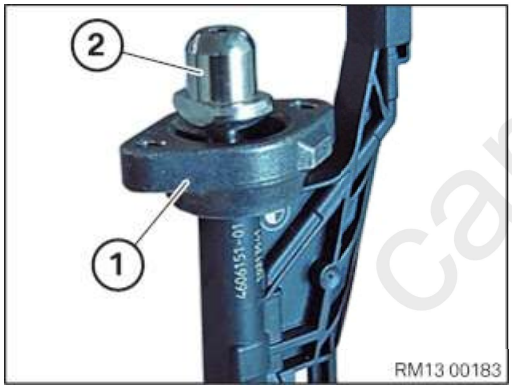


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

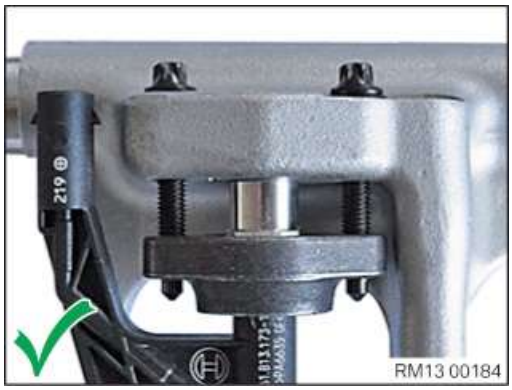
59 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



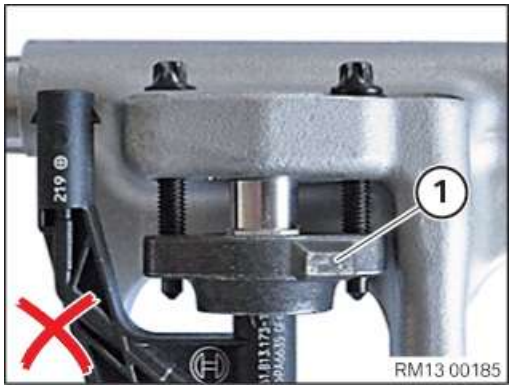
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

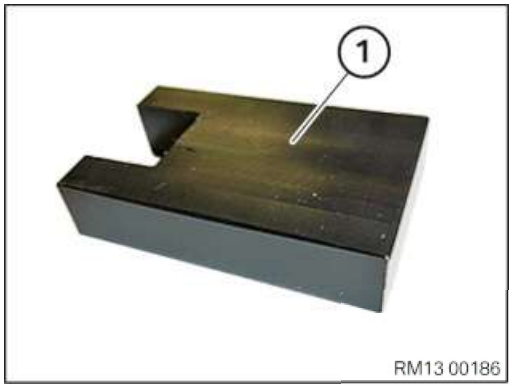
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



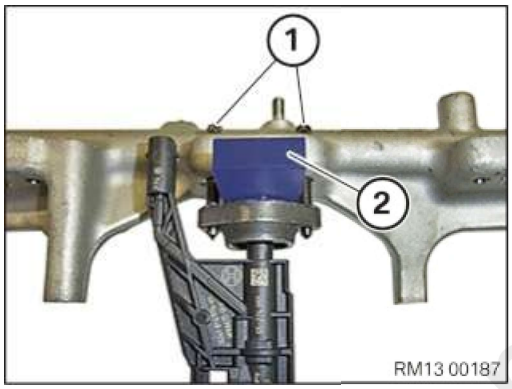
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



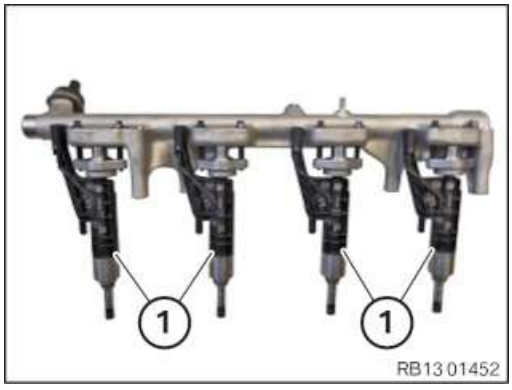
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

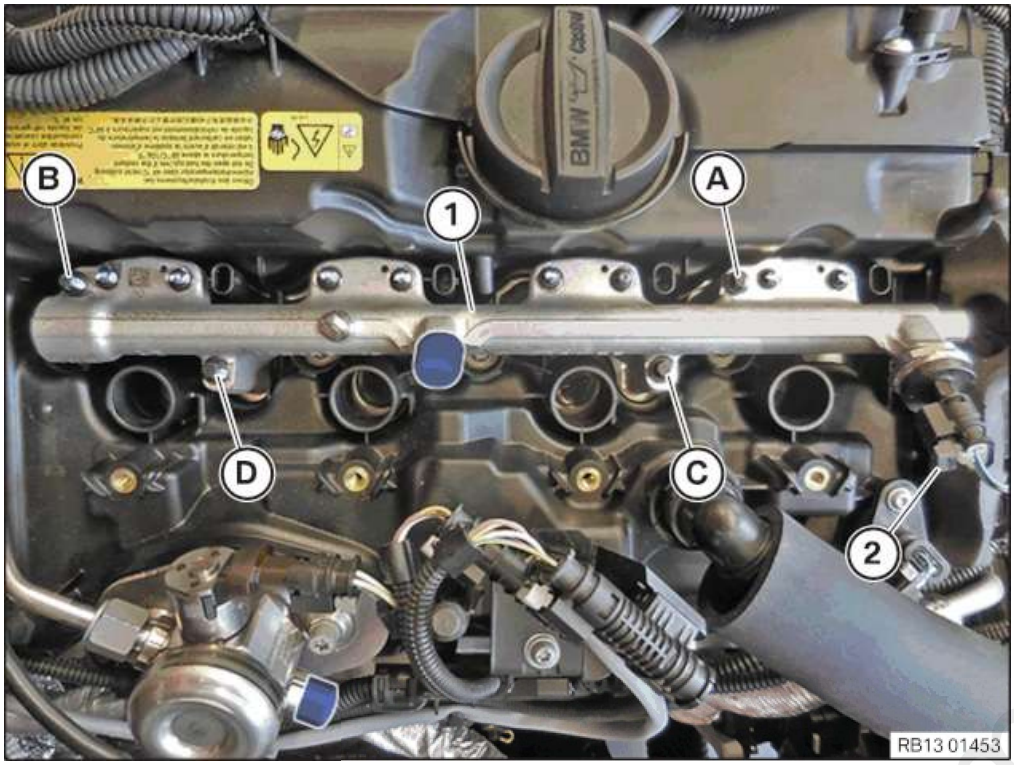


- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

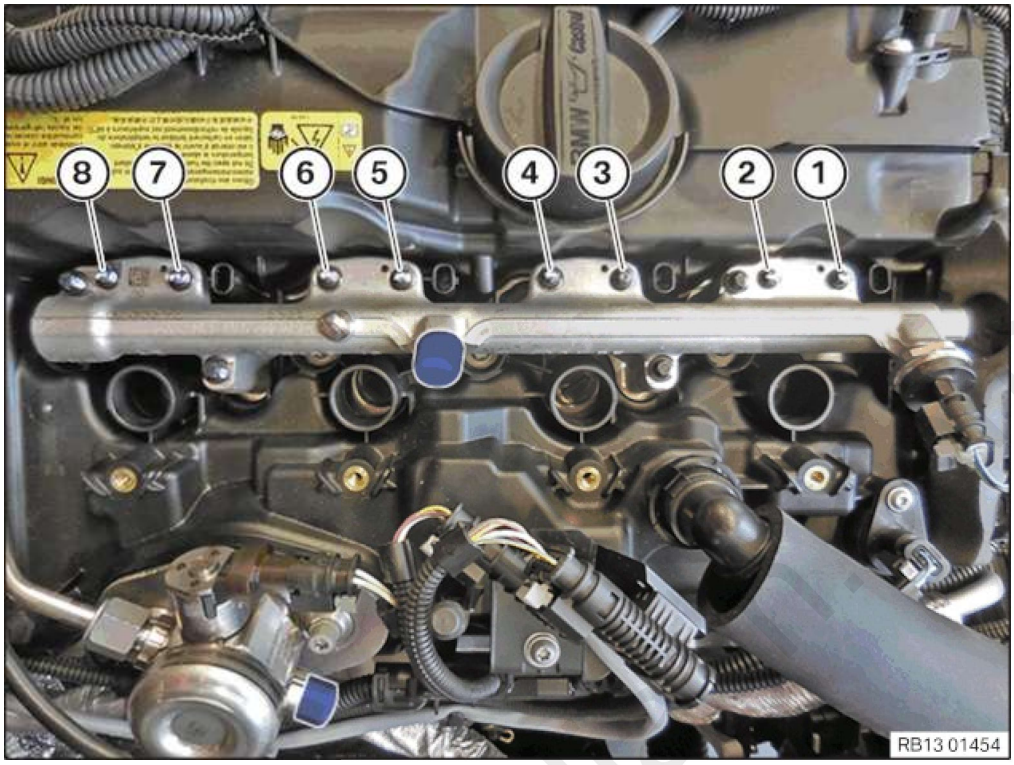
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.

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- Make sure that the rail (1) rests flat against the cylinder head.



- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

TECHNICAL INFORMATION

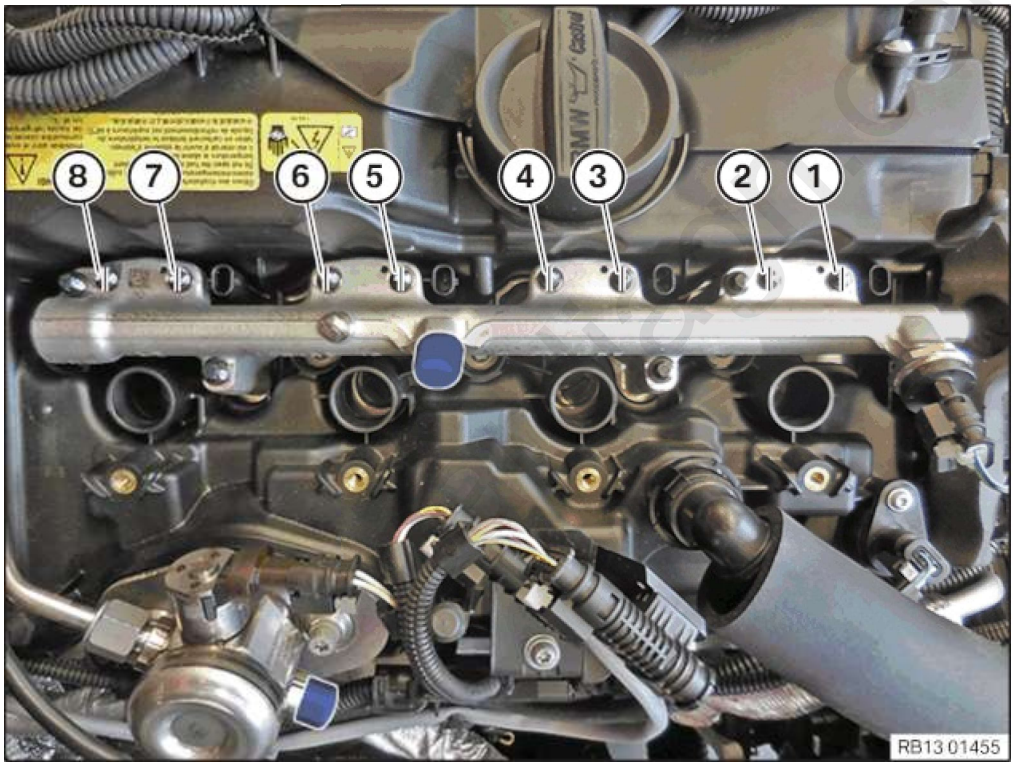
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

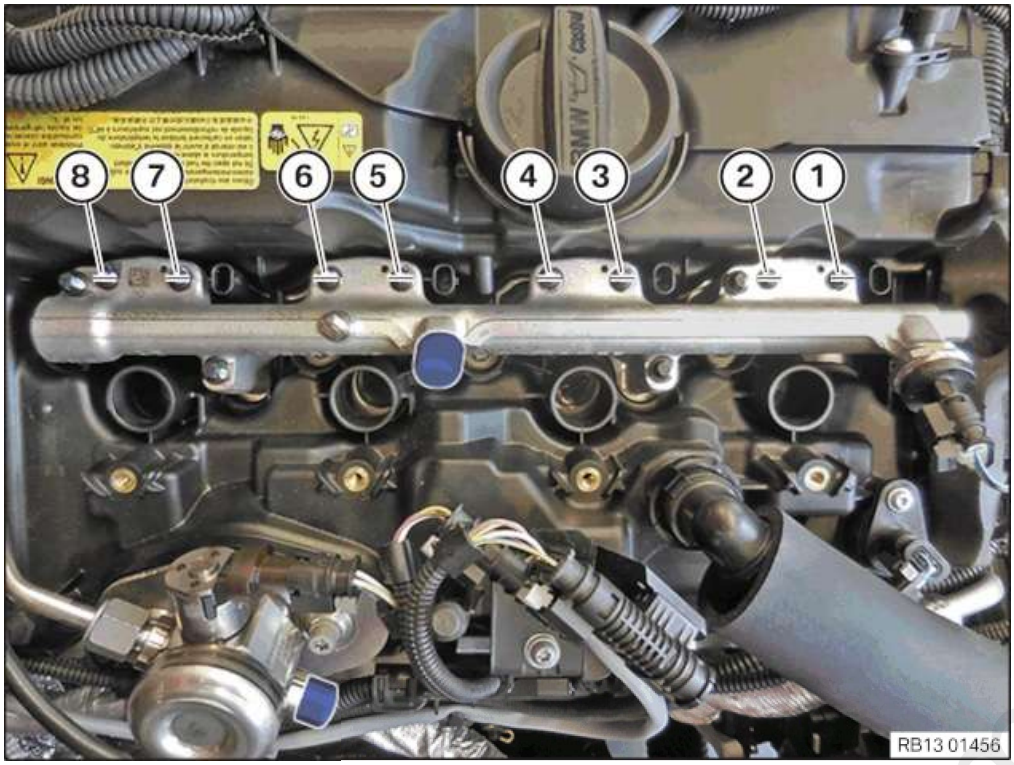
- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.

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- **Fuel injector 3:**
- Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
- **Fuel injector 4:**
- Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

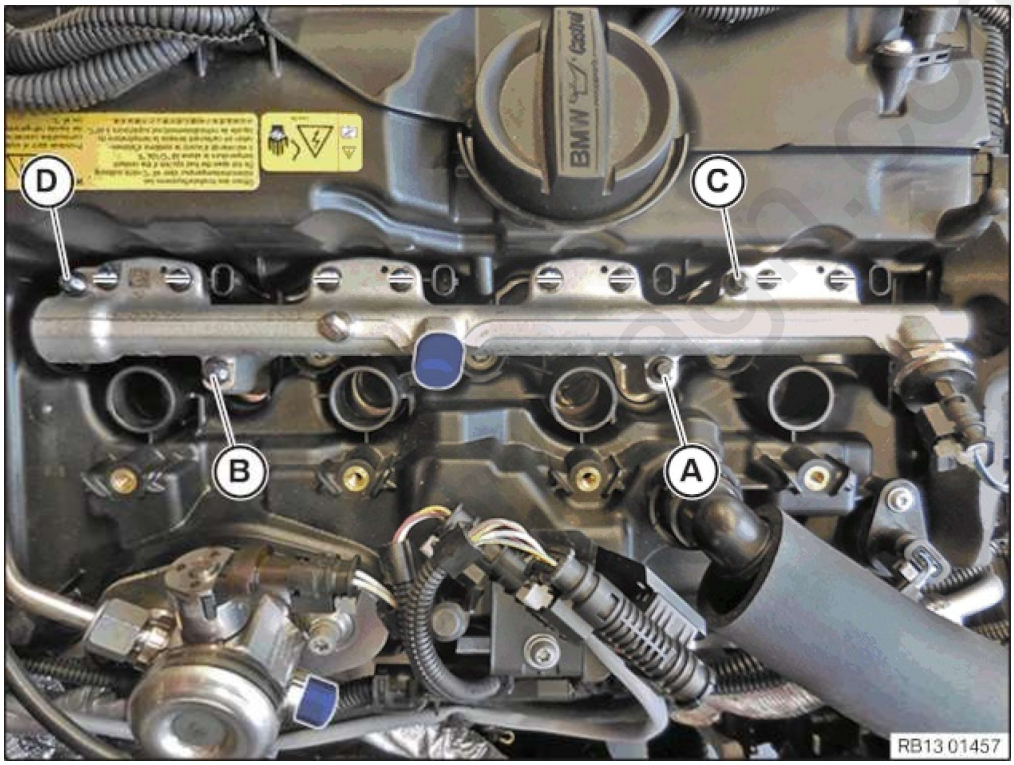


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

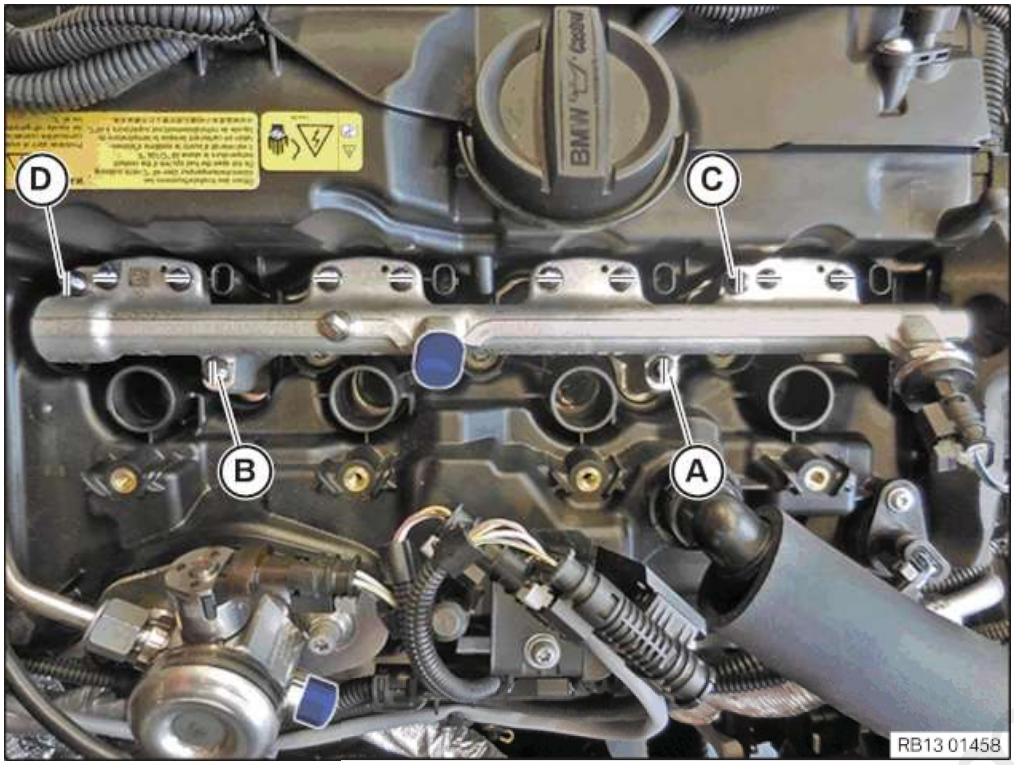
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

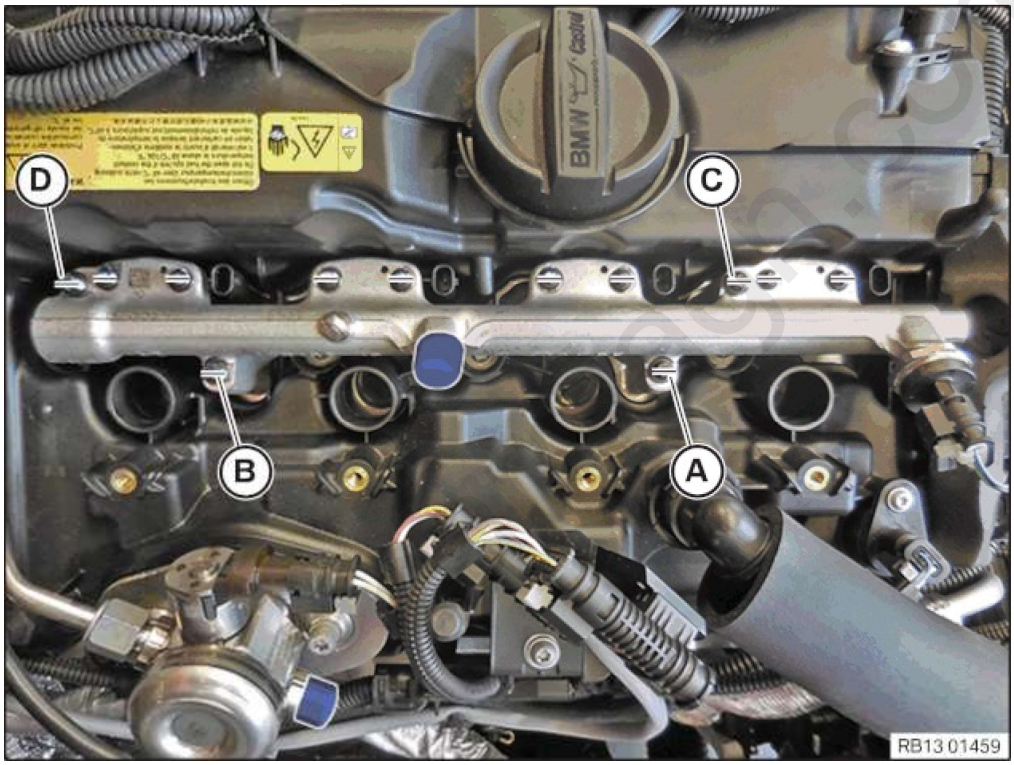
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

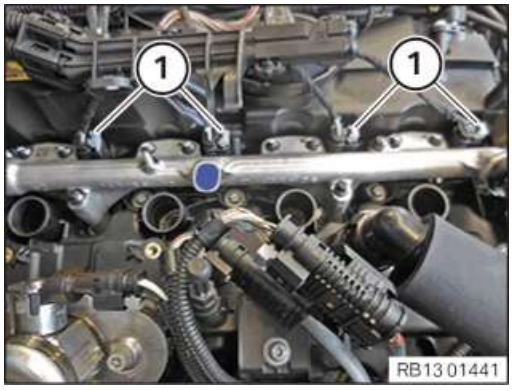


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



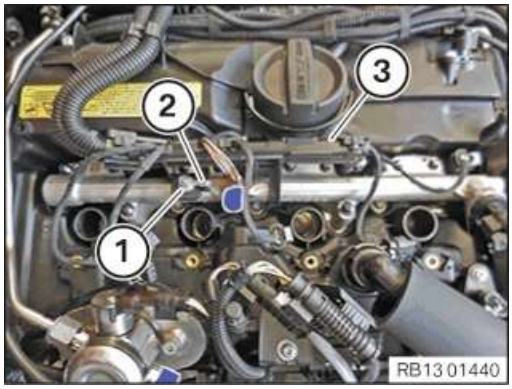
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

60 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

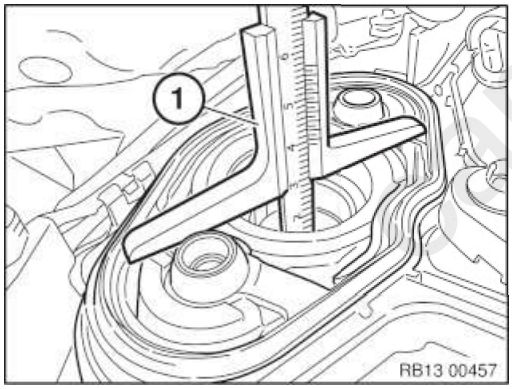
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

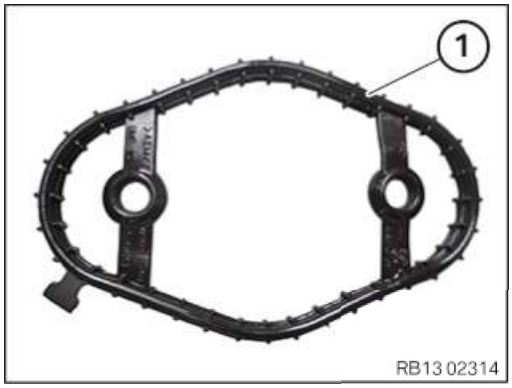
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



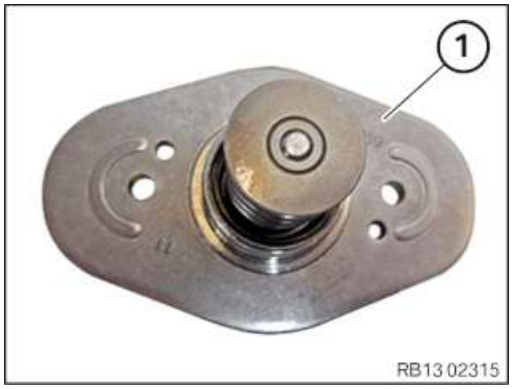
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

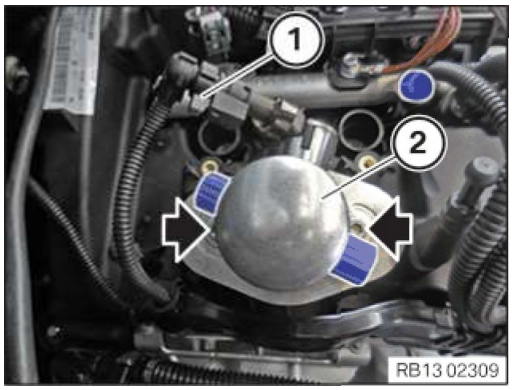
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

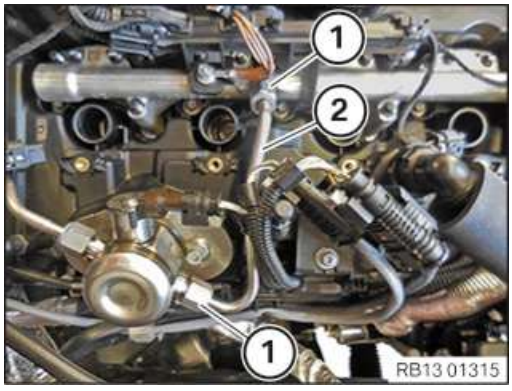
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

61 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

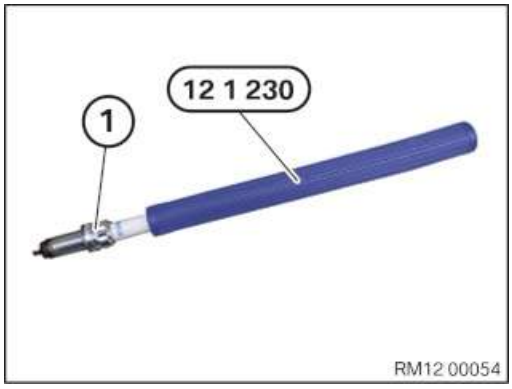
High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

62 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

M12x1.25		Tightening torque	23 Nm

63 – Installing the intake plenum

RISK OF DAMAGE

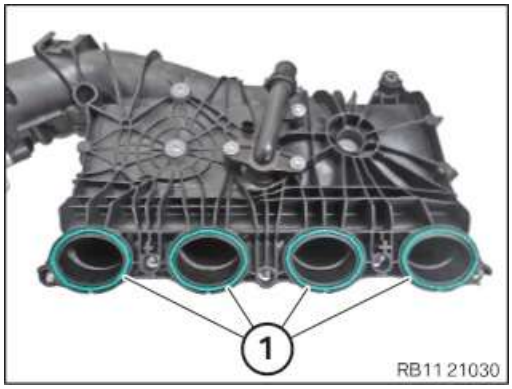
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

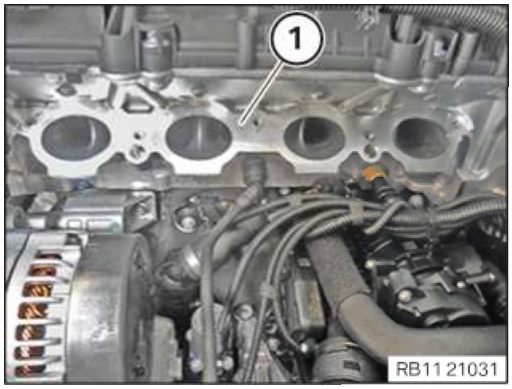
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

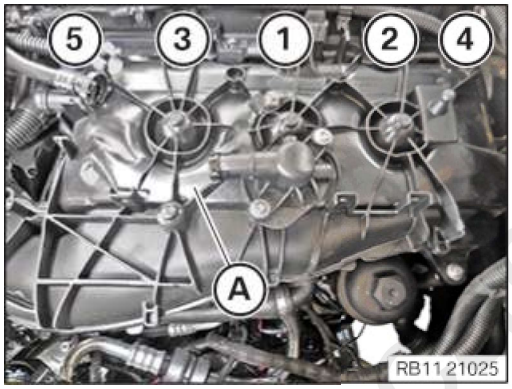


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

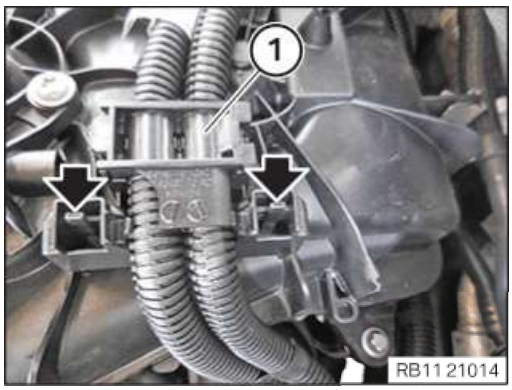
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- Tighten down screw (1).

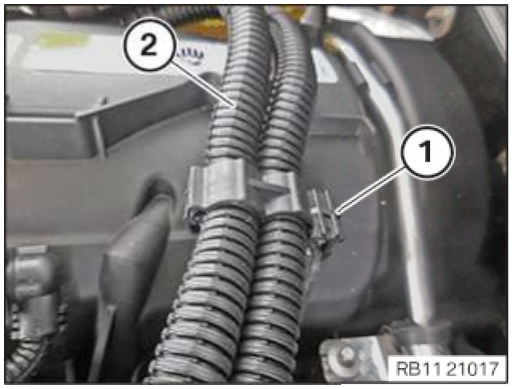
Intake plenum to support

M6X25		Tightening torque	8 Nm

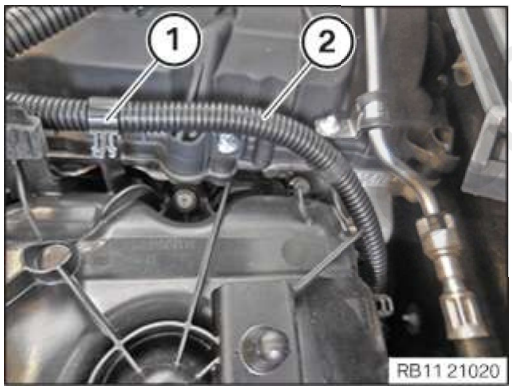


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

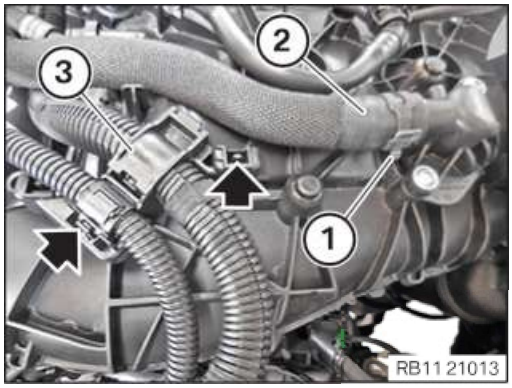
rdiagn.com



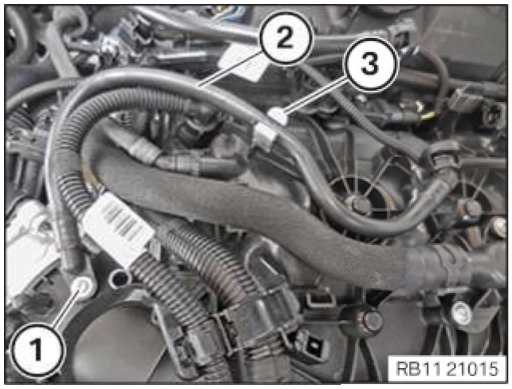
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



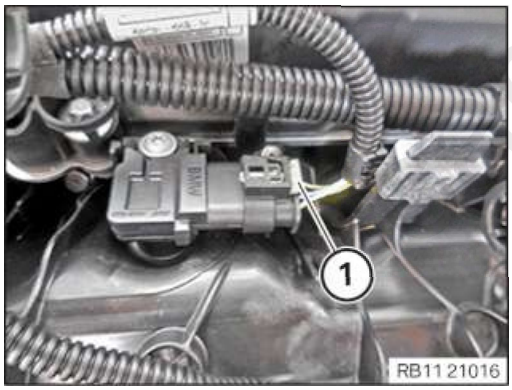
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

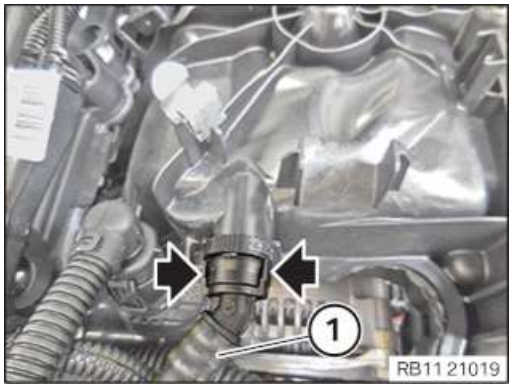
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

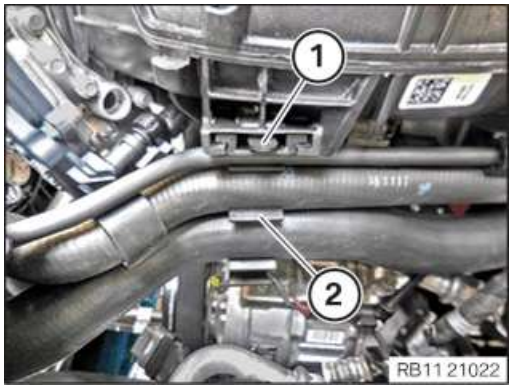
  The connector (1) must engage audibly.



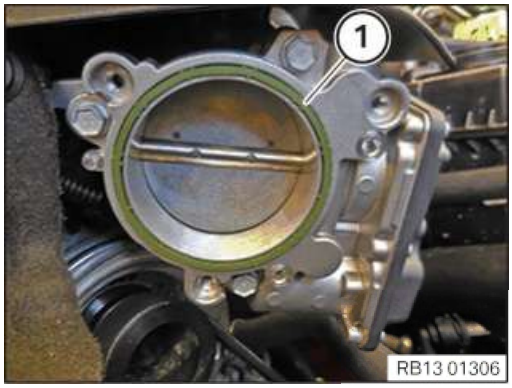
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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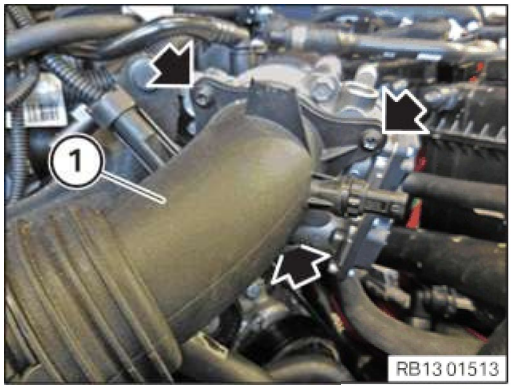


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

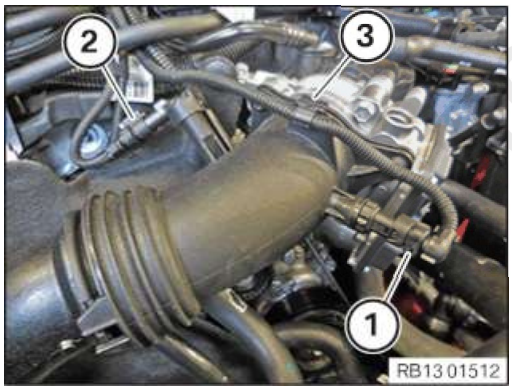
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

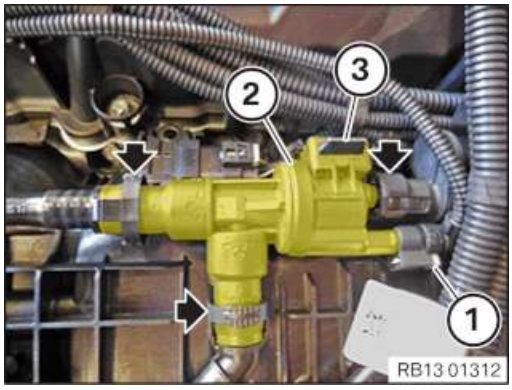
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

64 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

65 – Topping up the engine oil

rdiagn.com

RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

TECHNICAL INFORMATION

- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

- Fill in engine oil at the oil filler neck.

Engine oil

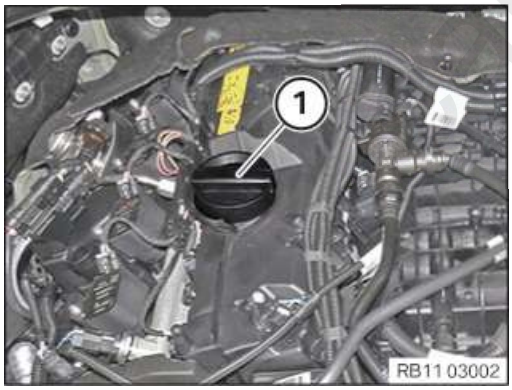
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

▸ **Installing the oil filler cap**

- Close oil filler cap (1).



66 – Remove the engine on an assembly stand

CAUTION

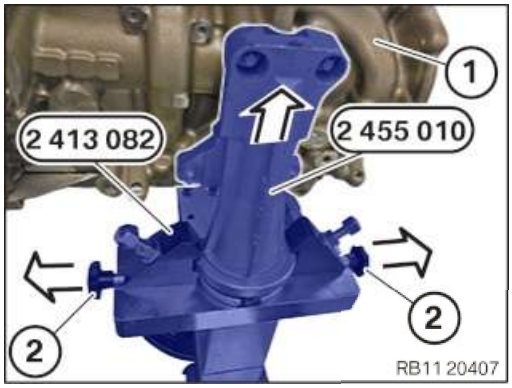
Heavy component.

Heavy components can lead to injury or damage.

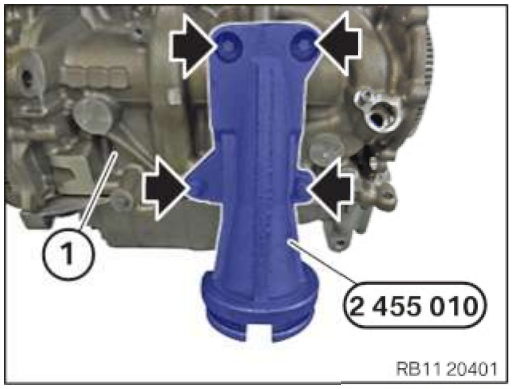
- Remove and install heavy components with the aid of another person/other persons.



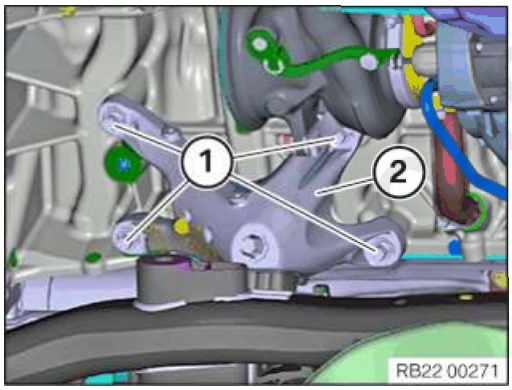
- Insert engine lifter with special tool and position engine (1).



- Unscrew the nuts on special tool .
- Detach the holder (2) in the direction of the arrow.
- Detach the engine (1) with special tool 2 455 010 out of the special tool in the direction of arrow.



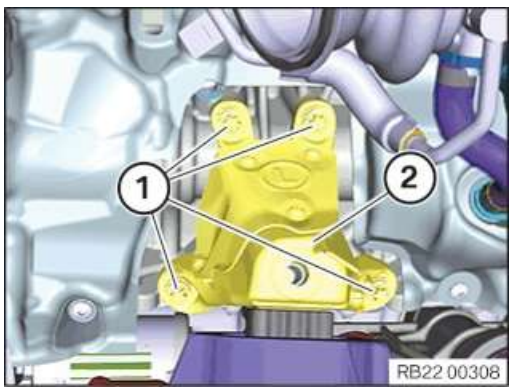
- Remove conventional screws (arrows).
- Feed out the special tool 2 455 010 on the engine (1) and remove.



- **Type: Rear-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm



- **Type: Four-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm

mdiagn.com



- See additional information.

Additional Information

Overview of Tightening Torques

Special tool 2 455 010 to crankcase			Used in step 2
M10x30		Tightening torque	38 Nm

Special tool 11 8 930 to special tool 00 2 320			Used in step 2
M14x35		Tightening torque	160 Nm

Oil drain plug			Used in step 4
M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head			Used in step 174252
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 174252
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 26
M8		Tightening torque	21,5 Nm

Rear timing case cover to crankcase			Used in step 3233
M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °

Crankshaft sensor to timing case cover			Used in step 33
			4.6 Nm

Oil sump to crankcase			Used in step 34
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission)			Used in step 34
M8 x 50		Tightening torque	19 Nm

Flywheel to crankshaft			Used in step 35
M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

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Battery positive lead to starter — Used in step 36

M8		Tightening torque	13,5 Nm

Cylinder head to crankcase — Used in step 41

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

Cylinder head bolt to timing case cover — Used in step 41

M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head — Used in step 41

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head — Used in step 41

M6x16			8 Nm

Cable routing to cylinder head, rear — Used in step 41

M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head — Used in step 41

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 41

M6x16		Tightening torque	8 Nm

Manifold support for intake air to cylinder head — Used in step 41

M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head — Used in step 41

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 41

M6			8 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 41

M6x12		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4849

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 51

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Oil return line to exhaust turbocharger/crankcase — Used in step 53

M6x14		Tightening torque	8 Nm

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Coolant feed line/coolant return line to exhaust turbocharger			Used in step 5455
M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger			Used in step 54
M6		Tightening torque	8 Nm

Coolant feed line to crankcase			Used in step 55
M6 x 12		Tightening torque	8 Nm

Cylinder head cover to cylinder head			Used in step 56
M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover			Used in step 56
M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover			Used in step 56
6X18		Tightening torque	6 Nm

Ground cable to rail			Used in step 59
M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange			Used in step 60
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail			Used in step 61
M14		Tightening torque	33 Nm

Spark plugs			Used in step 62
M12x1.25		Tightening torque	23 Nm

Intake plenum to cylinder head			Used in step 63
M6		Tightening torque	10 Nm

Intake plenum to support			Used in step 63
M6X25		Tightening torque	8 Nm

Throttle body to holder			Used in step 63
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 63
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body			Used in step 63
M6		Tightening torque	8 Nm

Engine support arm to engine			Used in step 66
M10		Tightening torque	38 Nm

Overview of Special Tools

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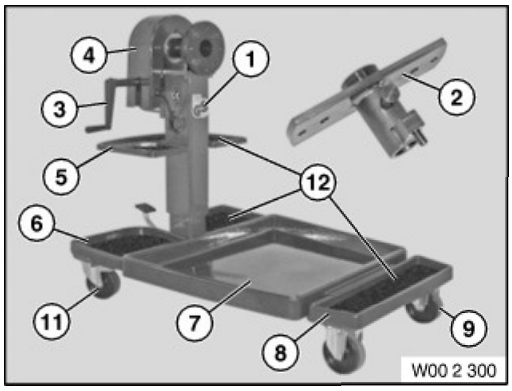
2 455 010 Engine support



Common Used in step 266

Usage	For accommodating engine on assembly stand. Engine: B3x, B4x, N47.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 495 187 (00 2 300) Assembly stand



Common Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	
2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	

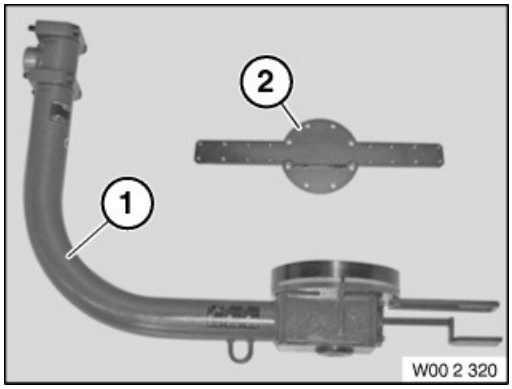
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7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

0 495 196 (00 2 320) Support arm

Used in step 2

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Common

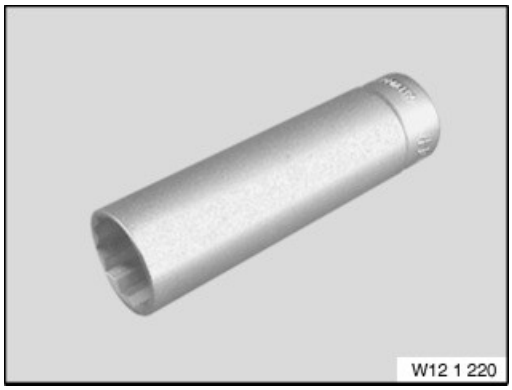
Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

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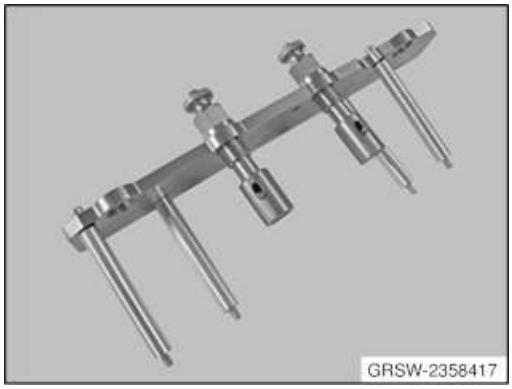
0 495 560 (12 1 220) Socket



Common Used in step 562

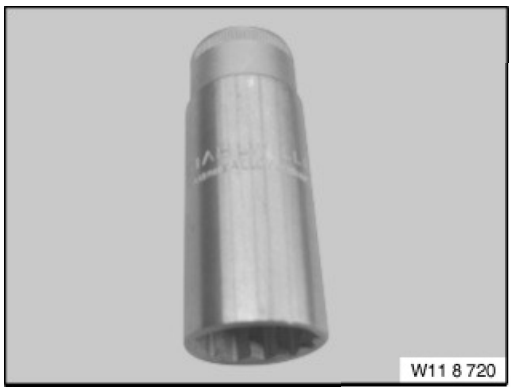
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

2 358 417 Device



Common	Used in step 8
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 8
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

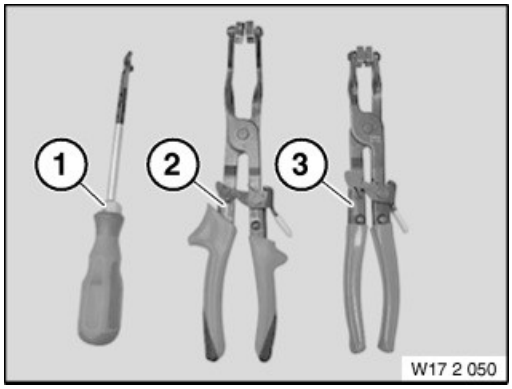
2 360 895 Pin wrench



Common	Used in step 957
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 794 (17 2 050) Pliers



Common

Used in step 1263

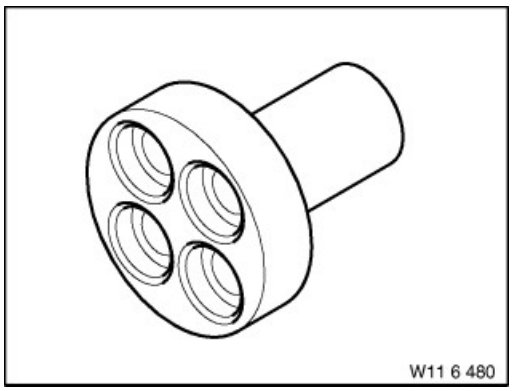
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

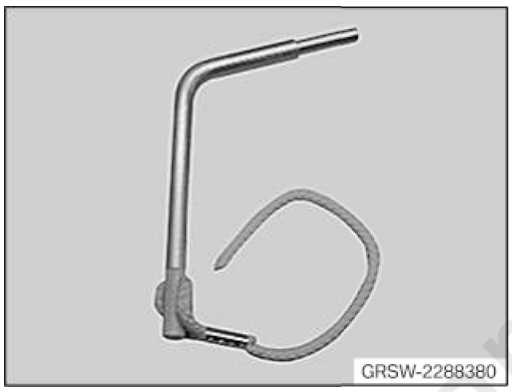
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0 493 380 (11 6 480) Connector



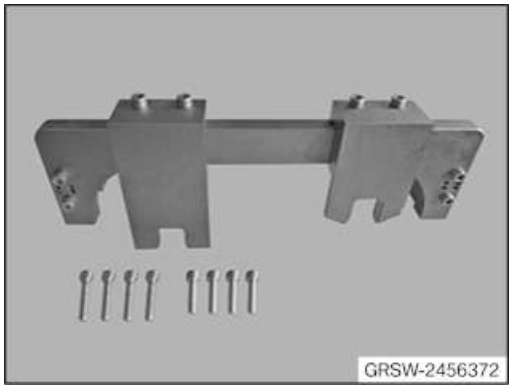
Common	Used in step 1737505260
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 17375052
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 1725425052
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 358 122 Gauge



Common	Used in step 172552
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



Common	Used in step 19204849
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

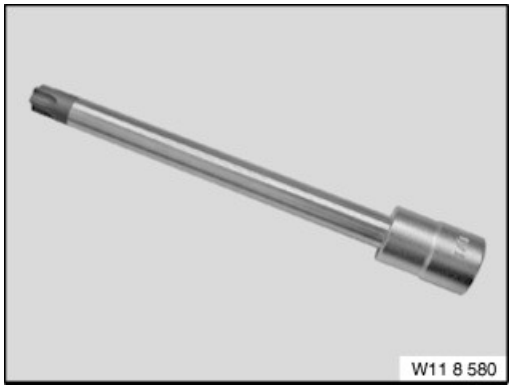
2 450 487 Socket



Common	Used in step 19204849
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

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0 495 747 (11 8 580) Socket wrench



Common	Used in step 2641
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

2 220 718 Workshop crane



Common	Used in step 26
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

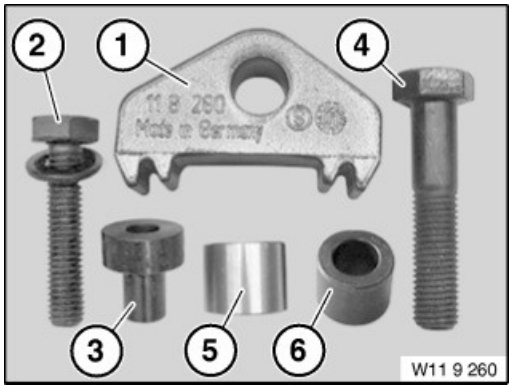
2 459 012 Holder



Common	Used in step 2641
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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0 493 938 (11 9 260) Holder



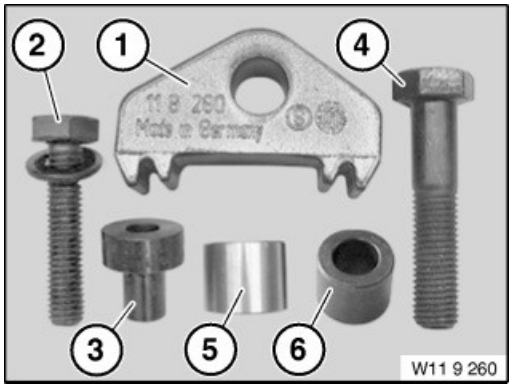
Common Used in step 2835

Usage	(Counter support with screw connection) For holding the flywheel when gearbox is removed
Included in the tool or work	
Storage location	A44
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 034 (11 9 261)		**Holder** (Individual counter support)	
2	0 494 035 (11 9 262)		**Screw** (Bolt (thread M10) with washer) For screwing counter support	
3	0 494 129 (11 9 263)		**Bush** (Bush for counter support) For counter support, for retaining flywheel when gearbox is removed Engine: N62, N73	
6	0 495 216 (11 9 266)		**Bush** For counter support, for retaining flywheel when gearbox is removed Engine: M57TU2	
4	0 494 130 (11 9 264)		**Screw** (Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed	
5	0 494 793 (11 9 265)		**Bush**	

0 494 130 (11 9 264) Screw

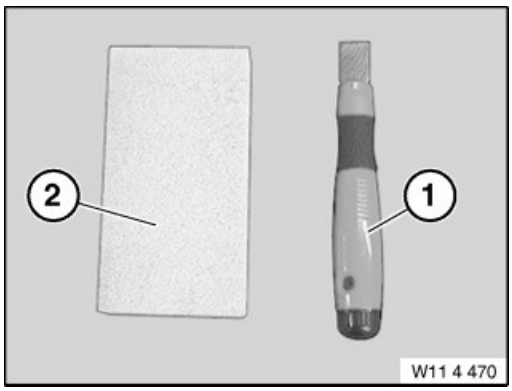


Common Used in step 2835

Usage	(Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed
Included in the tool or work	0 493 938
Storage location	A44
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool



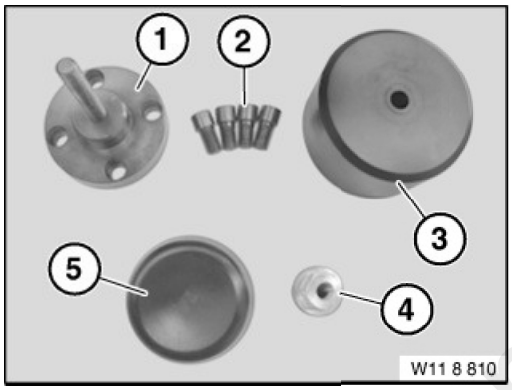
Common Used in step 323334

Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

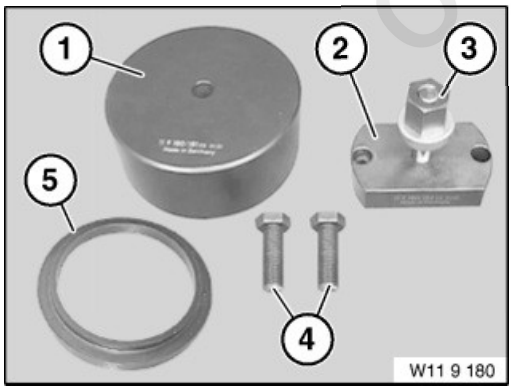
0 496 137 (11 8 815) Holding sleeve



Common Used in step 3233

Usage	(Slip sleeve) Liquidation of existing inventory and then available only via complete tool set 11 8 810 = 83 30 0 496 132 - status 09.12.2011
Included in the tool or work	0 496 132
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 494 029 (11 9 182) Synchronising key

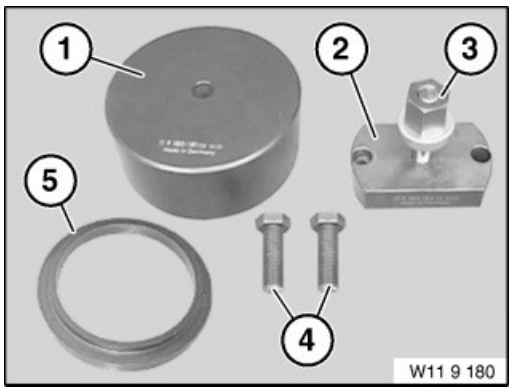


Common Used in step 32

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

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0 494 031 (11 9 184) Screw



Common	Used in step 32
Usage	(screws (2 x))
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

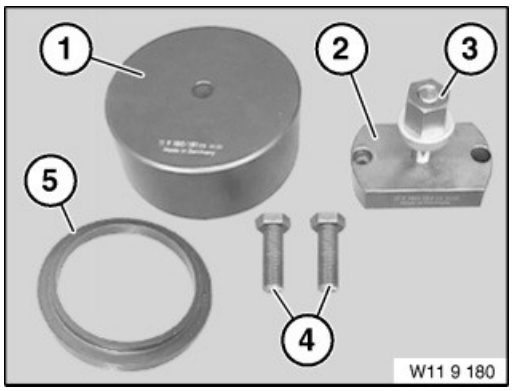
2 360 215 Adapter



Common	Used in step 32
Usage	For installing the rear radial shaft seal. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B56
Replaced by	
In connection with	11 9 180 = 0493881
SI-Number	01 13 14 (098)

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0 493 881 (11 9 180) Tool



Common Used in step 32

Usage	(pulling tool) For pulling radial shaft seal into engine block, rear
Included in the tool or work	
Storage location	C26
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 028 (11 9 181)		**Bush**	
2	0 494 029 (11 9 182)		**Synchronising key**	
3	0 494 030 (11 9 183)		**Nut**	
4	0 494 031 (11 9 184)		**Screw** (screws (2 x))	
5	0 496 660 (11 9 185)		**Ring** For installation shaft seal - rim offset 6.6 mm (N55).	

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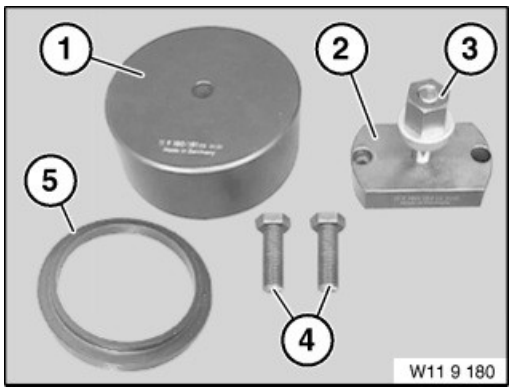
0 494 028 (11 9 181) Bush



Common Used in step 32

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 494 030 (11 9 183) Nut

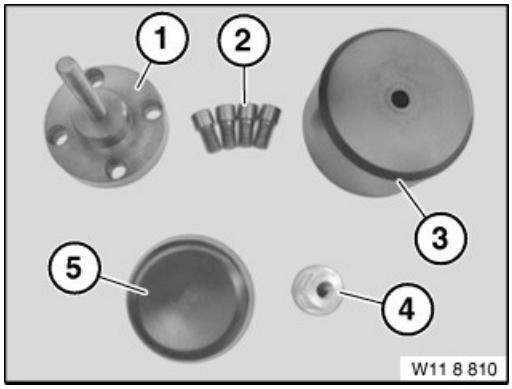


Common	Used in step 32
Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 496 132 (11 8 810) Device

Used in step 33

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Common

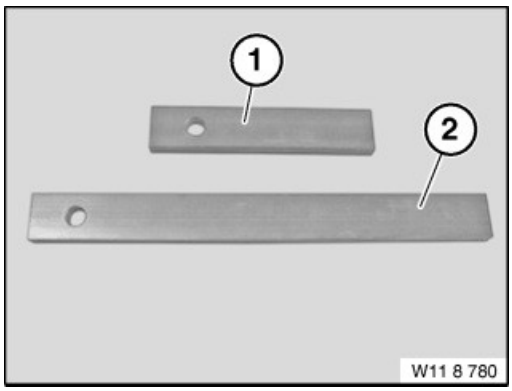
Usage	(Pulling device) For installing rear radial shaft seal.
Included in the tool or work	
Storage location	C22
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
4	0 496 136 (11 8 814)		**Nut** (Nut with bearing) Liquidation of existing inventory and then available only via complete tool set 11 8 810 = 83 30 0 496 132 - status 09.12.2011	
1	0 496 133 (11 8 811)		**Basic body** Liquidation of existing inventory and then available only as a complete tool set 11 8 810 = 83 30 0 496 132 - as of 09.12.2011	
2	0 496 134 (11 8 812)		**Screw** (Screw set) Liquidation of existing inventory and then available only via complete tool set 11 8 810 = 83 30 0 496 132 - status 09.12.2011	
3	0 496 135 (11 8 813)		**Holding sleeve** (Thrust sleeve) Liquidation of existing inventory and then available only via complete tool set 11 8 810 = 83 30 0 496 132 - status 09.12.2011	
5	0 496 137 (11 8 815)		**Holding sleeve** (Slip sleeve) Liquidation of existing inventory and then available only via complete tool set 11 8 810 = 83 30 0 496 132 - status 09.12.2011	

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0 496 120 (11 8 780) Plate



Common Used in step 34

Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

2 285 058 Tool set

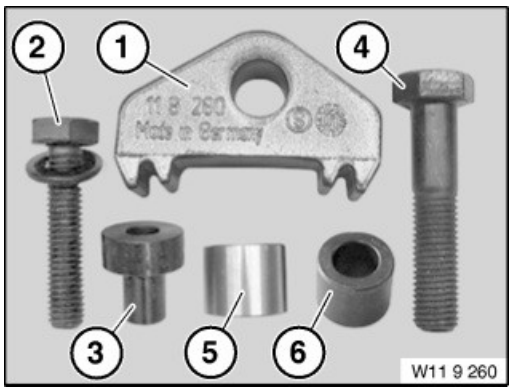


Common Used in step 35

Usage	
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 14 (069)

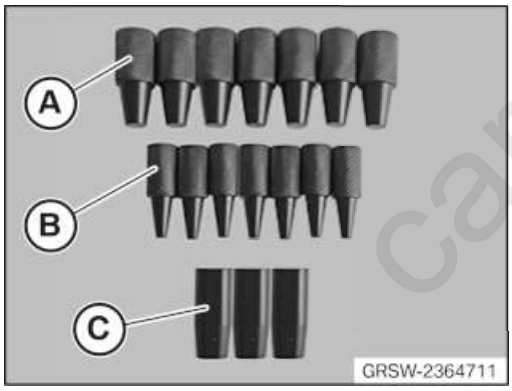
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0 494 034 (11 9 261) Holder



Common	Used in step 35
Usage	(Individual counter support)
Included in the tool or work	0 493 938
Storage location	
Replaced by	
In connection with	
SI-Number	

2 364 711 Plug



Common	Used in step 3839
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

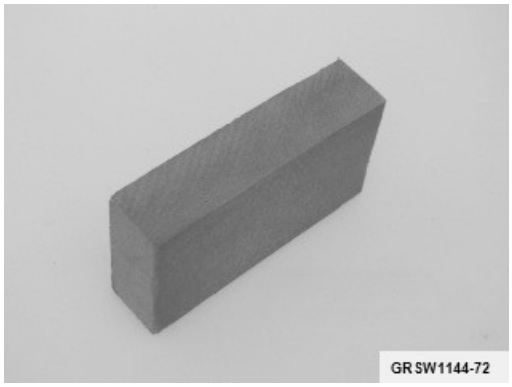
0 495 103 (11 4 471) Scraper



Common	Used in step 39
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

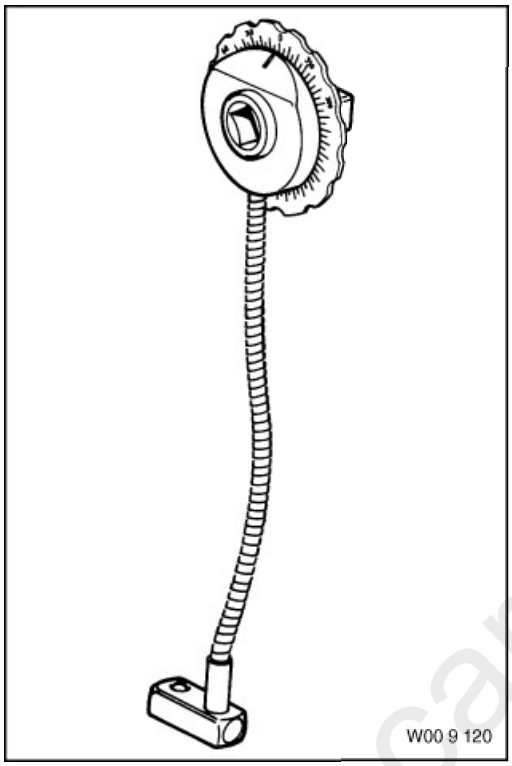
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0 495 104 (11 4 472) Extractor



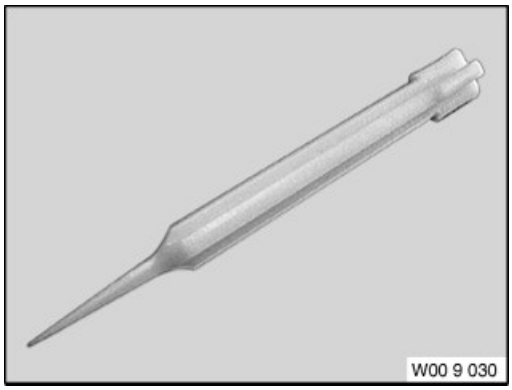
Common	Used in step 39
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 490 504 (00 9 120) Torque angle measuring dial



Common	Used in step 41
Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common	Used in step 415455
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

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2 455 654 Tensioning tool



Common	Used in step 4750
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 58
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 58
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

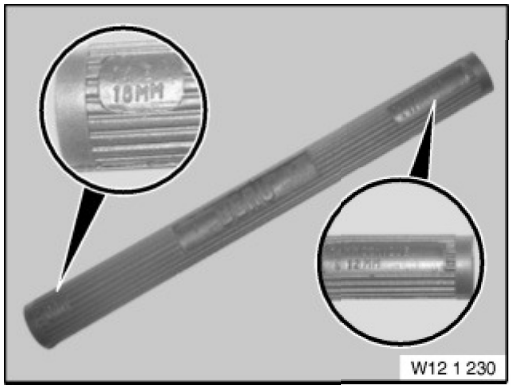
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2 358 022 Gauge



Common	Used in step 59
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

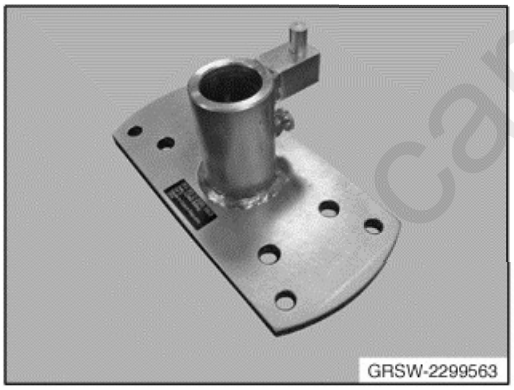
0 496 065 (12 1 230) Fitting aid



Common	Used in step 62
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

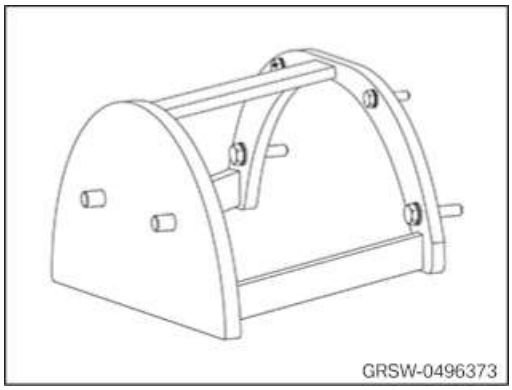
Replacement tools:

2 299 563 Adapter



Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

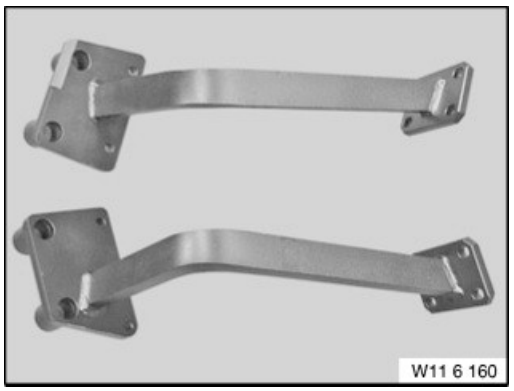
0 496 373 (11 5 420) Plate



Common	Used in step 2
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

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0 496 680 (11 6 160) Support



Common	Used in step 2
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

Overview Technical Data

Height of the sealing bead	Used in step 3233
	2,0 mm ... 2,5 mm

Engine oil	Used in step 65
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil B48B20O1/B46B20O1	Used in step 65
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Screw-in depth of thread cutter	Used in step 35
Screw-in depth	18 mm

Links

Functional descriptions	Used in step
Petrol particulate filter	65

General repair instructions	Used in step
11 00 ... Overview of consumables (Electronic Parts Catalogue)	323334

Repair instructions	Used in step
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
31 10 001 Completely removing and installing front axle with engine and transmission	167
11 00 050 Removing and installing engine	167

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11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
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11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	1
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine	167
11 00 050 Removing and installing the engine with a double-clutch transmission (DKG)	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine	167
11 00 050 Removing and installing the engine (manual gearbox)	167
11 00 050 Remove and install engine (Automatic)	167
11 00 050 Remove and install engine	167
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11 00 050 Remove and install engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine \PREMIUM	167
11 00 050 Removing and installing/replacing engine (N63)	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Removing and installing engine	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine (Automatic)	167

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11 00 050 Remove and install engine (Automatic)	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine (Automatic)	167
11 00 050 Remove and install engine (Automatic)	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine	167
11 00 050 Remove and install engine	167
11 00 050 Removing and installing the engine with a double-clutch transmission (DKG)	167
11 00 050 Remove and install engine	167
13 53 ... Clean the cylinder head around the injectors due to grit / dust	8
61 13 ... Unlocking and disconnecting different plug connections	81056
61 35 ... Notes on ESD protection (Electro Static Discharge)	8911
61 35 ... Notes on ESD protection (Electro Static Discharge)	911

Operating materials	**Used in step**
3.0 Technically appropriate engine oils for BMW Group engines	65

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11 14 005 Replacing front crankshaft seal

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Removing the clean air pipe with the resonator

WARNING

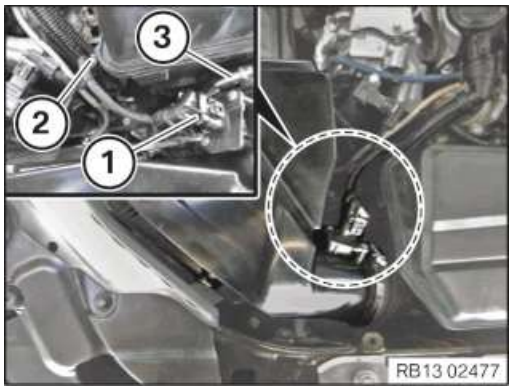
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

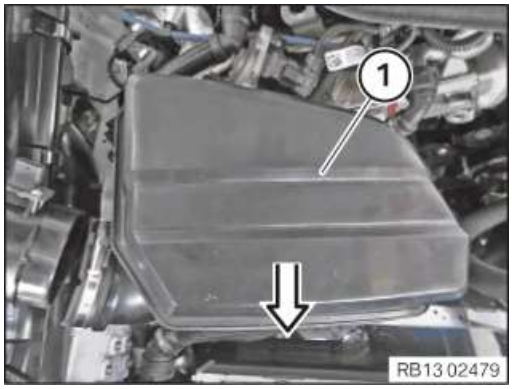


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

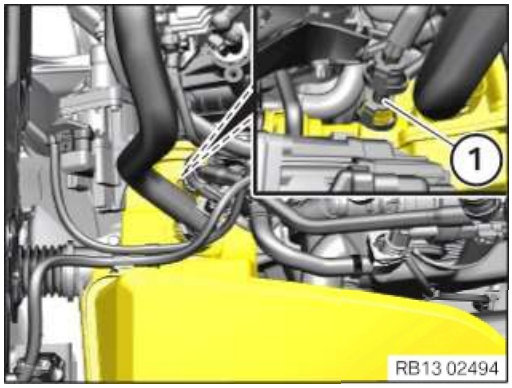


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

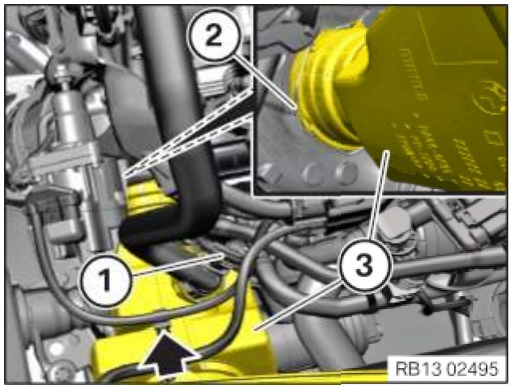
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- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

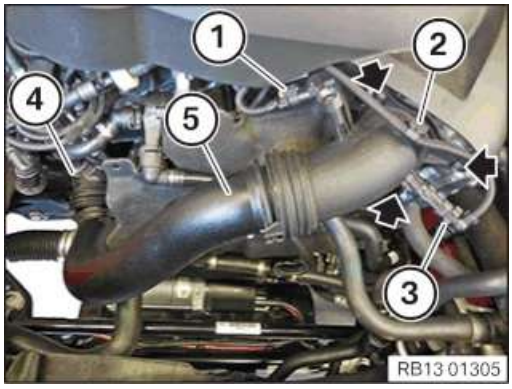
4 – Remove charge air line

WARNING

Hot surfaces.

Risk of burning!

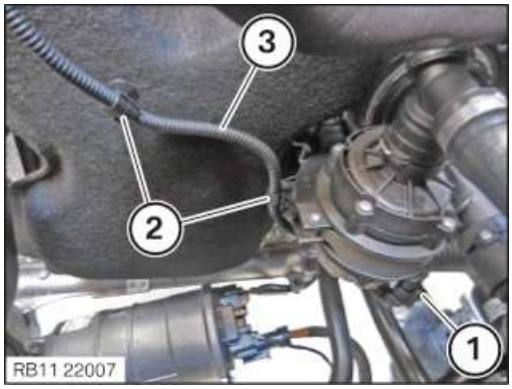
- Perform all work only on components that have cooled down.



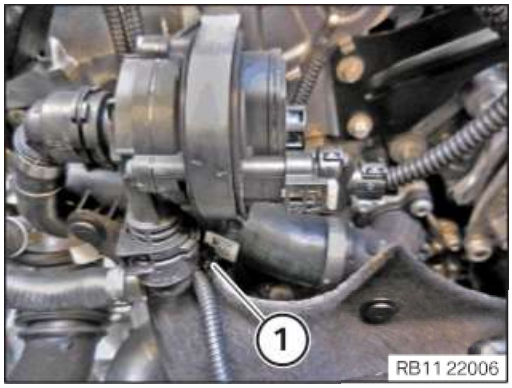
- Unlock and loosen the connector (1) on the charging pressure sensor.
- Unlock and loosen clamp (2).
- Unlock and disconnect the connector (3) from the charge-air temperature sensor.
- Remove screws (arrows).
- Unlock and loosen the clamp (4) on the exhaust turbocharger.
- Guide out and remove charge air line (5).

5 – Removing the acoustic cover for the engine at the front

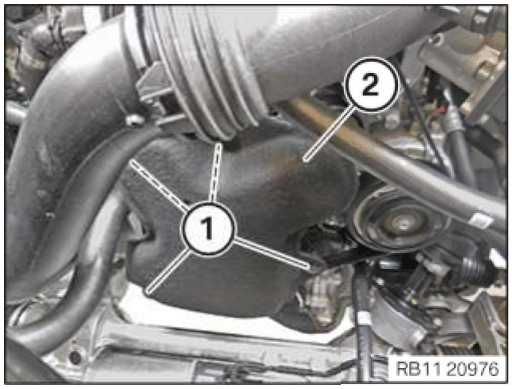
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

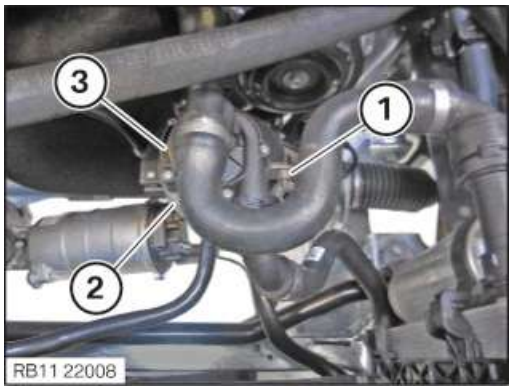
6 – Releasing the electrical auxiliary coolant pump for the charge air cooler or the air conditioning condenser

RISK OF DAMAGE

Non-visible damage to the coolant pump.

Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.



- Loosen nut (1).
- Thread out holder (2) and set aside.
- Guide out the electrical auxiliary coolant pump (3) and set it aside.

7 – Removing the drive belt for alternator

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CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

Component with preload.

Danger of injury!

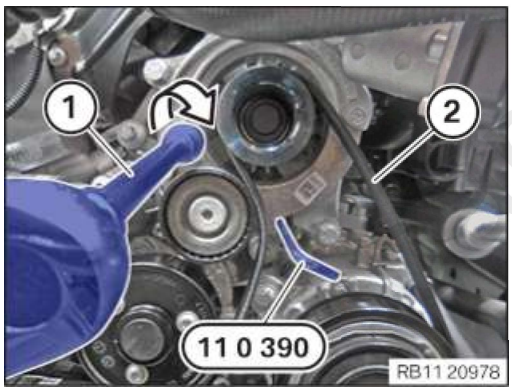
- Reduce preload as far as possible before disassembly. Relieve component.

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

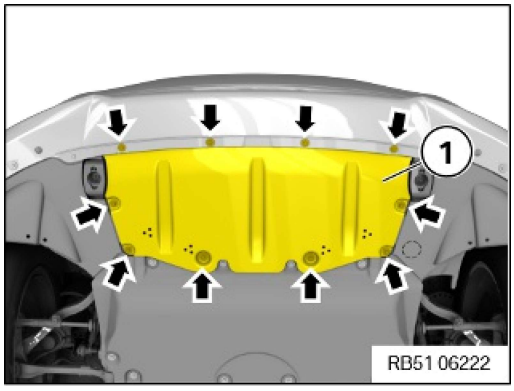
TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.



- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Secure the belt tensioner with the special tool 0 496 268 (11 0 390).
- Guide out the drive belt for the alternator (2) and remove it.

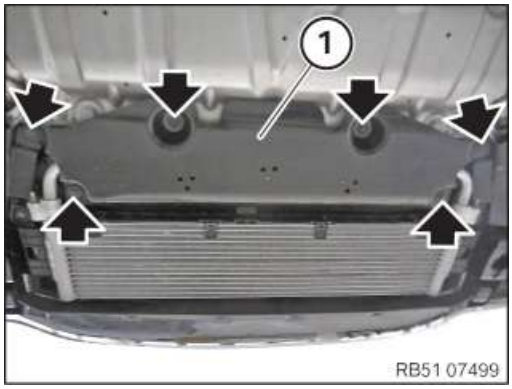
8 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

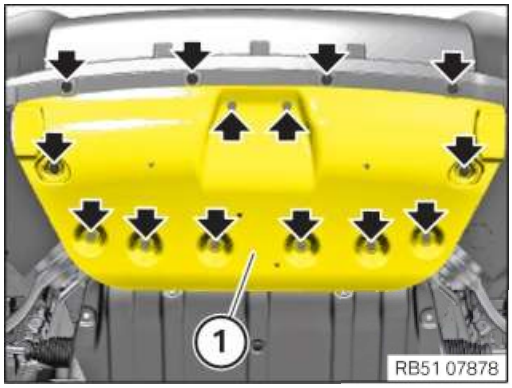
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

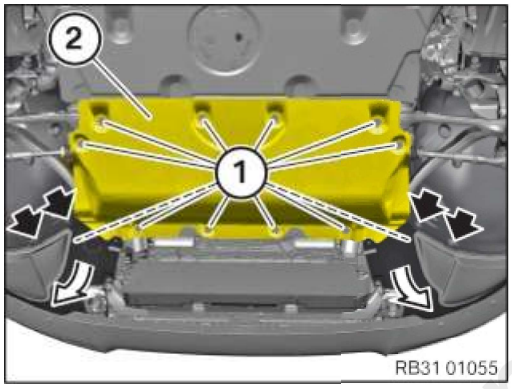


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

9 – Remove the underbody protection of the steering gear



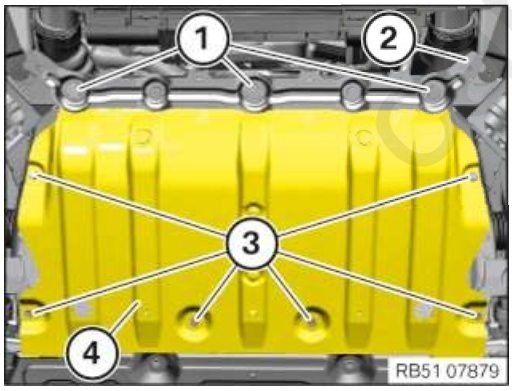
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

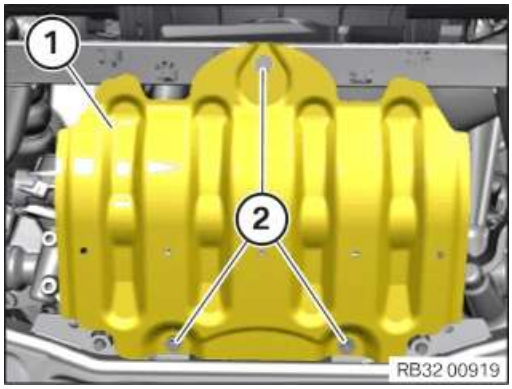
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

10 – If installed: Removing the steering start protection

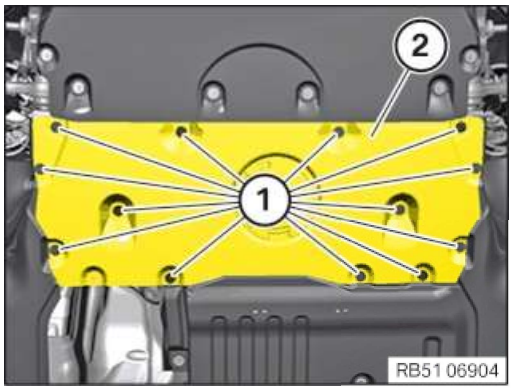
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

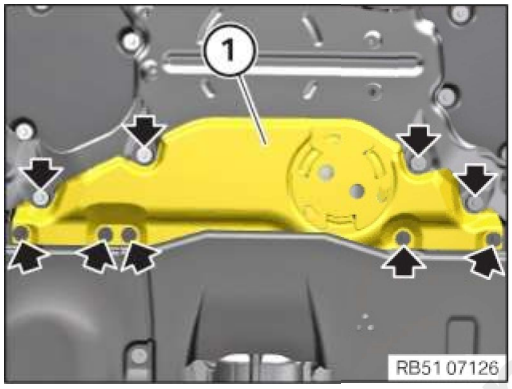
11 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

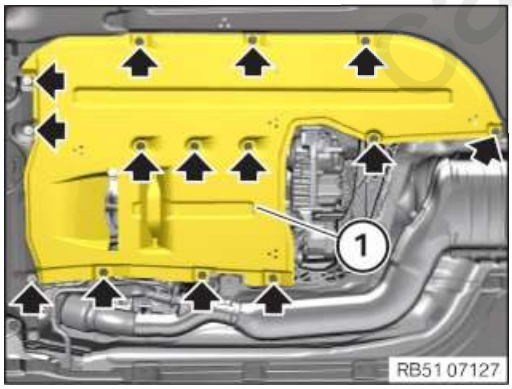


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

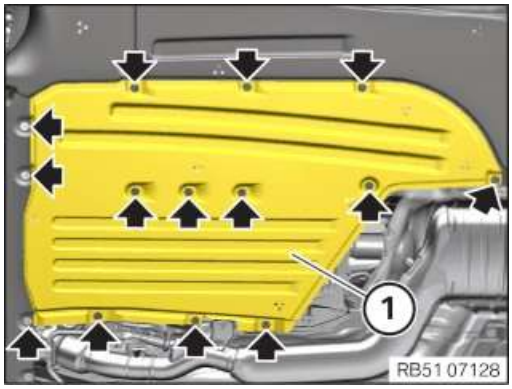
12 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

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13 – Removing starter motor

Prerequisite

Battery earth leads are disconnected.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

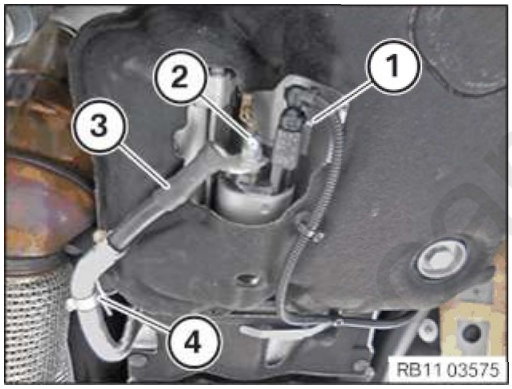
Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

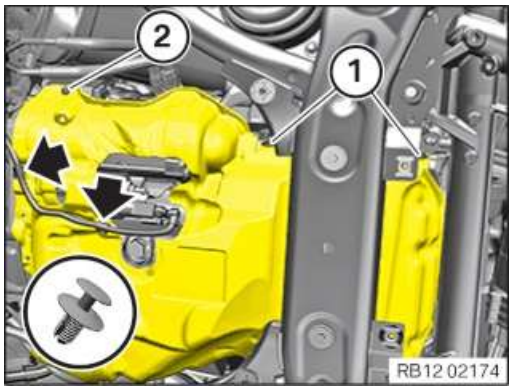
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

TECHNICAL INFORMATION

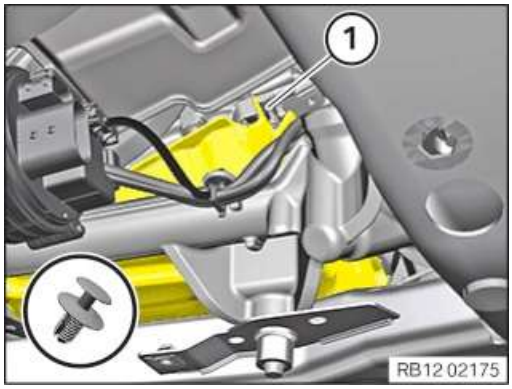
Make sure that the acoustic cover is **not** damaged while removing the starter motor.
A damaged lower acoustic cover can only be renewed when the front axle is lowered.



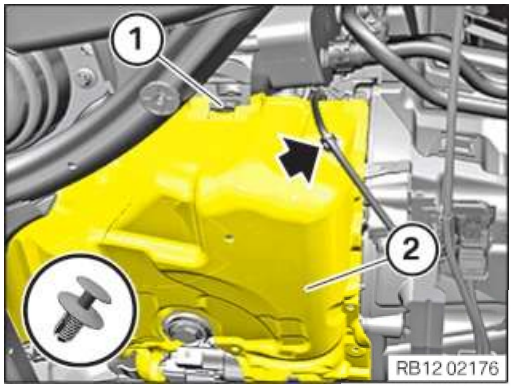
- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Release positive battery cable (3) from holder (4).



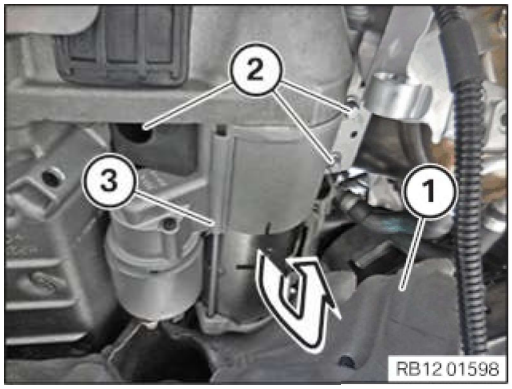
- Loosen the expanding rivet (1).
- Undo fir tree clip (2).
- Release the clamps (arrows).



- Loosen expanding rivet (1).
- Lower the acoustic cover of the oil sump.

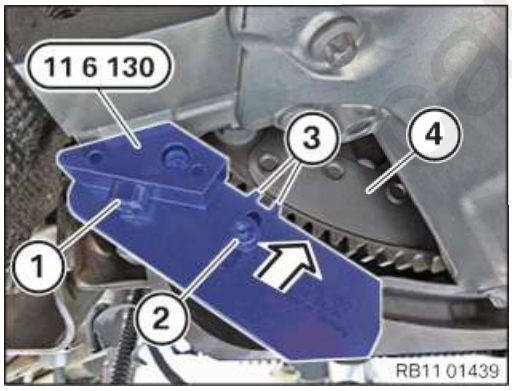


- Loosen expanding rivet (1).
- Loosen the clamp (arrow).
- Lower acoustic cover (2).



- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Loosen screws (2).
- Carefully guide out the starter motor (3) in direction of arrow and remove.

14 – Removing the vibration damper



- Position the special tool 0 496 595 (11 6 130) and secure it on the timing case cover using the bolt (1).

  The special tool 0 496 595 (11 6 130) must lie flat on the transmission housing.
- If necessary, turn the engine in the direction of rotation until the teeth (3) engage completely in the gearing of the flywheel (4).
- Slide the counter support with the bolt (2) up until the teeth (3) engage completely in the gearing of the flywheel.
- Tighten down screw (2).



- Unscrew the bolts (arrows) on the vibration damper (1).
- Feed out and remove the vibration damper (1).

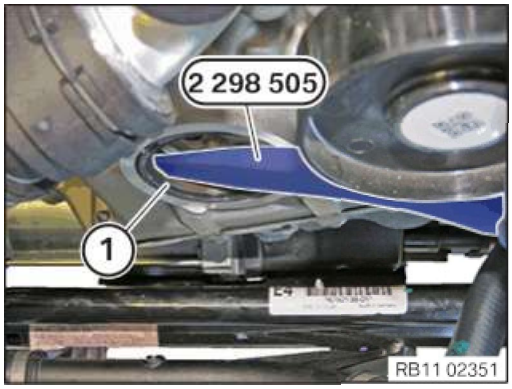
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15 – Renewing the front crankshaft seal

▸ Removing the front crankshaft seal

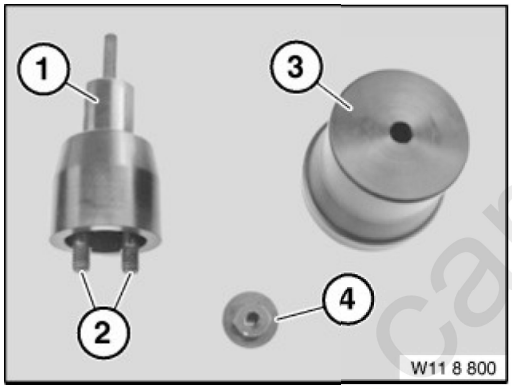


- Drive in the crankshaft seal (1) in the marked area with a punch to approx. 1 cm deep.



- Lever out the crankshaft seal (1) with the special tool 2 298 505.
- Make sure that the sealing surface on the crankcase is **not** scratched.

▸ Installing the front crankshaft seal

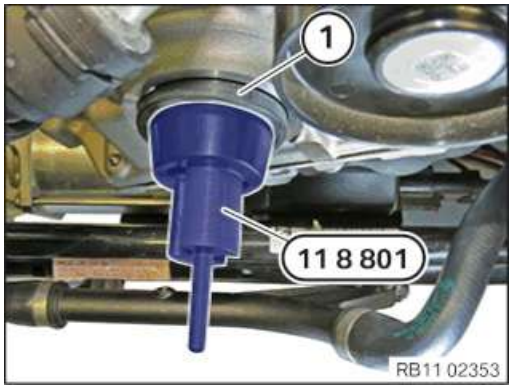


- Prepare special tool 0 496 130 (11 8 803).



- Clean the special tool 0 496 128 (11 8 801) from the set of special tools 0 496 127 (11 8 800) and coat it with fresh engine oil.
- Secure special tool 0 496 128 (11 8 801) using special tool 0 496 129 (11 8 802) from the set of special tools 0 496 127 (11 8 800) to the crankshaft.

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RISK OF DAMAGE

Radial shaft seal damage.

Touching the sealing lip (inner) and applying oil to the radial shaft seal will lead to its destruction.

- Do not touch the sealing lip (inner) of the radial shaft seal.
- Do not apply oil to the radial shaft seal.
- Install the radial shaft seal dry.

- Carefully slide crankshaft sealing ring (1) straight **in a rotational movement** onto special tool 0 496 128 (11 8 801) from the set of special tools 0 496 127 (11 8 800) until the crankshaft sealing ring (1) rests against the crankcase.



- Mount special tool 0 496 130 (11 8 803) on special tool 0 496 128 (11 8 801) from the set of special tools0 496 127 (11 8 800) in the direction of the arrow.



- Screw in special tool (sleeve) 0 496 130 (11 8 803) using special tool 0 496 131 (11 8 804) from the set of special tools 0 496 127 (11 8 800) and a suitable tool until the sleeve rests flush against crankcase (1).



- Release and remove special tool 0 496 131 (11 8 804).

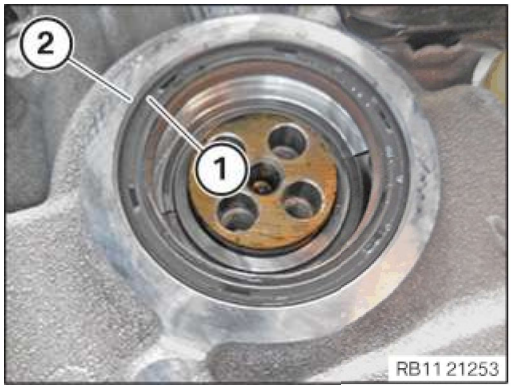
mdiag.com



- Guide out and remove special tool 0 496 130 (11 8 803) in the direction of the arrow from special tool 0 496 128 (11 8 801) from the set of special tools 0 496 127 (11 8 800).



- Release special tool 0 496 129 (11 8 802).
- Guide out and remove special tool 0 496 128 (11 8 801) I 0 496 129 (11 8 802) on the crankshaft.



- Ensure that crankshaft sealing ring (1) is fitted correctly on crankcase (2).

POSTPROCESSES

16 – Installing the vibration damper

RISK OF DAMAGE

Radial shaft seal damage.

When installing the vibration damper, the rotary shaft seal can be damaged.

- The special tool must be used to install the vibration damper.

TECHNICAL INFORMATION

When removing and installing or replacing the vibration damper, the rotary shaft seal must be replaced.

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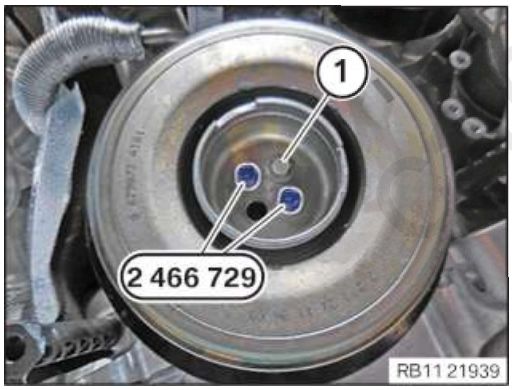
- Clean the sealing surface (1) from oil and contamination.



- Screw special tool 2 466 729 into the crankshaft by hand.



- Insert vibration damper (1) into the special tool 2 466 729 and install.



- Renew the bolts (arrows).

  Parts: Bolts
- Hand-tighten the bolt (1).
- Guide the special tool 2 466 729 out and remove.

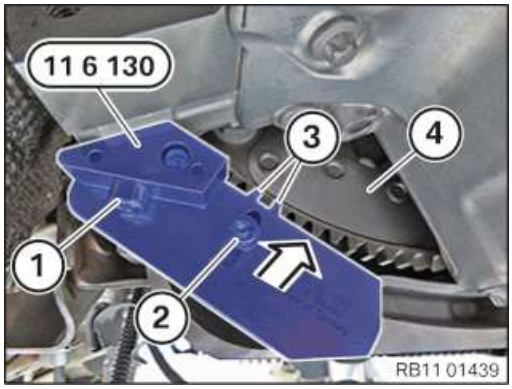


- Position vibration damper (1).
- Tighten the bolts (arrows) on the vibration damper (1).

Vibration damper with belt pulley to crankshaft

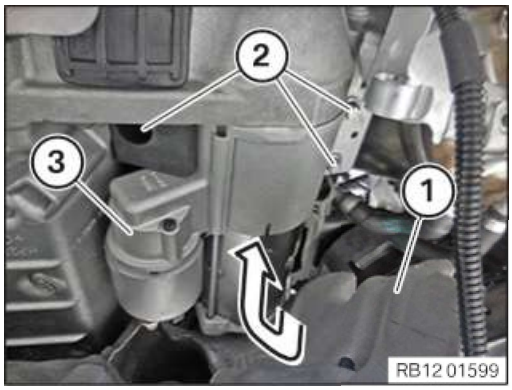
M10x65	Renew screws. Tighten screws crosswise.	1. Jointing torque	40 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

carsdiagn.com



- Loosen screw (2).
- Slide the counter support with the bolt (2) down until the teeth (3) are no longer engaged in the gearing of the flywheel (4).
- Release the screw (1) and feed out and remove special tool 0 496 595 (11 6 130).

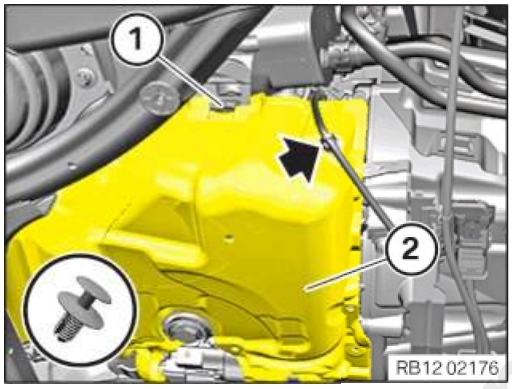
17 – Installing starter motor



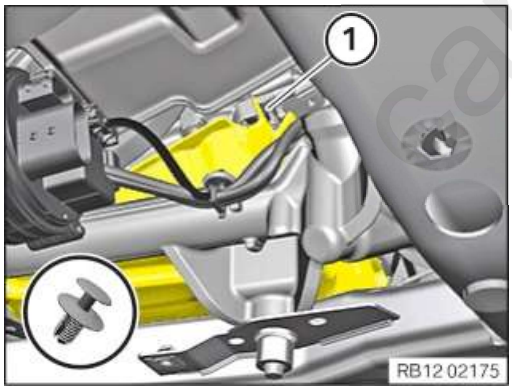
- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Feed in and install the starter motor (3) in the direction of the arrow.
- Tighten the screws (2).

Starter motor to engine

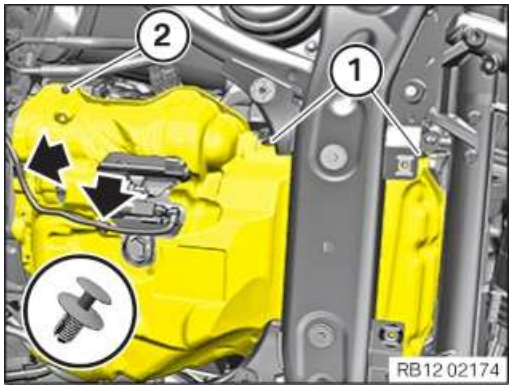
M8X60		Tightening torque	19 Nm



- Position the acoustic cover (2).
- Fasten expanding rivet (1).
- Secure clamp (arrow).

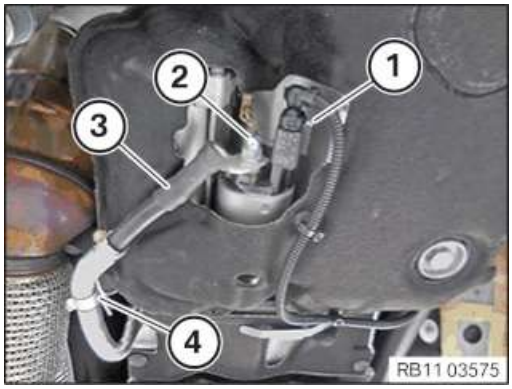


- Fasten expanding rivet (1).

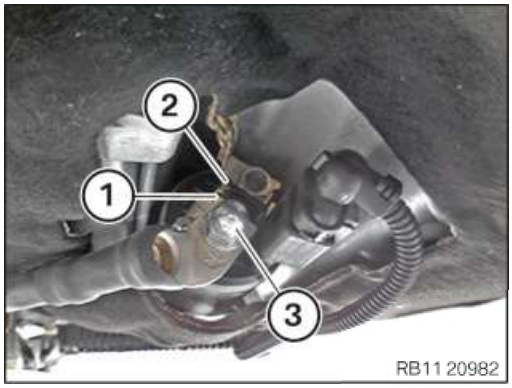


- Secure fir tree clip (2).
- Secure expanding rivet (1).
- Secure the clamps (arrows).

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- Secure the positive battery cable (3) in the holder (4) and position it at the starter motor.
- Tighten the nut (2) hand-tight.
- Connect the connector (1) and audibly lock it.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

18 – Installing the drive belt for alternator

Overview of drive belt for alternator



1. Drive belt for alternator

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

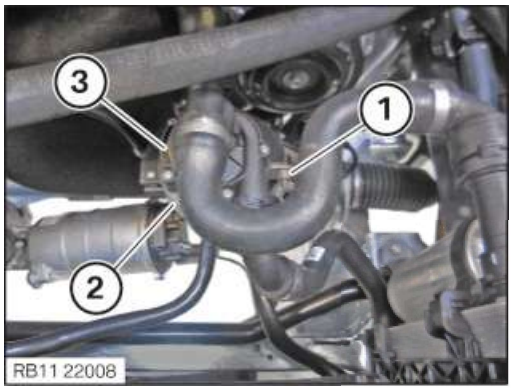
The drive belt must be replaced if contaminated with coolant- and oil residues.

rdiagn.com



- Position the drive belt for alternator (2) on the ancillary components.
- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Feed the special tool 0 496 268 (11 0 390) out of the belt tensioner and remove it.

19 – Mounting the electrical auxiliary coolant pump for the charge air cooler/air conditioning condenser

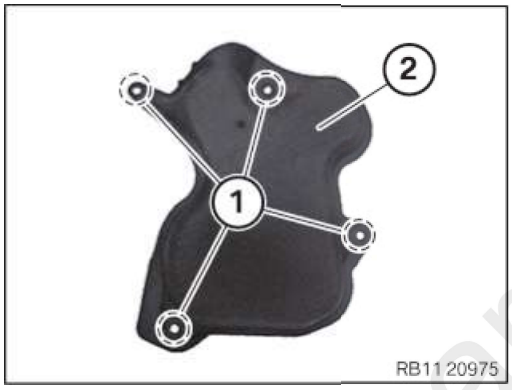


- Feed in and position the electrical auxiliary coolant pump (3).
- Insert and install the holder (2).
- Tighten nut (1).

Electric coolant pump to holder

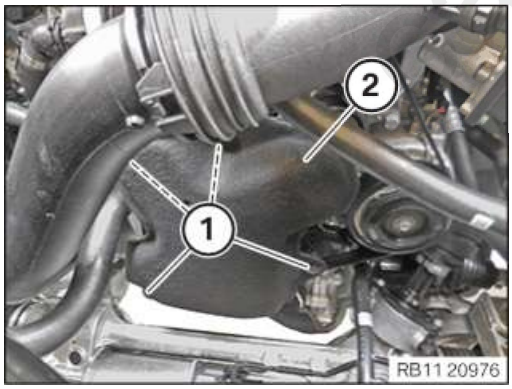
M6		Tightening torque	8 Nm

20 – Install the acoustic cover for the engine at the front

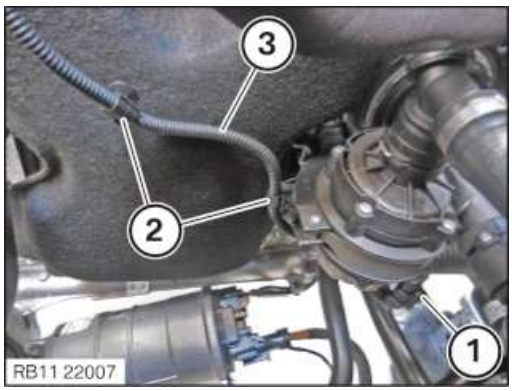


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



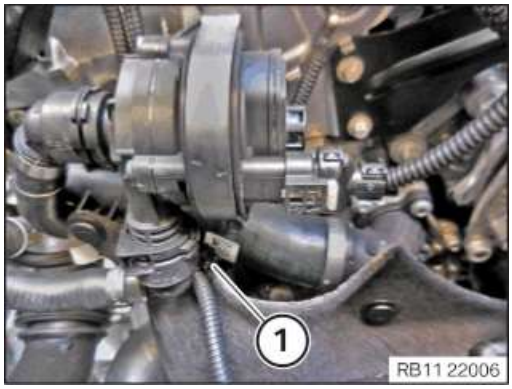
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

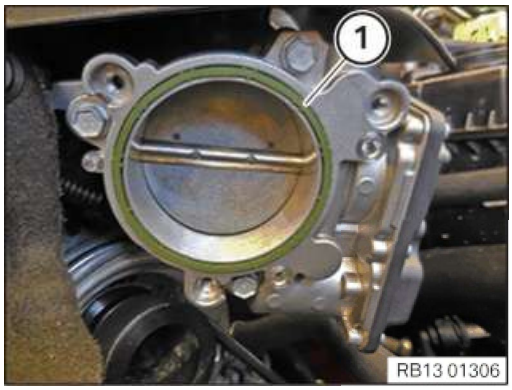
  The connector (1) must engage audibly.

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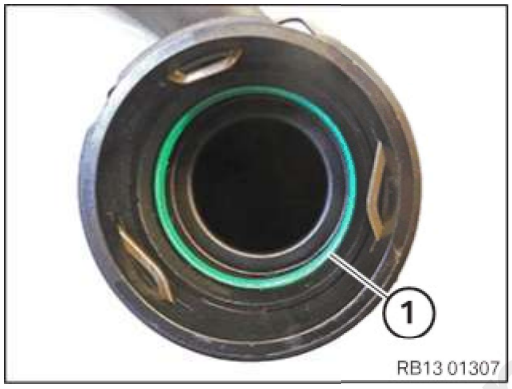
- Secure clamps (1).

21 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring

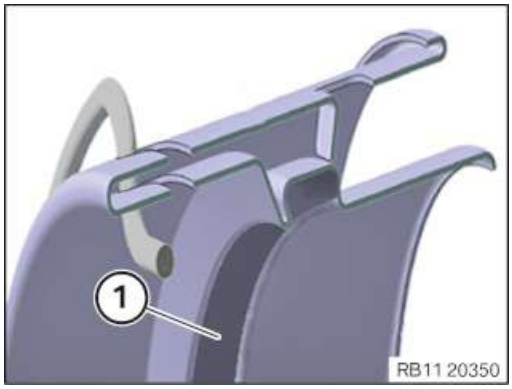


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▶ **Replace damaged gasket**

TECHNICAL INFORMATION

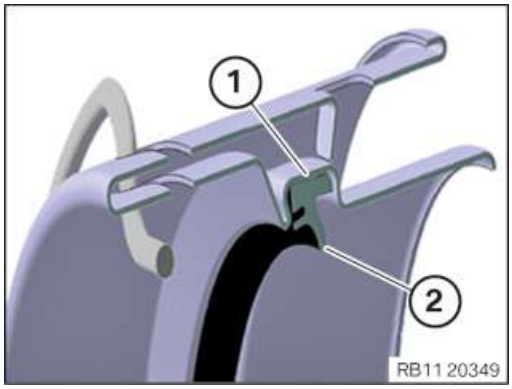
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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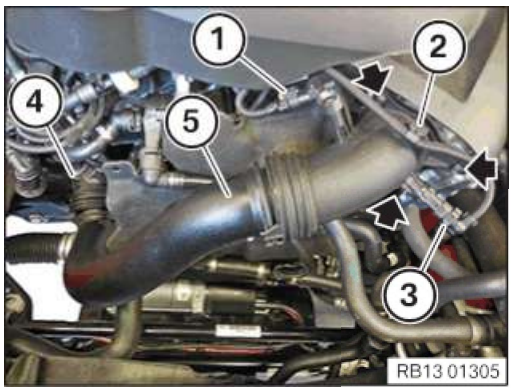
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

Charge air line to throttle body

M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

22 – Installing the clean air pipe with resonator



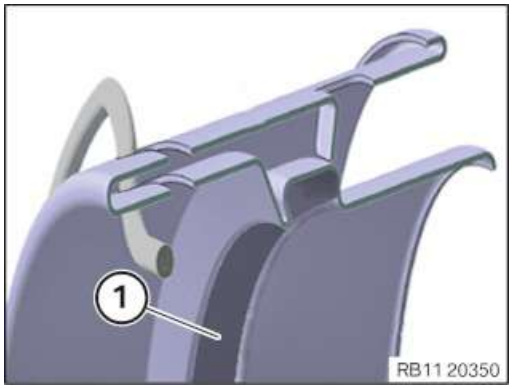
- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

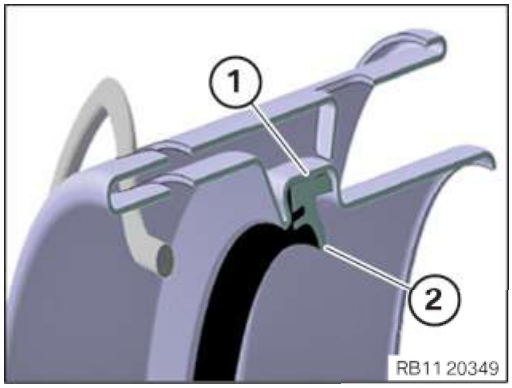
Do not use pointed or sharp-edged tools for the installation and/or removal.

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- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



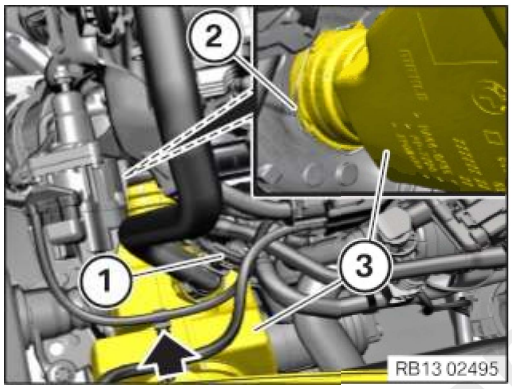
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

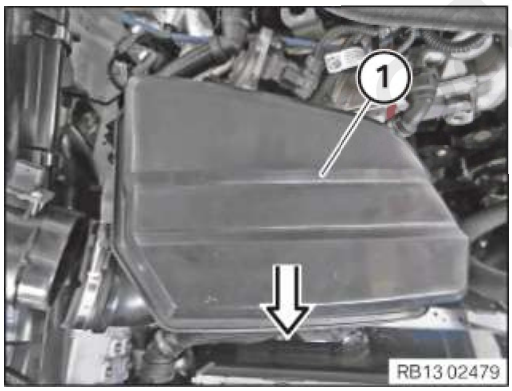
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



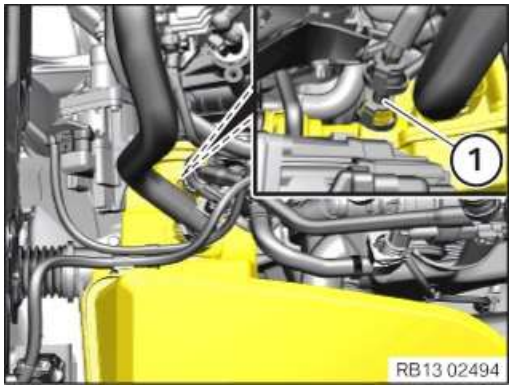
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

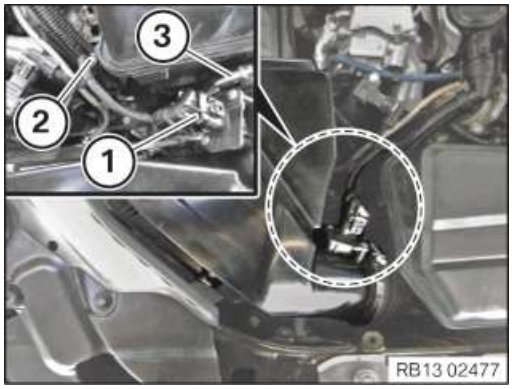
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

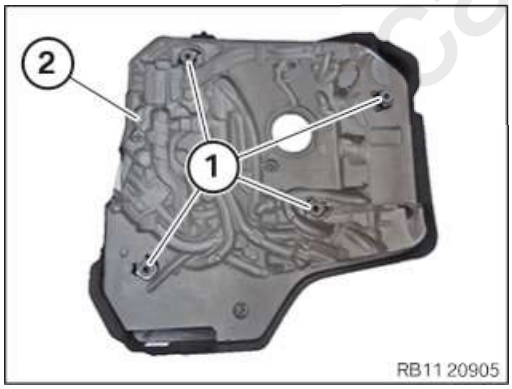
23 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

24 – Disconnecting all battery earth leads



- See additional information.

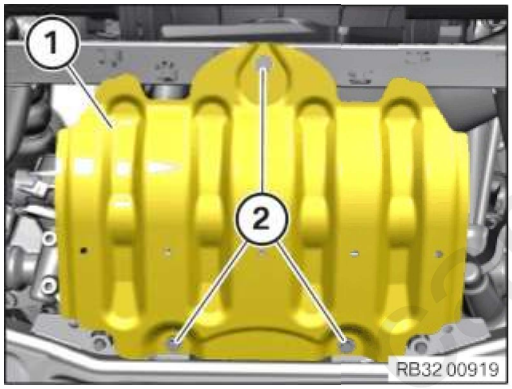
25 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

26 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



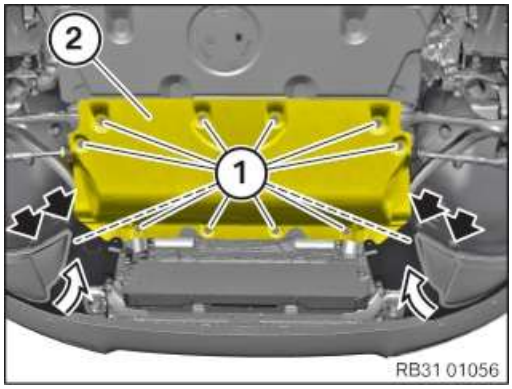
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

27 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

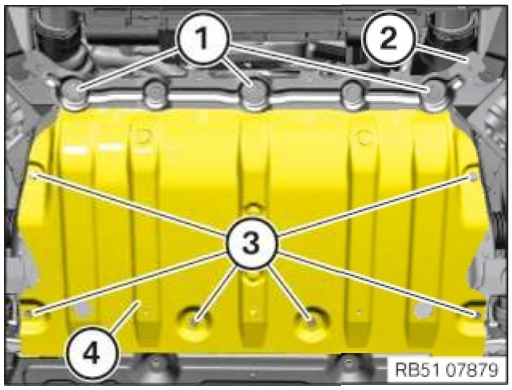
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

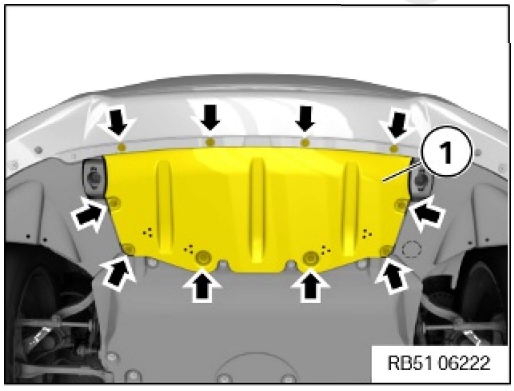
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

28 – Installing the front underbody protection



- **Version 1:**

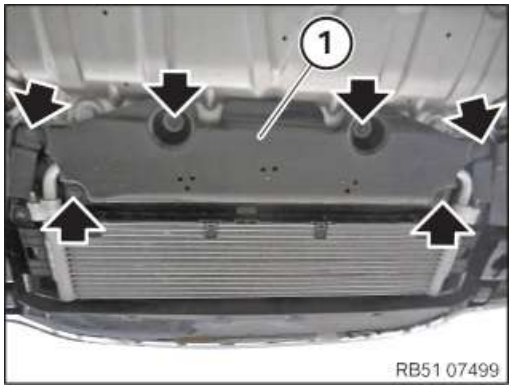
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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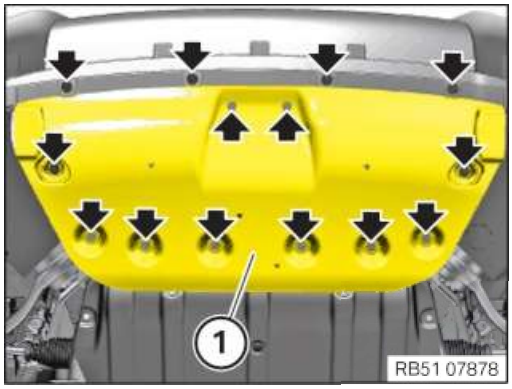
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

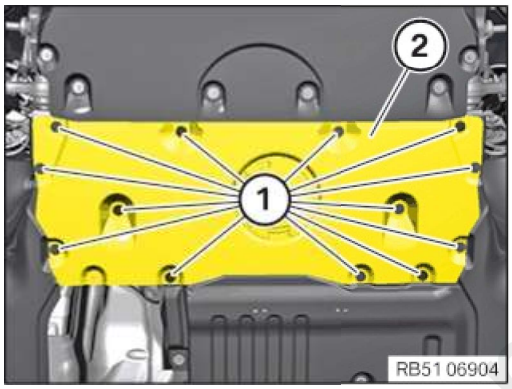
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

29 – Installing the centre underbody protection



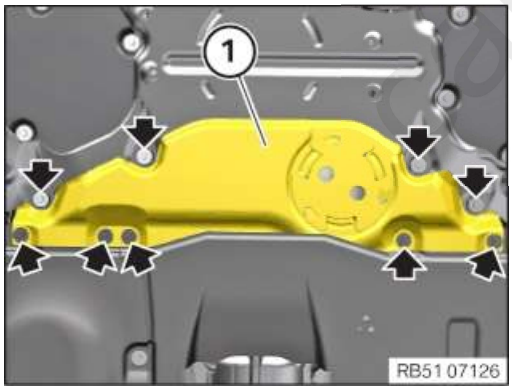
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

  Guide in and install the centre of underbody protection (1).

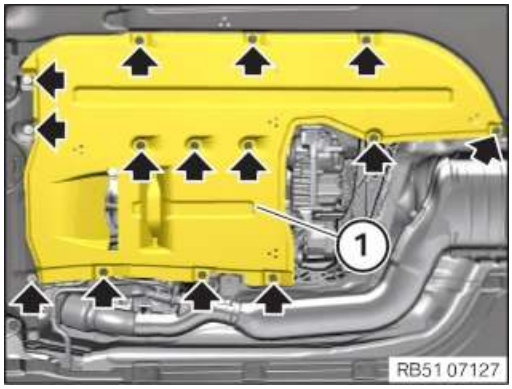
  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

30 – Installing underbody protection at rear

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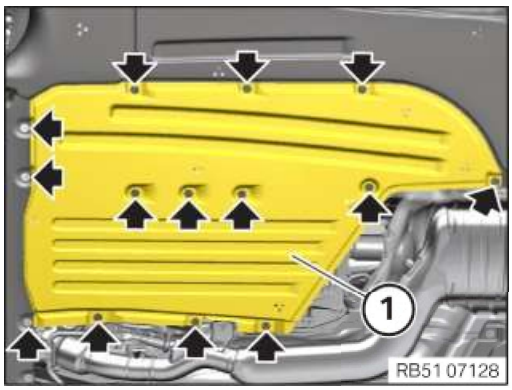
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

Additional Information

Overview of Tightening Torques

Vibration damper with belt pulley to crankshaft — Used in step 16

M10x65	Renew screws. Tighten screws crosswise.	1. Jointing torque	40 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

Starter motor to engine — Used in step 17

M8X60		Tightening torque	19 Nm

Battery positive lead to starter — Used in step 17

M8		Tightening torque	13,5 Nm

Electric coolant pump to holder — Used in step 19

M6		Tightening torque	8 Nm

Charge air line to throttle body — Used in step 21

M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 22

Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 26

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 27

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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Wheel arch cover (screws) Used in step 27

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support Used in step 27

M10		Tightening torque	56 Nm

Underbody protection front Used in step 28

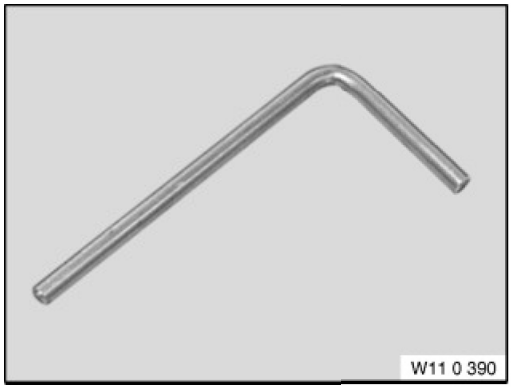
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection Used in step 2930

Hexagon screw		Tightening torque	3 Nm

Overview of Special Tools

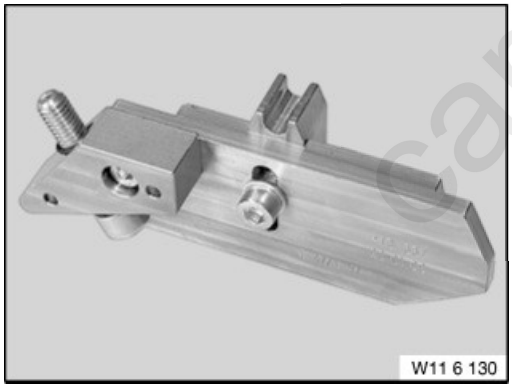
0 496 268 (11 0 390) Pin



Common Used in step 718

Usage	(roll pin) For securing new tensioning pulley (poly-V belt)
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 15 07 (390)

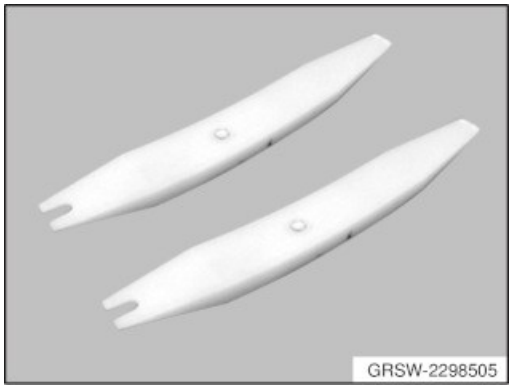
0 496 595 (11 6 130) Holder



Common Used in step 1416

Usage	(counter support) For securing flywheel when releasing and tightening down screw connection of vibration absorber. Series: E90, E91, E92 with 4WD.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 05 09 (519)

2 298 505 Wedge

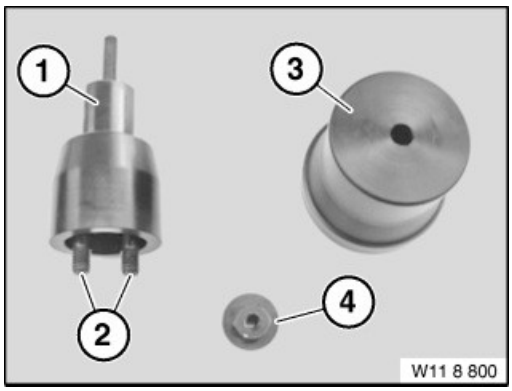


Common Used in step 15

Usage	Set (delivery of 2 pieces)
Included in the tool or work	
Storage location	C34
Replaced by	
In connection with	
SI-Number	01 03 12 (792)

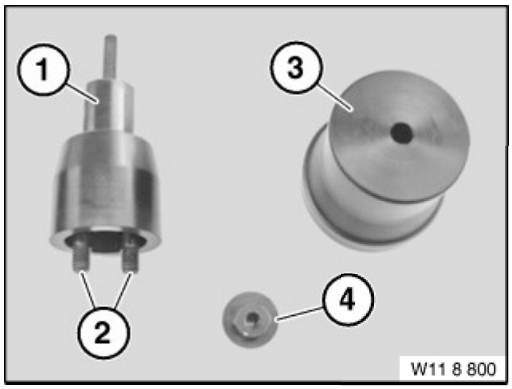
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0 496 130 (11 8 803) Holding sleeve



Common	Used in step 15
Usage	(Thrust piece) sale of existing inventory and then available as part of complete tool set 11 8 800 = 83 30 0 496 127 only - as of 30.11.2011
Included in the tool or work	0 496 127
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 496 128 (11 8 801) Basic body

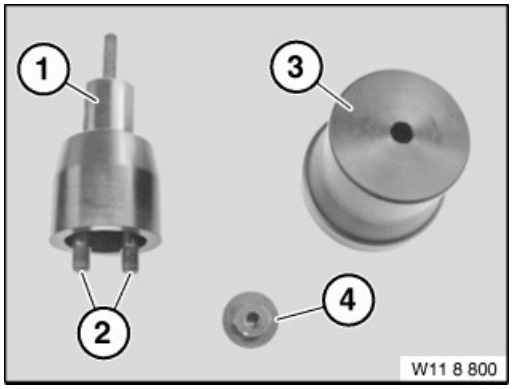


Common	Used in step 15
Usage	Available only as a complete tool set 11 8 800 = 83 30 0 496 127 - as of 30.11.2011
Included in the tool or work	0 496 127
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 496 127 (11 8 800) Device

Used in step 15

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Common

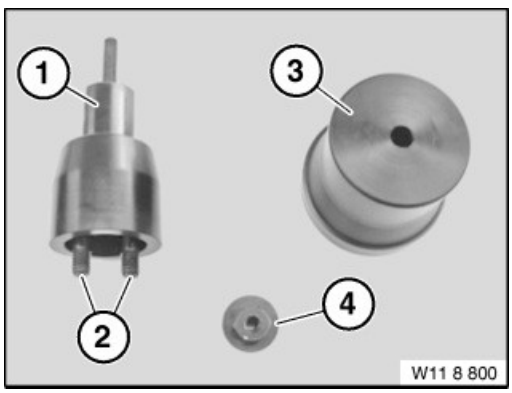
Usage	(Pulling device) For installing front radial shaft seal.
Included in the tool or work	
Storage location	B23
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
3	0 496 130 (11 8 803)		**Holding sleeve** (Thrust piece) sale of existing inventory and then available as part of complete tool set 11 8 800 = 83 30 0 496 127 only - as of 30.11.2011	
1	0 496 128 (11 8 801)		**Basic body** Available only as a complete tool set 11 8 800 = 83 30 0 496 127 - as of 30.11.2011	
2	0 496 129 (11 8 802)		**Screw** (Set of screws) Can only be ordered as part of complete tool 11 9 660 = 0495955	
4	0 496 131 (11 8 804)		**Nut** (Nut with collar) available as part of set of tools 11 8 800 = 83 30 0 496 127 only - as of 30.11.2011	

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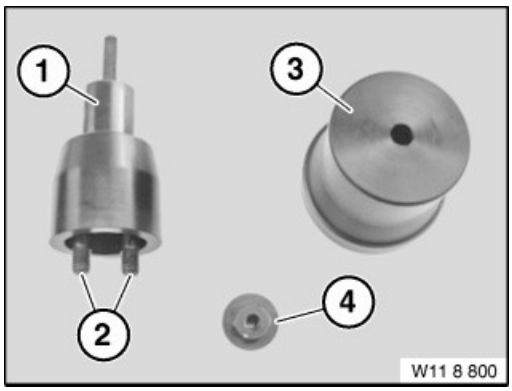
0 496 129 (11 8 802) Screw



Common Used in step 15

Usage	(Set of screws) Can only be ordered as part of complete tool 11 9 660 = 0495955
Included in the tool or work	0 496 127
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 496 131 (11 8 804) Nut



Common	Used in step 15
Usage	(Nut with collar) available as part of set of tools 11 8 800 = 83 30 0 496 127 only - as of 30.11.2011
Included in the tool or work	0 496 127
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

2 466 729 Fitting aid



Common	Used in step 16
Usage	For the installation of the vibration damper. Engine: B48, B58. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	
SI-Number	01 07 18 (545)

Overview Technical Data

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	124
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	124
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
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61 20 900 Disconnecting and connecting battery earth lead 124
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61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads) 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 35 ... Notes on ESD protection (Electro Static Discharge) 6

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11 14 151 Replacing the crankshaft seal

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Removing the clean air pipe with the resonator

WARNING

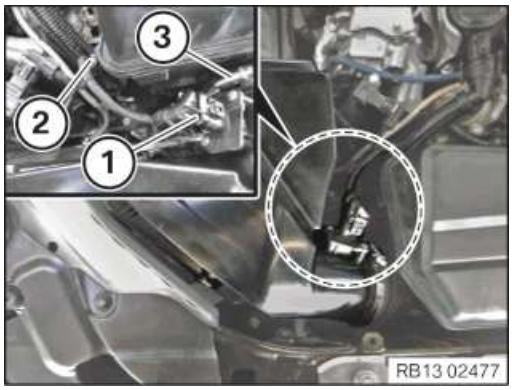
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

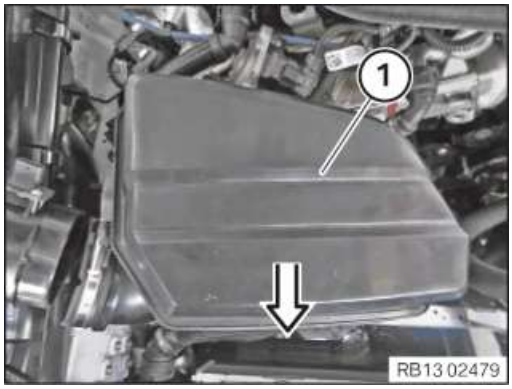


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

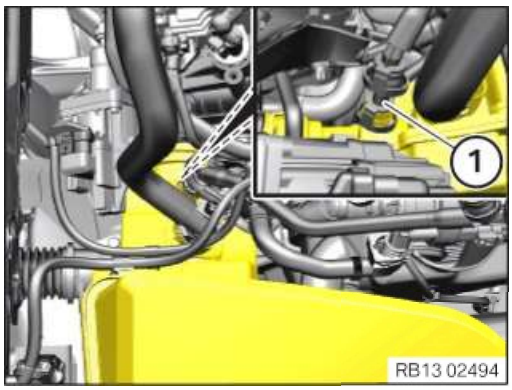


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

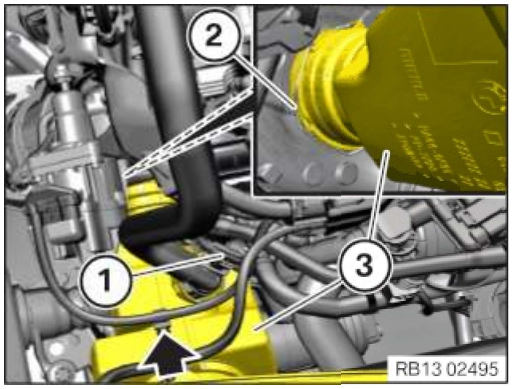
bmwdiagn.com



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

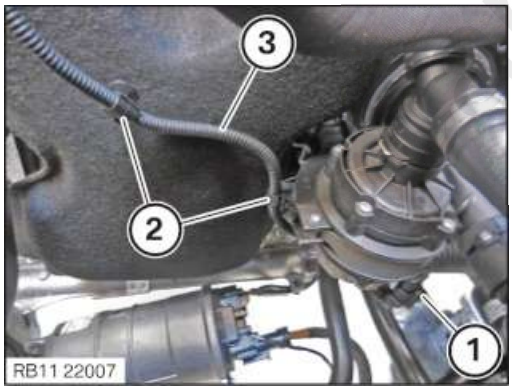


- Unlock and disconnect the tank ventilation line (1).

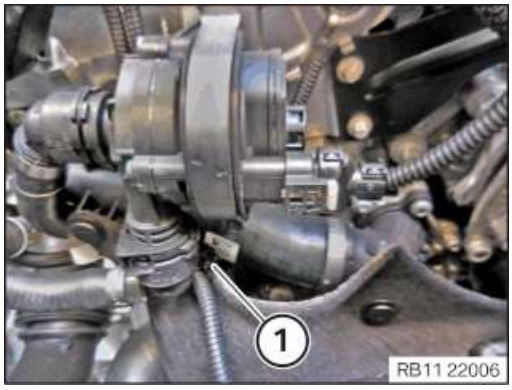


- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

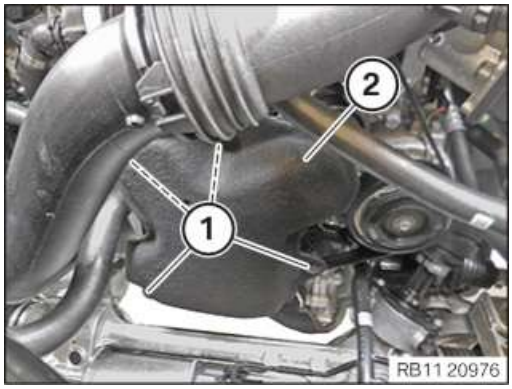
4 – Removing the acoustic cover for the engine at the front



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

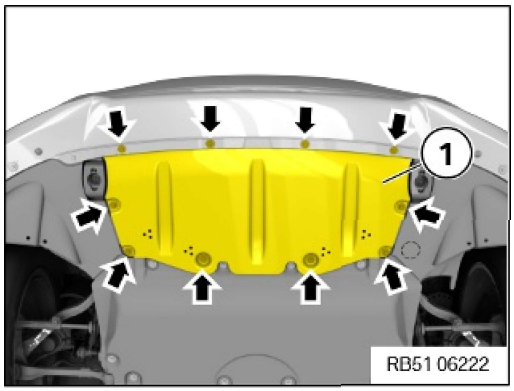


- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

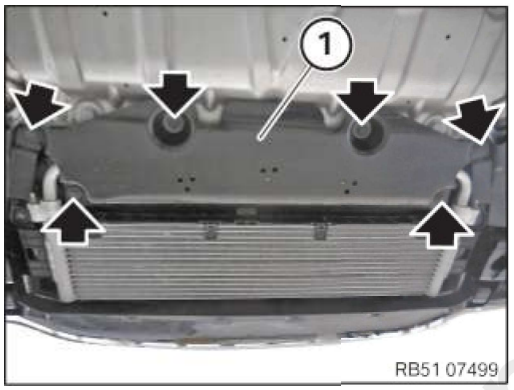
5 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

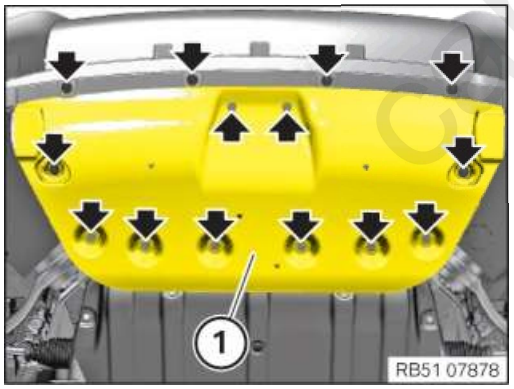
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

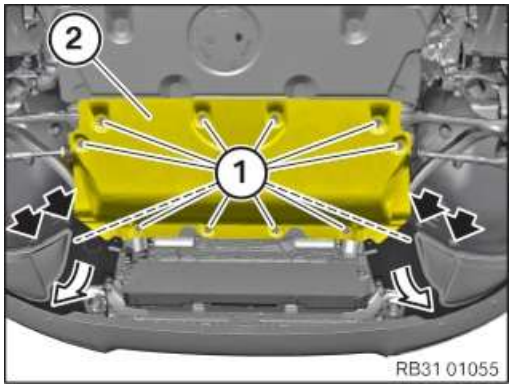


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

6 – Remove the underbody protection of the steering gear



- **Version 1:**

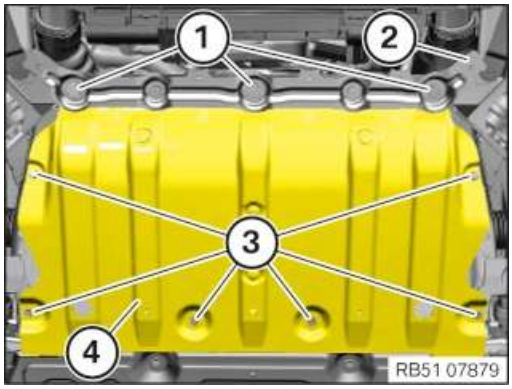
  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).

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- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

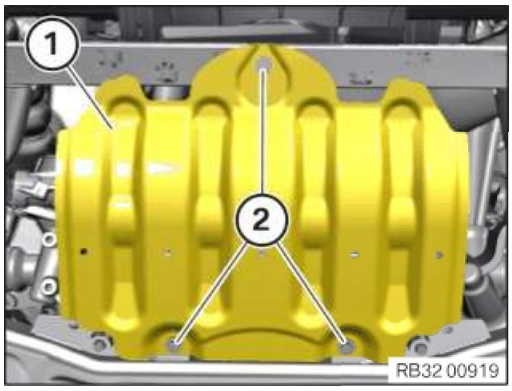
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

7 – If installed: Removing the steering start protection

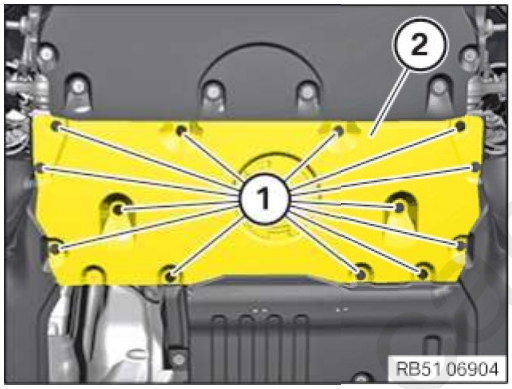
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

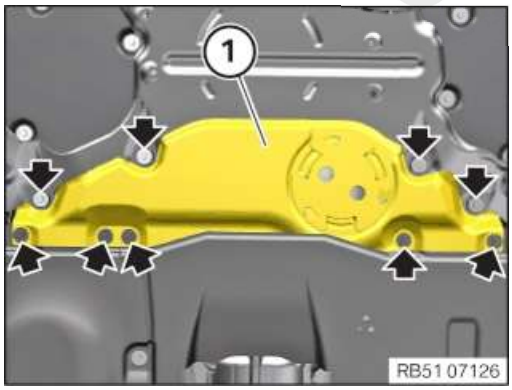
8 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



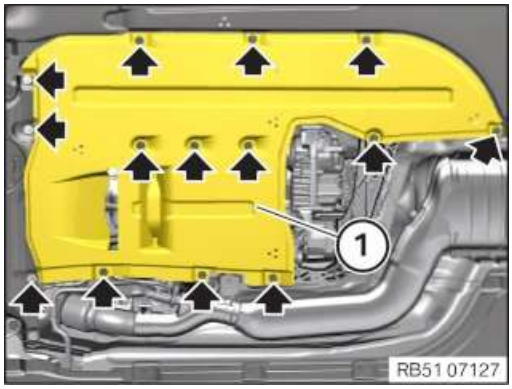
- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

9 – Remove rear underbody protection

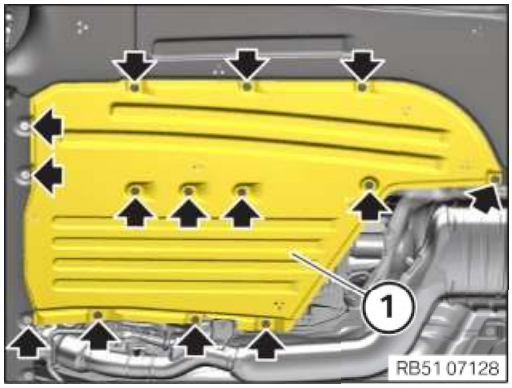
autodiagn.com



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

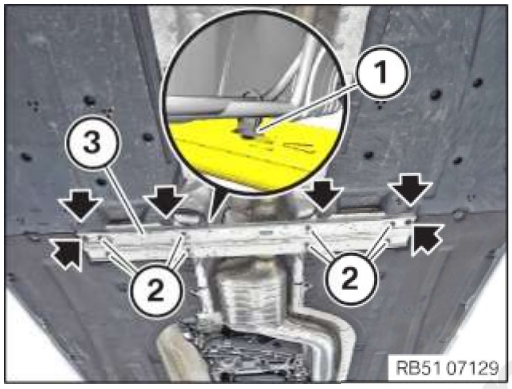


- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

10 – Remove the connecting support from the tunnel



- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

11 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

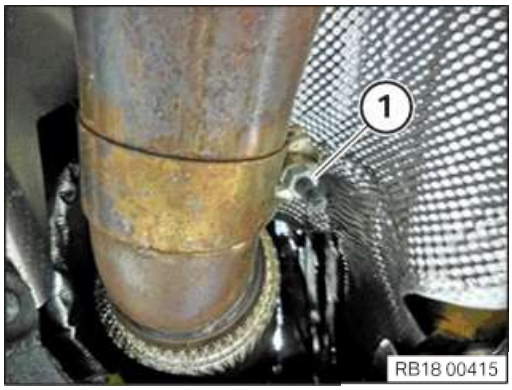
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CAUTION

Heavy component.

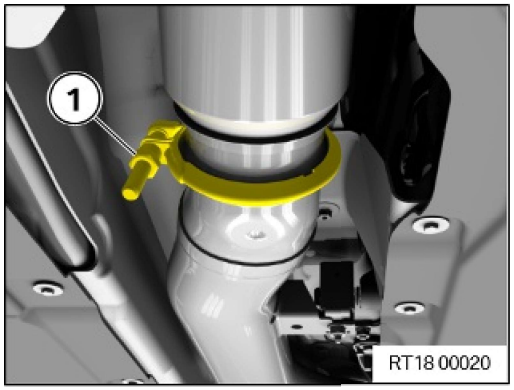
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



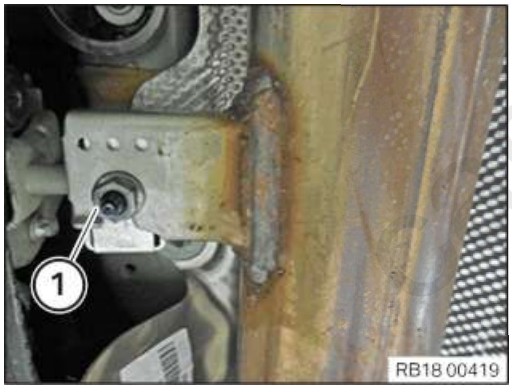
- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).

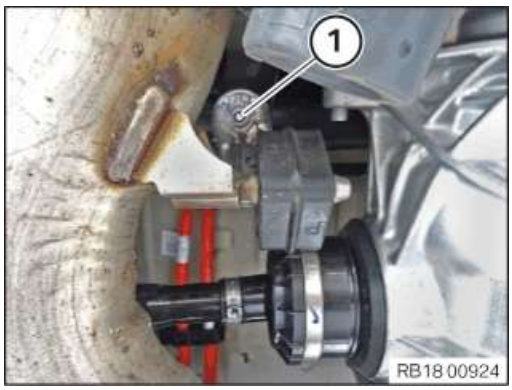


- **Equipment specification 2 (V-clips)**

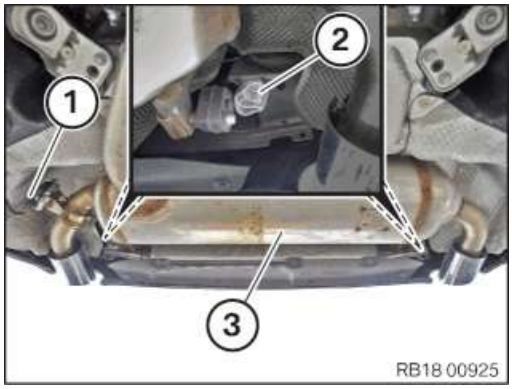
  Unfasten clamp (1).



- Loosen nut (1).



- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

12 – Removing starter motor

Prerequisite

Battery earth leads are disconnected.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

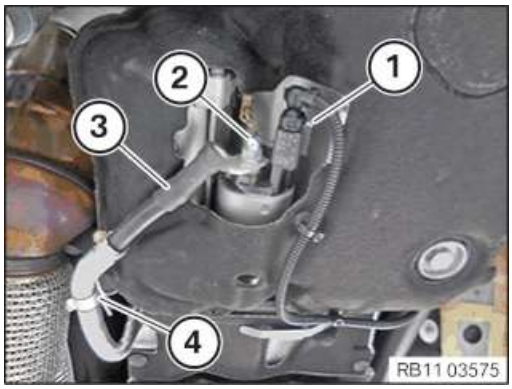
Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

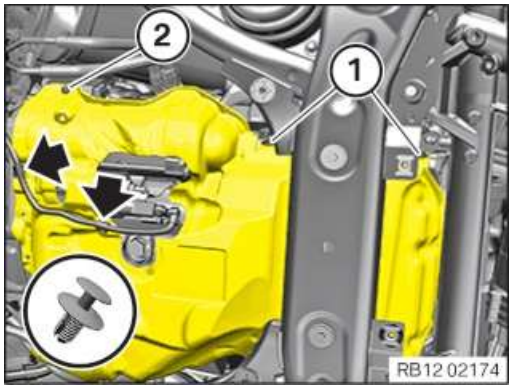
TECHNICAL INFORMATION

Make sure that the acoustic cover is **not** damaged while removing the starter motor.
A damaged lower acoustic cover can only be renewed when the front axle is lowered.

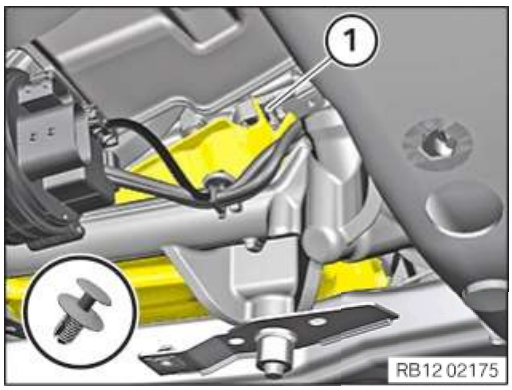


- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Release positive battery cable (3) from holder (4).

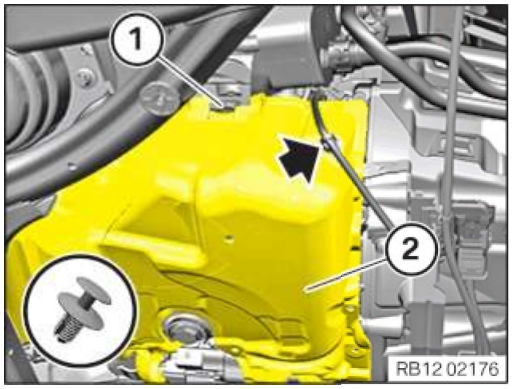
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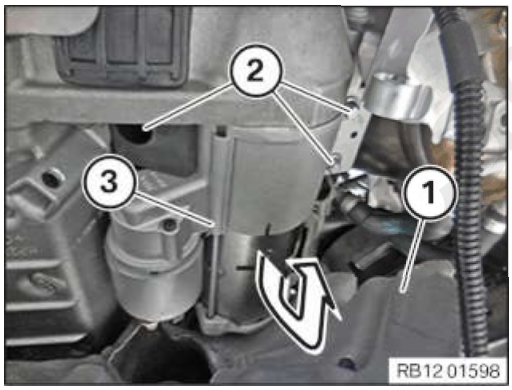
- Loosen the expanding rivet (1).
- Undo fir tree clip (2).
- Release the clamps (arrows).



- Loosen expanding rivet (1).
- Lower the acoustic cover of the oil sump.

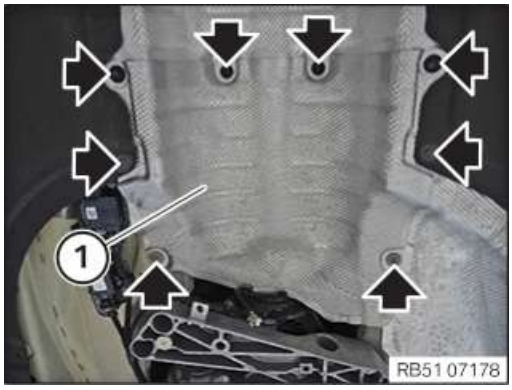


- Loosen expanding rivet (1).
- Loosen the clamp (arrow).
- Lower acoustic cover (2).



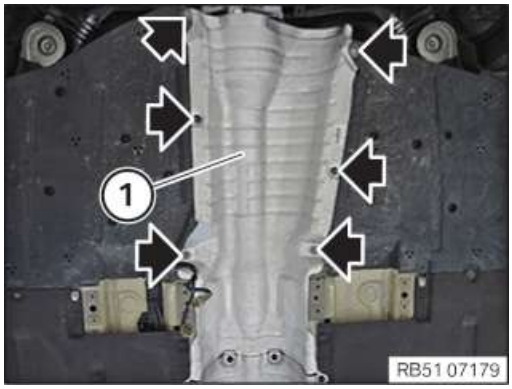
- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Loosen screws (2).
- Carefully guide out the starter motor (3) in direction of arrow and remove.

13 – Remove heat shields



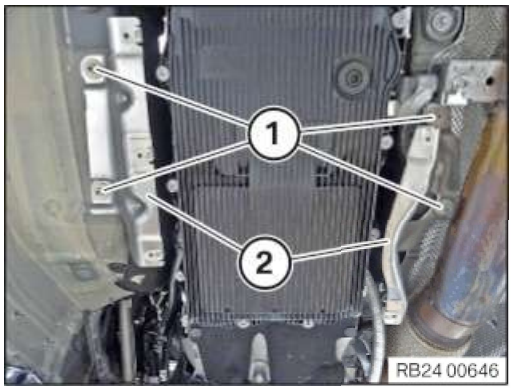
- Loosen bolts and nuts (arrows).
- Remove heat shield (1).

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- Loosen bolts and nuts (arrows).
- Remove heat shield (1).

14 – Remove the retaining plates



- Loosen nuts (1).
- Feed out retaining plates (2) and remove.

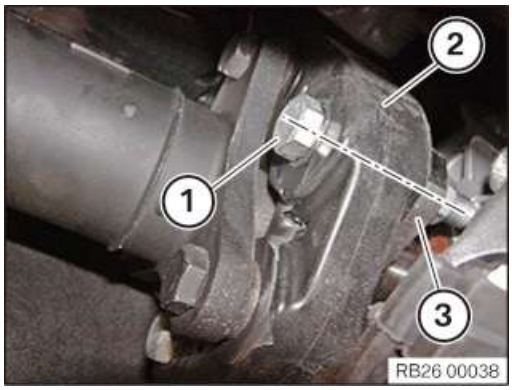
15 – Partially release propeller shaft

RISK OF DAMAGE

Damage to propeller shaft during removal.

Non-observance of the removal guidelines for the propeller shaft on the rear axle differential may cause severe damage.

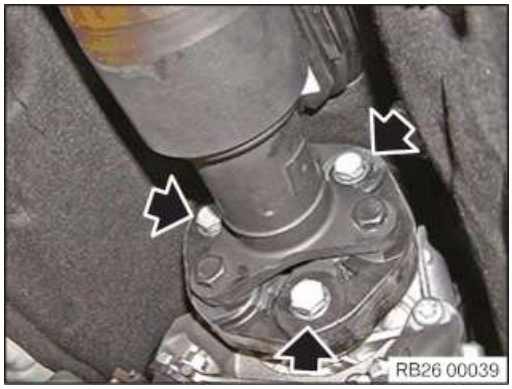
- Do not disassemble the three-hole flange, flexible disc and propeller shaft. The three-hole flange to the rear axle differential is balanced with the flexible disc and propeller shaft.
- Loosen the recessed nut against the direction of travel in clockwise direction. The propeller shaft must be loosened on the recessed nut only and exclusively in the direction of rotation otherwise the anti-twist lock of the bi-hexagonal flange nut is damaged.
- In the event of a damaged anti-twist lock on the bi-hexagonal flange nut: Replace the rear axle differential.



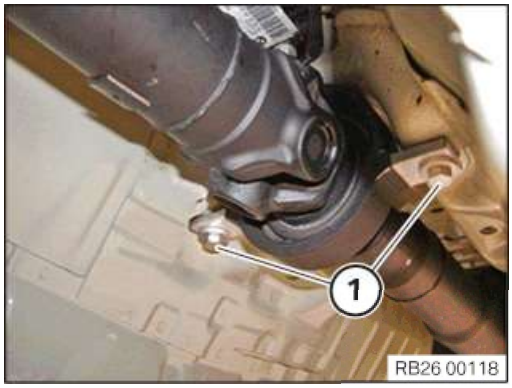
- Mark the installation position of the screw connection (1) of the flexible disc (2) and the three-hole flange (3).

  The mark makes it possible for the propeller shaft to be installed again in the same position. This should prevent a humming noise from the drive train during driving.

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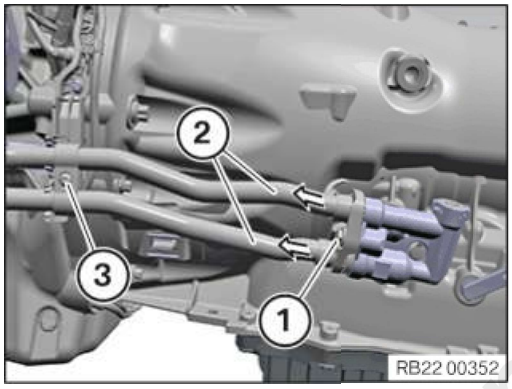
- Remove screws (arrows).



- Unscrew the bolts (1) on the centre mount and hold down the propeller shaft.

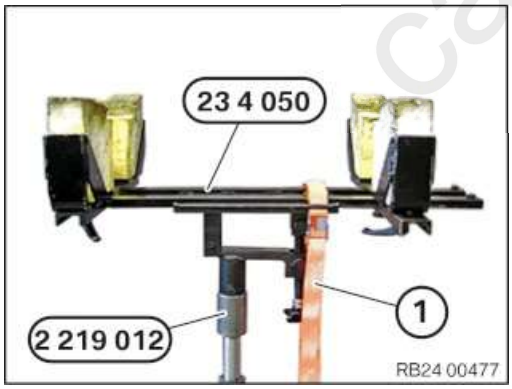
  Major deflection angles of the propeller shaft may damage the propeller shaft and/or the joints.
- Tie up propeller shaft to underbody.

16 – Disconnect hydraulic lines on the transmission

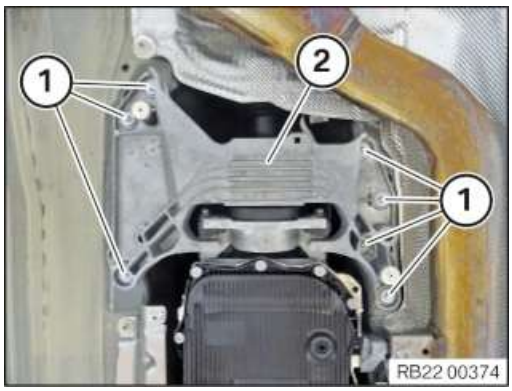


- Loosen screw (1).
- Loosen screw (3).
- Disconnect hydraulic lines (2) to transmission oil cooler.

17 – Detach transmission cross member



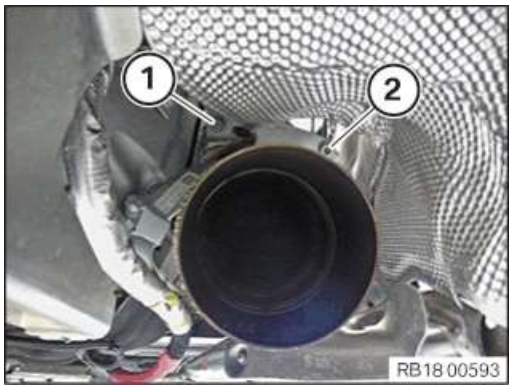
- Support the transmission using special tools 0 495 498 (23 4 050) and 2 219 012.
- Secure the transmission with the tensioning strap (1).



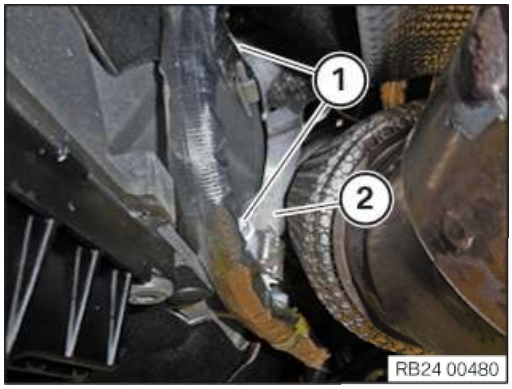
- Loosen screws (1).
- Release transmission cross member (2).

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18 – Remove exhaust system holder



- Loosen screw (1).
- Loosen nut (2).



- Loosen screws (1).
- Remove the exhaust bracket (2).

19 – Remove automatic transmission (GA8HP51Z)

CAUTION

Materials harmful to health.

Contact with fluids harmful to health!

- Note and follow safety information on containers.
- Conduct all work in appropriate personal protective equipment only.

RISK OF DAMAGE

Damage to the engine block.

Damaged and corroded bolts will lead to major damage in the engine block and the transmission.

- It is imperative that protruding threads of the transmission bolts are checked for corrosion and damage prior to removal.
- It is imperative that all rust is removed from corroded threads and that they are cleaned prior to removal.
- Renew rusted and damaged bolts.

RISK OF DAMAGE

Damage of components in the engine compartment.

When removing the transmission, tilting of the engine may damage components in the engine compartment.

- Before removing the transmission: Support engine.
- Secure the engine against tilt movements.
- Follow the specifications of the repair instructions.

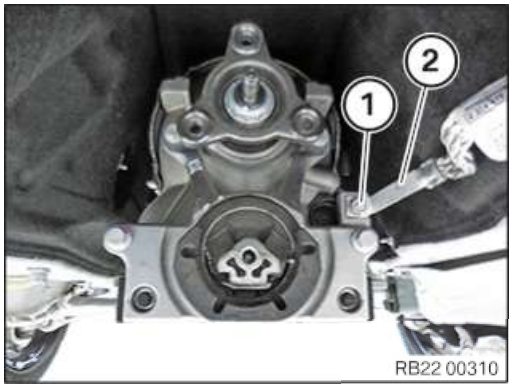
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RISK OF DAMAGE

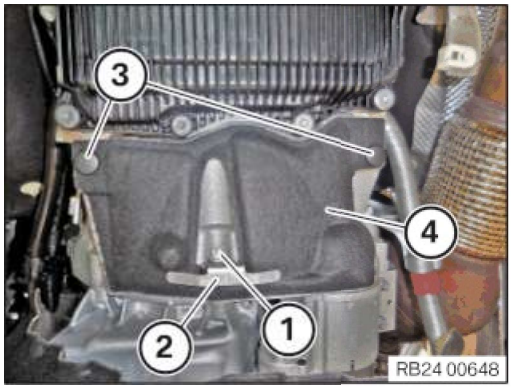
Damage to the transmission.

Damage to the transmission through unapproved transmission oil.

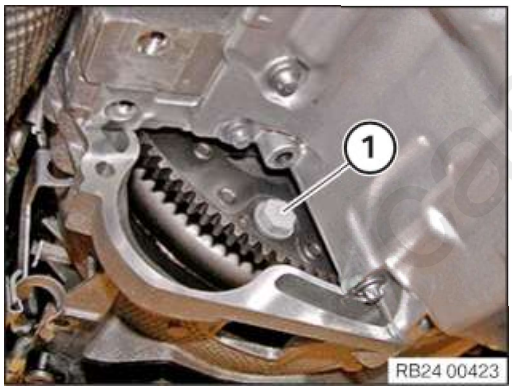
- Use only the approved transmission oil.
- After completion of repair work, check transmission oil level.



- Unscrew the bolt (1) and disconnect the ground strap (2).



- Loosen the screw (1) and remove the holder (2).
- Pull the expanding rivet (3) off.
- Remove the acoustic cover (4).



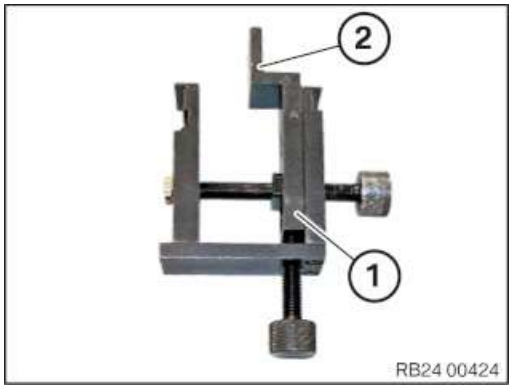
TECHNICAL INFORMATION

Only G05 and G07

In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

- Turn the engine on the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of rotation until the bolt (1) becomes visible in the recess.
- Undo all 6 screws (1) on the torque converter.

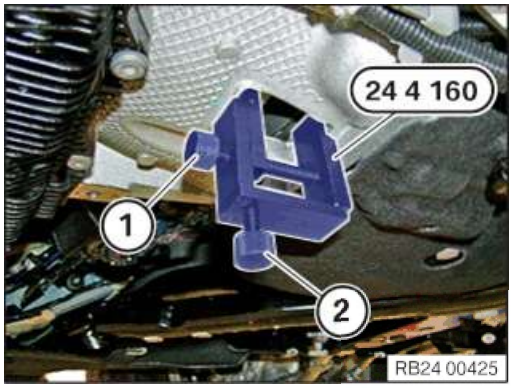


- Prepare special tool 0 494 478 (24 4 161) (1) with the shaped element 0 496 061 (24 4 166) (2) as shown.

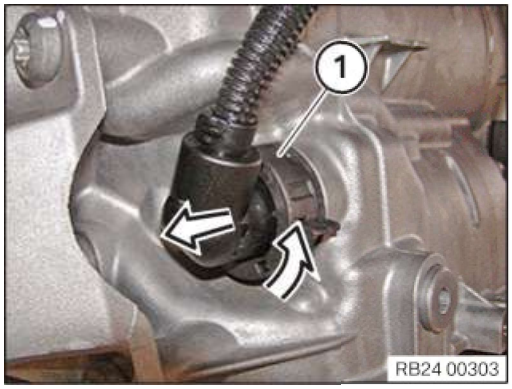
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- Remove the sealing cap (1).



- Insert special tool 0 494 451 (24 4 160) into the recess of the transmission housing and apply slight tension using the screw (1).
- Screw the bolt (2) in to the stop.
- Tighten down screw (1).

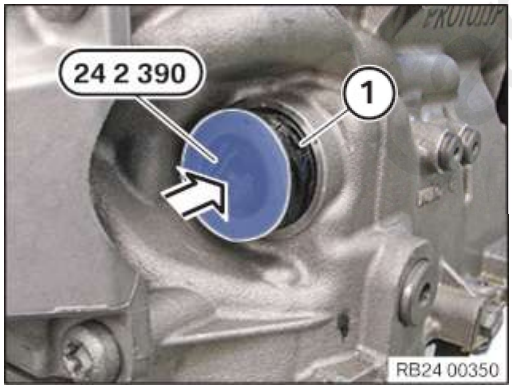


TECHNICAL INFORMATION

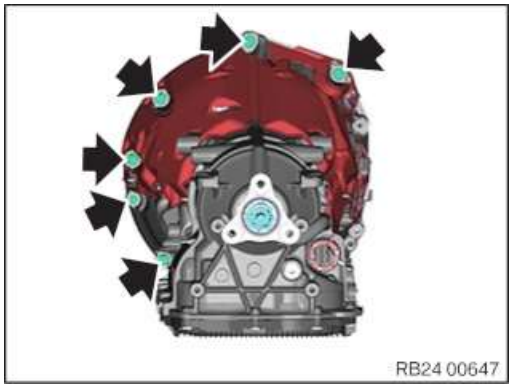
Notes on mechatronics are a fundamental requirement for these repair instructions and must be complied with at all times.

For additional information see: 24 34 ... Notes on mechatronics (GA8HP50Z/GA8HP51Z/GA8HP75Z/GA8HP76Z/GA8HP95Z)

- Unlock connector (1) by turning and pull off.
- Do not touch pins.
- Loosen all cable clips.

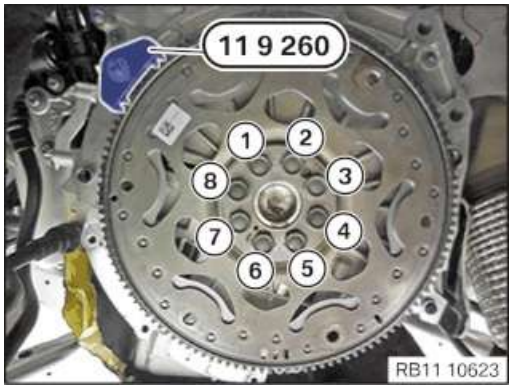


- Insert the special tool 0 494 213 (24 2 390) in the sealing sleeve (1) in direction of arrow.



- Support engine.
- Release remaining screws.
- Remove transmission.

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- Fasten the flywheel with the special tool 0 493 938 (11 9 260) and tighten with the special tool 0 494 130 (11 9 264).
- Loosen screws (1-8).

MAIN WORK

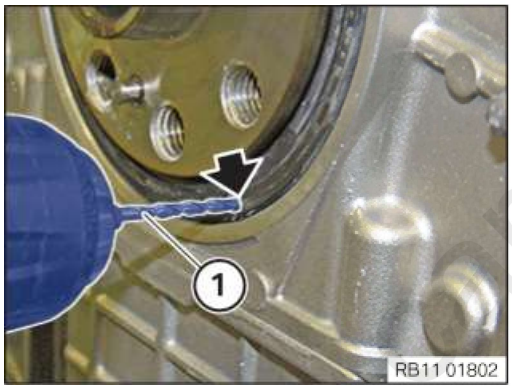
21 – Renewing the crankshaft sealing ring

▸ **Removing the rear crankshaft seal**



- Remove the magnet wheel (1).
- Protect the magnet wheel from swarf with a plastic bag.

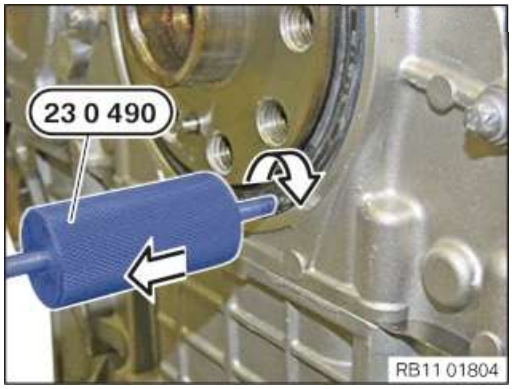
  The magnet wheel is magnetic.



- Drill a hole at the crankshaft seal.

Note: Use the drill (1) with a maximum diameter of 2.5 mm.

- Remove the swarf immediately with the vacuum cleaner. Do not remove swarf with compressed air!



- Screw in special tool 0 491 454 (23 0 490) in direction of arrow.
- Drive out crankshaft seal with impact weight in direction of arrow.

▸ **Installing the rear crankshaft seal**

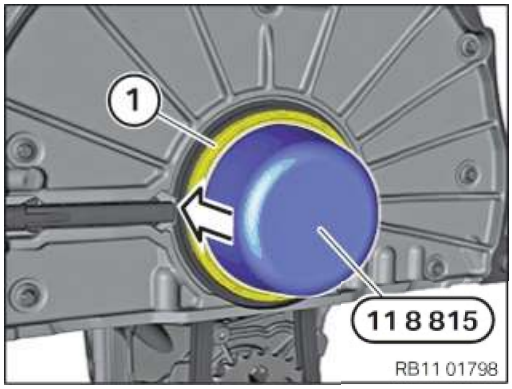
carmanualsdiagn.com

RISK OF DAMAGE

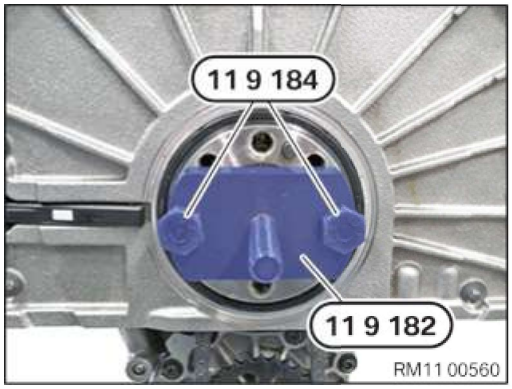
Radial shaft seal damage.

Touching the sealing lip (inner) and applying oil to the radial shaft seal will lead to its destruction.

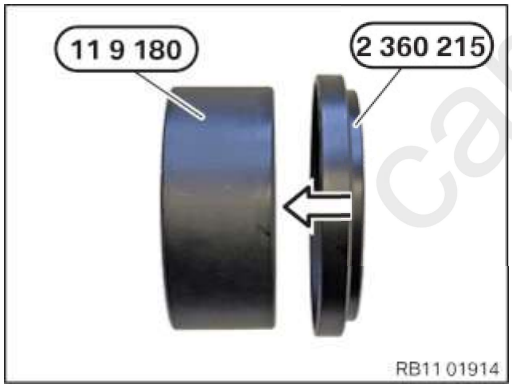
- Do not touch the sealing lip (inner) of the radial shaft seal.
- Do not apply oil to the radial shaft seal.
- Install the radial shaft seal dry.



- Preassemble special tool 0 496 137 (11 8 815) on crankshaft.
- Carefully slide the crankshaft seal (1) straight off the special tool 0 496 137 (11 8 815) using a rotational movement until the crankshaft seal is positioned flush with the timing case cover.



- Secure special tool 0 494 029 (11 9 182) to the crankshaft using special tool 0 494 031 (11 9 184).

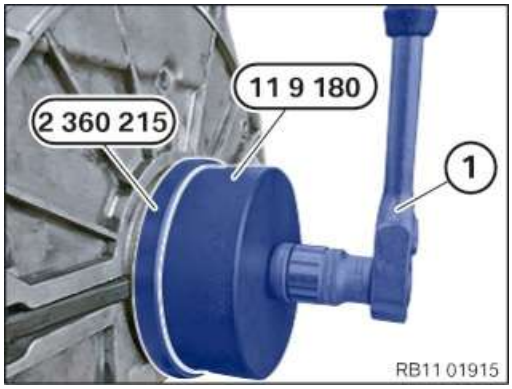


- Connect special tool 2 360 215 onto special tool 0 493 881 (11 9 180).



- Draw in the crankshaft seal with special tools 0 494 028 (11 9 181) and 2 360 215 in combination with the special tool 0 494 030 (11 9 183).

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- Screw in the crankshaft seal using the tool (1) up to the limit position.



- Note the installation position of the magnet wheel (1).
- Position the magnet wheel (1) on the crankshaft.

POSTPROCESSES

22 – Installing the flywheel



TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).



- Use the set of special tools 2 285 058.

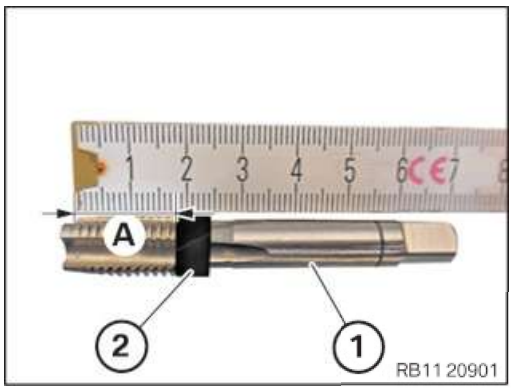
Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool

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- Assemble tool set.

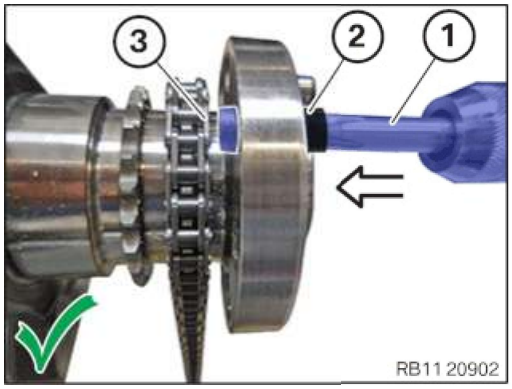
Number	Description
1	Tool holder
2	Thread cutter M12X1,5



- Mark the screw-in depth (A) on thread cutter (1) from the set of special tools 2 285 058 with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm



NOTICE

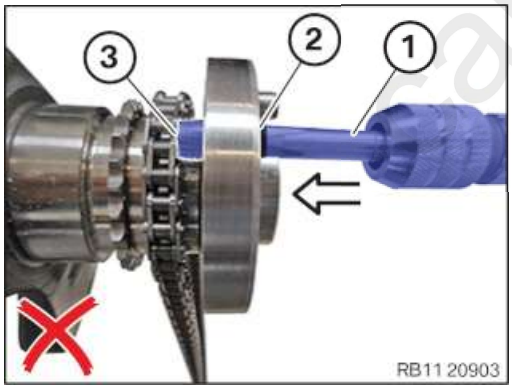
To provide a better overview: Shown with engine removed.

- Screw in the thread cutter (1) from the set of special tools 2 285 058 in direction of arrow up to the screw-in depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).



TECHNICAL INFORMATION

- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

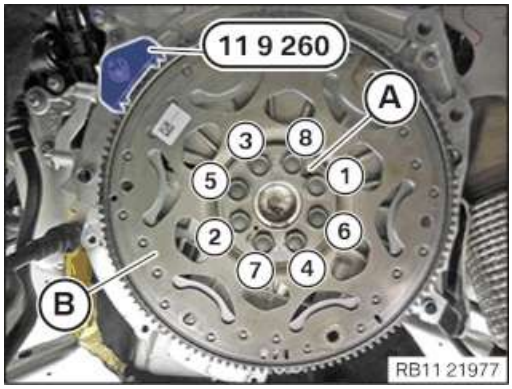
- Make sure that the screw-in depth (2) of the screw tap (1) is not exceeded.

  The thread cutter (1) may not rest on the timing chain (3).



- Make sure the magnet wheel (1) is installed correctly.

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- Renew screws (1) to (8).

  Parts: Bolts
- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool 0 494 034 (11 9 261) and screw the special tool 0 494 130 (11 9 264) tightly.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten flywheel bolts in sequence (1) to (8).

Flywheel to crankshaft

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

- Remove special tool 0 493 938 (11 9 260).

23 – Install automatic transmission (GA8HP51Z)

RISK OF DAMAGE

Damage to the transmission.

Damage to the transmission through unapproved transmission oil.

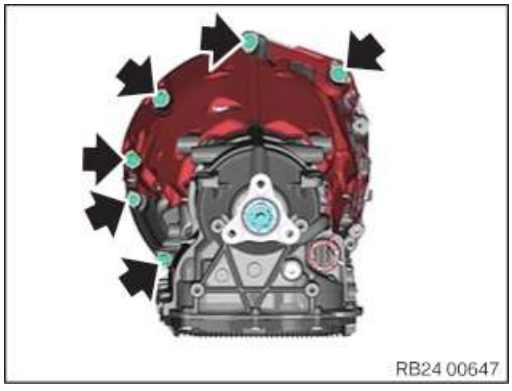
- Use only the approved transmission oil.
- After completion of repair work, check transmission oil level.

TECHNICAL INFORMATION

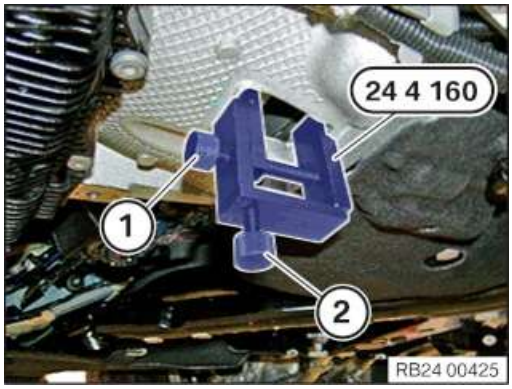
After completion of the work, program the control unit for the electronic transmission control (EGS).



- Check the fitting sleeves (1) for correct fit and damage and renew as needed.



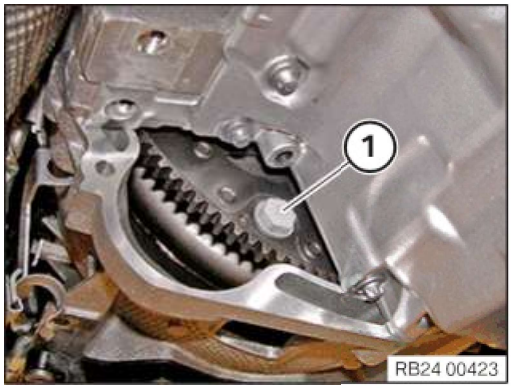
- Transmission flange-mount.
- Rotate the torque converter until the bore hole of the torque converter is flush with bore hole in drive plate.
- Fit the transmission bolts (arrows) and apply lightly.



- Release screw (1) and screw (2).
- Remove special tool 0 494 451 (24 4 160).



- Install the sealing cap (1).



TECHNICAL INFORMATION

Only G05 and G07

In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

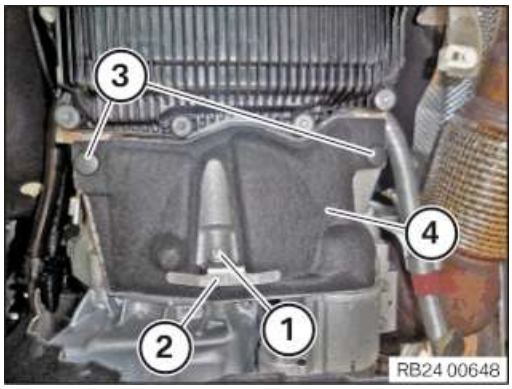
For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

- Renew screws.

  Parts: Bolts
- Crank the engine on the vibration damper in the direction of rotation using special tool 0 493 380 (11 6 480) to tighten all six screws (1).
- Tighten all 6 screws (1) of the torque converter using special tool 0 491 667 (24 1 110) .

Torque converter to flywheel

M10	Renew screws.	Tightening torque	56 Nm



- Install acoustic cover (4).
- Install expanding rivet (3).
- Install the holder (2) and tighten the screw (1).

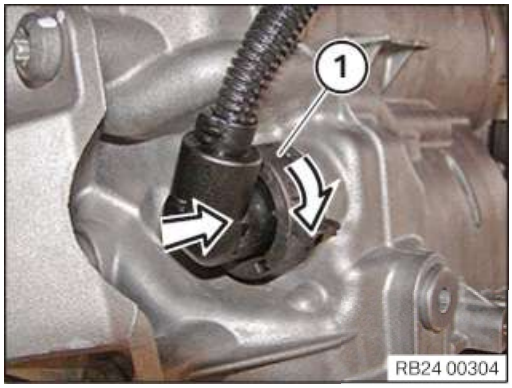
Transmission to engine

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm

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- Remove the special tool 0 494 213 (24 2 390) from the sealing sleeve in direction of arrow.

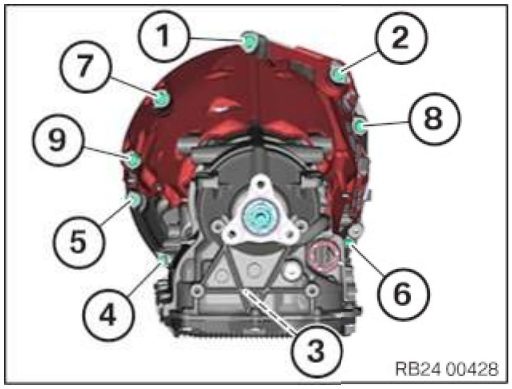


TECHNICAL INFORMATION

Notes on mechatronics are a fundamental requirement for these repair instructions and must be complied with at all times.

For additional information see: 24 34 ... Notes on mechatronics (GA8HP50Z/GA8HP51Z/GA8HP75Z/GA8HP76Z/GA8HP95Z)

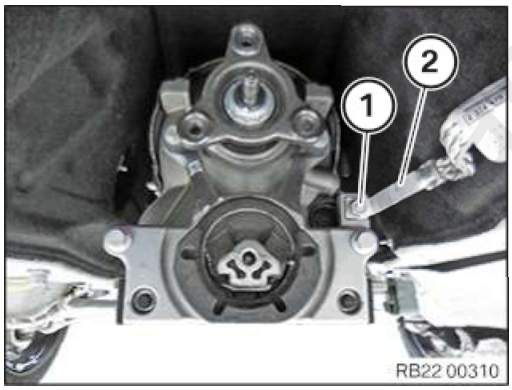
- Slide the connector (1) on and turn it to lock.



- Tighten the transmission bolts in sequence (1) to (9).

Transmission to engine

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm

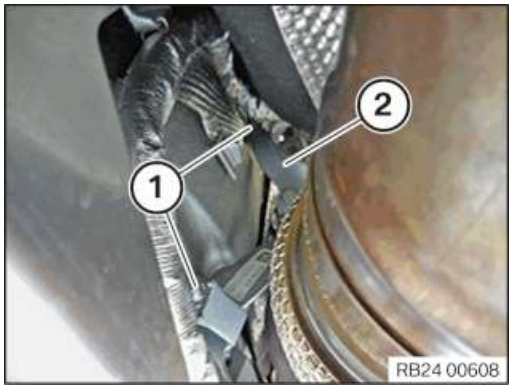


- Install the ground strap (2).
- Tighten down screw (1).

Ground strap to transmission or body

M8		Tightening torque	19 Nm

24 – Install the exhaust bracket

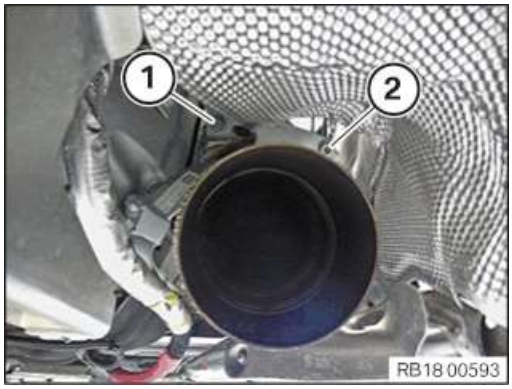


- Install the exhaust bracket (2).
- Tighten the screws (1).

Transmission to engine

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm

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- Tighten down screw (1).

Catalytic converter to holder

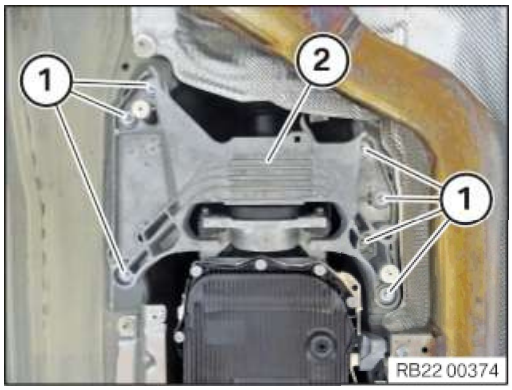
M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (1).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm

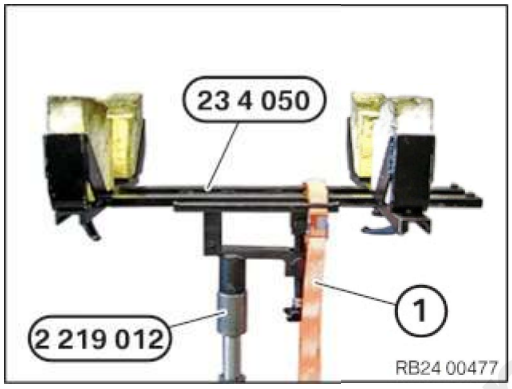
25 – Install transmission cross member.



- Install the transmission cross member (2).
- Tighten the screws (1).

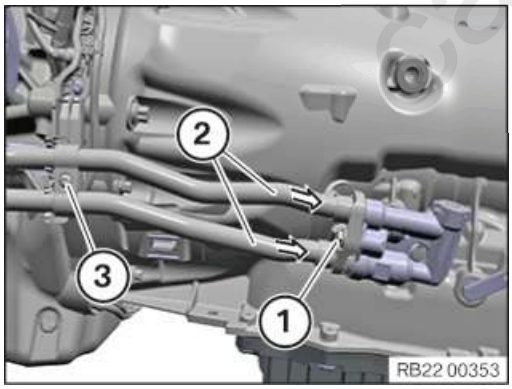
Transmission cross member to body

M8	Renew screws.	Tightening torque	19 Nm



- Loosen the tensioning strap (1) from the transmission.
- Remove the special tools 0 495 498 (23 4 050) and 2 219 012 from the transmission.

26 – Fix hydraulic lines



- Renew sealing rings.

  Parts: Sealing ring
- Install hydraulic lines (2) on transmission.
- Position and tighten the screw (1).

Transmission oil line to transmission

M6x25	Renew the sealing ring.	Tightening torque	8 Nm

- Position and tighten the screw (3).

Transmission oil line on holder

M6		Tightening torque	8 Nm

27 – Partially installing the propeller shaft

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- Check centring (1) for damage; renew if necessary.

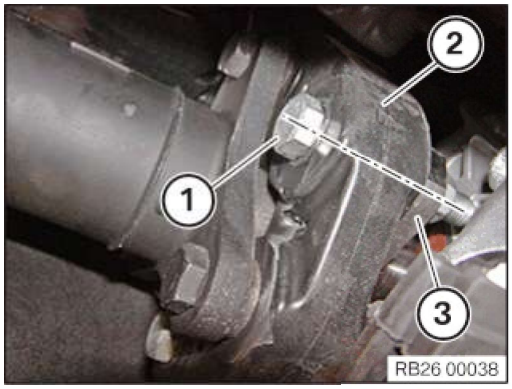


- Apply a thin coat of grease to the soft centring (1), if necessary.

  Do not grease the hard centring (2).

Expendable materials

Lubricating grease Olistamoly 2 LN 584 LO	100 g, Tube	83 19 0 447 919

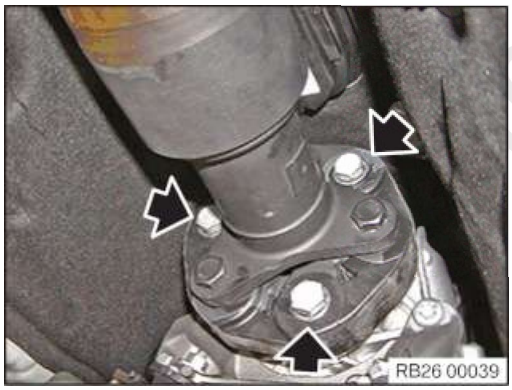


- Renew screws and the self-locking nuts.

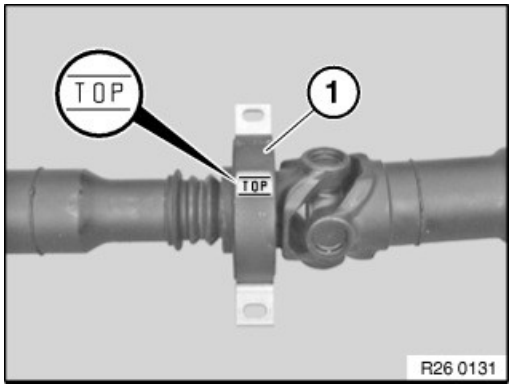
  Parts: Screws, self-locking nuts

- Assemble the screw connections (1) of the flexible disc (2) and the three-hole flange (3) according to the self-affixed identification.

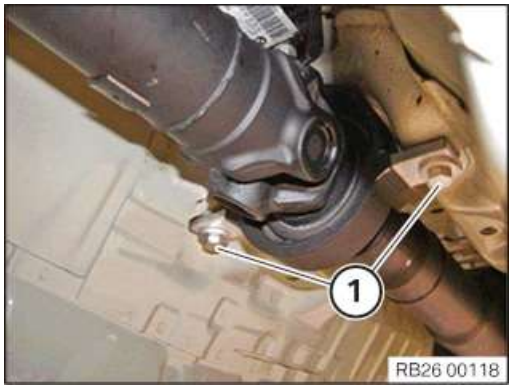
  This should prevent a humming noise from the drive train during driving.



- Hand-tighten the screws and nuts (arrows), but do not tighten fully.



- **Centre mount with TOP marking:**
- The centre mount (1) must be installed with the TOP marking at the top in the gearbox tunnel.



- Position centre mount.
- Hand-tighten the bolts (1), but do not tighten fully.



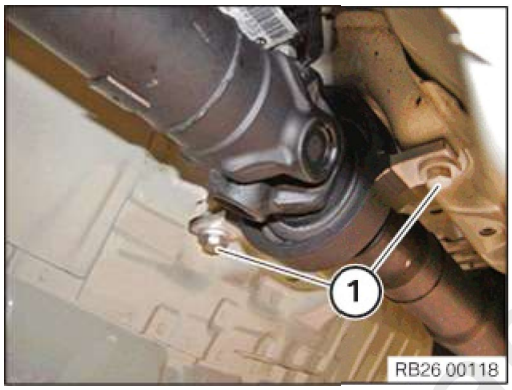
- Renew screws.

  Parts: Bolts
- Provide counter support for the bolts of the flexible disc on the nut and tighten with the bolts.

Front flexible disc to propeller shaft

M12	Renew screws. Comply with jointing torque and angle of rotation. Tightening via screw.	Jointing torque Angle of rotation	55 Nm 90 °

- Secure the special tool 0 490 504 (00 9 120) with the special tool on the vehicle underbody and continue to screw it in according to the angle of rotation.

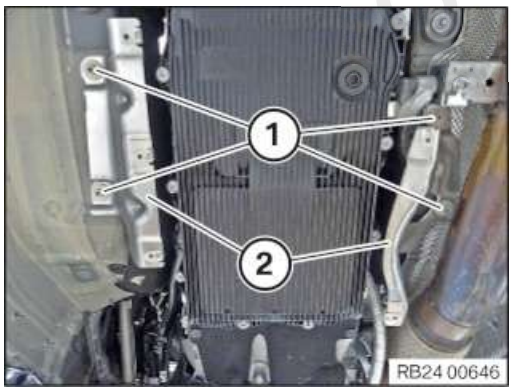


- Tighten the screws (1).

Centre mount to body

M8	Tightening torque	19 Nm

28 – Install the retaining plates



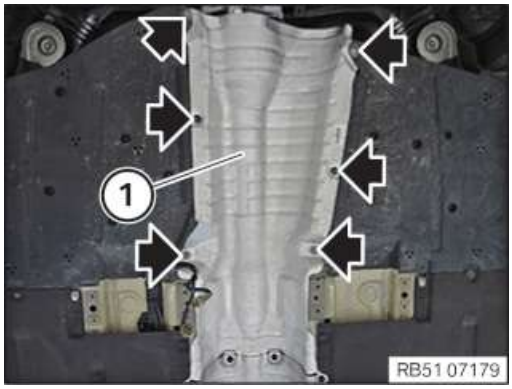
- Feed in retaining plate (2) and install.
- Tighten nuts (1).

Retaining plates for vehicle underbody cover

Sheet metal nut	Replace nuts.	Tightening torque	3 Nm

29 – Install the heat shields

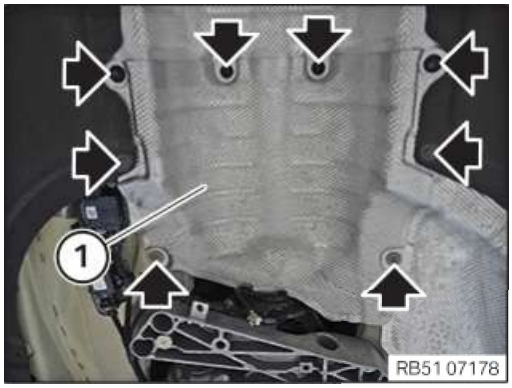
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- Install heat shield (1).
- Tighten the nuts and bolts (arrows).

Heat shield to vehicle underbody

Screws and nuts		Tightening torque	3 Nm

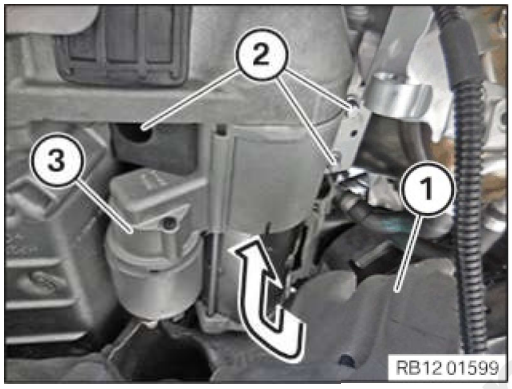


- Install heat shield (1).
- Tighten the nuts and bolts (arrows).

Heat shield to vehicle underbody

Screws and nuts		Tightening torque	3 Nm

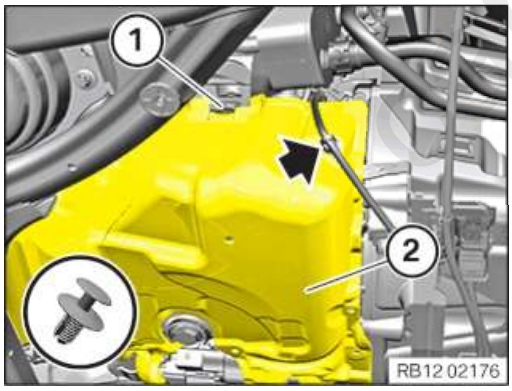
30 – Installing starter motor



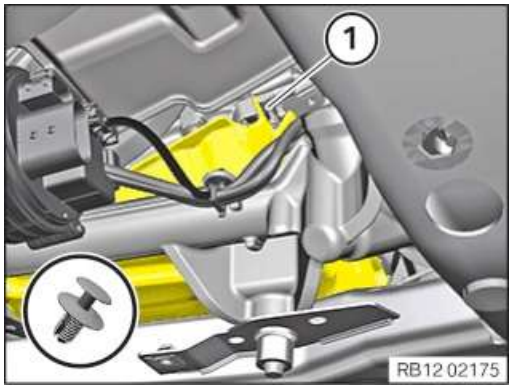
- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Feed in and install the starter motor (3) in the direction of the arrow.
- Tighten the screws (2).

Starter motor to engine

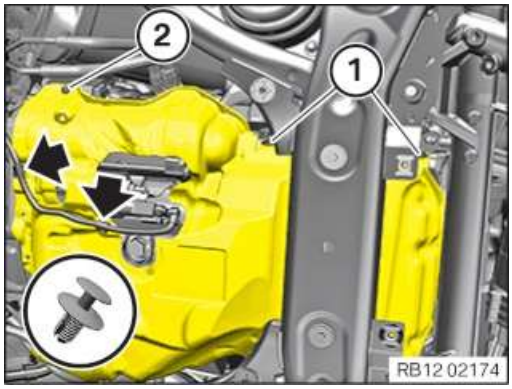
M8X60		Tightening torque	19 Nm



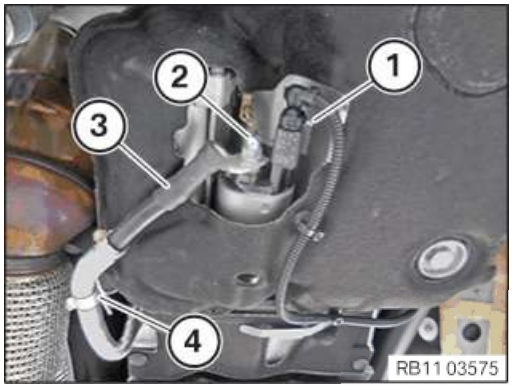
- Position the acoustic cover (2).
- Fasten expanding rivet (1).
- Secure clamp (arrow).



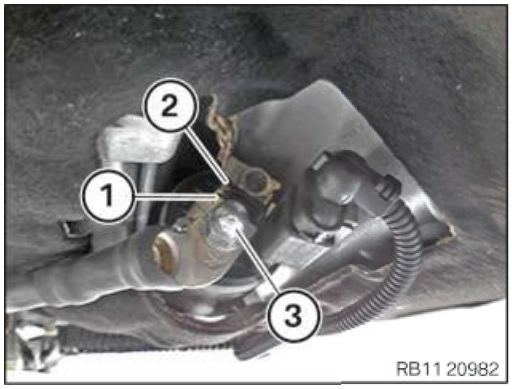
- Fasten expanding rivet (1).



- Secure fir tree clip (2).
- Secure expanding rivet (1).
- Secure the clamps (arrows).



- Secure the positive battery cable (3) in the holder (4) and position it at the starter motor.
- Tighten the nut (2) hand-tight.
- Connect the connector (1) and audibly lock it.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

31 – Installing the complete exhaust system

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

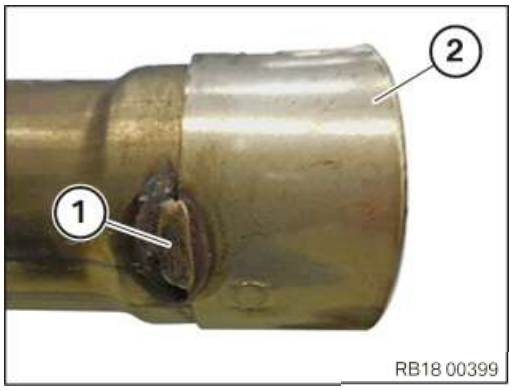
cardiagn.com

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



CAUTION

Swarf resulting from sawing or grinding components.

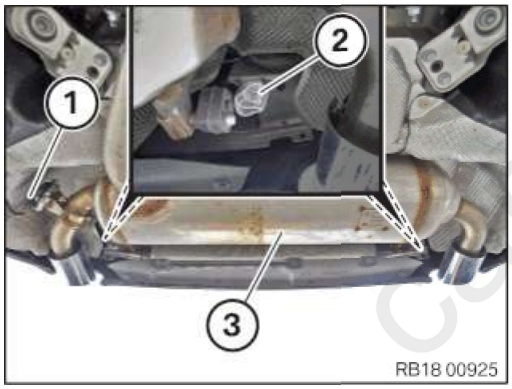
Danger of injury!

- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp



- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

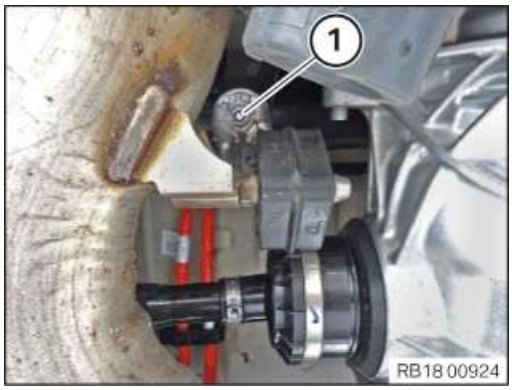
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm

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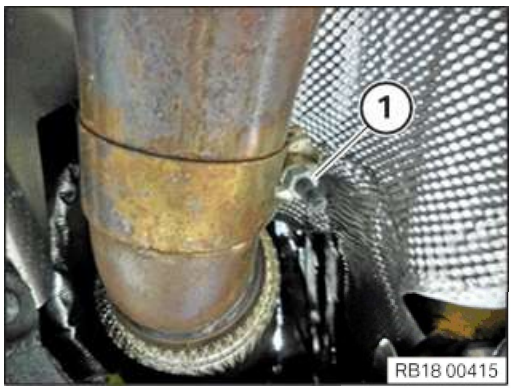
- Renew nut (1).

  Parts: Nut

- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

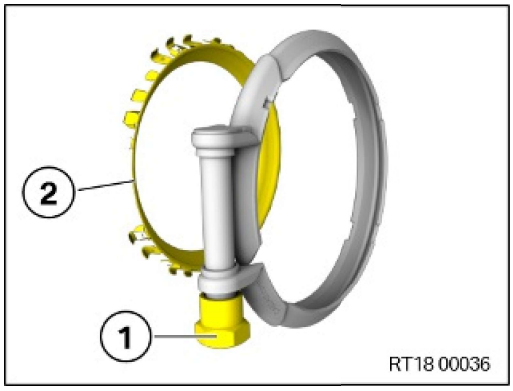
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

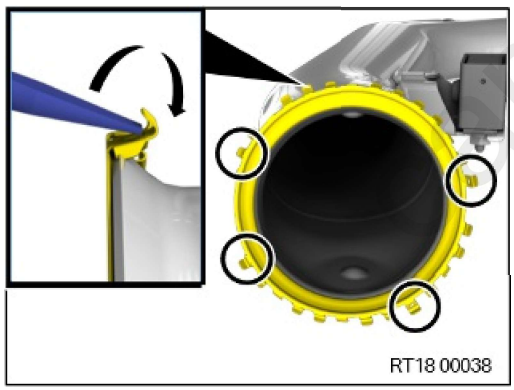


- **Equipment specification 2 (V-clips)**

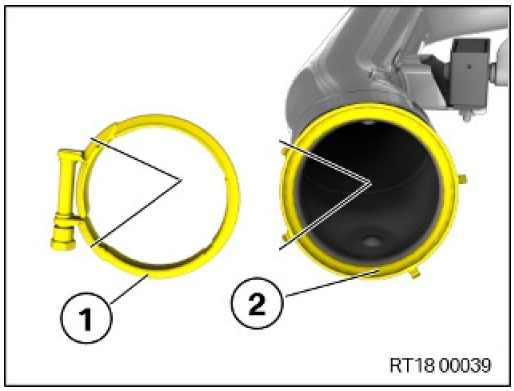
  Renew V-band clamp.

  Parts: V-band clamp

  Unscrew the nut (1) and remove the sealing ring (2).

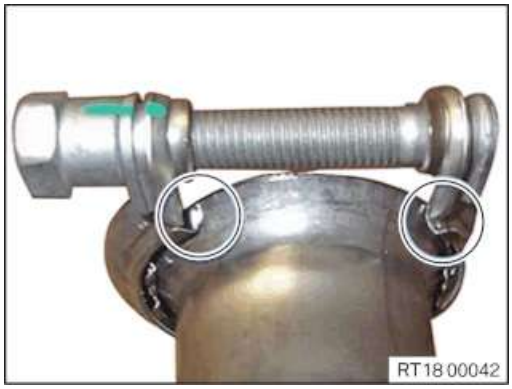


- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.

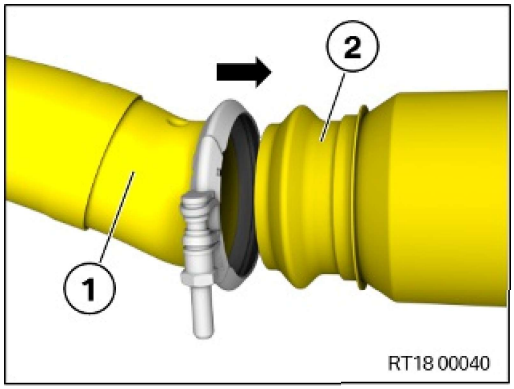


- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).

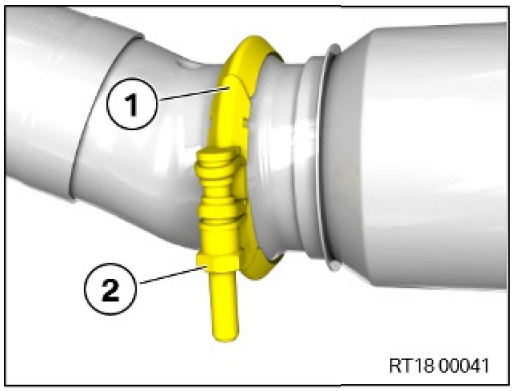
ardiagn.com



- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.



- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).

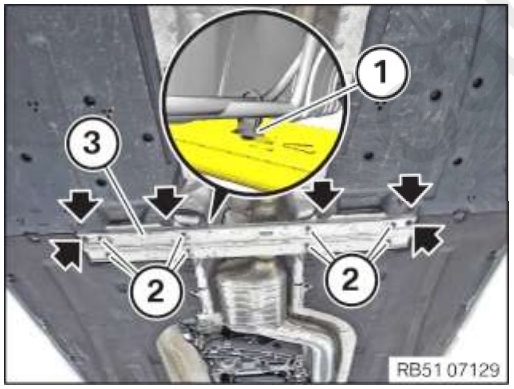


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

32 – Install the connecting supports on the tunnel



- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- Tighten screws (arrows).

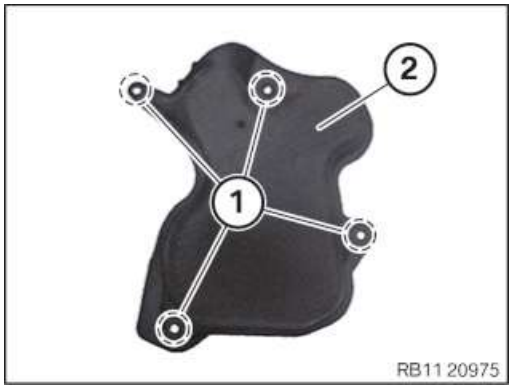
Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

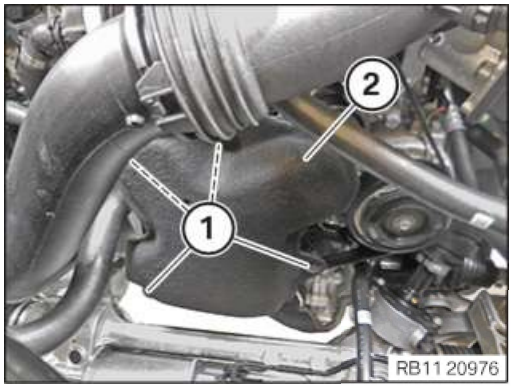
33 – Install the acoustic cover for the engine at the front

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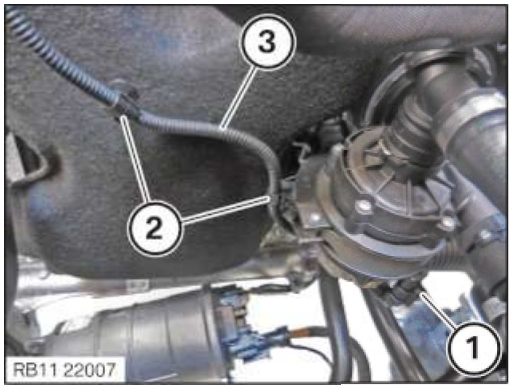


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

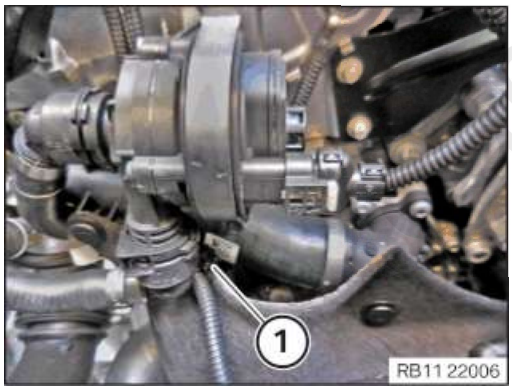


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



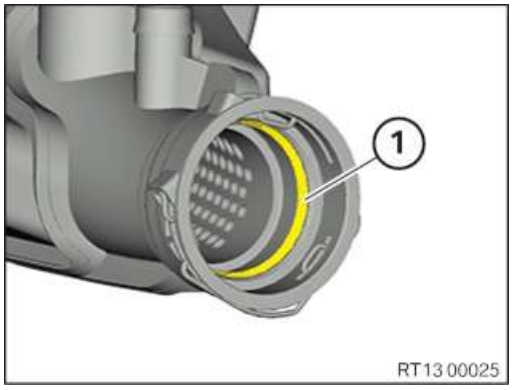
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

34 – Installing the clean air pipe with resonator



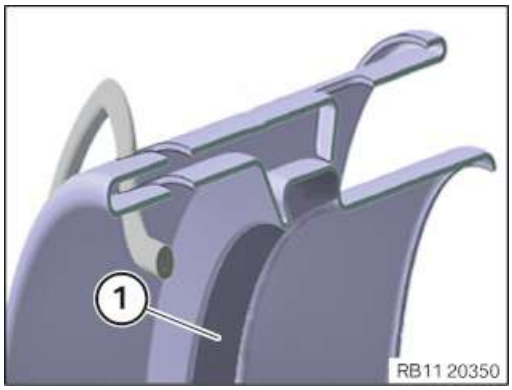
- Check the seal (1) for damages, replace if necessary.

► **Replace damaged gasket**

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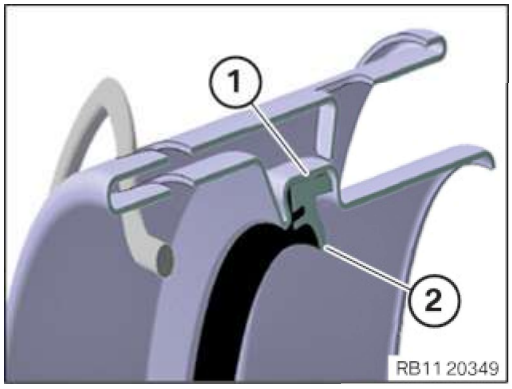
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



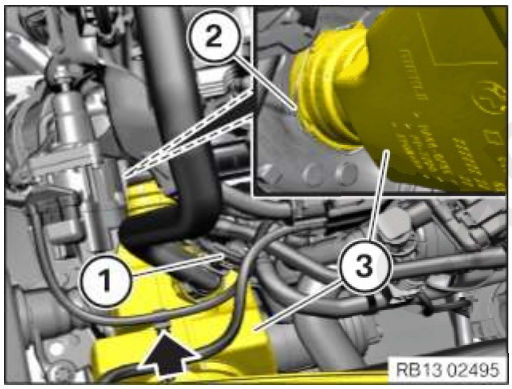
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

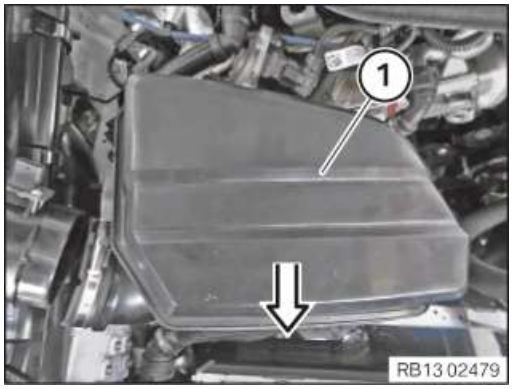
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



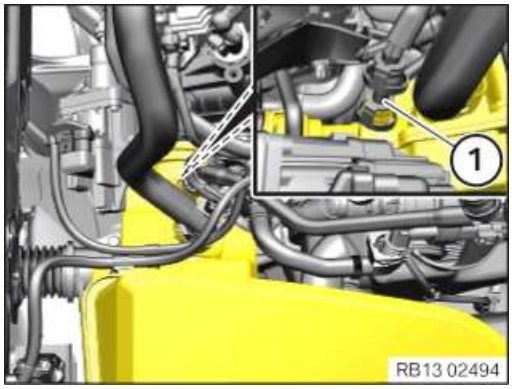
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

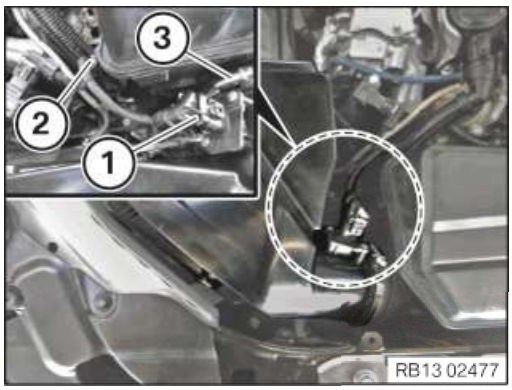
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

35 – Disconnecting all battery earth leads



- See additional information.

36 – Checking/topping up oil level in automatic transmission

Prerequisite

Vehicle in horizontal position.

The vehicle is secured against rolling away.

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CAUTION

Materials harmful to health.

Contact with fluids harmful to health!

- Note and follow safety information on containers.
- Conduct all work in appropriate personal protective equipment only.

TECHNICAL INFORMATION

To set the correct oil level, it is mandatory that the service function "Transmission control unit: Oil-level adjustment" is carried out with the diagnosis system.

TECHNICAL INFORMATION

Performing oil-level adjustment:

Certain fault memory entries may require an oil-level adjustment in the automatic transmission and after repairs have been completed (e.g. exchange of mechatronics, exchange of the converter, exchange of the transmission, servicing of automatic transmission oil).

TECHNICAL INFORMATION

The automatic transmission fluid specified by BMW must be used for the automatic transmission.

For additional information see: SBS-ANL-SBS1996-240596143_A14 (automatic transmission fluid for ZF transmissions, etc.)

- Connect diagnosis system.
- Observe preconditions for the oil-level adjustment with the diagnosis system:
  - Precondition for beginning: Transmission oil temperature 30°C to 40°C.
  - Precondition for ending: Transmission oil temperature 40°C to 50°C.
- Call up service function (drive).
- Carry out oil-level adjustment in accordance with instructions.



- **Top up the automatic transmission fluid:**
- Loosen the oil filler plug (1) using the special tool 2 405 614.
- Top up automatic transmission fluid according to the instructions in the diagnosis system.

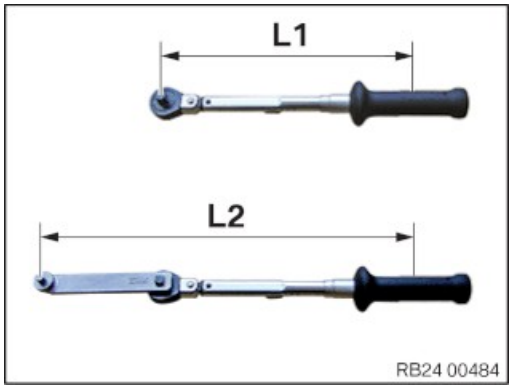
GA8HP51Z transmission capacity

	min. 9,28 l
Transmission oil: Automatic transmission fluid ATF 3+	

GA8HP76Z transmission capacity

	min. 9,35 l
Transmission oil: Automatic transmission fluid ATF 3+	

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TECHNICAL INFORMATION

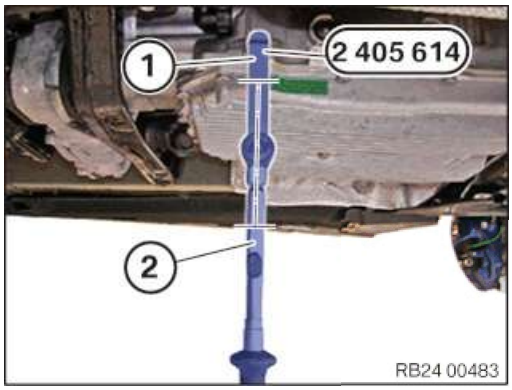
The setpoint torque deviates from the torque to be set when using special tool 2 405 614.

- **Converting the setpoint torque into the torque to be set:**

  (setpoint torque x L1) : L2 =torque to be set.

  L1 = Length from the centre of the handle to the reversible ratchet head

  L2 = Length from the centre of the handle to the engaging of the special tool in the bolt.



- Renew the oil filler plug (1) and the sealing ring.

  Parts: Oil filler plug, sealing ring

- Make sure that the special tool 2 405 614 and the torque wrench (2) align while tightening the oil filler plug (1).
- Tighten the oil filler plug (1) with the special tool 2 405 614 and the torque wrench (2).

Oil filler plug

M18x1.5		Tightening torque	35 Nm

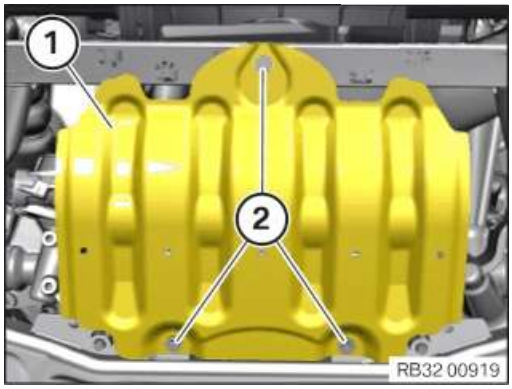
37 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

38 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



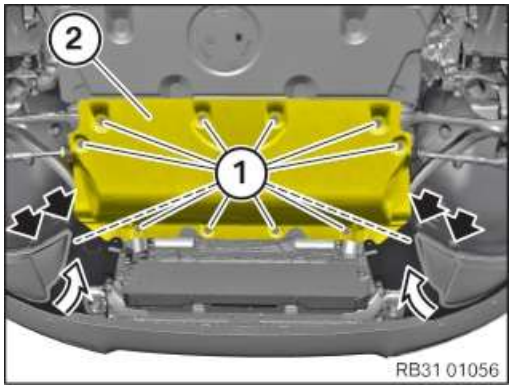
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

39 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

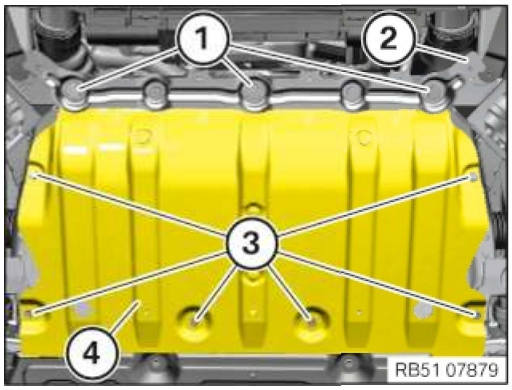
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

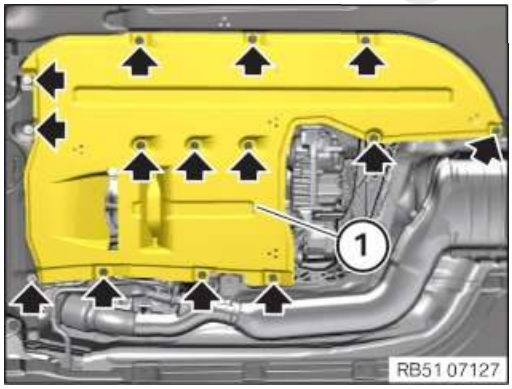
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

40 – Installing underbody protection at rear



- **Version 1:**

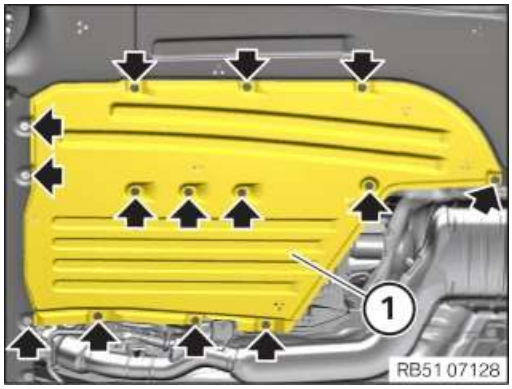
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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- **Version 2:**

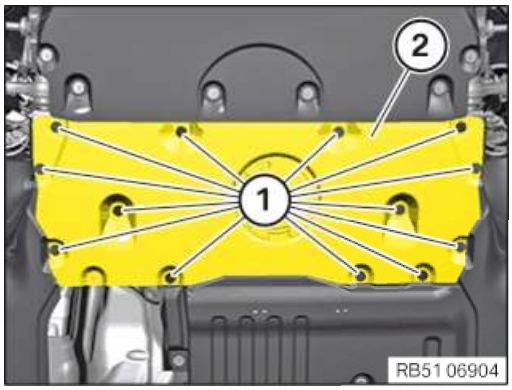
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

41 – Installing the centre underbody protection



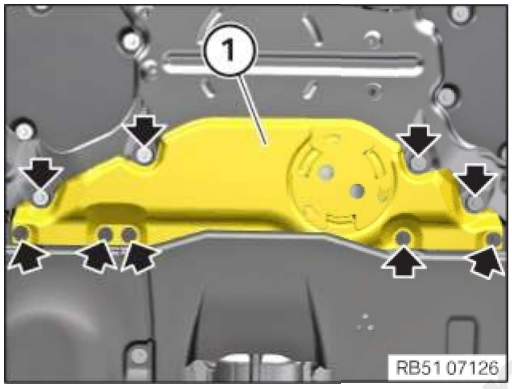
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

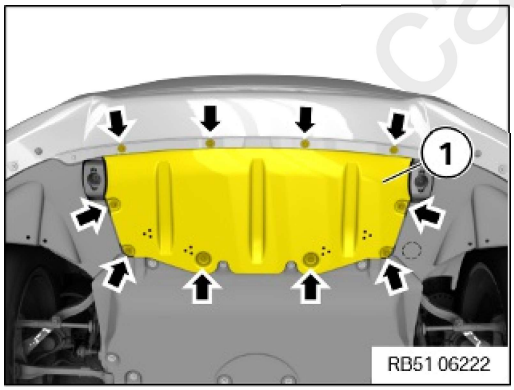
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

42 – Installing the front underbody protection



- **Version 1:**

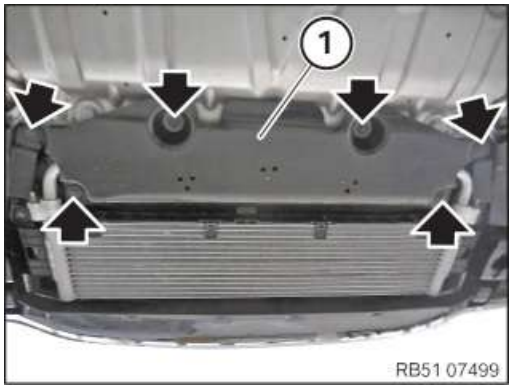
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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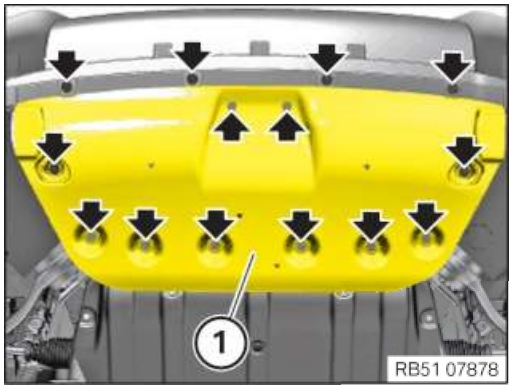
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Flywheel to crankshaft — Used in step 22

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

Torque converter to flywheel — Used in step 23

M10	Renew screws.	Tightening torque	56 Nm

Transmission to engine — Used in step 2324

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm

Ground strap to transmission or body — Used in step 23

M8		Tightening torque	19 Nm

Catalytic converter to holder — Used in step 24

M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder — Used in step 24

M8	Renew nut.	Tightening torque	19 Nm

Transmission cross member to body — Used in step 25

M8	Renew screws.	Tightening torque	19 Nm

Transmission oil line to transmission — Used in step 26

M6x25	Renew the sealing ring.	Tightening torque	8 Nm

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Transmission oil line on holder — Used in step 26

M6		Tightening torque	8 Nm

Front flexible disc to propeller shaft — Used in step 27

M12	Renew screws. Comply with jointing torque and angle of rotation. Tightening via screw.	Jointing torque Angle of rotation	55 Nm 90 °

Centre mount to body — Used in step 27

M8		Tightening torque	19 Nm

Retaining plates for vehicle underbody cover — Used in step 28

Sheet metal nut	Replace nuts.	Tightening torque	3 Nm

Heat shield to vehicle underbody — Used in step 29

Screws and nuts		Tightening torque	3 Nm

Starter motor to engine — Used in step 30

M8X60		Tightening torque	19 Nm

Battery positive lead to starter — Used in step 30

M8		Tightening torque	13,5 Nm

Rear silencer to body / bumper support — Used in step 31

M8	Replace nuts.	Tightening torque	19 Nm

Exhaust system to rear axle carrier — Used in step 31

Nut M8	Renew nut.	Tightening torque	19 Nm

Front silencer / petrol particulate filter on transmission bracket — Used in step 31

M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter — Used in step 31

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter — Used in step 31

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

Connecting support to tunnel — Used in step 32

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Clean air pipe to upper section of intake filter housing — Used in step 34

Clamp		Tightening torque	3 Nm

Oil filler plug — Used in step 36

M18x1.5		Tightening torque	35 Nm

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Bumper buffer device steering on front axle support Used in step 38

M10		Tightening torque	56 Nm

Underbody protection of the steering gear Used in step 39

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) Used in step 39

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support Used in step 39

M10		Tightening torque	56 Nm

Underbody protection Used in step 4041

Hexagon screw		Tightening torque	3 Nm

Underbody protection front Used in step 42

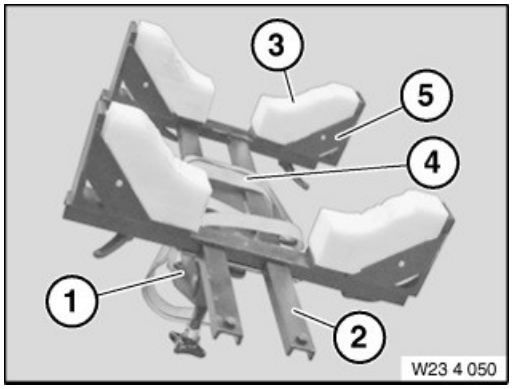
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

0 495 498 (23 4 050) Support

Used in step 1725

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Common

Usage	(universal gearbox holder) Support for removing and installing manual gearboxes and automatic transmissions for BMW & RR.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 06 (256)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
3	0 495 549 (23 4 053)		**Insert** (Foam material insert (1 set = 4 pieces)) deleted, can be ordered only via tool set	
1	0 495 547 (23 4 051)		**Joint** Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	
2	0 495 548 (23 4 052)		**Frame** (Basic frame) Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	
4	0 495 550 (23 4 054)		**Belt** (Tensioning strap) Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	
5	0 496 018 (23 4 055)		**Support** (Fixture for foam insert) Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	

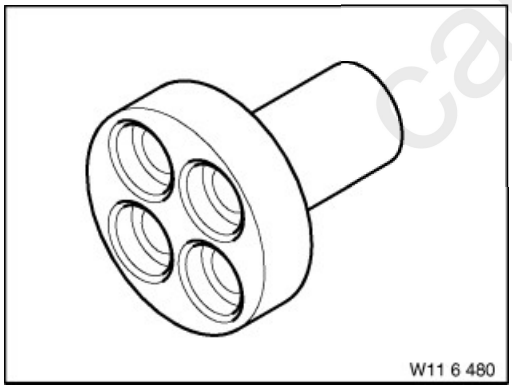
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2 219 012 Hydraulic lifter



Common	Used in step 1725
Usage	For raising and lowering various vehicle components.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 90 (207)

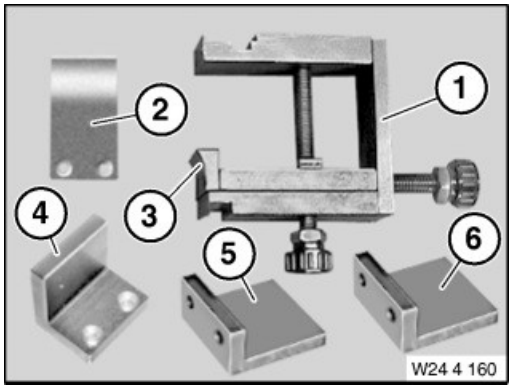
0 493 380 (11 6 480) Connector



Common	Used in step 1923
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

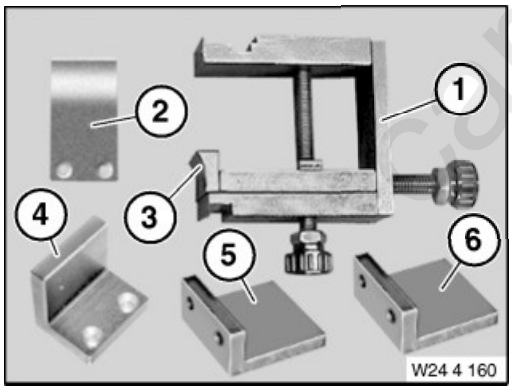
cardiagn.com

0 494 478 (24 4 161) Basic body



Common	Used in step 19
Usage	
Included in the tool or work	0 494 451
Storage location	C46
Replaced by	
In connection with	
SI-Number	

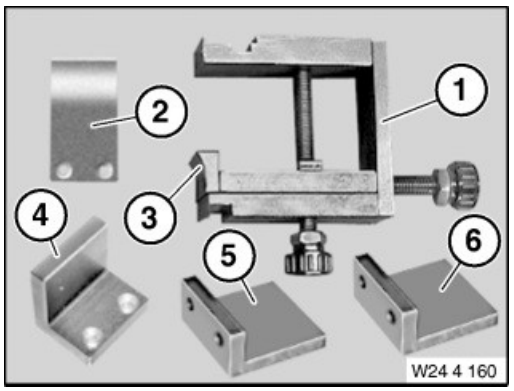
0 496 061 (24 4 166) Shaped element



Common	Used in step 19
Usage	Transmission: GA6L45R (GM6) in E83 / N52K Deletion, only available via tool set
Included in the tool or work	0 494 451
Storage location	C46
Replaced by	
In connection with	
SI-Number	01 02 07 (334)

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0 494 451 (24 4 160) Holder



Common Used in step 1923

Usage	For securing converter during removal and installation of transmission
Included in the tool or work	
Storage location	B45
Replaced by	
In connection with	
SI-Number	01 11 02 (908)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 494 479 (24 4 162)		**Shaped element** For converter version N73 discontinued, available as part of set of special tools only	
5	0 494 965 (24 4 165)		**Shaped element** Transmission: GA6 HP19 in E87, E90 Discontinued, available as part of set of special tools only	
3	0 494 477 (24 4 163)		**Shaped element** For converter version M57TU discontinued, available as part of set of special tools only	
1	0 494 478 (24 4 161)		**Basic body**	
4	0 494 622 (24 4 164)		**Shaped element** For converter version M54 discontinued, available as part of set of special tools only	
6	0 496 061 (24 4 166)		**Shaped element** Transmission: GA6L45R (GM6) in E83 / N52K Discontinued, available as part of set of special tools only	

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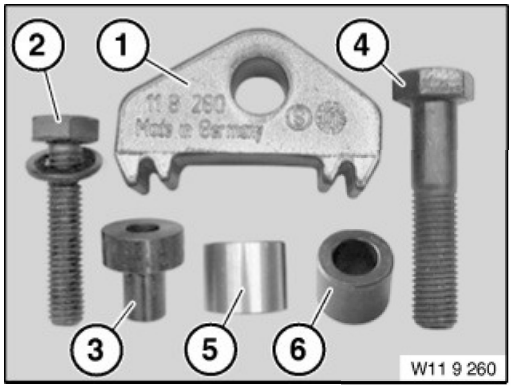
0 494 213 (24 2 390) Cap



Common Used in step 1923

Usage	(protective cap) For sealing off the guide sleeve of the transmission connector
Included in the tool or work	
Storage location	C49
Replaced by	
In connection with	
SI-Number	01 14 01 (766)

0 493 938 (11 9 260) Holder



Common Used in step 2022

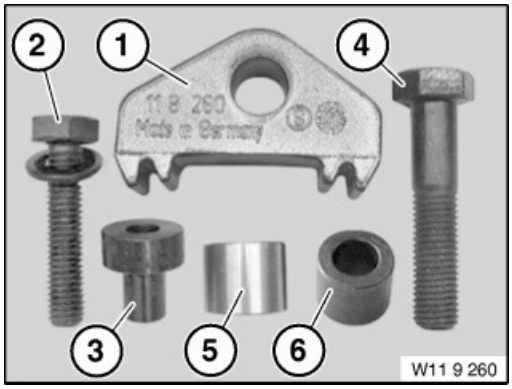
Usage	(Counter support with screw connection) For holding the flywheel when gearbox is removed
Included in the tool or work	
Storage location	A44
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 034 (11 9 261)		**Holder** (Individual counter support)	
2	0 494 035 (11 9 262)		**Screw** (Bolt (thread M10) with washer) For screwing counter support	
3	0 494 129 (11 9 263)		**Bush** (Bush for counter support) For counter support, for retaining flywheel when gearbox is removed Engine: N62, N73	
6	0 495 216 (11 9 266)		**Bush** For counter support, for retaining flywheel when gearbox is removed Engine: M57TU2	
4	0 494 130 (11 9 264)		**Screw** (Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed	
5	0 494 793 (11 9 265)		**Bush**	

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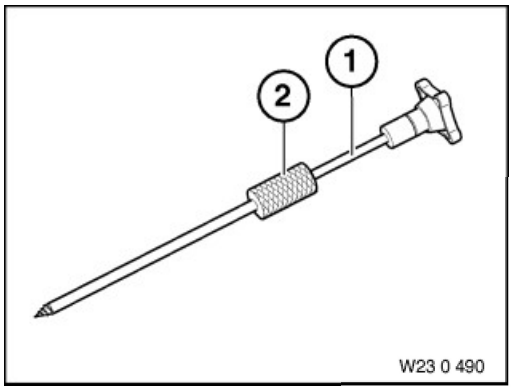
0 494 130 (11 9 264) Screw



Common Used in step 2022

Usage	(Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed
Included in the tool or work	0 493 938
Storage location	A44
Replaced by	
In connection with	
SI-Number	

0 491 454 (23 0 490) Puller



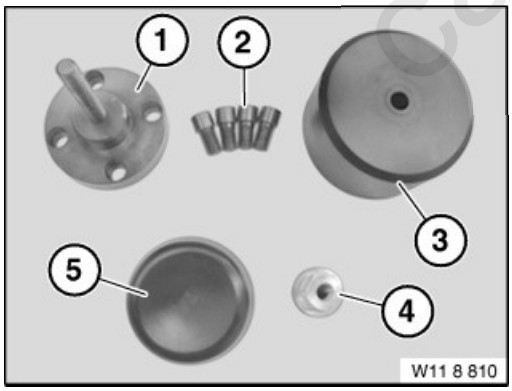
Common Used in step 21

Usage	For removing shaft seal
Included in the tool or work	
Storage location	A13
Replaced by	
In connection with	
SI-Number	01 15 96 (106)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 491 455 (23 0 491)		**Rod** With self-tapping screw Deletion, only available via tool set	
2	0 491 456 (23 0 492)		**Weight** (Weight)	

0 496 137 (11 8 815) Holding sleeve

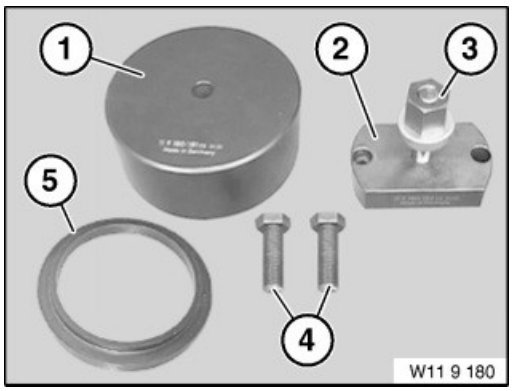


Common Used in step 21

Usage	(Slip sleeve) Liquidation of existing inventory and then available only via complete tool set 11 8 810 = 83 30 0 496 132 - status 09.12.2011
Included in the tool or work	0 496 132
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

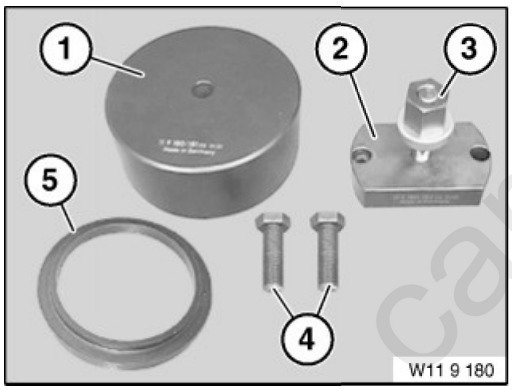
cardiagn.com

0 494 029 (11 9 182) Synchronising key



Common	Used in step 21
Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 494 031 (11 9 184) Screw



Common	Used in step 21
Usage	(screws (2 x))
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

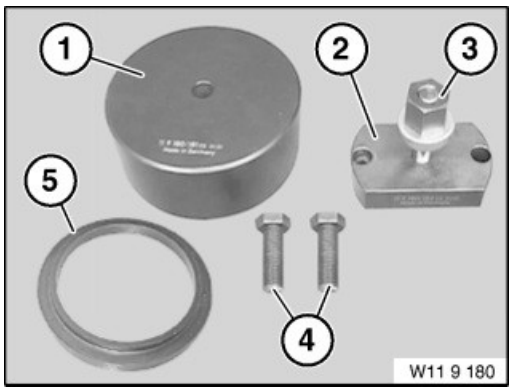
2 360 215 Adapter



Common	Used in step 21
Usage	For installing the rear radial shaft seal. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B56
Replaced by	
In connection with	11 9 180 = 0493881
SI-Number	01 13 14 (098)

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0 493 881 (11 9 180) Tool



Common Used in step 21

Usage	(pulling tool) For pulling radial shaft seal into engine block, rear
Included in the tool or work	
Storage location	C26
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 028 (11 9 181)		**Bush**	
2	0 494 029 (11 9 182)		**Synchronising key**	
3	0 494 030 (11 9 183)		**Nut**	
4	0 494 031 (11 9 184)		**Screw** (screws (2 x))	
5	0 496 660 (11 9 185)		**Ring** For installation shaft seal - rim offset 6.6 mm (N55).	

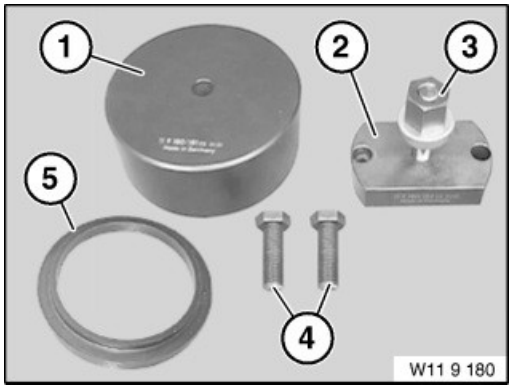
0 494 028 (11 9 181) Bush



Common Used in step 21

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 494 030 (11 9 183) Nut

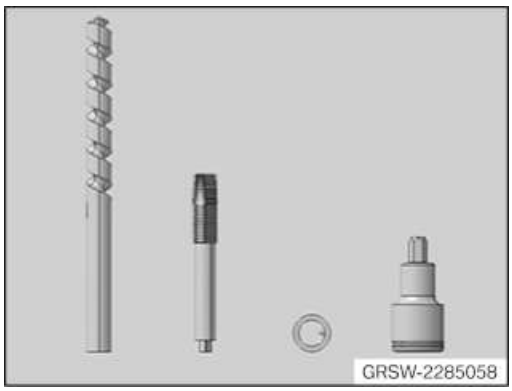


Common Used in step 21

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

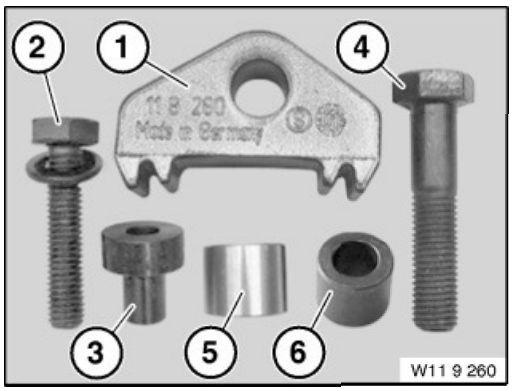
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2 285 058 Tool set



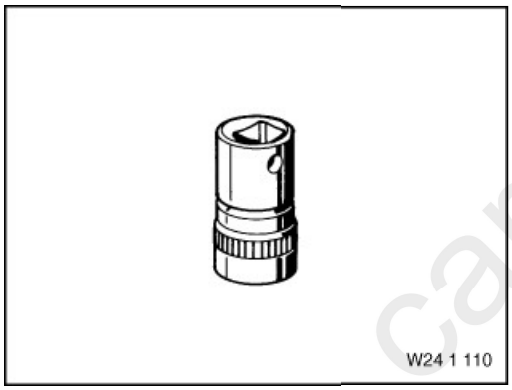
Common	Used in step 22
Usage	
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 14 (069)

0 494 034 (11 9 261) Holder



Common	Used in step 22
Usage	(Individual counter support)
Included in the tool or work	0 493 938
Storage location	
Replaced by	
In connection with	
SI-Number	

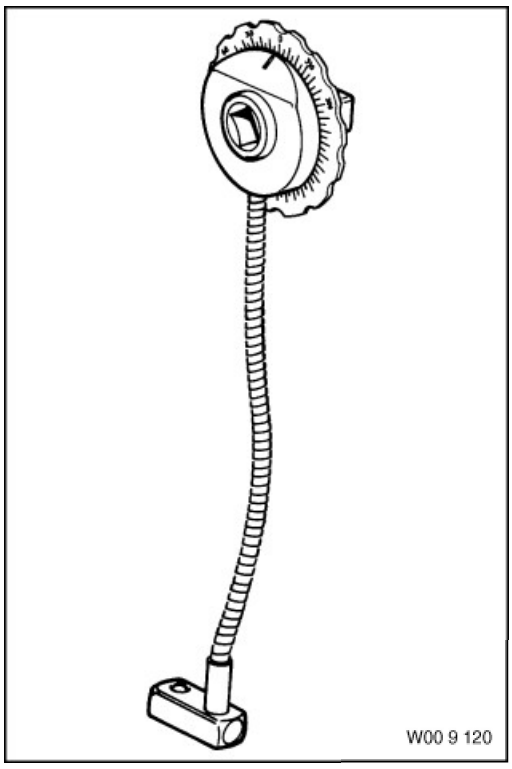
0 491 667 (24 1 110) Socket wrench insert



Common	Used in step 23
Usage	Loosening and fastening the converter fastener
Included in the tool or work	
Storage location	A14
Replaced by	
In connection with	
SI-Number	01 04 86 (566)

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0 490 504 (00 9 120) Torque angle measuring dial



Common Used in step 27

Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

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2 405 614 Socket wrench



Common	Used in step 36
Usage	For opening and closing the oil filler plug. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969). Replaced by 2455997
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 33 15 (305)

Overview Technical Data

GA8HP51Z transmission capacity — Used in step 36

	min. 9,28 l

Transmission oil: Automatic transmission fluid ATF 3+

GA8HP76Z transmission capacity — Used in step 36

	min. 9,35 l

Transmission oil: Automatic transmission fluid ATF 3+

Screw-in depth of thread cutter — Used in step 22

Screw-in depth	18 mm

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	135
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	135
61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	135
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	135
61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting battery earth lead	135
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61 20 900 Disconnecting and connecting battery earth lead	135
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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	135
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61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting battery earth lead	135
61 20 900 Disconnecting and connecting battery earth lead	135
17 11 035 Removing and installing/replacing fan cowl with electric fan	19

Operating materials	Used in step
14.0 Automatic transmission fluid for ZF-transmission GA8HP45Z / GA8HP50Z / GA8HP70Z / GA8HP90Z / GA8P70H / GA8P75H / GA8HP75Z	36

Parts

Parts required

Designation	Used in step
Radial shaft seal	21
Seal, screws	21

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11 15 001 Replace engine ventilation line

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

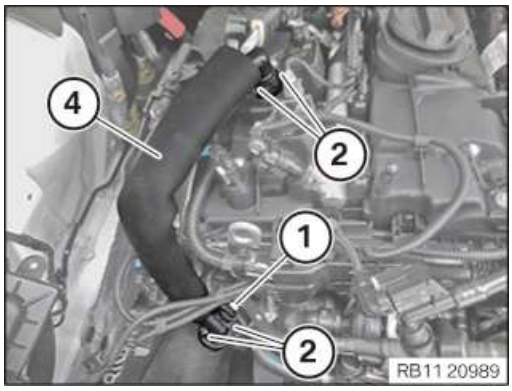
- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

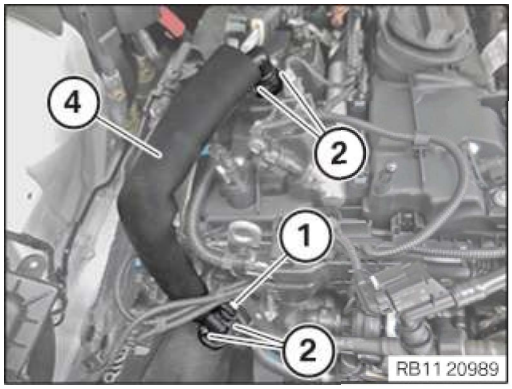
bmwdiagn.com

2 – Remove engine ventilation line



- Unlock and loosen connector (1).
- Unlock the locks (2) on the upper engine ventilation line (4) and pull them off from the cylinder head cover.
- Unlock and release locks (2) of the engine ventilation line (4) upwards from the clean air pipe.
- Feed out the engine ventilation line (4) and remove.

3 – Install engine ventilation line



TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

- Guide in and install the engine ventilation line (4) on the clean air pipe.
- Make sure that the locks (2) engage audibly on the clean air pipe.
- Guide in and install the upper engine ventilation line (4) on the cylinder head cover.
- Make sure that locks (2) engage audibly on the cylinder head cover.
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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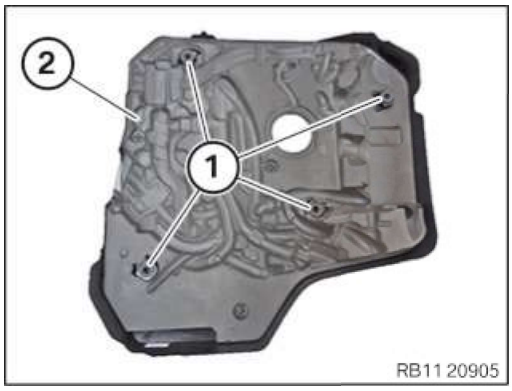
4 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

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This documentation refers to special tools that were not yet available when going to press.

11 21 531 Replace all crankshaft main bearing shells

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Removing engine



- See additional information.

2 – Mount engine on assembly stand

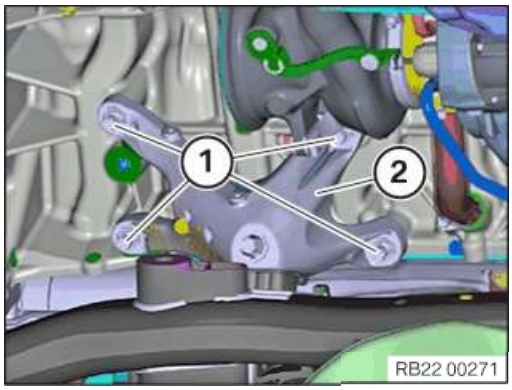
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CAUTION

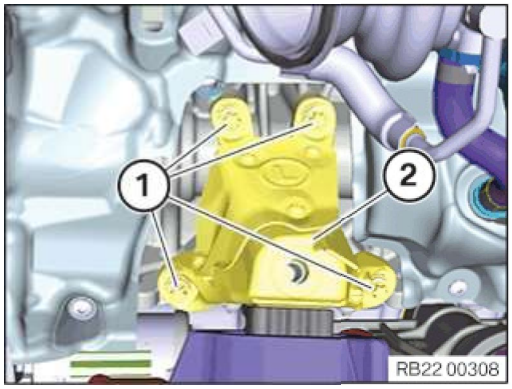
Heavy component.

Heavy components can lead to injury or damage.

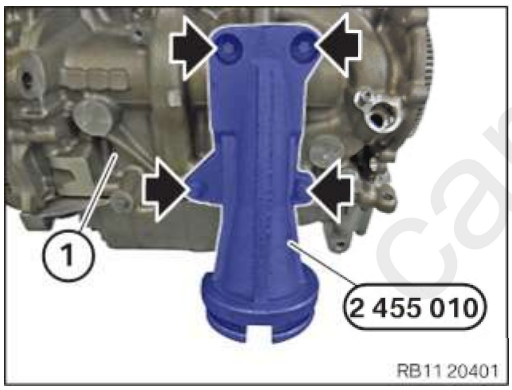
- Remove and install heavy components with the aid of another person/other persons.



- **Type: Rear-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



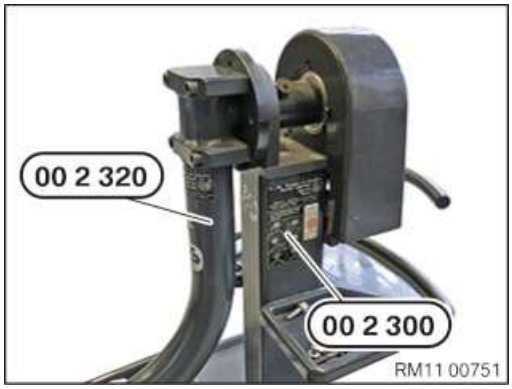
- **Type: Four-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



- Position the special tool 2 455 010 on the engine (1).
- Position the standard bolts **M10x30**.
- Tighten the standard bolts (arrows).

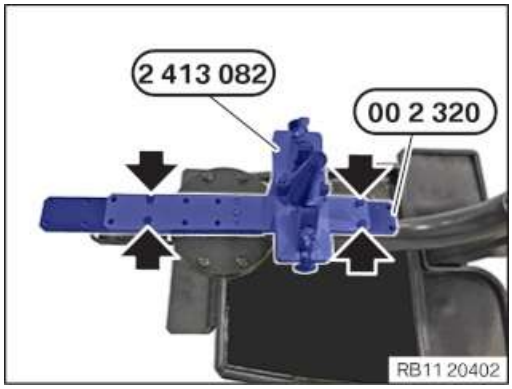
Special tool 2 455 010 to crankcase

M10x30		Tightening torque	38 Nm



- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).

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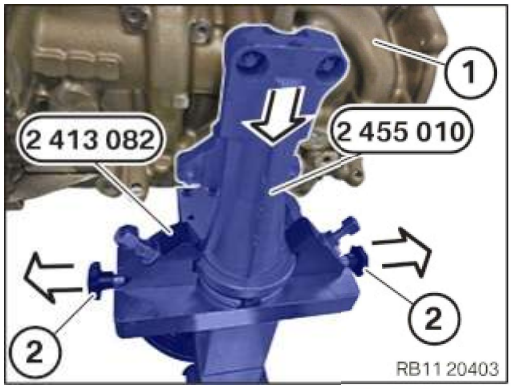
- Screw the special tool to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

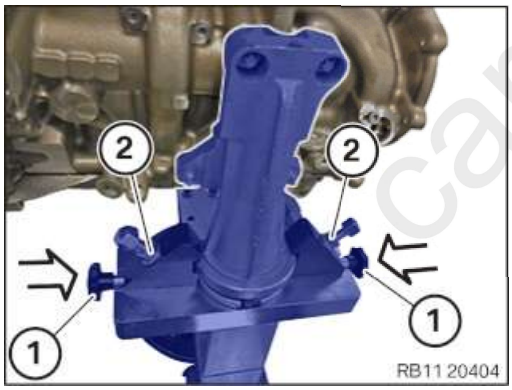
M14x35		Tightening torque	160 Nm



- Position the engine lifter with the special tool and the engine on the special tool 0 495 187 (00 2 300).



- Detach the holder (2) in the direction of the arrow.
- Position the engine (1) with the special tool 2 455 010 in the direction of the arrow on the special tool .



- Lock the holder (1) in direction of arrow.
- Tighten nuts (2).

3 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

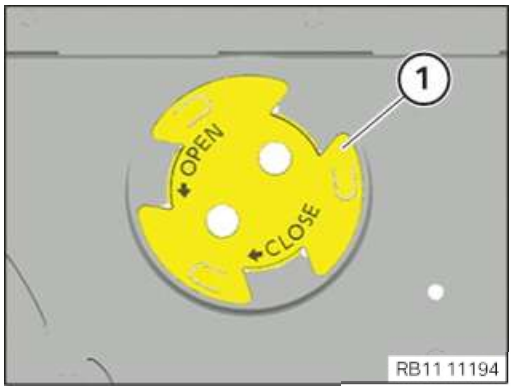
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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).



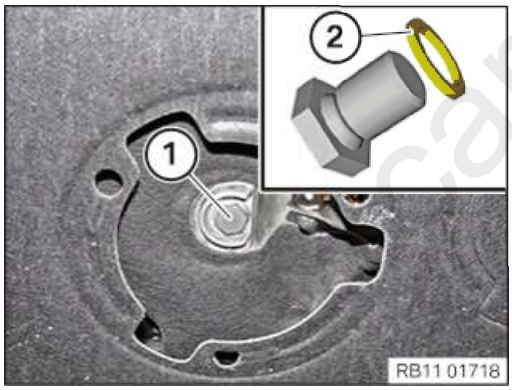
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

4 – Tightening the oil drain plug

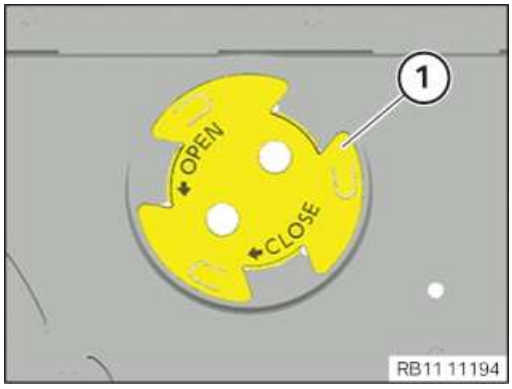


- Renew sealing ring (2).

  Parts: Sealing ring
- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

M12x16	Renew the sealing ring.	Tightening torque	25 Nm



- Install service cap (1).

5 – Removing all spark plugs

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

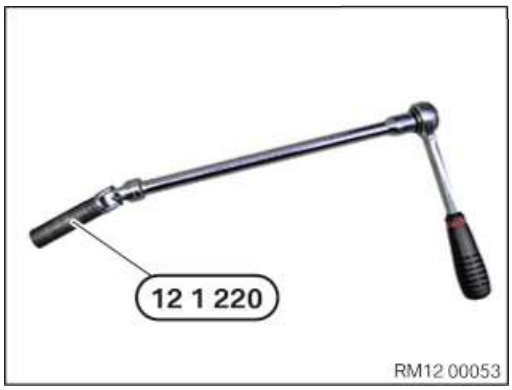
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

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- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

6 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

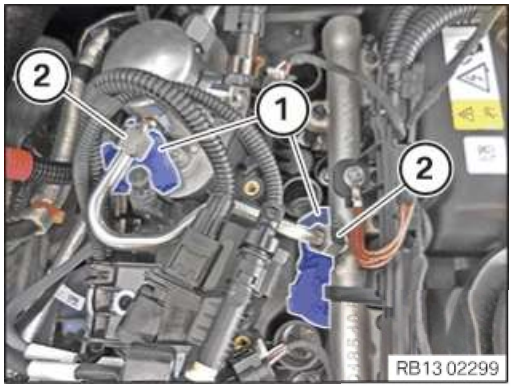
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

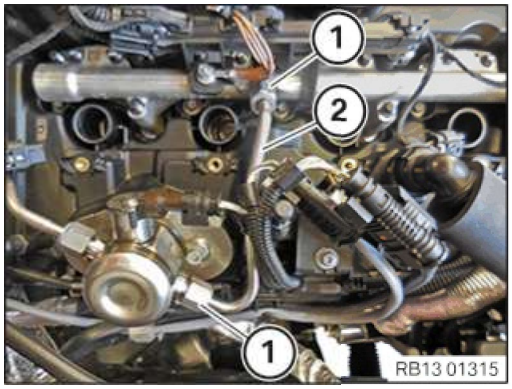
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- Have the special tool ready.



- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

7 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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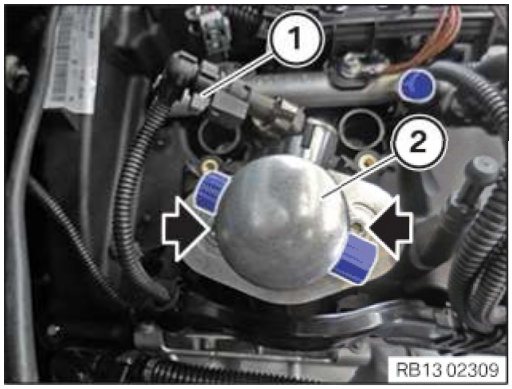
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

8 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

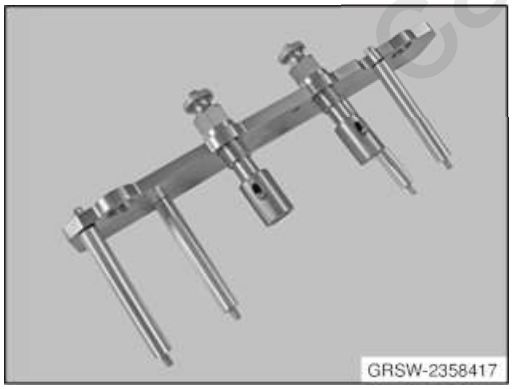
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Prepare special tool .

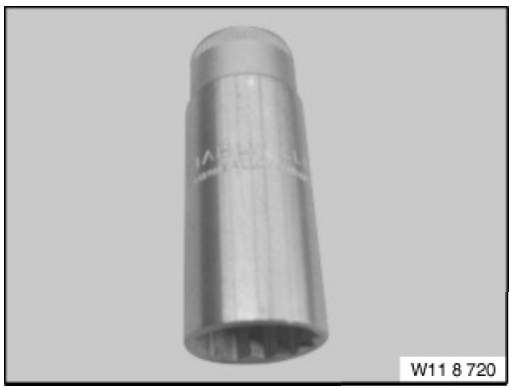


- Prepare special tool 2 358 417.

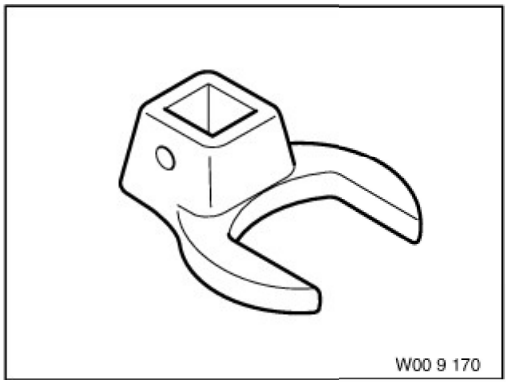
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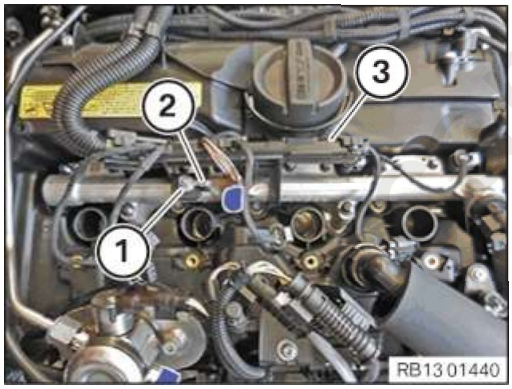
- Prepare special tool .



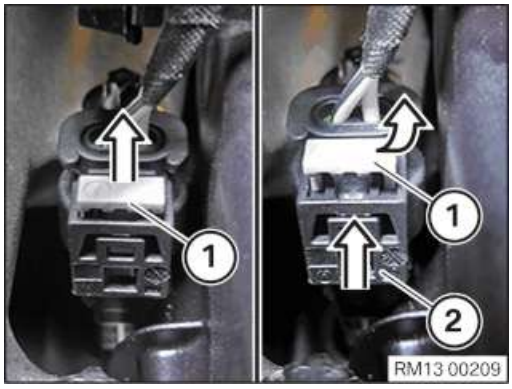
- Prepare special tool 0 496 106 (11 8 720).



- Prepare special tool .

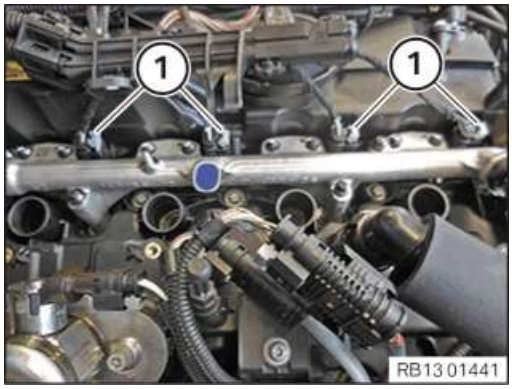


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.



- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.

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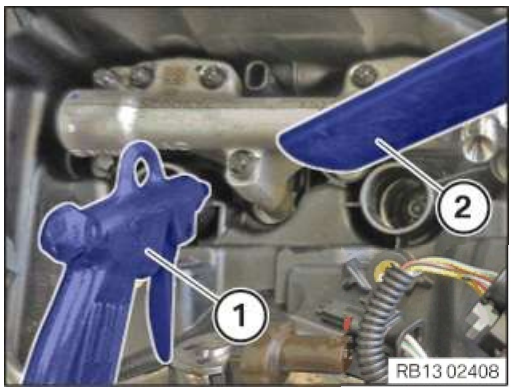
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

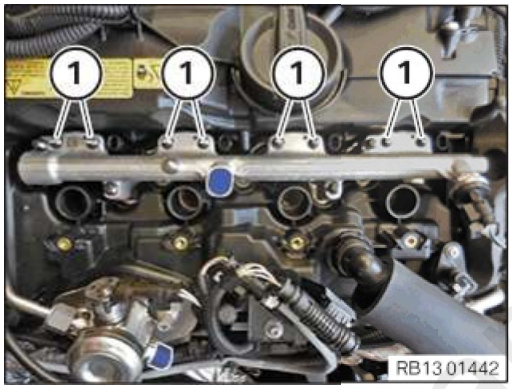


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

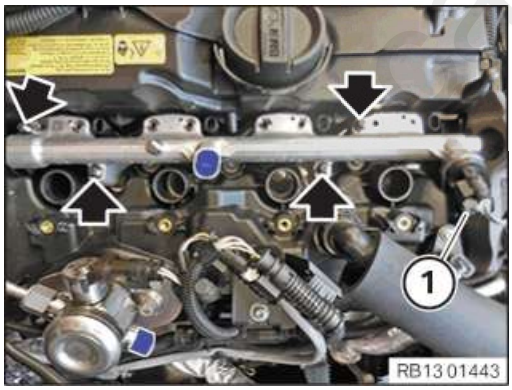
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

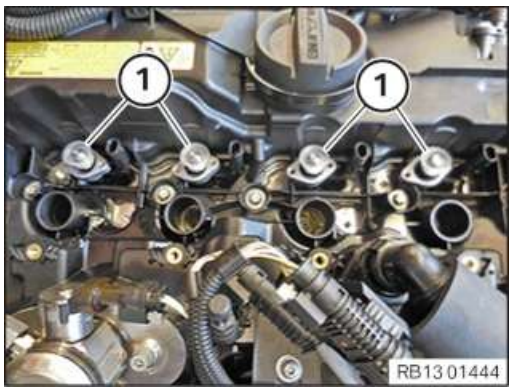


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

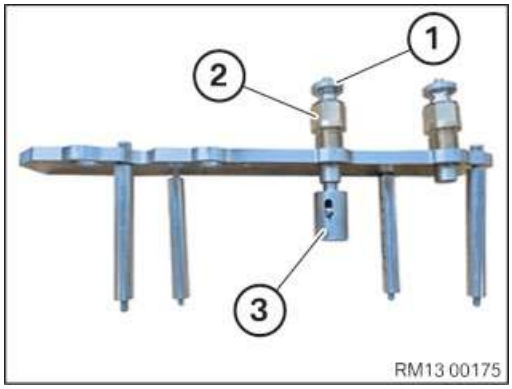
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

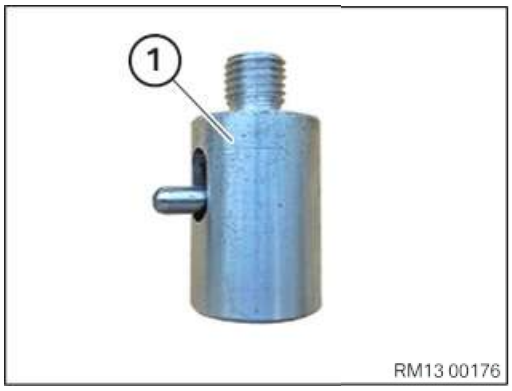
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

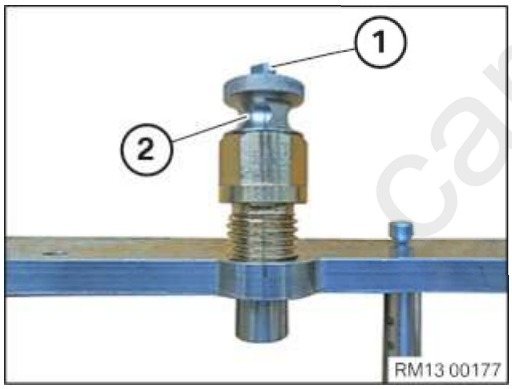
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

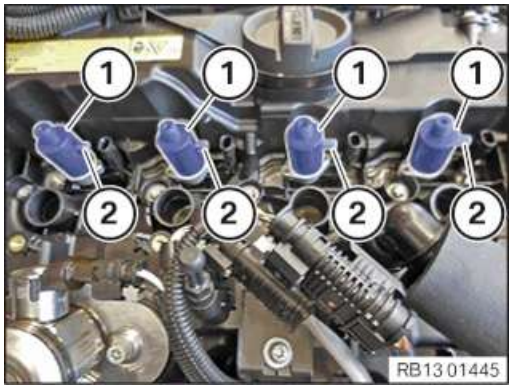
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



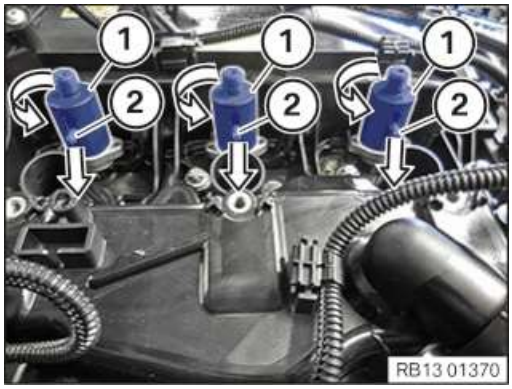
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



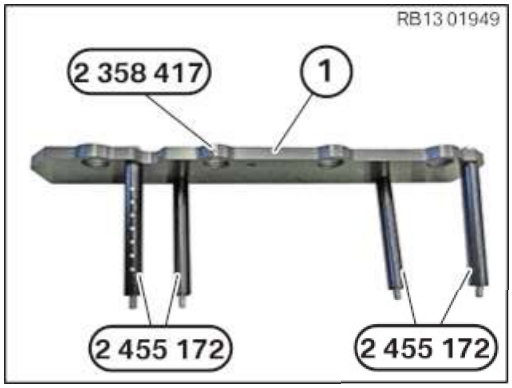
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

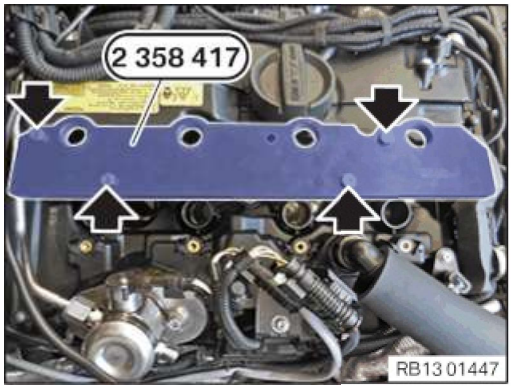
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



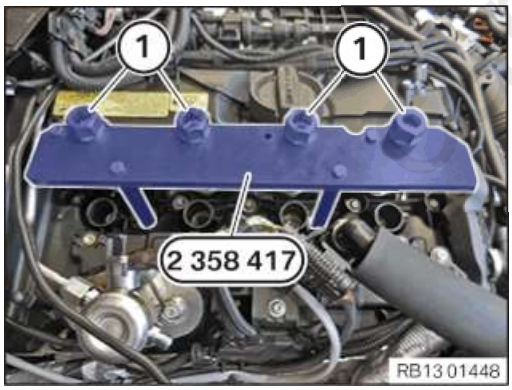
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

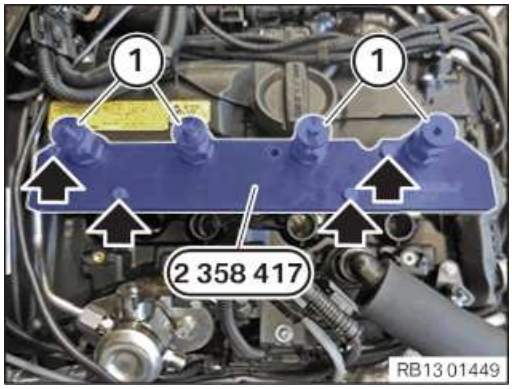
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

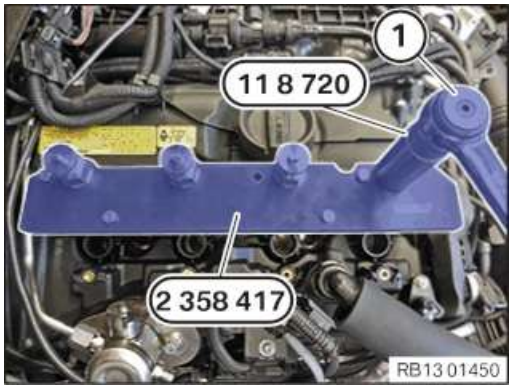
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

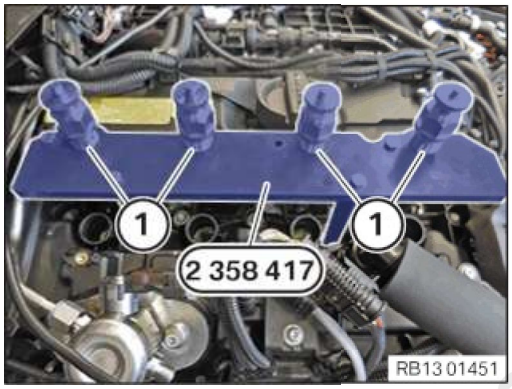


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

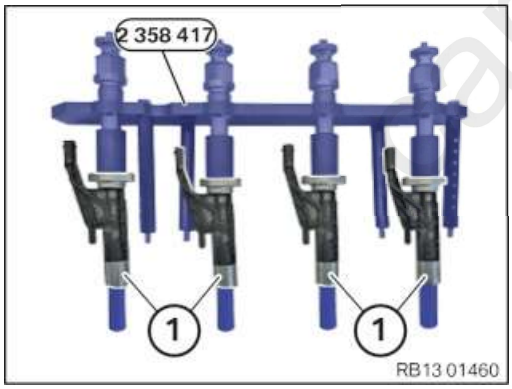
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

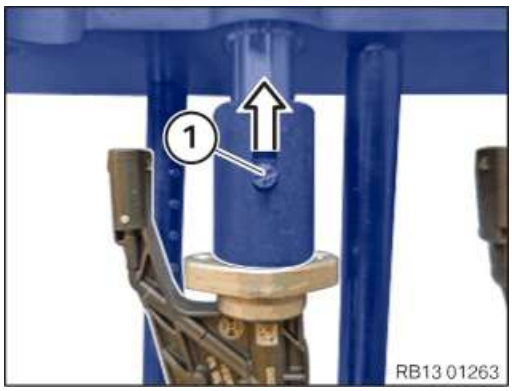


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

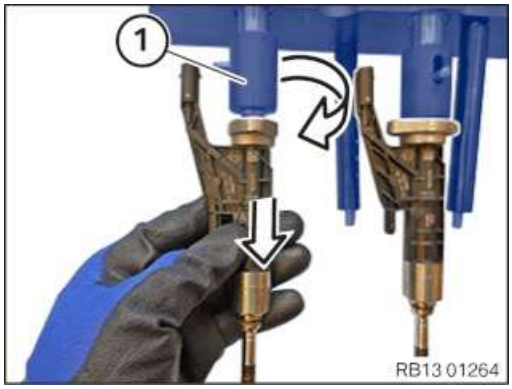


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

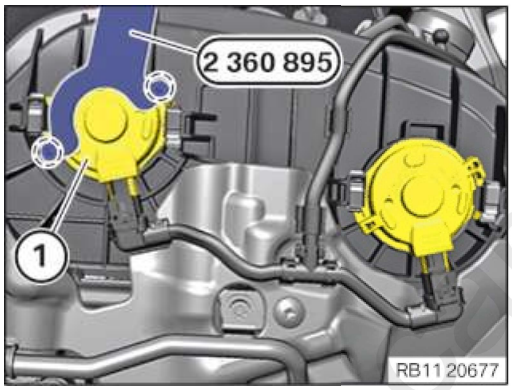
9 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

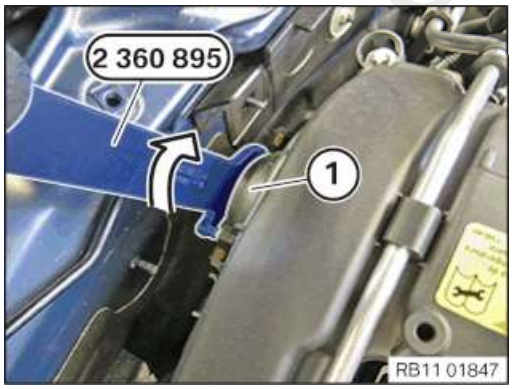
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



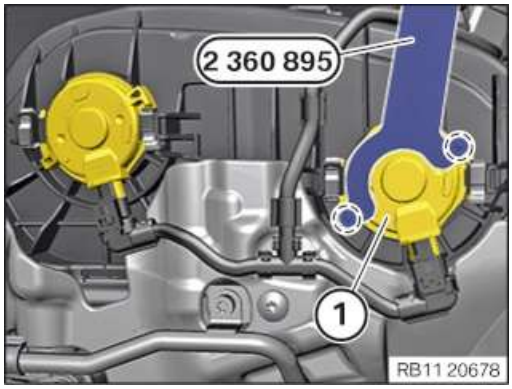
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



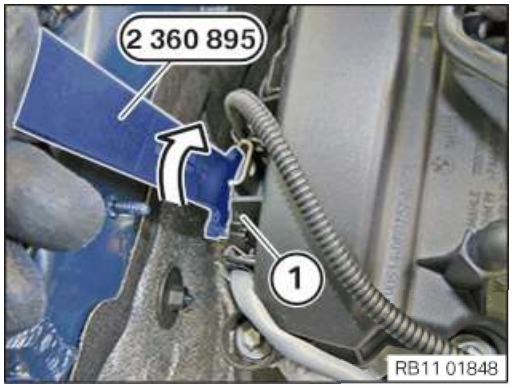
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



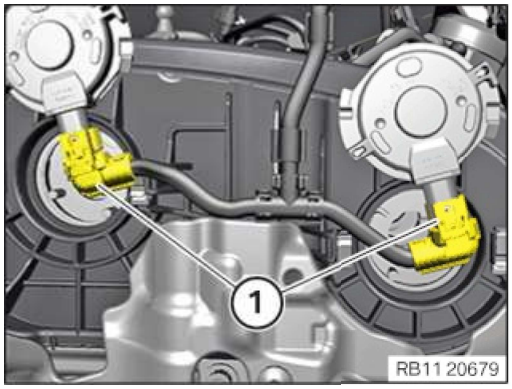
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

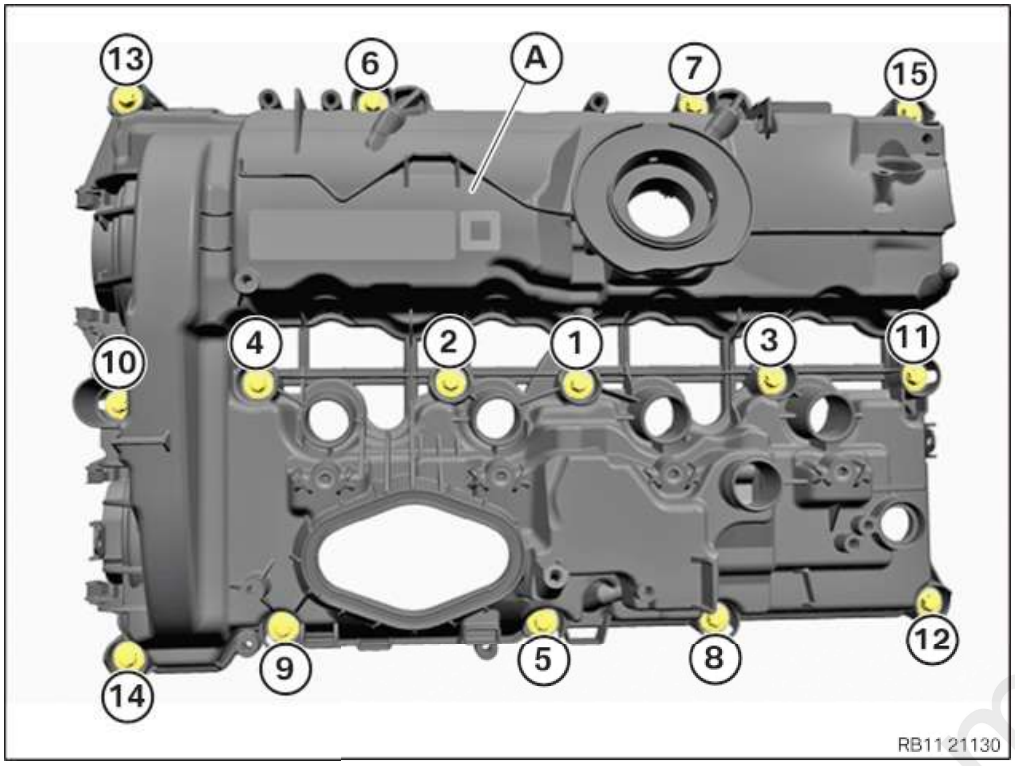
The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

10 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

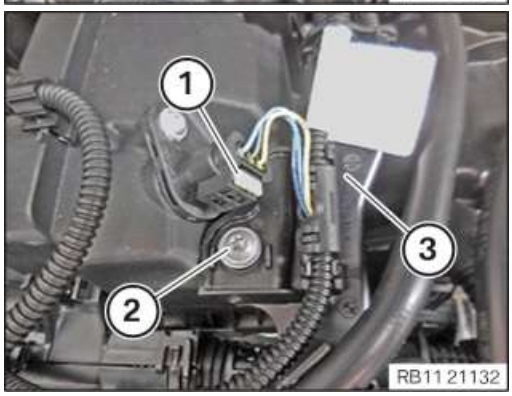
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

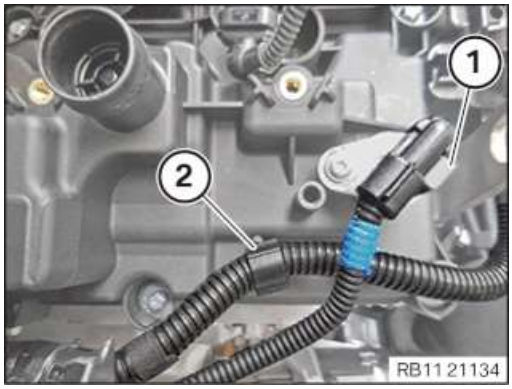
- Do not pull on the wires when disconnecting connectors and plug connections.



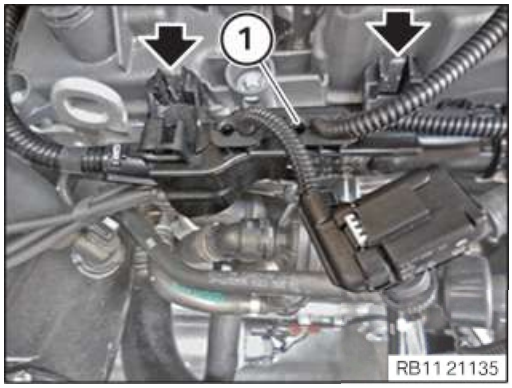
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



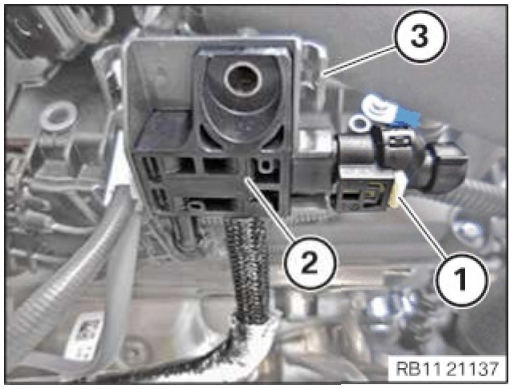
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



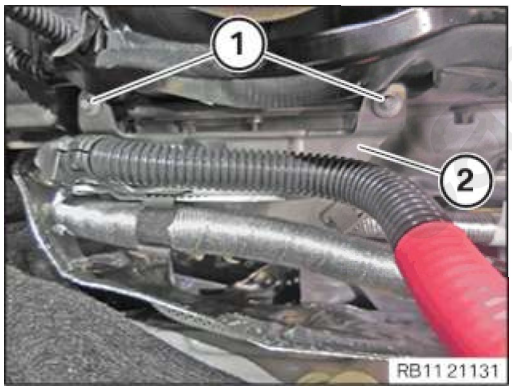
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



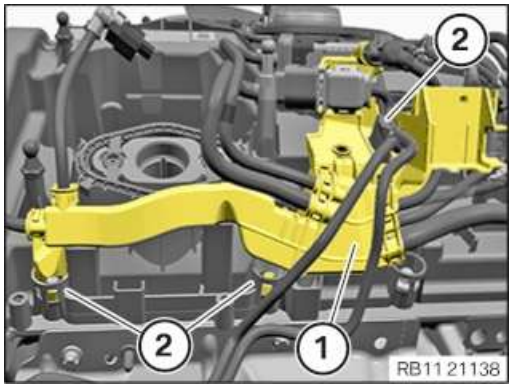
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.

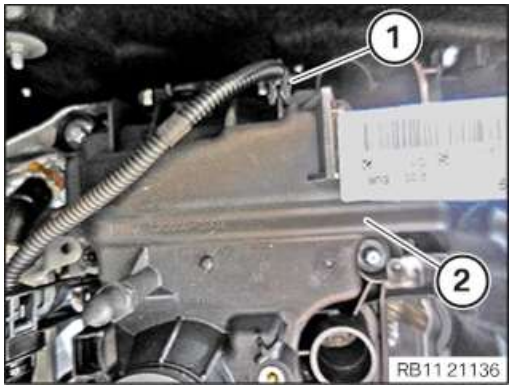


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

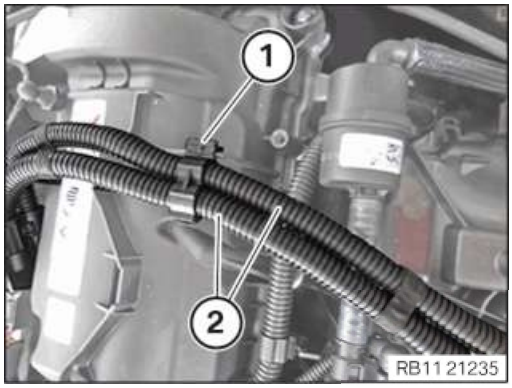


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

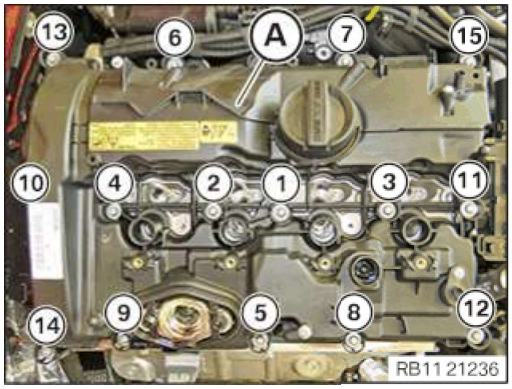
ardiagn.com



- Loosen clamp (1).



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

11 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

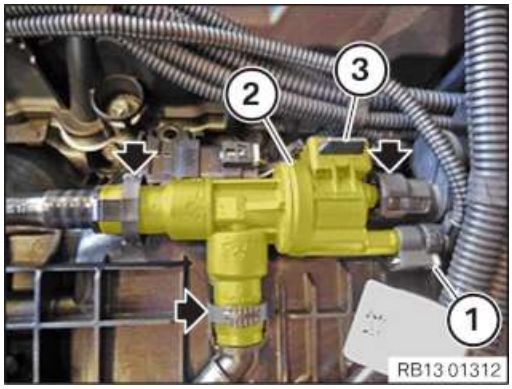
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

12 – Removing the intake plenum

RISK OF DAMAGE

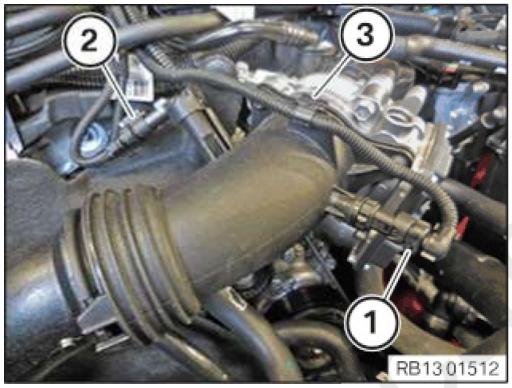
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

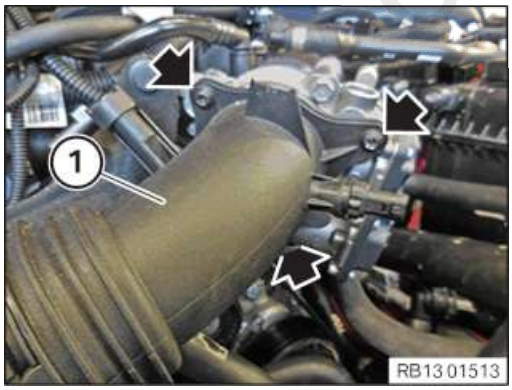
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

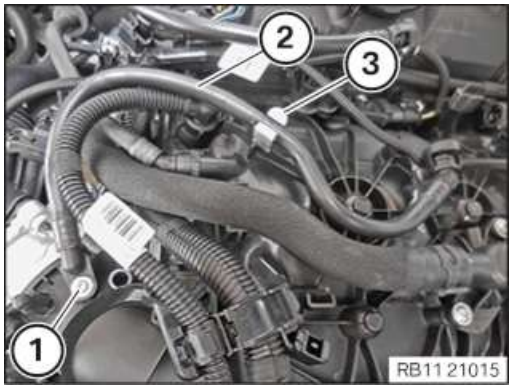
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



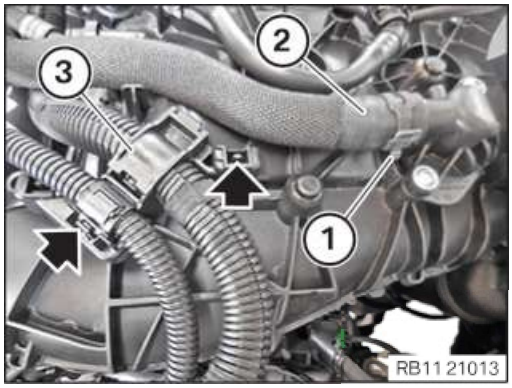
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



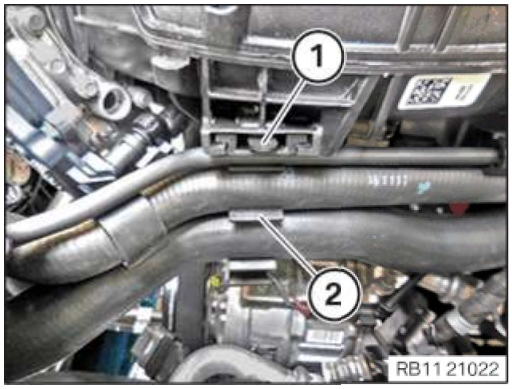
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



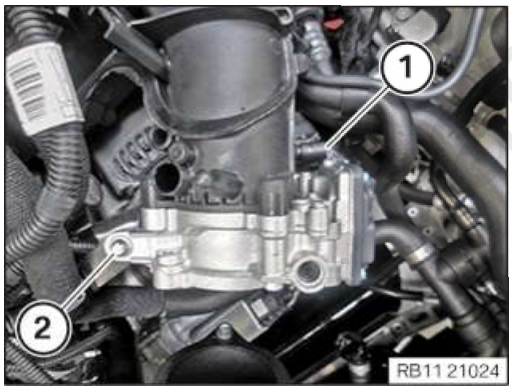
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



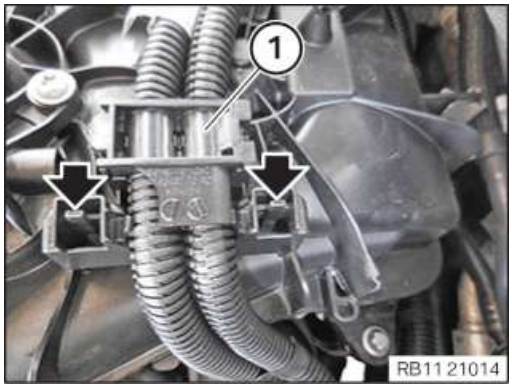
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

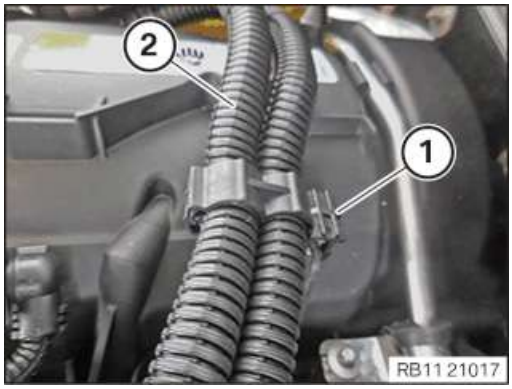


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

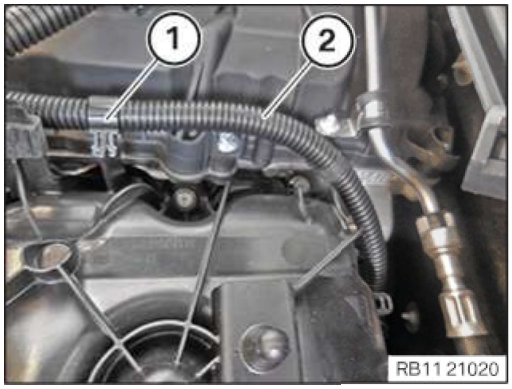
mdiagn.com



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



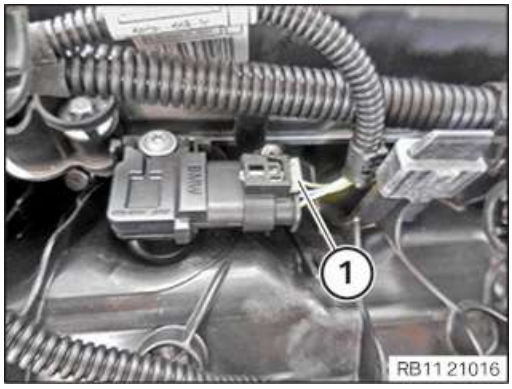
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

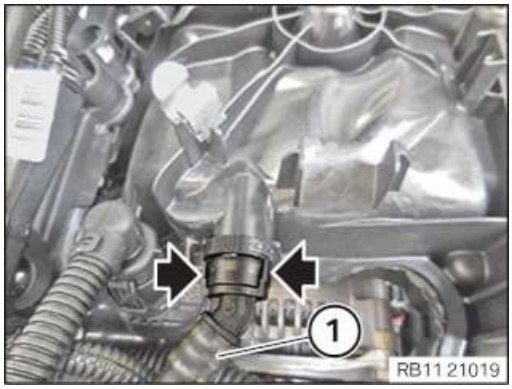


- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

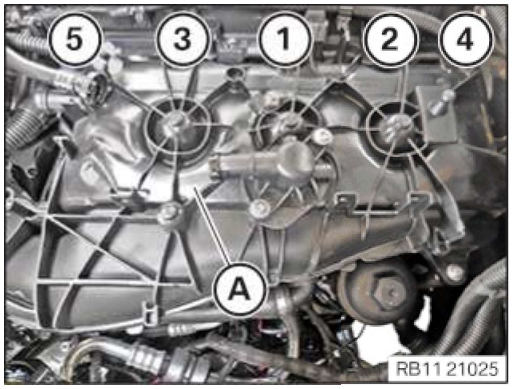
rdiagn.com



- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

13 – Remove the heat shield on the cylinder head

WARNING

Hot surfaces.

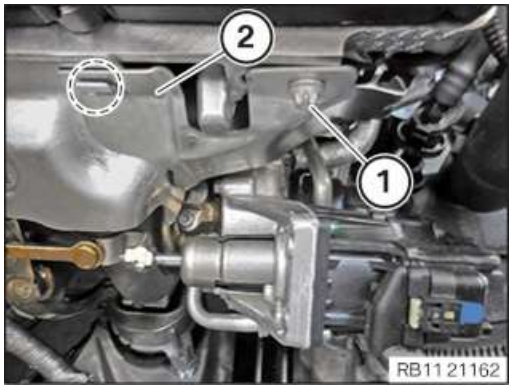
Risk of burning!

- Perform all work only on components that have cooled down.

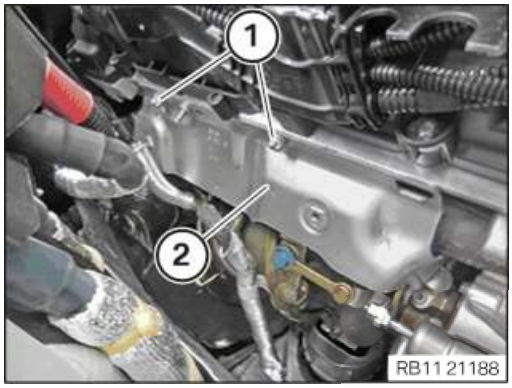


- Loosen screw (1).

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- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

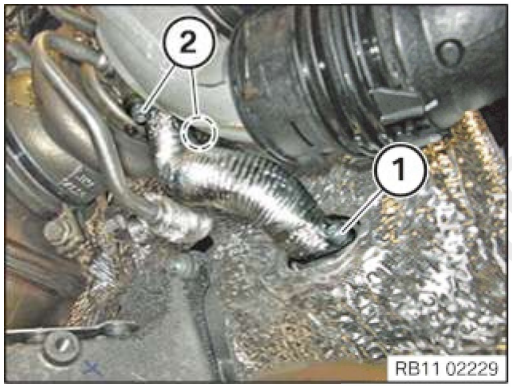


- Loosen screws (1).
- Feed out and remove the heat shield (2).

14 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

15 – Remove the coolant return line for the exhaust turbocharger

WARNING

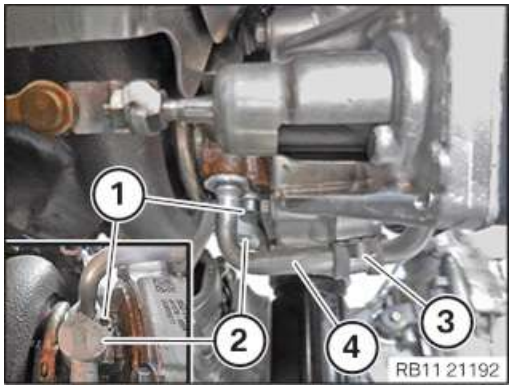
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

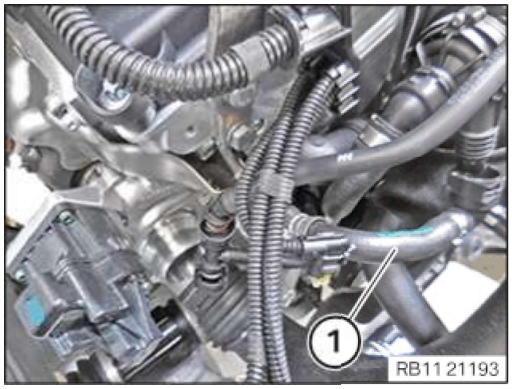
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

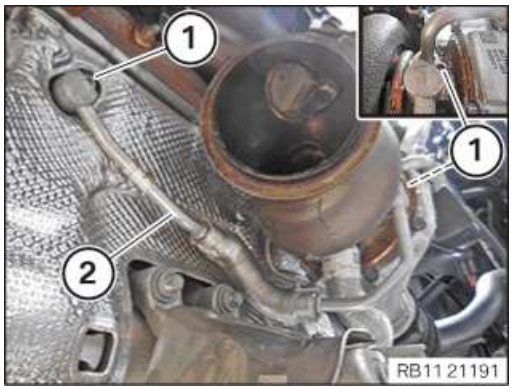


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

16 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

17 – Block the engine with the special tool in TDC firing position

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- Thread the sealing cap (1) out and remove.



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

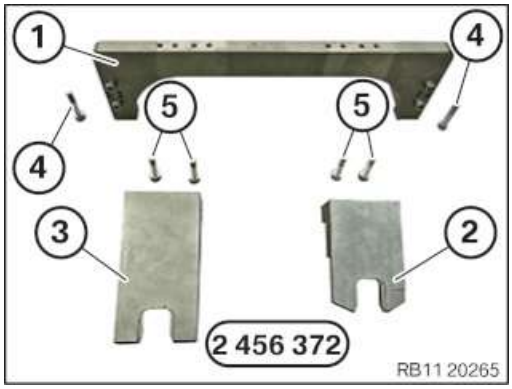


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

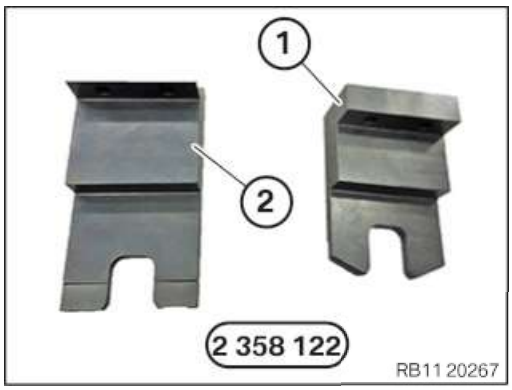
  The engine is in the TDC firing position of cylinder 1.

erdiagn.com



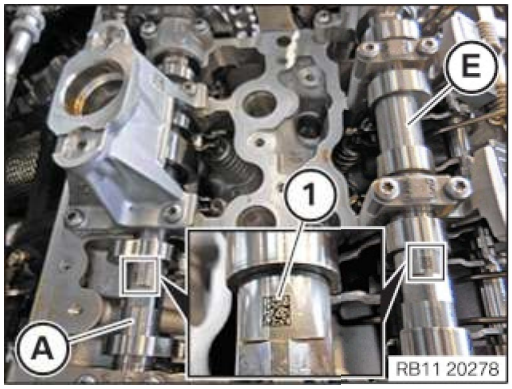
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

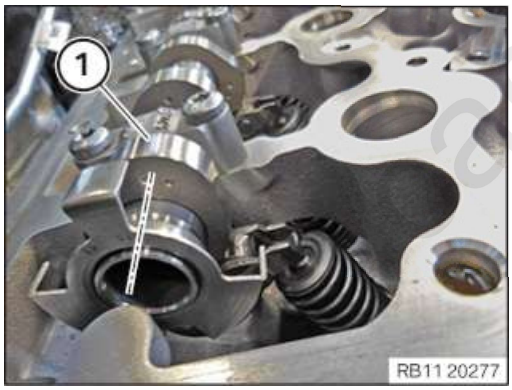


- Overview of the test gauges from the set of special tools 2 358 122:

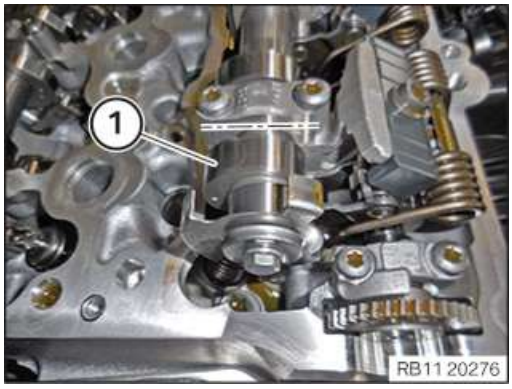
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

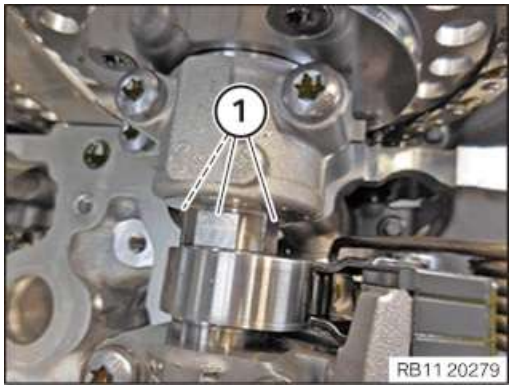


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

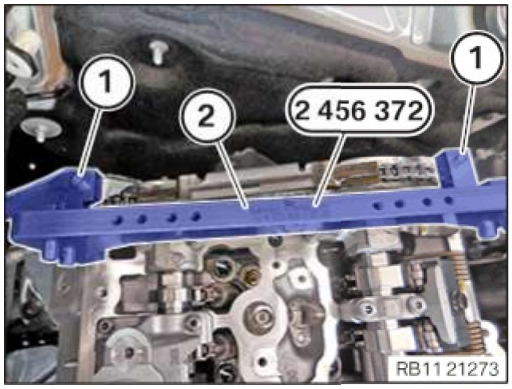
ardiagn.com



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



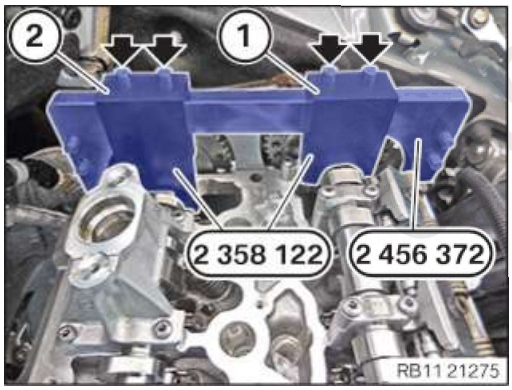
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

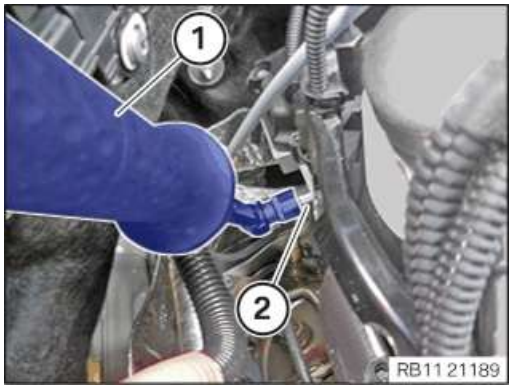
M6		Tightening torque	8 Nm

18 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

diagn.com



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

19 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

The figure shows the rear side of the engine.

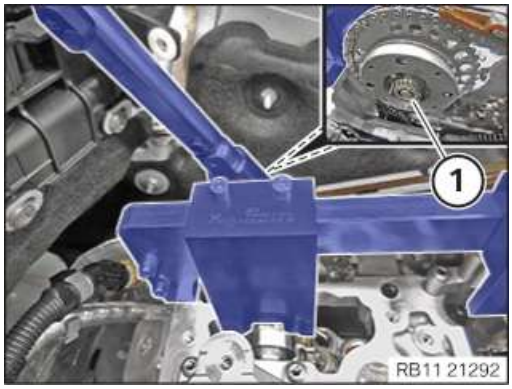
- Release the VANOS central valve (1) of the intake adjuster.

20 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

carsdiagn.com

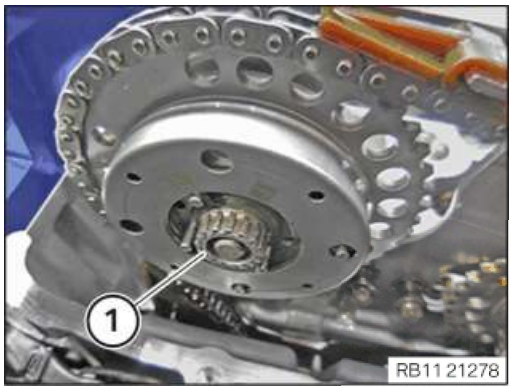


NOTICE

The figure shows the rear side of the engine.

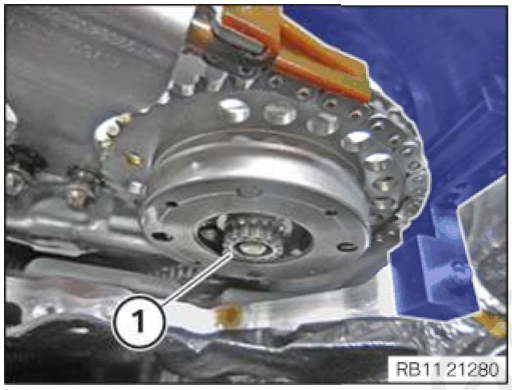
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

21 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

22 – Remove the VANOS central valve of the exhaust camshaft adjuster



- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

23 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.



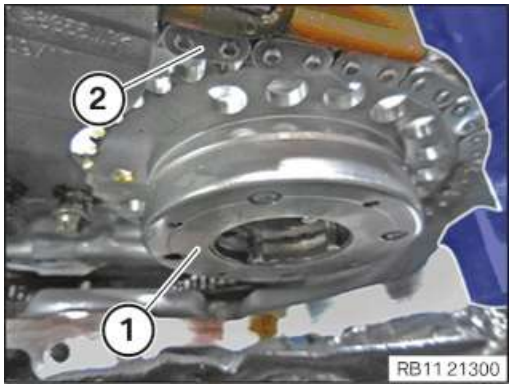
- Guide out the intake adjuster (1) from the timing chain (2) and remove.

24 – Remove exhaust camshaft adjuster

cardiagn.com

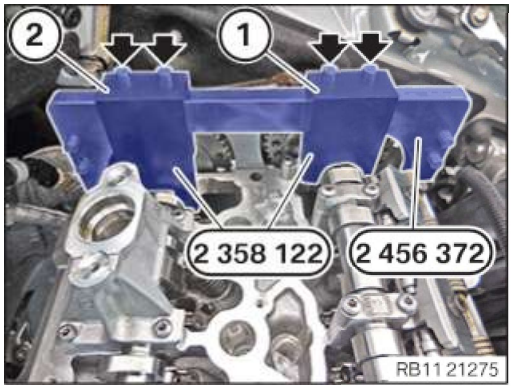
NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

25 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

26 – Remove cylinder head.

CAUTION

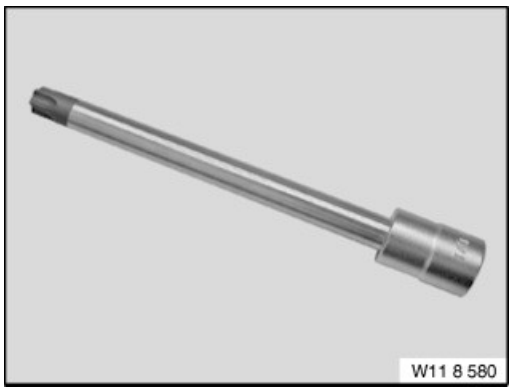
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

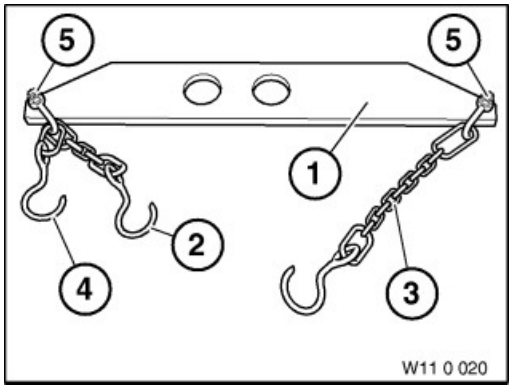
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Prepare special tool 0 495 747 (11 8 580).

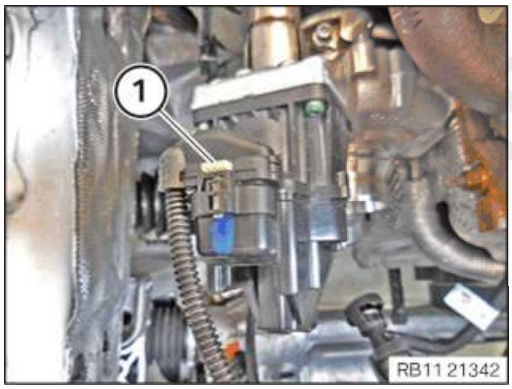
cardiagn.com



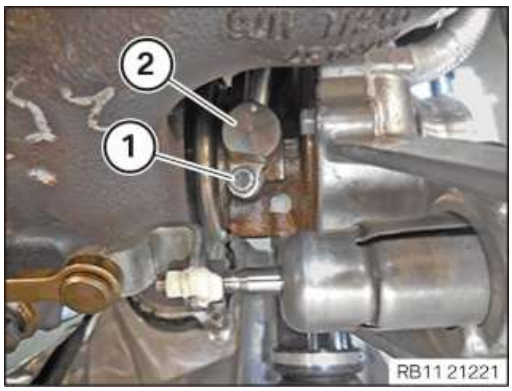
- Prepare special tool .



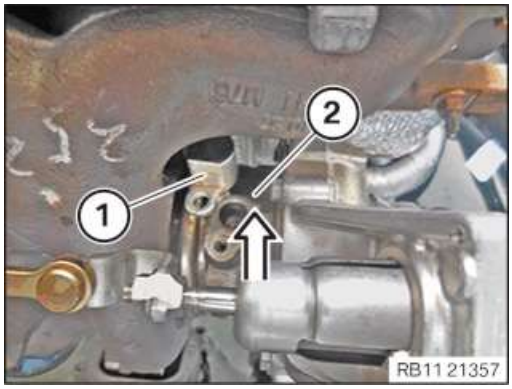
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.



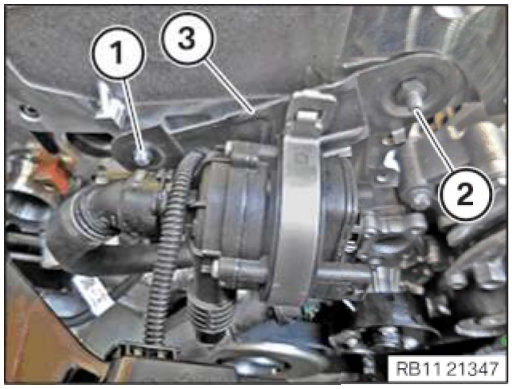
- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.



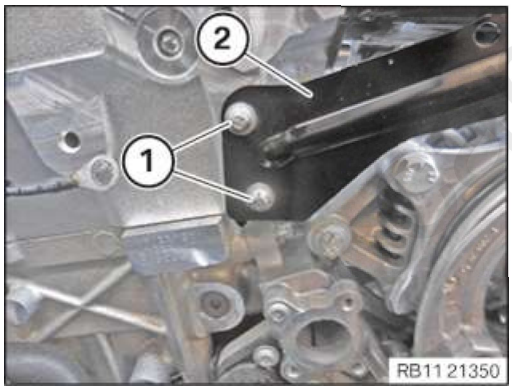
- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.

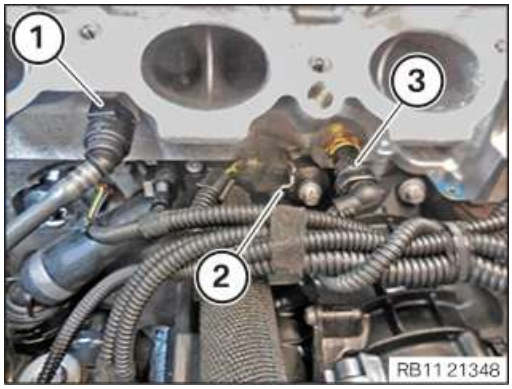


- Loosen screws (1).
- Thread out holder (2) and set aside.

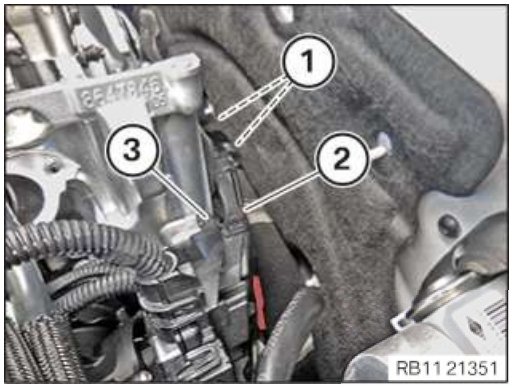


- Unlock plug connection (1) and disconnect.

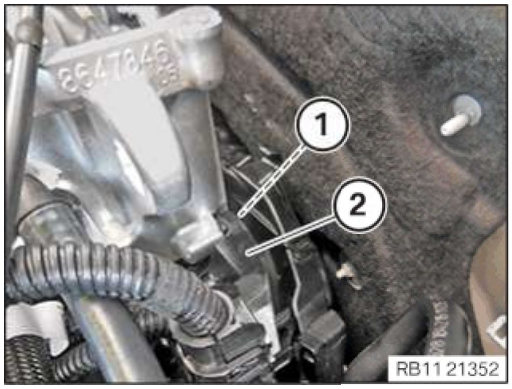
rdiagn.com



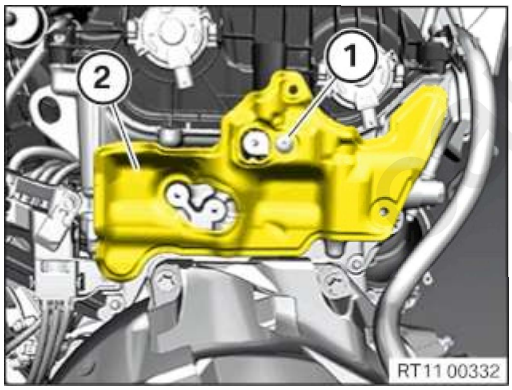
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



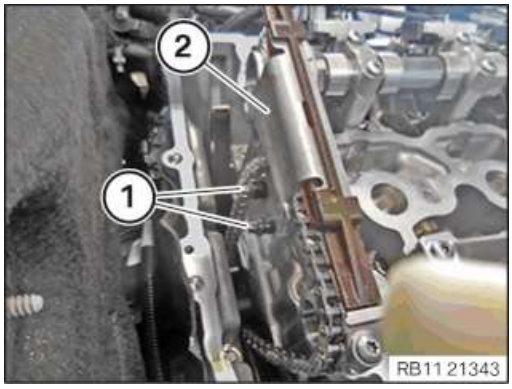
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



NOTICE

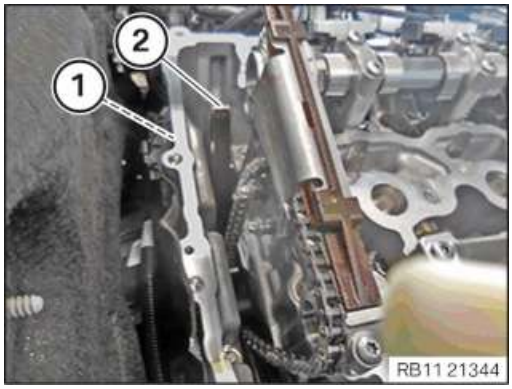
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

carsdiagn.com



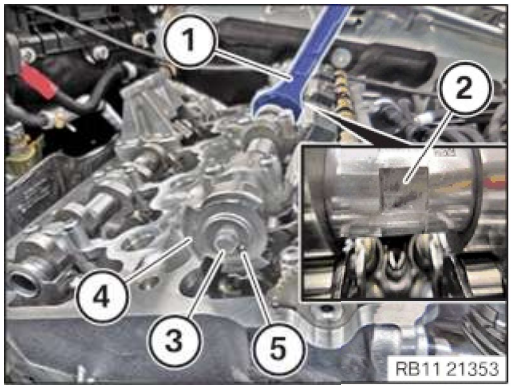
- Release the bearing journal (1) from the guide rail (2).



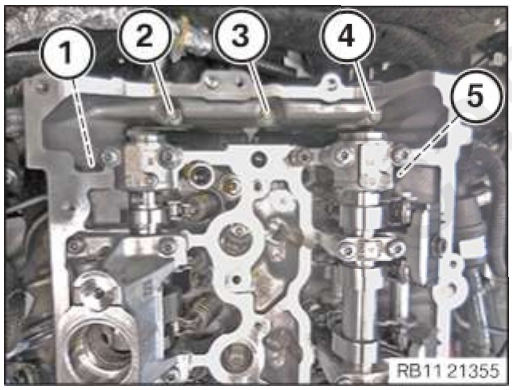
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm



- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.

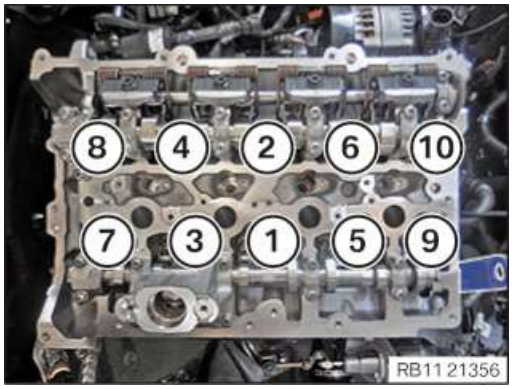


- Loosen the cylinder head bolts in the sequence from (5) to (1).

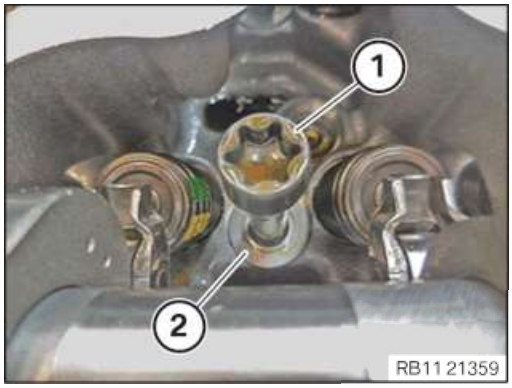


- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

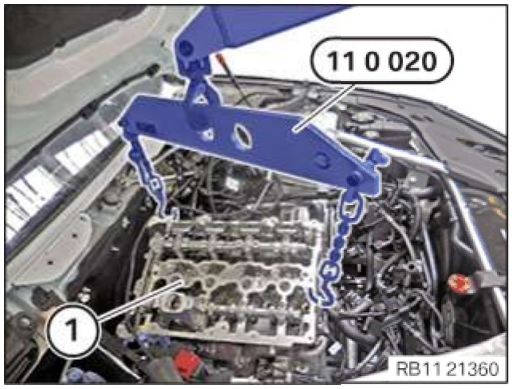
tdiagn.com



- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to the guide rails.

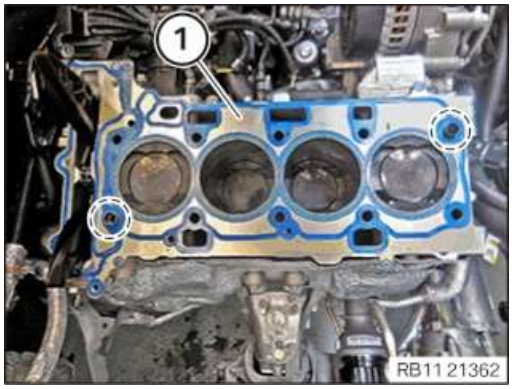
Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Attach special tool to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an **auxiliary person**, the workshop crane and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

27 – Removing the cylinder head gasket

carmagn.com

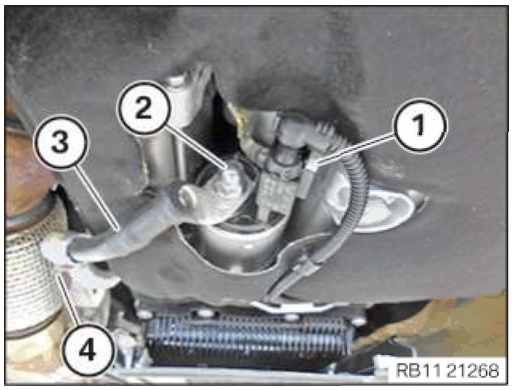


- Guide out and remove cylinder head gasket (1) in the **marked** area.

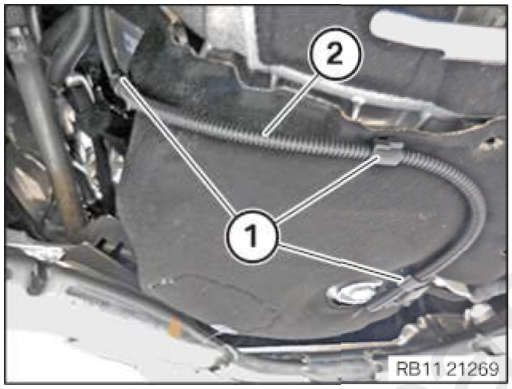
28 – Removing the acoustic cover of the oil sump

Prerequisite

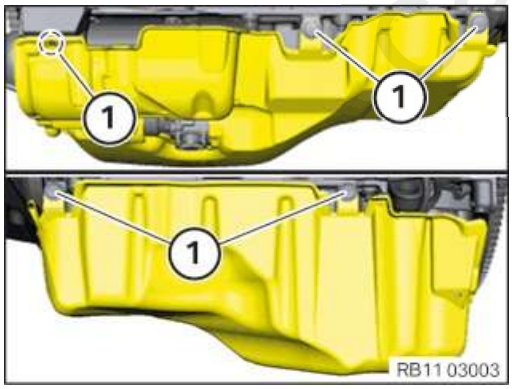
Disconnect all negative battery cables.



- Unlock and loosen connector (1).
- Loosen nut (2).
- Guide the positive battery cable (3) out of the clamp (4) and lay to one side.



- Unlock and loosen the clamps (1).
- Guide out the wiring harness section of automatic transmission (2) and set it aside.

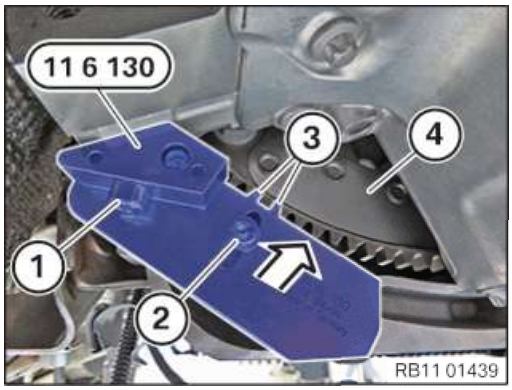


- Detach all expanding rivets (1).



- Guide out acoustic cover (1) downwards to the rear and remove it.

29 – Removing the vibration damper



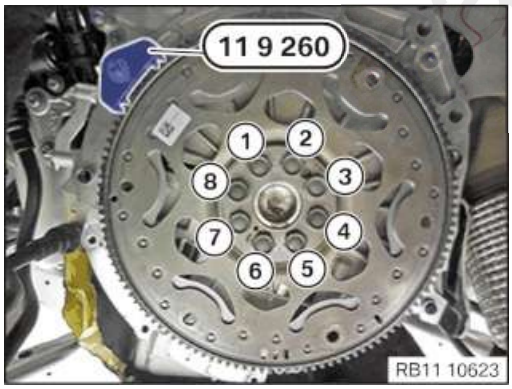
- Position the special tool 0 496 595 (11 6 130) and secure it on the timing case cover using the bolt (1).

  The special tool 0 496 595 (11 6 130) must lie flat on the transmission housing.
- If necessary, turn the engine in the direction of rotation until the teeth (3) engage completely in the gearing of the flywheel (4).
- Slide the counter support with the bolt (2) up until the teeth (3) engage completely in the gearing of the flywheel.
- Tighten down screw (2).



- Unscrew the bolts (arrows) on the vibration damper (1).
- Feed out and remove the vibration damper (1).

30 – Removing flywheel



- Fasten the flywheel with the special tool 0 493 938 (11 9 260) and tighten with the special tool 0 494 130 (11 9 264).
- Loosen screws (1-8).

31 – Remove oil sump

RISK OF DAMAGE

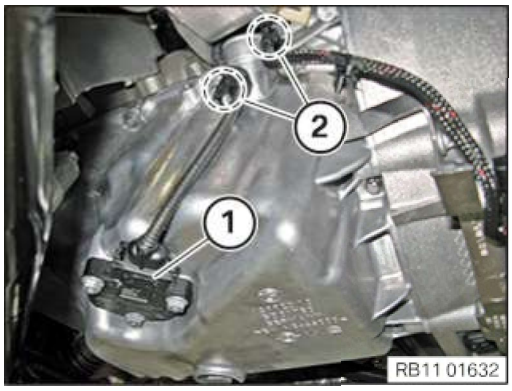
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

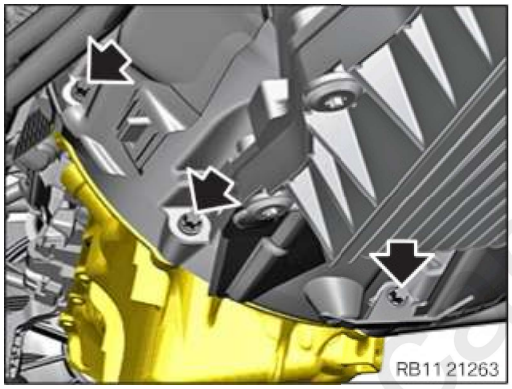
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

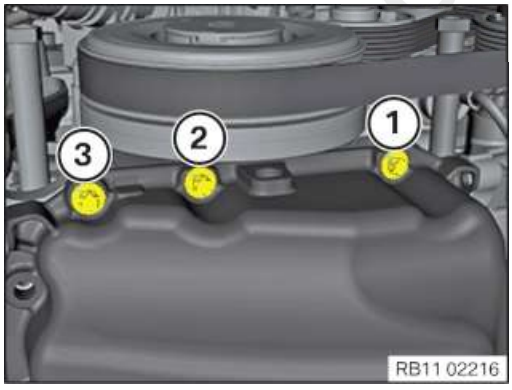
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Unlock and loosen connector (1).
- Release the cable from the clips (2) of the oil sump.

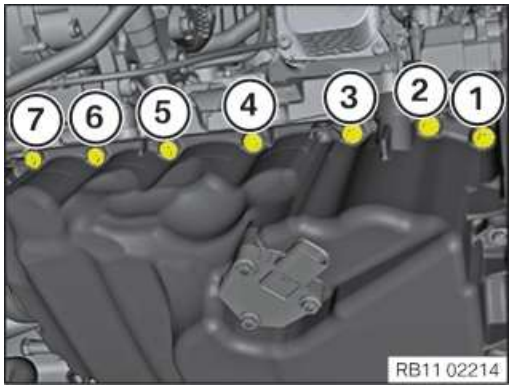


- Unscrew the transmission bolts (arrows).

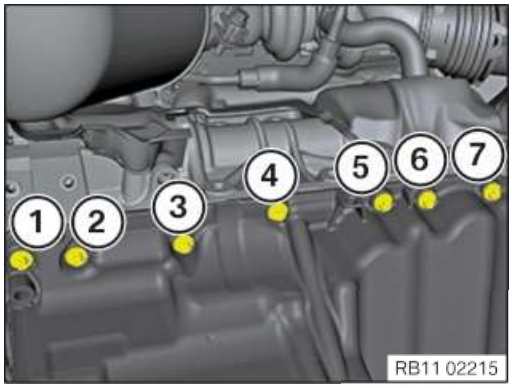


- Loosen screws (1), (2) and (3).

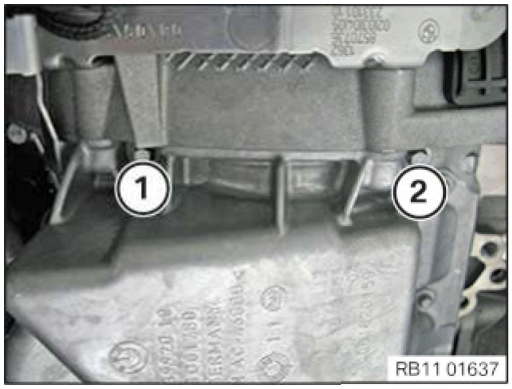
carsdiagn.com



- Loosen screws (1) to (7).



- Loosen screws (1) to (7).



- Loosen screws (1) and (2).



TECHNICAL INFORMATION

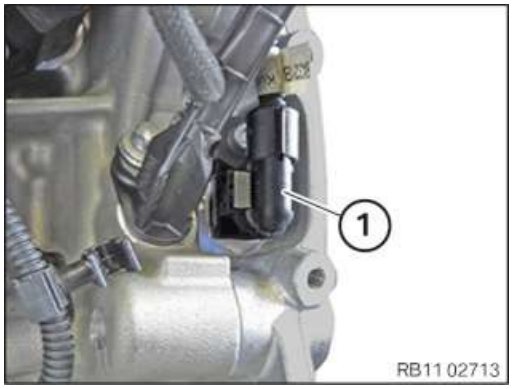
Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump in the **marked** areas using suitable tools (1).

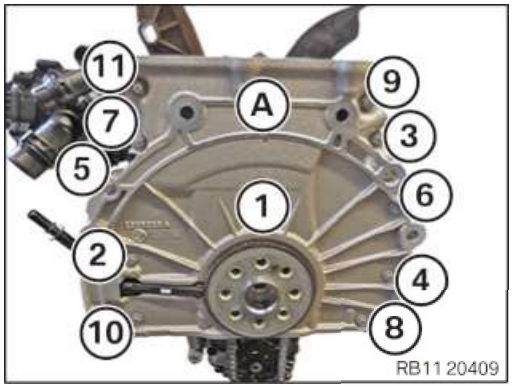


- Guide out the oil sump (1) downwards to the rear and remove.

32 – Remove rear timing case cover



- Unlock the connector (1) and pull it off the crankshaft sensor.



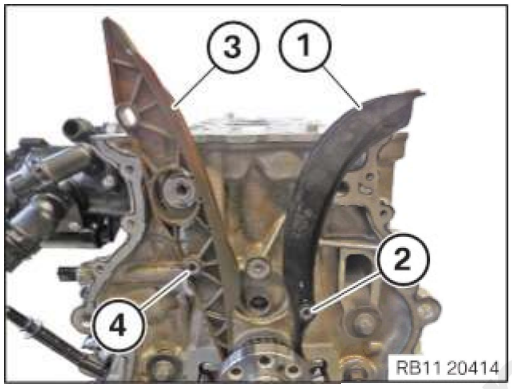
- Loosen screws in the order (11) to (1).

TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

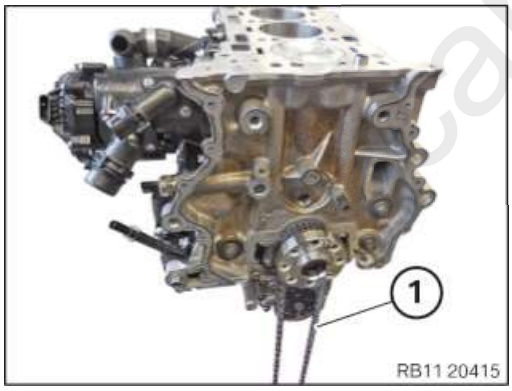
- Carefully loosen and remove the timing case cover (A).

33 – Removing timing chain



- Thread the tensioning rail (1) out of the bearing journal (2) and remove.

  The bearing journal does not have to be removed.
- Loosen the bearing journals (4).
- Guide out the guide rail (3) and remove.



- Guide out the timing chain (1) and remove.

34 – Remove the oil vacuum pump

RISK OF DAMAGE

Contaminant or foreign body.

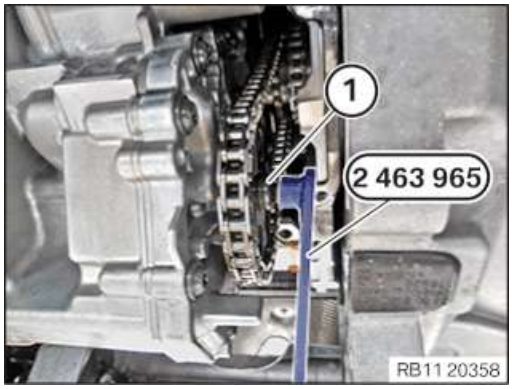
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

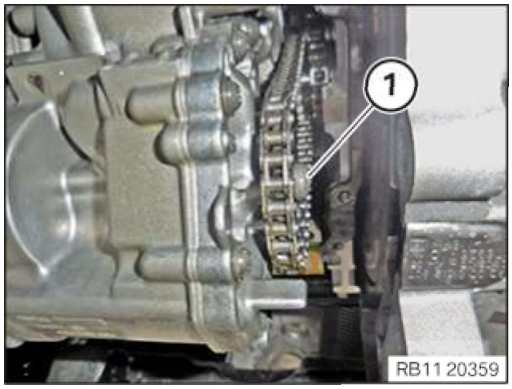
carsdiagn.com

TECHNICAL INFORMATION

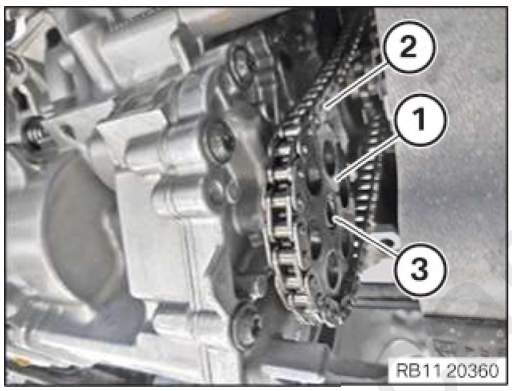
The thread is a left-hand thread.



- Release bolt (1) with the special tool 2 463 965.



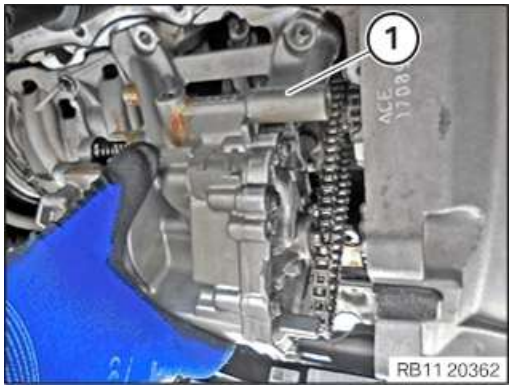
- Thread out the bolt (1) and remove it.



- Detach the camshaft sprocket (1) from the oil vacuum pump (3).
- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.

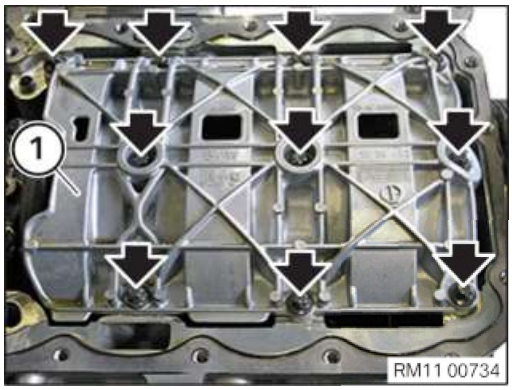


- Loosen screws (1).



- Feed out the oil vacuum pump (1) and remove it.

35 – Removing the oil deflector



- Release all bolts (arrows).
- Remove the oil deflector (1).

36 – Removing all pistons with connecting rod

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the piston with connecting rod**

TECHNICAL INFORMATION

Piston, gudgeon pin, connecting rod and connecting rod bearing shells are matched to each other and balanced.

Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

TECHNICAL INFORMATION

The connecting rods of the engine are balanced and are matched to each other.

A single connecting rod is not permitted to be replaced. Always replace all connecting rods.

▹ **Detach the lower connecting rod bearing**

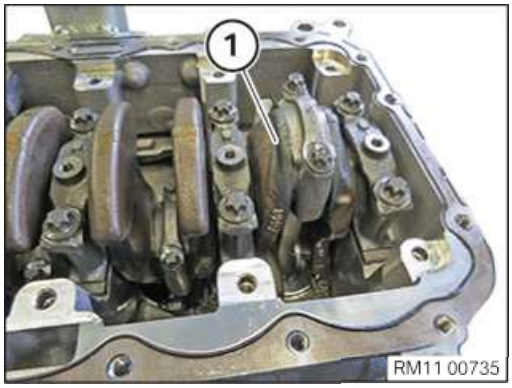
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RISK OF DAMAGE

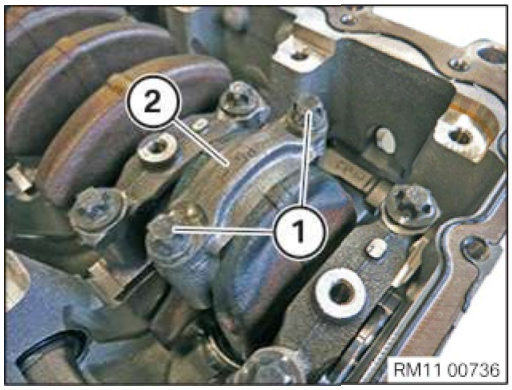
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.



- Turn the crankshaft until the connecting rod bearing journal (1) reaches a vertical position.



RISK OF DAMAGE

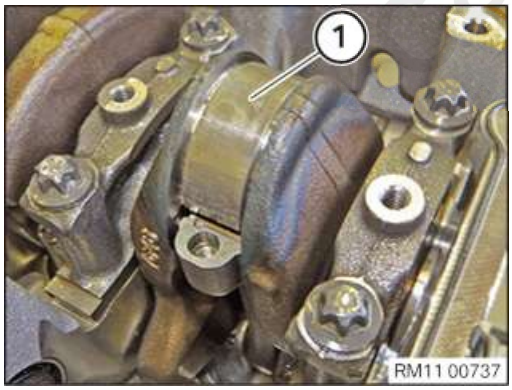
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Unscrew the connecting rod bolts (1).
- Remove the connecting rod bearing cap (2) and put to one side in the correct order.

  Make sure that the connecting rod bearing cap (2) can be re-installed in the correct position.



RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

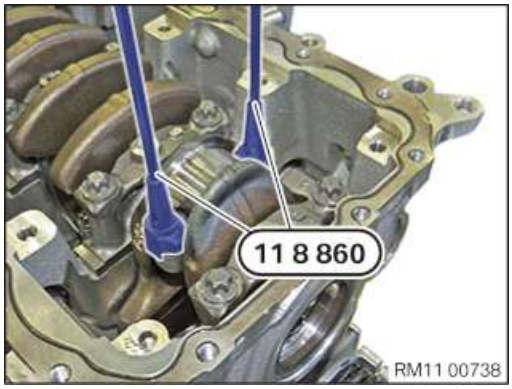
- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Remove the connecting rod bearing (1).

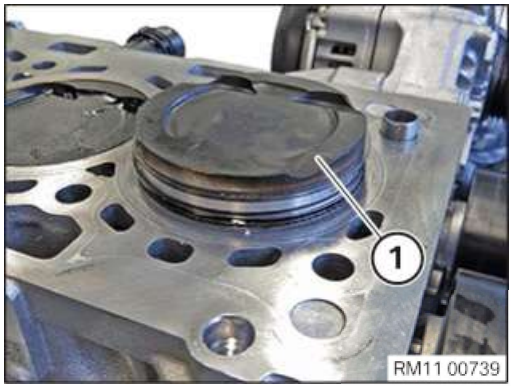
  Make sure that the connecting rod bearing (1) can be re-installed in the correct position.

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- Screw special tool 0 496 144 (11 8 860) in at large connecting rod eye.

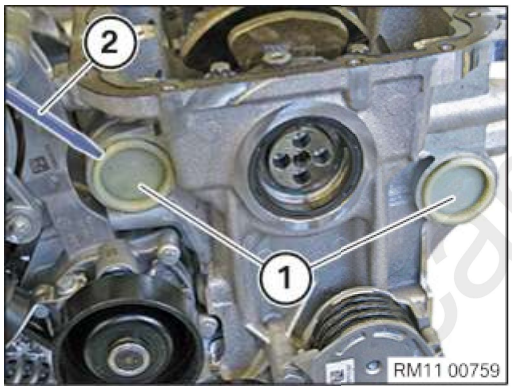


- Press piston (1) with connecting rod up and out of crankcase.

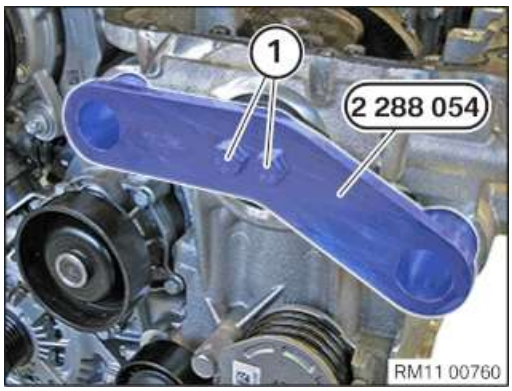
37 – Remove crankshaft

NOTICE

In the following operations, the engine is rotated by 180 degrees. The bottom points up.

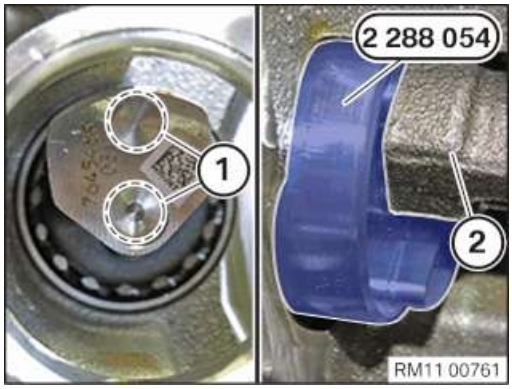


- Remove both sealing caps (1) with a suitable tool (2).



- Rotate the crankshaft to the **TDC of the first cylinder**.
- Mount the special tool 2 288 054 and abut the bolts (1).

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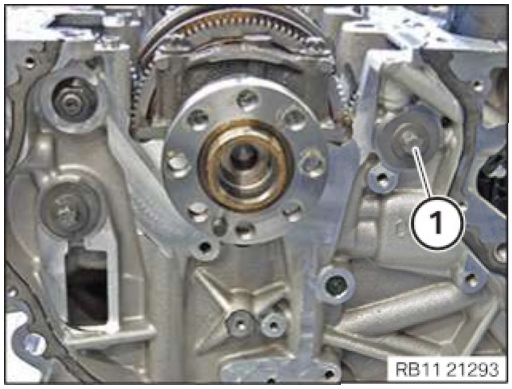
NOTICE

The description is for one component only. The procedure is identical for all further components.

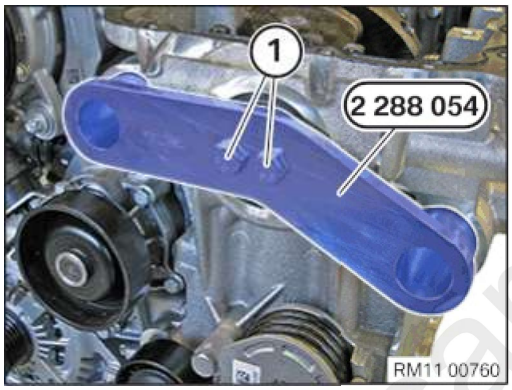
- Make sure the special tool 2 288 054 is correctly fitted in the guides (1) of the counterbalance shafts (2).
- If necessary, turn the crankshaft slightly.
- Tighten special tool 2 288 054.

Special tool 2 288 054 to crankshaft

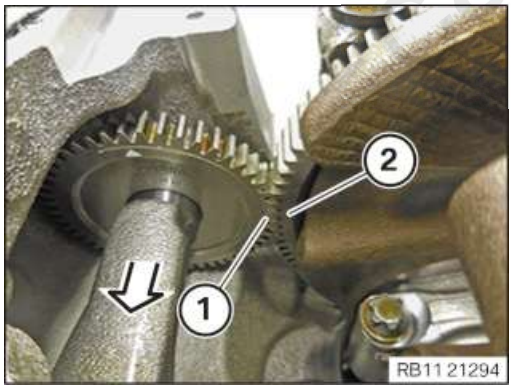
		Tightening torque	20 Nm



- Loosen screws (1) on the counterbalance shaft on the intake side.

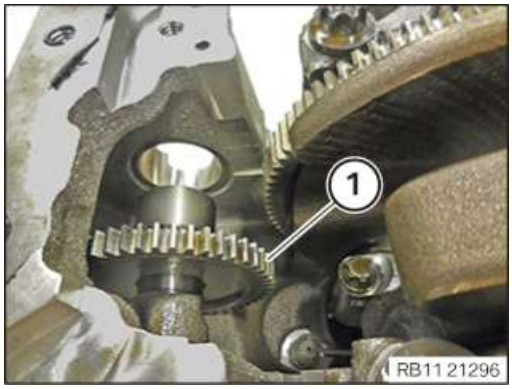


- Loosen screws (1).
- Guide the special tool 2 288 054 out and remove.

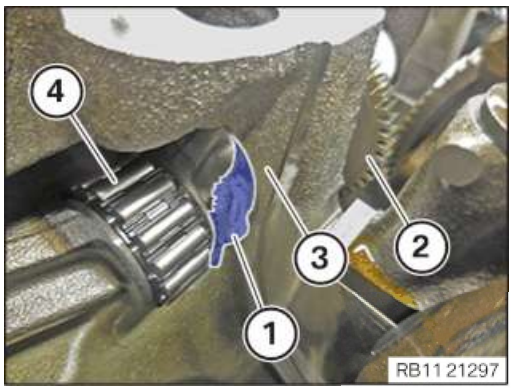


- Guide out counterbalance shaft (1) on the intake side from crankshaft (2) in the **direction of the arrow**.

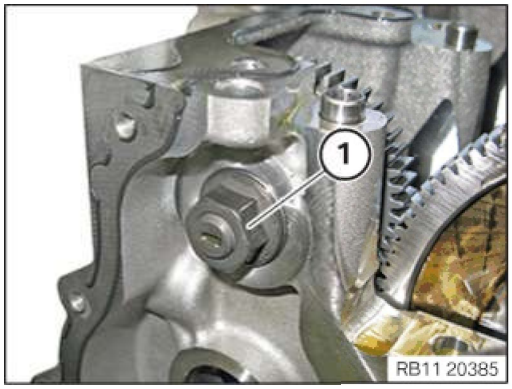
cardiagn.com



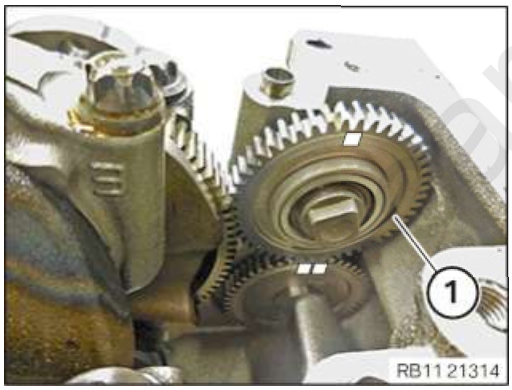
- **Carefully** place aside counterbalance shaft (1) on the intake side.



- Position a clean lint-free cleaning rag (1) between counterbalance shaft (2) on the intake side and crankcase (3).
- Ensure that needle bearing (4) is not **damaged**.

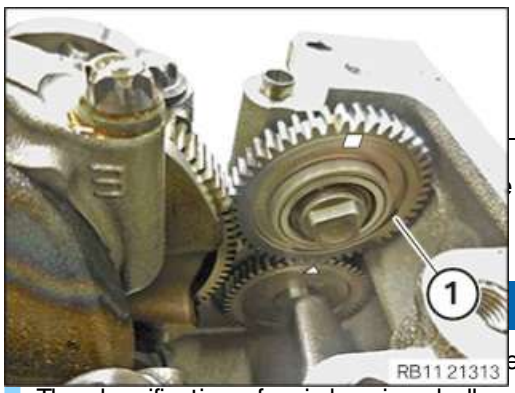


- Unfasten nut (1).



- **Vehicles up to year of manufacture until 07/16**

  Thread out the intermediate wheel (1) and remove.



- **Vehicles up to year of manufacture from 07/16**

  Thread out the intermediate wheel (1) and remove.

---

crankshaft main bearing shell

lls are classified via colours or numbers.

The classification of main bearing shells and guide bearing shells is changed to a classification, exclusively based on numbers. The classification based on colours is deleted.

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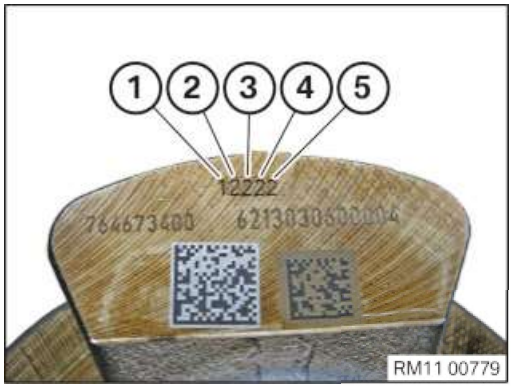


- Read the code lettering (1) on the crankcase bearing caps.

  K = Clutch side

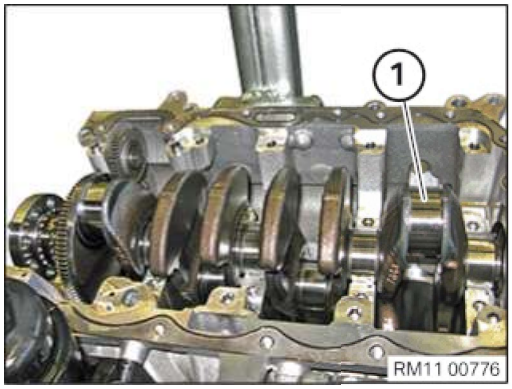
  The mounting orientation must be maintained.

  The item numbers (5) to (1) describe the bearing seats 5 to 1. The **code** is located on the **crankshaft bearing caps**.



- Read the identification numbers (1) to (5) on the **crankshaft** and enter in the table.
- Place the main bearing caps neatly in the special tool 1455 055 61 (1 4489).

  The item numbers (1) to (5) describe the bearing seats 1 to 5. The **codes** are located on the **crankshaft bearing caps**.



- Enter the code letters of the **crankcase**.
- Enter the identification numbers of the **crankshaft**.

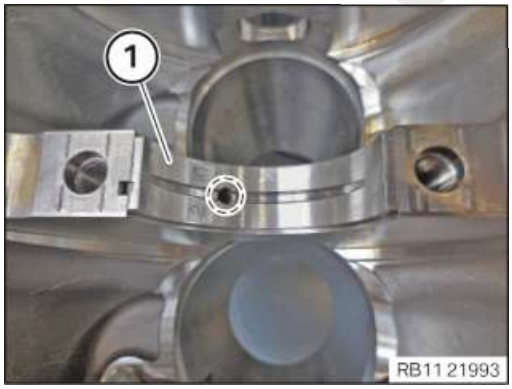
CAUTION

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide out and remove crankshaft (1).

Heavy component	**Code letters** on crankcase	**Code letters/identification numbers** on the crankshaft
Bearing seat 1		
Bearing seat 2		
Bearing seat 3		
Bearing seat 4		
Bearing seat 5		

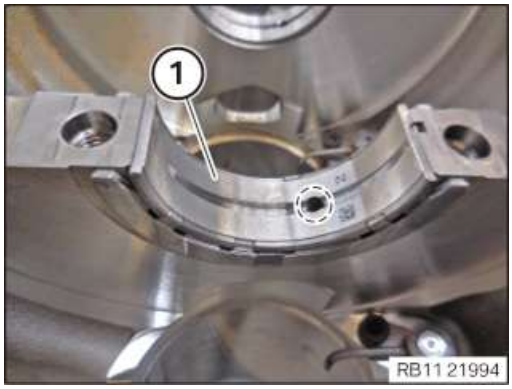


- Using the table, determine the respective correct main bearing shell with lubricating groove (1) for the crankcase.

  The main bearing shells are classified by **colours** or **numbers**.

	A	**B**	**C**
1	Classification 1 (blue)	Classification 2 (green)	Classification 2 (green)
2	Classification 1 (blue)	Classification 2 (green)	Classification 3 (brown)
3	Classification 2 (green)	Classification 2 (green)	Classification 3 (brown)

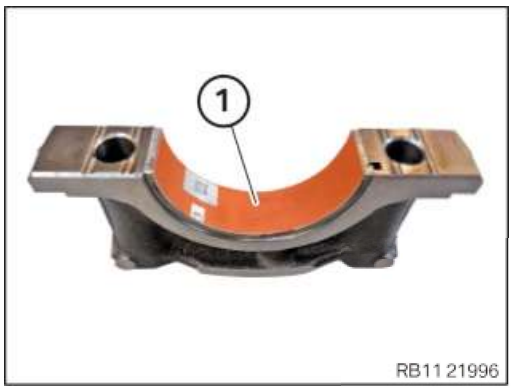
carmanual.com



- Using the table, determine the respective correct guide bearing shell with lubricating groove (1) for the crankcase.

  The guide bearing shells are classified by **colours** or **numbers**.

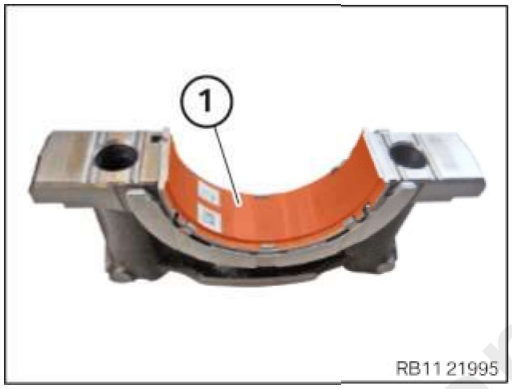
	A	B	C
1	Classification 1 (blue)	Classification 2 (green)	Classification 2 (green)
2	Classification 1 (blue)	Classification 2 (green)	Classification 3 (brown)
3	Classification 2 (green)	Classification 2 (green)	Classification 3 (brown)



- Using the table, determine the correct main bearing shell without lubricating groove (1) for the respective crankcase bearing cap.

  The main bearing shells are classified by **colours** or **numbers**.

	A	B	C
1	Classification 1 (blue)	Classification 1 (blue)	Classification 2 (green)
2	Classification 2 (green)	Classification 2 (green)	Classification 2 (green)
3	Classification 2 (green)	Classification 3 (brown)	Classification 3 (brown)

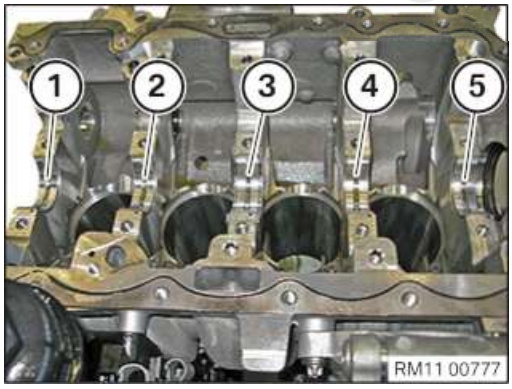


- Using the table, determine the correct guide bearing shell without lubricating groove (1) for the respective crankcase bearing cap.

  The guide bearing shells are classified by **colours** or **numbers**.

	A	B	C
1	Classification 1 (blue)	Classification 1 (blue)	Classification 2 (green)
2	Classification 2 (green)	Classification 2 (green)	Classification 2 (green)
3	Classification 2 (green)	Classification 3 (brown)	Classification 3 (brown)

39 – Renewing the crankshaft main bearing shells



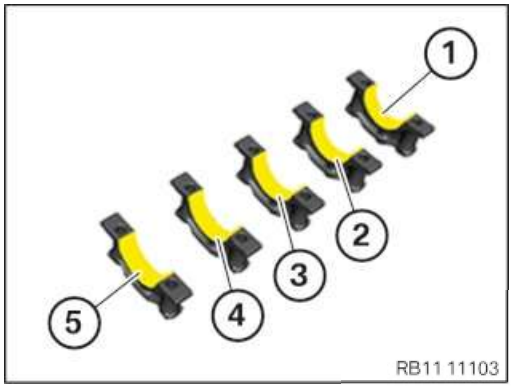
- Renew crankshaft main bearing shells (1) to (5) (with lubricating groove) in the crankcase.

  Note: The thrust bearing of the crankshaft is installed at bearing position (3).

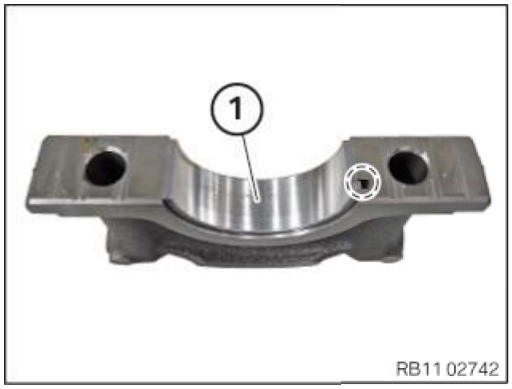
cardiagn.com



- Make sure the crankshaft main bearing shell (1) is correctly installed with the guide lug in the highlighted area.



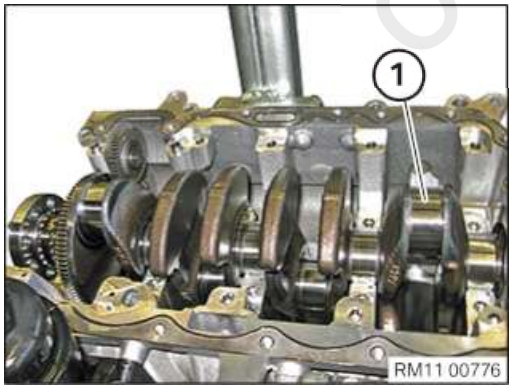
- Renew the crankshaft main bearing shells (1) to (5) (without lubricating groove) on the crankshaft bearing caps.



- Make sure the crankshaft main bearing shell (1) is correctly installed with the guide lug in the highlighted area.

POSTPROCESSES

40 – Installing the crankshaft



CAUTION

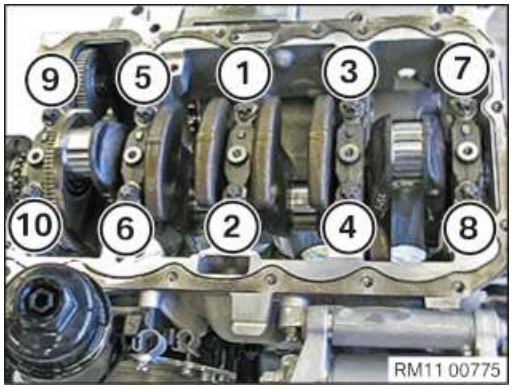
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide in and install crankshaft (1).

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TECHNICAL INFORMATION

The crankshaft bearing cap, main bearing shell and guide bearing shell are aligned with each other.

Always install the crankshaft bearing cap, main bearing shells and guide bearing shells in the cylinder from which they were removed.

- Observe numbering on the main bearing cap.
- Position the main bearing cap.
- Tighten the screws in the following sequence: (1) - (10).

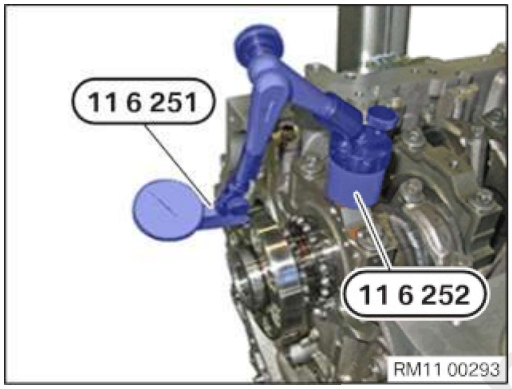
Main bearing cap to crankcase

M10x1.5	Renew screws.	1. Jointing torque	25 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

▸ **Check the crankshaft side clearance**

Check

- Attach the dial gauge 0 493 144 (11 6 251) with the tripod 0 493 145 (11 6 252) to the engine.



Axial play of crankshaft

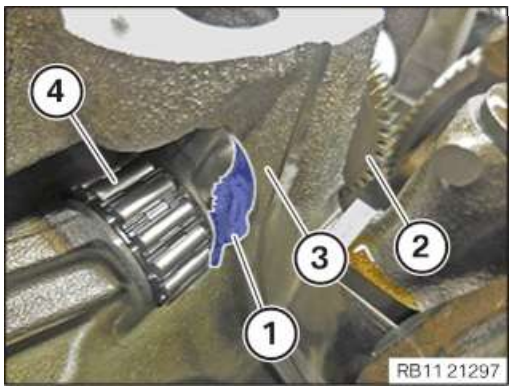
	min. 0,060 mm
	max. 0,250 mm

Result

» The side clearance has been exceeded.

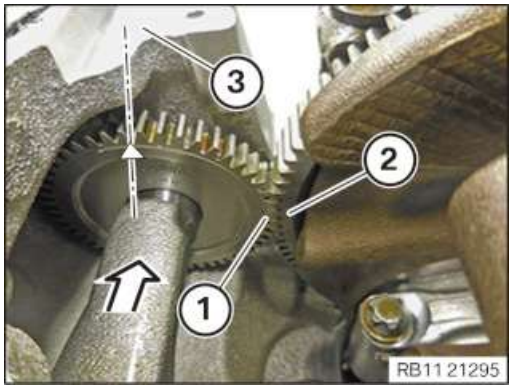
Measure

- Renew worn components.

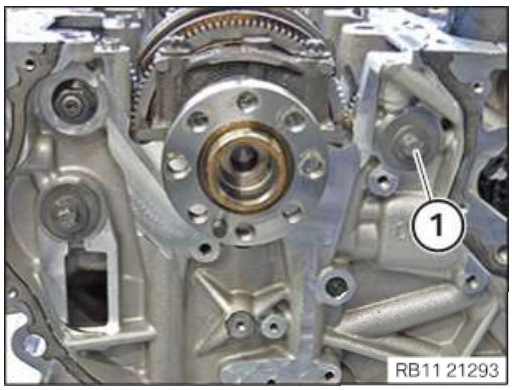


- Guide out lint-free cleaning rag (1) between counterbalance shaft (2) on the intake side and crankcase (3) and remove it.
- Ensure that needle bearing (4) is **not** damaged.

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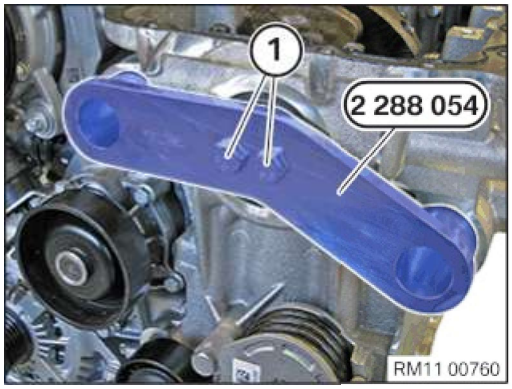


- Bring or adjust crankshaft (2) to the **TDC position** .
- Position counterbalance shaft (1) on the intake side in the **direction of the arrow** on crankshaft (2).
- The mark on gear (1) on the intake side of the counterbalance shaft must point **upwards**, **perpendicular** to the sealing surface of oil sump (3).

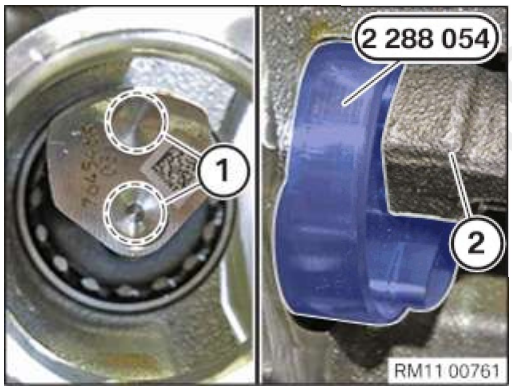


- Renew the screw (1).

  Parts: Screw
- Screw screw (1) into the counterbalance shafts on the intake side.
- Do **not** tighten screw (1) since otherwise the counterbalance shafts can no longer be positioned in the next step.



- Rotate the crankshaft to the **TDC of the first cylinder**.
- Mount the special tool 2 288 054 and abut the bolts (1).



NOTICE

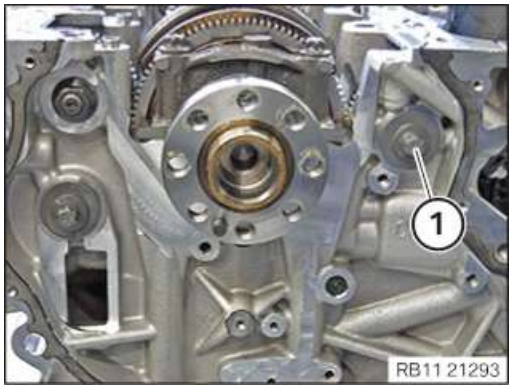
The description is for one component only. The procedure is identical for all further components.

- Make sure the special tool 2 288 054 is correctly fitted in the guides (1) of the counterbalance shafts (2).
- If necessary, turn the crankshaft slightly.
- Tighten special tool 2 288 054.

Special tool 2 288 054 to crankshaft

		Tightening torque	20 Nm

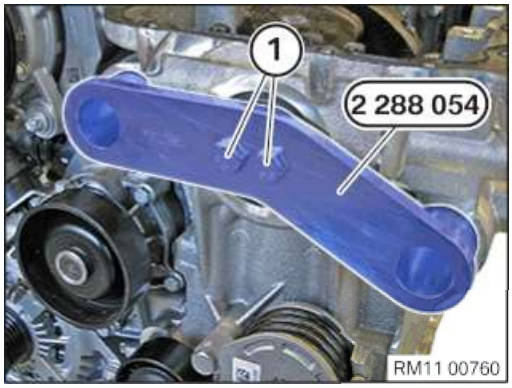
mdiagn.com



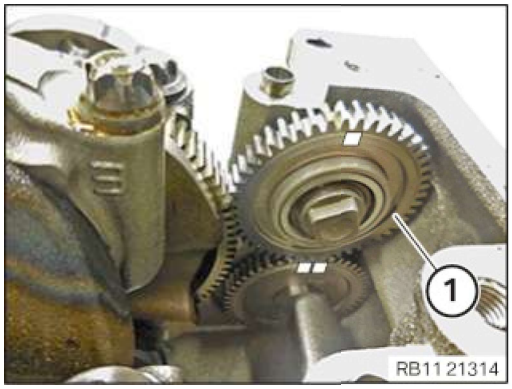
- Tighten screw (1) of the counterbalance shaft on the intake side.

Gear to counterbalance shaft

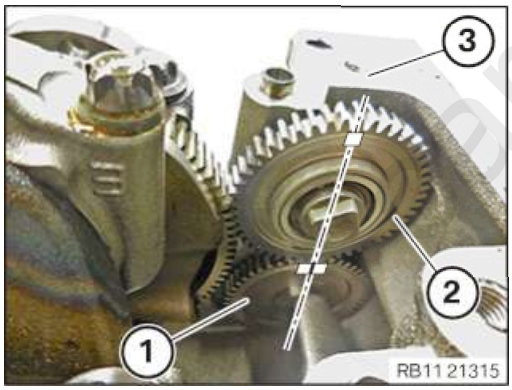
		1. Jointing torque	40 Nm
		2. Angle of rotation	70 °



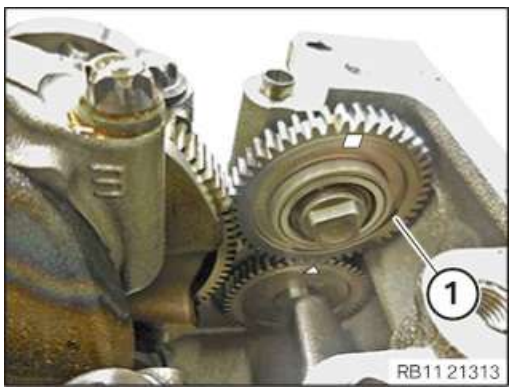
- Loosen screws (1).
- Guide the special tool 2 288 054 out and remove.



- **Vehicles up to year of manufacture 07/16**
- Guide in and install intermediate wheel (1).

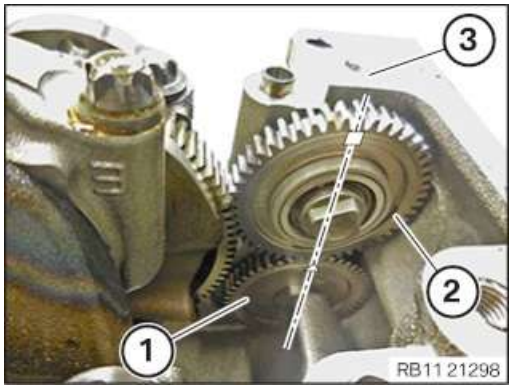


- **Vehicles up to year of manufacture 07/16**
- The marks on gear (1) and also on intermediate wheel (2) must point **upwards**, **perpendicular** to the sealing surface of oil sump (3).
- Mark on intermediate wheel (2) of the counterbalance shaft on the exhaust side: a square.
- Mark on gear (1) of the counterbalance shaft on the exhaust side: two squares.

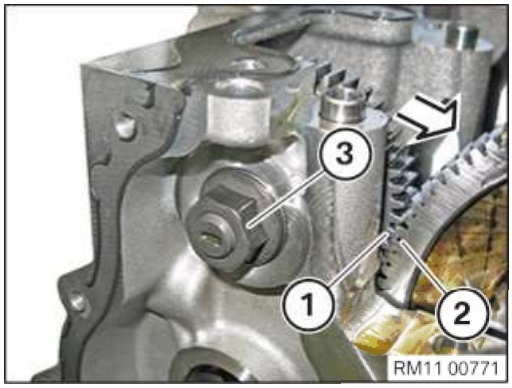


- **Vehicles from year of manufacture 07/16**
- Guide in and install intermediate wheel (1).

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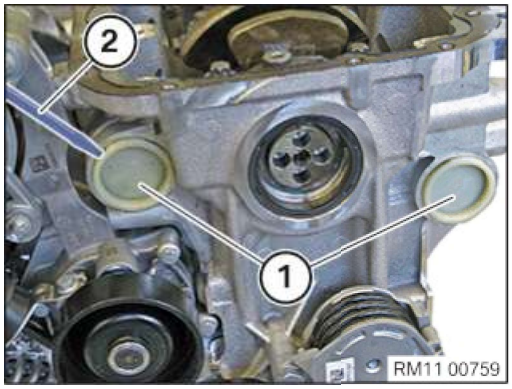
- **Vehicles from year of manufacture 07/16**
- The marks on gear (1) and also on intermediate wheel (2) must point **upwards**, **perpendicular** to the sealing surface of oil sump (3).
- Mark on intermediate wheel (2) of the counterbalance shaft on the exhaust side: a square.
- Mark on gear (1) of the counterbalance shaft on the exhaust side: a triangle.



- Move intermediate wheel (1) in the **direction of the arrow** to gear (2) of the crankshaft.
- Tighten nut (3).

Gear to crankcase

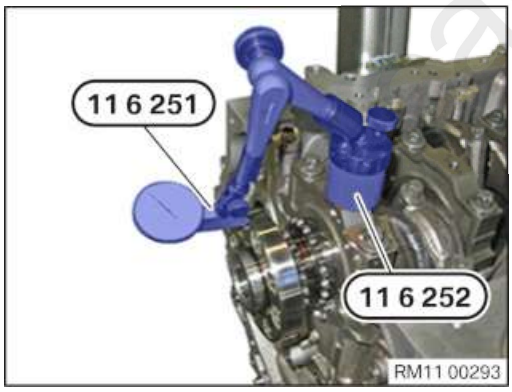
			70 Nm



- Renew the sealing cap (1).

  Parts: Sealing cap
- Make sure the O-rings of the sealing cap (1) are fitted correctly.
- Mount both sealing caps (1).

41 – Check the crankshaft side clearance



Check

- Attach the dial gauge 0 493 144 (11 6 251) with the tripod 0 493 145 (11 6 252) to the engine.

Axial play of crankshaft

	min. 0,060 mm
	max. 0,250 mm

Result

» The side clearance has been exceeded.

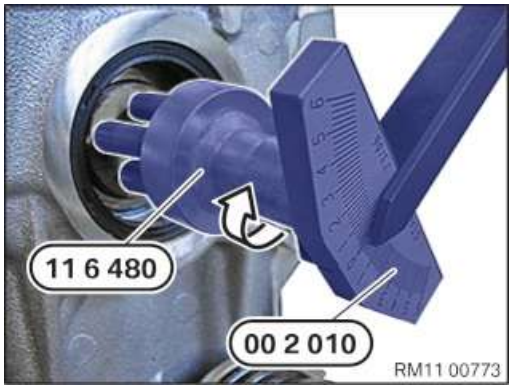
Measure

- Renew worn components.

42 – Check the coefficient of friction for the crankshaft

Check

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- Turn the crankshaft clockwise with the special tool 0 490 130 (00 2 010) and compare the reading on the scale to the maximum permitted torque.

Maximum permitted torque of the crankshaft

	max. 2 Nm

Result

» The maximum permitted torque is exceeded.

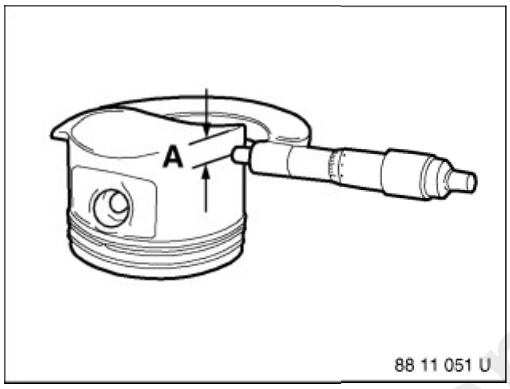
Measure

- Correct the radial clearance.

43 – Measuring piston

NOTICE

The description is for one component only. The procedure is identical for all further components.



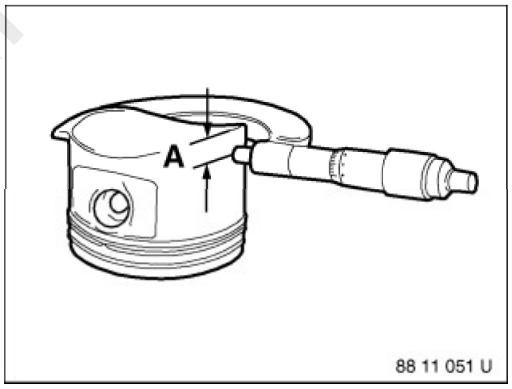
Check

- Position measuring bolt in area (A) and measure piston installation clearance transversely to gudgeon pin.

Piston diameter

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Result

» Piston does not correspond to the specifications.

Measure

- Renew the piston.

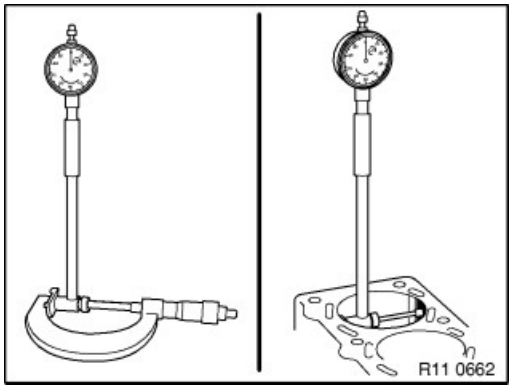
44 – Measuring a cylinder

Prerequisite

Cylinder barrel is cleaned.

Check

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- Carry out a measurement at all cylinders.
- Adjusting measuring screw to nominal dimension of cylinder bore.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

- Insert internal measuring device into measuring screw and set to zero.
- With the internal measuring device, measure the cylinder at the following points and check the deviations from the nominal dimension.
  - Lower third of the cylinder bore in direction of travel,
  - Lower third of the cylinder bore transversely to direction of travel,
  - Middle third of the cylinder bore in direction of travel,
  - Middle third of the cylinder bore transversely to direction of travel,
  - Upper third of the cylinder bore in direction of travel,
  - Upper third of the cylinder bore transversely to direction of travel.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Result

» Cylinder does not correspond to the specifications.

Measure

- Renew the crankcase.

45 – Installing all pistons with connecting rod

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Installing piston with connecting rod**

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RISK OF DAMAGE

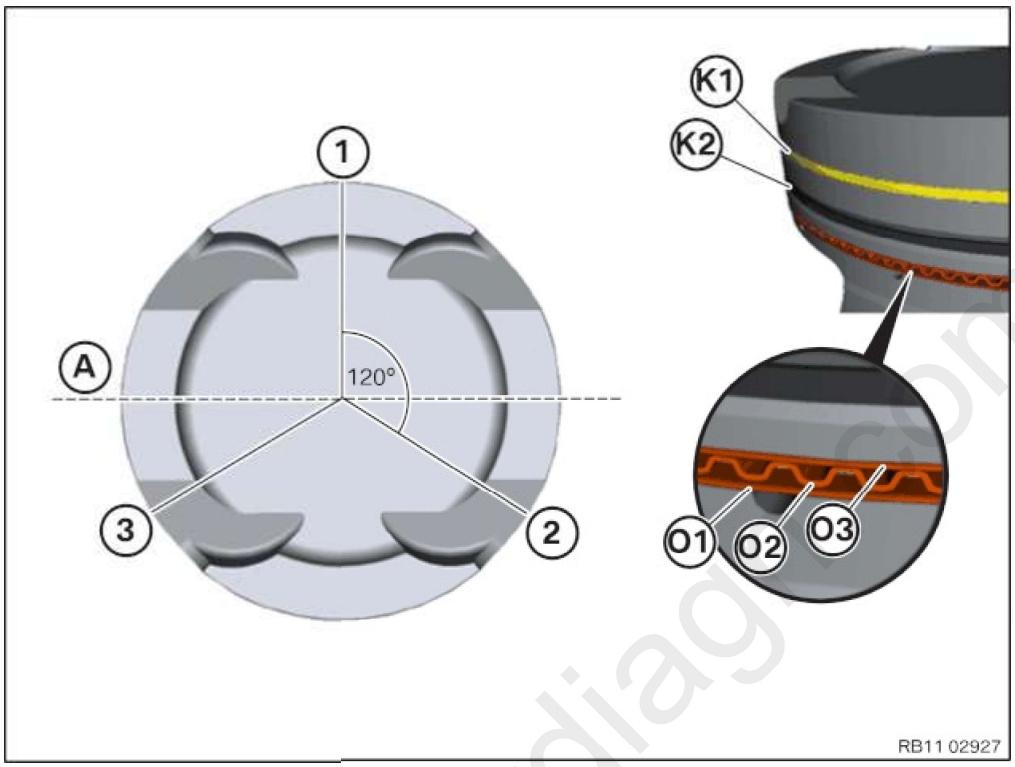
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

▷ **Aligning piston rings**

Aligning piston rings



1 12 o'clock position

2 4 o'clock position

3 8 o'clock position

A Axis of gudgeon pin

K1 Upper piston ring

K2 Middle piston ring

O1 Lower oil scraper ring

O2 Spring

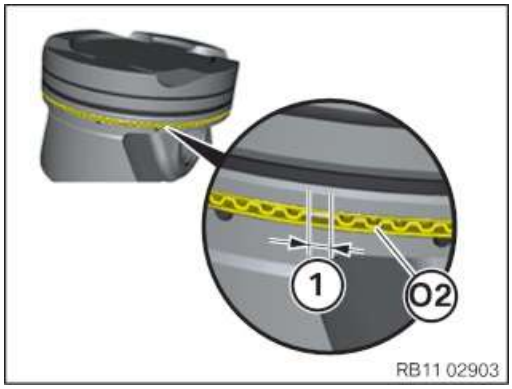
O3 Upper oil scraper ring

- Align the contact points of all piston rings rotated by 120° each.

  Do not position contact points over axis of gudgeon pin (A).

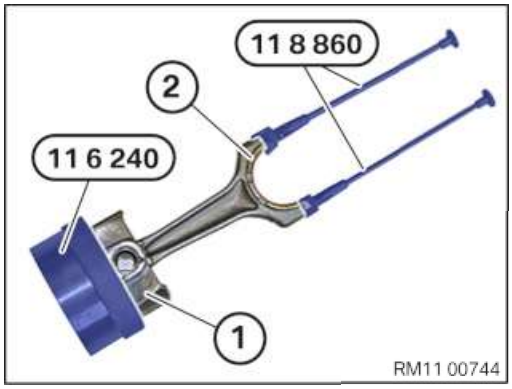
Piston ring	Align at the following position
Lower oil scraper ring (O3)	Align at the 12 o'clock position (1)
Spring (O2)	Align at the 4 o'clock position (2)
Upper oil scraper ring (O1)	Align at the 8 o'clock position (3)
Middle piston ring (K2)	Align at the 12 o'clock position (1)
Upper piston ring (K1)	Align at the 4 o'clock position (2)

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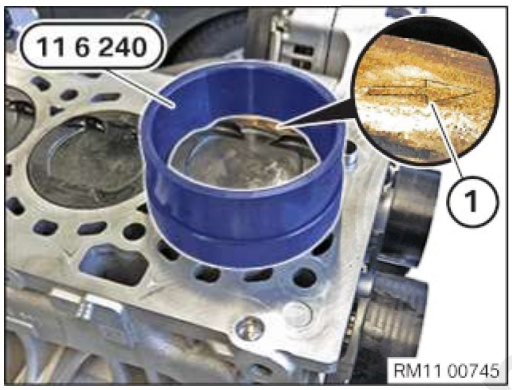


- Make sure that contact point (1) does not overlap spring (O2).

◁



- Coat the pistons (1) and piston rings lightly with oil.
- Insert the pistons (1) with the piston rings into the bush 0 495 373 (11 6 240).
- Screw special tool 0 496 144 (11 8 860) on at large connecting rod eye (2).



- Align the piston so that the arrow (1) points to cylinder 1.
- Insert the piston with the connecting rod into the special tool 0 495 373 (11 6 240) and guide it into the cylinder.

RISK OF DAMAGE

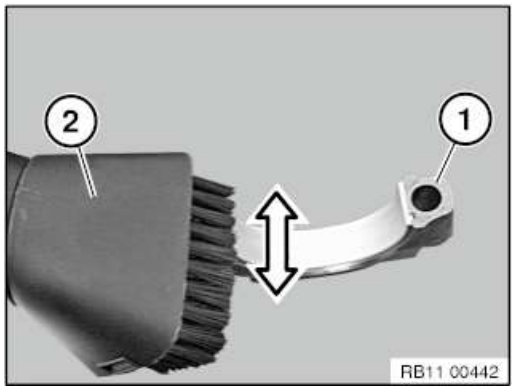
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

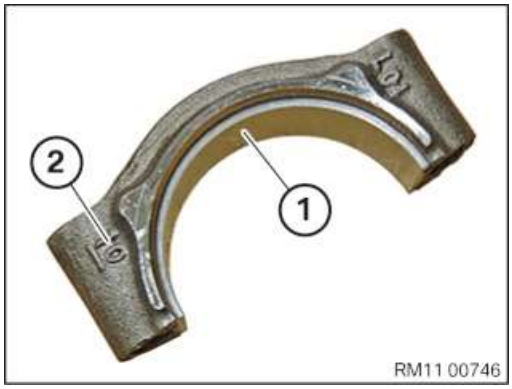
- Push in piston by hand with only little force. Do not use striking tools.

▷ **Install the lower connecting rod bearing**

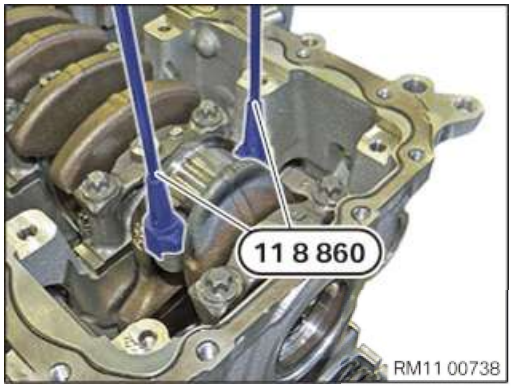


- Vacuum the connecting rod bearing shell and cracked surface (1) with a vacuum cleaner (2).

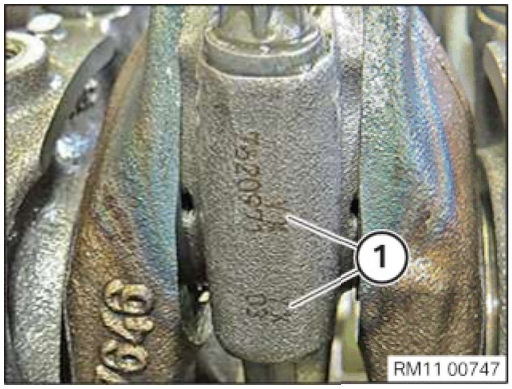
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- Insert the connecting rod bearing shell (1) into the connecting rod bearing cap (2).
- Apply a light coat of oil to the connecting rod bearing shell (1).



- If necessary, screw the assembly tool 0 496 144 (11 8 860) into the large connecting rod eye.
- Pull the connecting rod up to the connecting rod bearing journal.



RISK OF DAMAGE

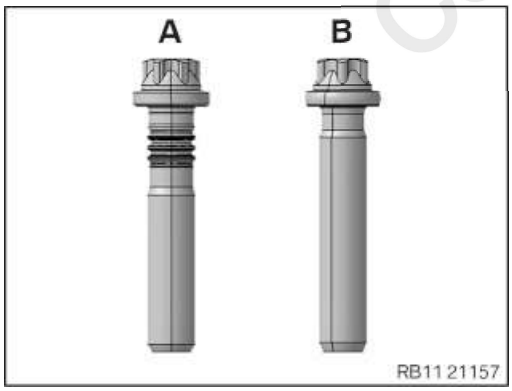
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

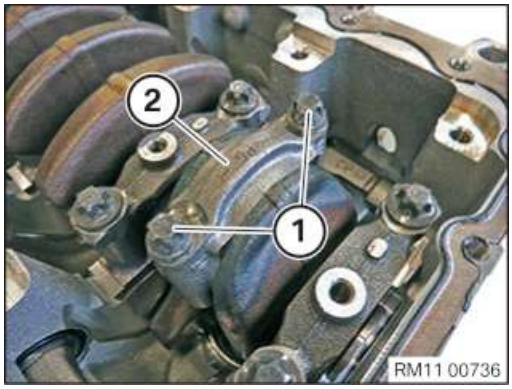
- Attach the connecting rod bearing caps to the connecting rod until the designations (1) match.

  Make sure that the connecting rod bearing (2) is attached to the same connecting rod that it was detached from.



- A mixed installation of connecting rod bolts (A) and (B) on a connecting rod bearing cap is **not** permitted.

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TECHNICAL INFORMATION

When installing new connecting rod bolts, ensure that two identical connecting rod bolts are used on one connecting rod bearing cap.

A mixed installation of different connecting rod bolts on one connecting rod bearing cap is not permitted.

- Renew screws (1).
- Tighten the screws.

  Make sure that the connecting rod bearing cap (2) rests completely on the connecting rod.

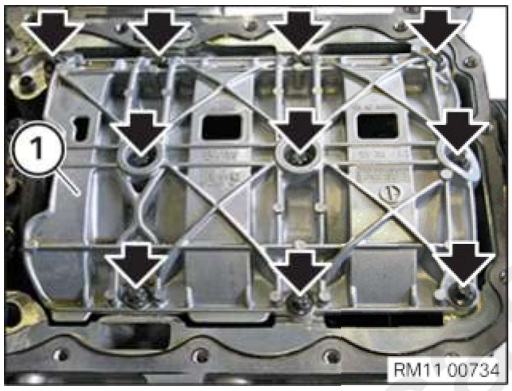
Connecting rod bearing cap to connecting rod

Renew screws.

Tighten screws crosswise.	Jointing torque	20 Nm
	1. Angle of rotation	70 °
	2. Angle of rotation	70 °

◁

46 – Installing the oil deflector



- Install the oil deflector (1).
- Renew screws.

  Parts: Bolts
- Tighten all bolts cross-wise.

Oil deflector to crankcase

M8 x 35		Renew screws.	15 Nm
			45 °

47 – Oil vacuum pump preparation

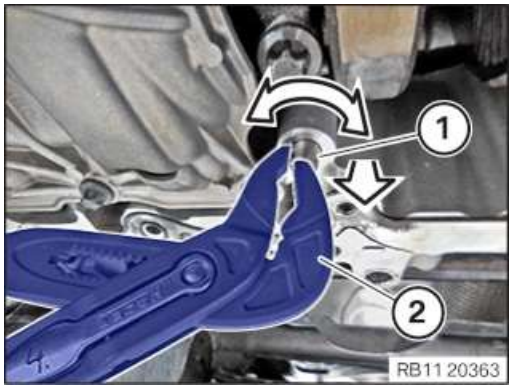
RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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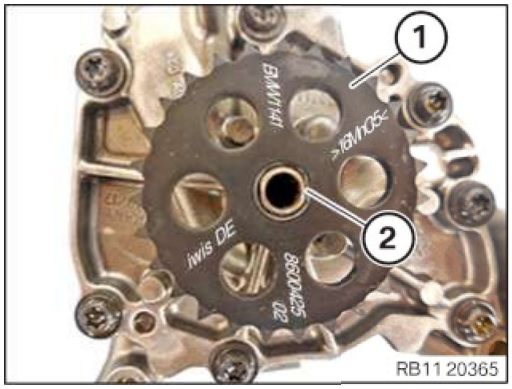


- Remove the centring sleeves (1) in direction of arrow using conventional tools (2).
- Renew the centring sleeves (1).

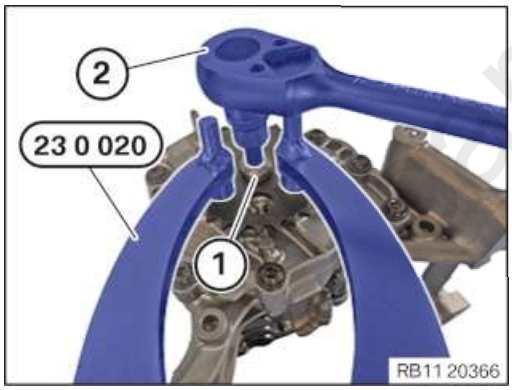
  Parts: Centring sleeves



- Insert and install new centring sleeves (1) on the oil vacuum pump (2).



- Insert and install the camshaft sprocket (1) on the oil vacuum pump (2).
- Make sure the **labelling** on the camshaft sprocket points to the **front**.



TECHNICAL INFORMATION

The thread is a left-hand thread.

- Insert and install the new screw (1).
- Hold camshaft sprocket with special tool 0 491 440 (23 0 020) and tighten screw (1) with conventional tools (2).

Note: Carry out work with a second person assisting.

Camshaft sprocket to oil vacuum pump

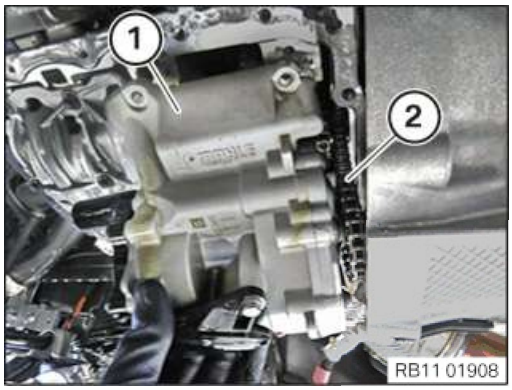
M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °



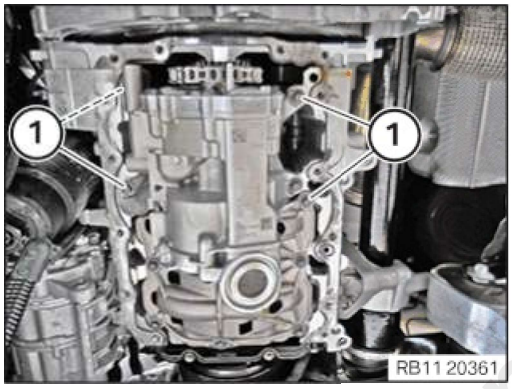
- Make sure the sealing ring (1) is installed correctly.

  The sealing ring (1) must not be damaged or missing.

48 – Install the oil vacuum pump



- Feed the oil vacuum pump (1) into the drive chain (2) and position it.

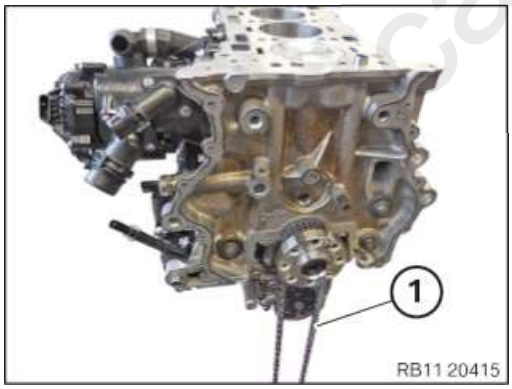


- Tighten the new bolts (1).

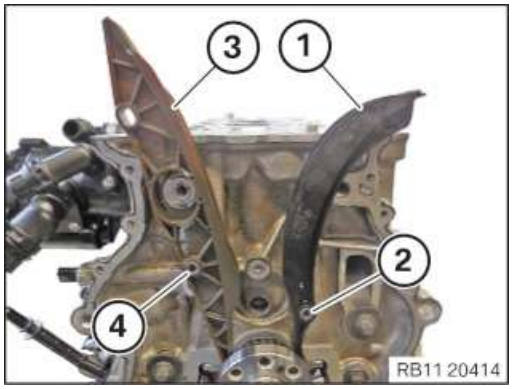
Oil vacuum pump to crankcase

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

49 – Installing timing chain



- Insert and install the timing chain (1).



- Insert and install the tensioning rail (1) on the bearing journal (2).
- Insert and install the guide rail (3).
- Renew bearing journal (4).

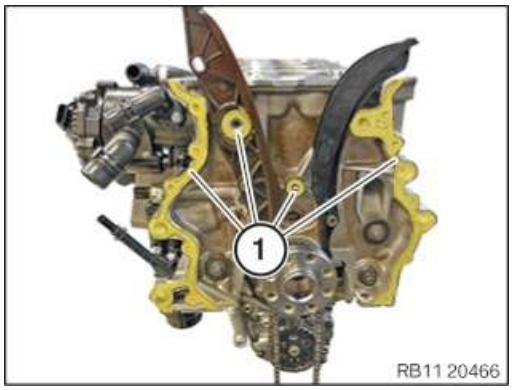
  Parts: Bearing journal
- Tighten the bearing journals (4).

Bearing journal to crankcase

Bearing journal	Replace bearing journal.	Tightening torque	20 Nm

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50 – Install the rear timing case cover



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

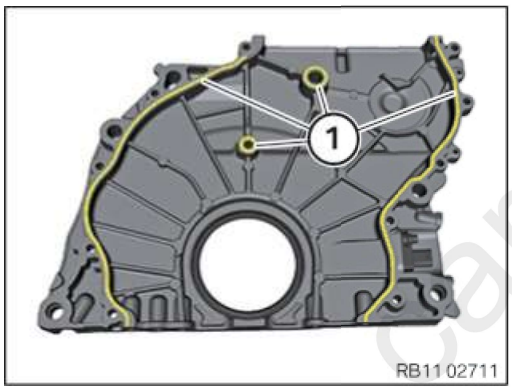
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove sealing residue in this area (1) using special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

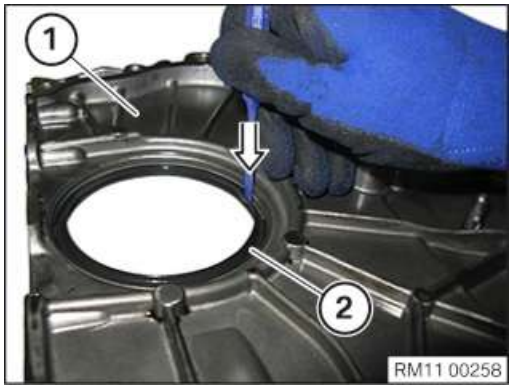
The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove sealing residue in this area (1) using special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

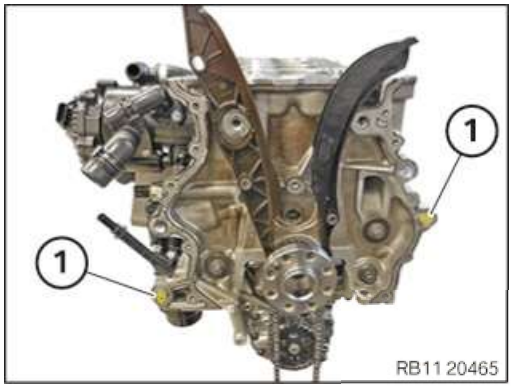
Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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- Position the timing case cover (1) underneath.
- Position the inner punch in the crankshaft sealing ring (2).
- Remove the crankshaft sealing ring (2) outward in the direction of the arrow.



- Check the fitting sleeves (1) for damage and renew, if necessary.
- Check for correct fit of fitting sleeves(1).



- Have the special tool ready.



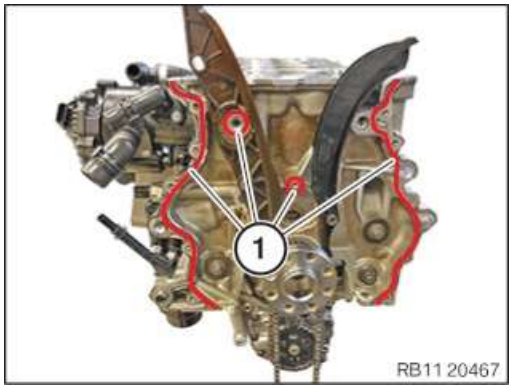
TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

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TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound in area (1)along the inner edge.

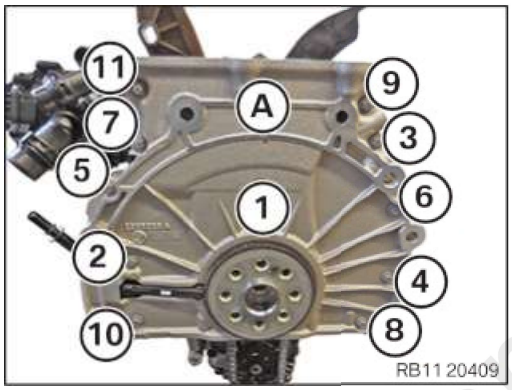
Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

2,0 mm ... 2,5 mm

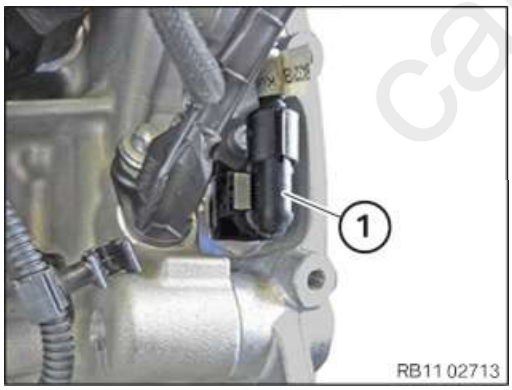


- Renew screws (1) to (11).

  Parts: Bolts
- Carefully mount the timing case cover (A).
- Tighten screws in the order (1) to (11).

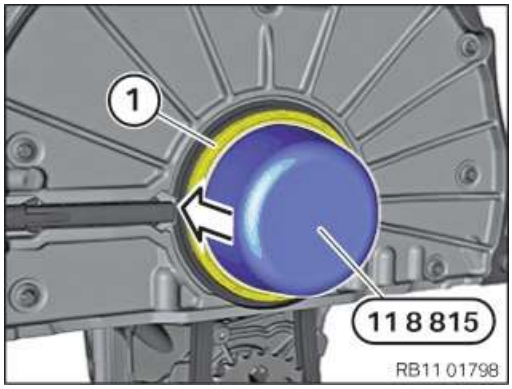
Rear timing case cover to crankcase

M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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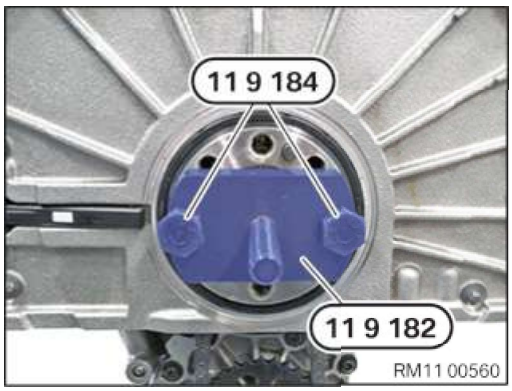
RISK OF DAMAGE

Radial shaft seal damage.

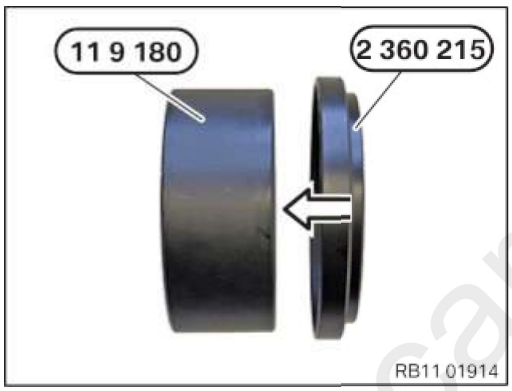
Touching the sealing lip (inner) and applying oil to the radial shaft seal will lead to its destruction.

- Do not touch the sealing lip (inner) of the radial shaft seal.
- Do not apply oil to the radial shaft seal.
- Install the radial shaft seal dry.

- Preassemble special tool 0 496 137 (11 8 815) on crankshaft.
- Carefully slide the new crankshaft sealing ring (1) straight off the special tool 0 496 137 (11 8 815) using a rotational movement until the new crankshaft sealing ring is positioned parallel on the timing case cover.



- Secure special tool 0 494 029 (11 9 182) to the crankshaft using special tool 0 494 031 (11 9 184).

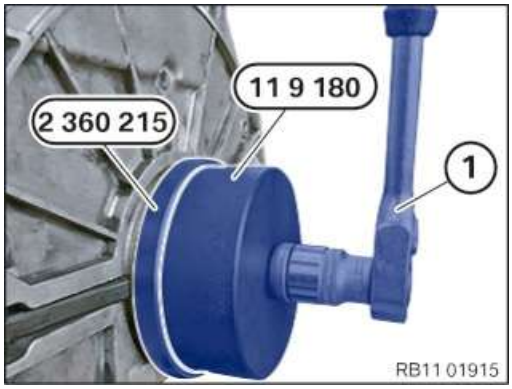


- Connect special tool 2 360 215 onto special tool 0 493 881 (11 9 180).



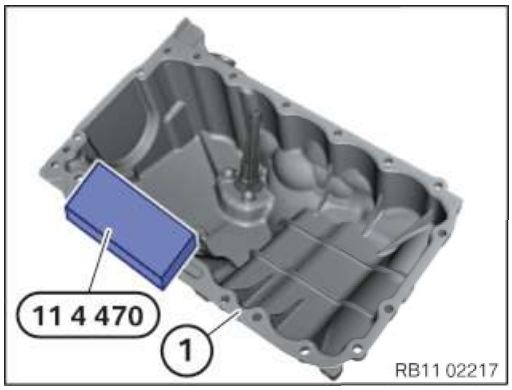
- Pull in the new crankshaft sealing ring with special tools 0 494 028 (11 9 181) and 2 360 215 together with the special tool 0 494 030 (11 9 183).

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- Screw in the new crankshaft sealing ring with the tool (1) to the stop.

51 – Refitting sump



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the rough seal remains on the sealing surface (1) of the crankcase with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



- Have the special tool ready.



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

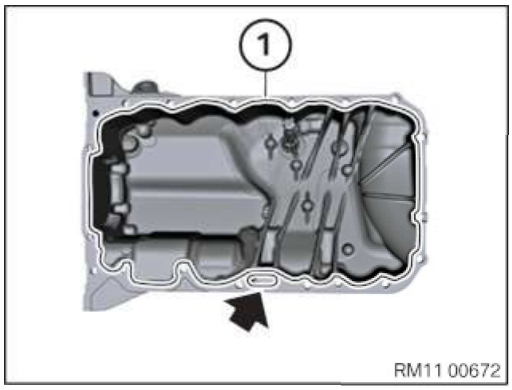
- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

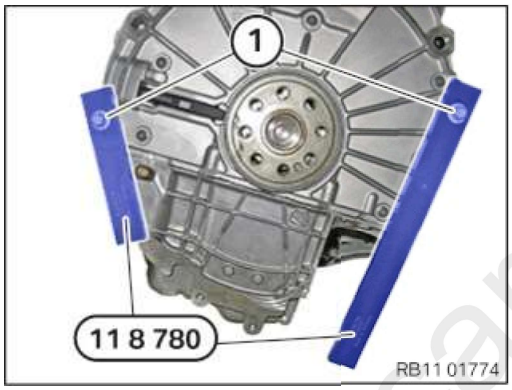


TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound along the line (1) with a thickness of 2 mm to 2.5 mm.

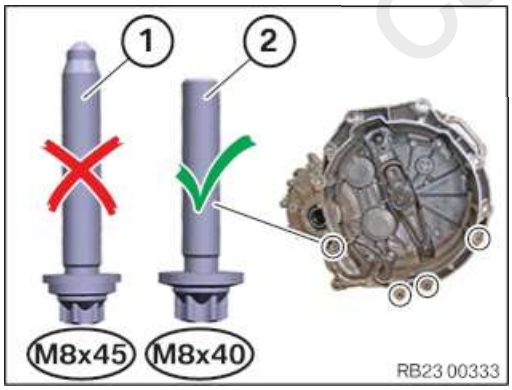
  Apply the sealing compound along the inner edge.
- Completely encircle the oil return orifice (arrow) with the sealing compound.



TECHNICAL INFORMATION

The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with engine block.
- If necessary, renew fitting sleeves.



RISK OF DAMAGE

Component damage caused by incorrect screw length.

The use of screws with the incorrect screw length can damage the component.

- Check for correct screw length.
- Re-install screws that correspond to the original screw length.

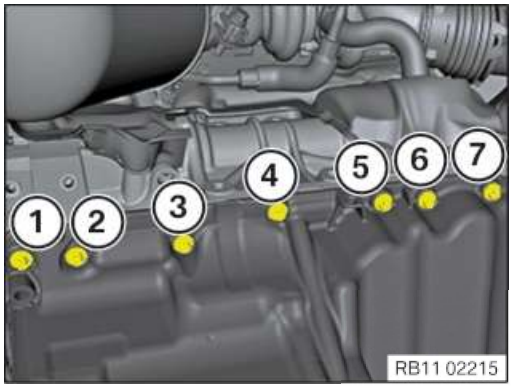
- Ensure that the **correct** screw (2) (M8x40) is used for mounting the oil sump on the transmission.

  The screw (1) (mounting bolt of the starter motor) may **never** be used for mounting the oil sump.

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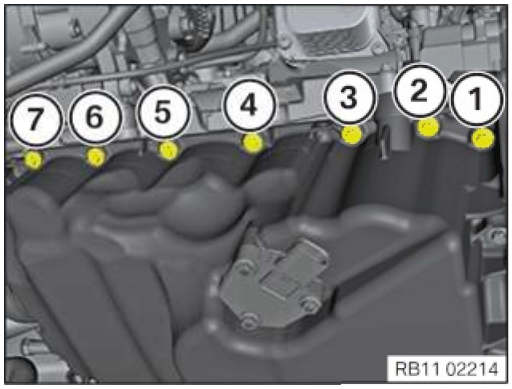
- Install oil sump (1) to top front.
- **Hand-tighten** all oil sump screws but do not tighten completely.



- Tighten the screws (1) to (7).

Oil sump to crankcase

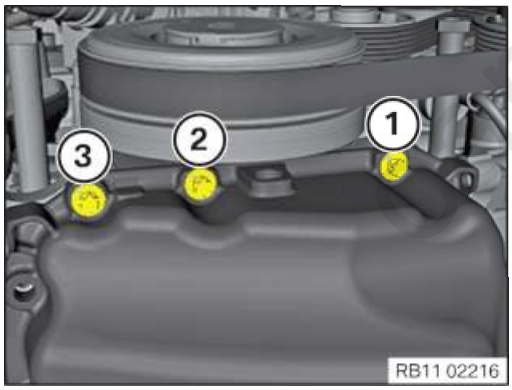
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1) to (7).

Oil sump to crankcase

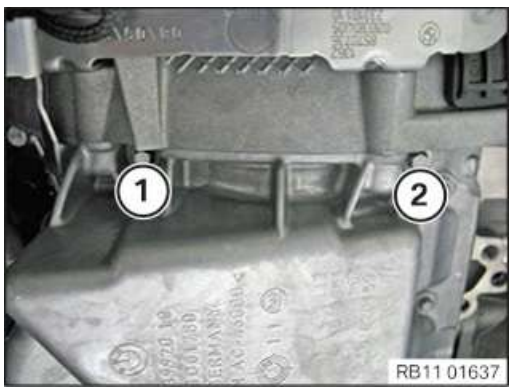
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1), (2) and (3).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

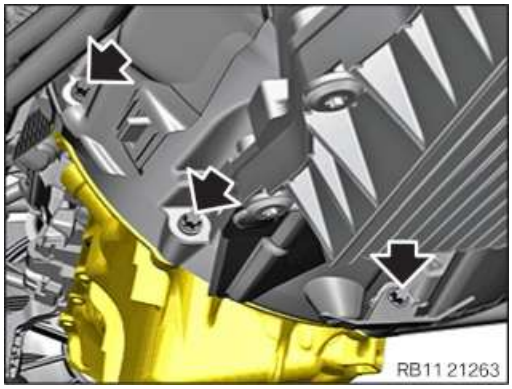


- Tighten down screws (1) and (2).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

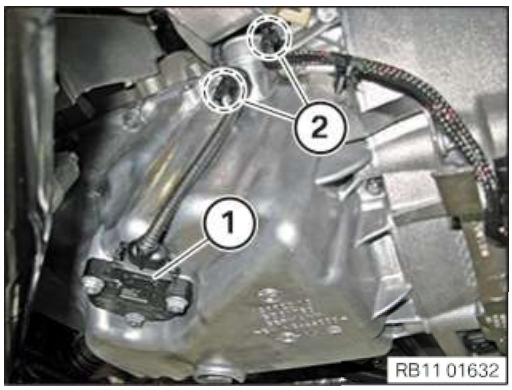
rdiagn.com



- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm



- Fasten cable on the clips (2) from the oil sump.
- Connect and lock the connector (1).
- Make sure the connector 1 engages audibly.

52 – Installing the flywheel



TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).



- Use the set of special tools 2 285 058.

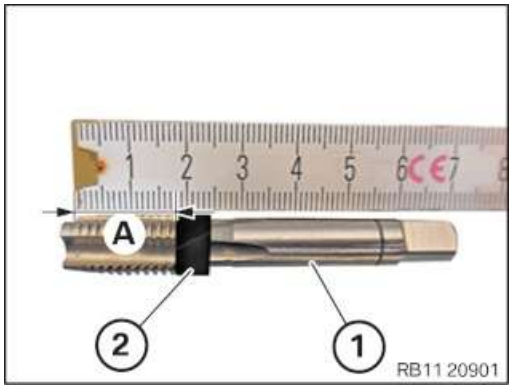
Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool



- Assemble tool set.

Number	Description
1	Tool holder
2	Thread cutter M12X1,5

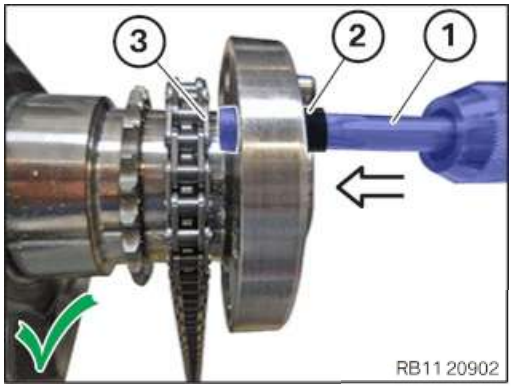
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- Mark the screw-in depth (A) on thread cutter (1) from the set of special tools 2 285 058 with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm



NOTICE

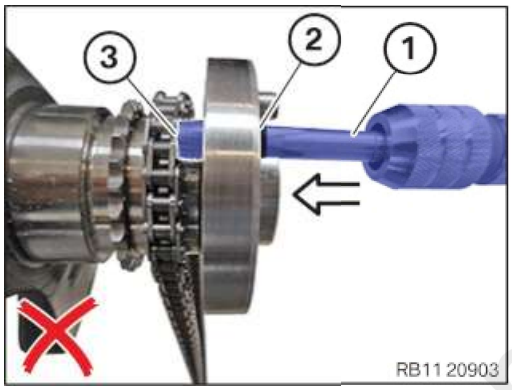
To provide a better overview: Shown with engine removed.

- Screw in the thread cutter (1) from the set of special tools 2 285 058 in direction of arrow up to the screw-in depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).



TECHNICAL INFORMATION

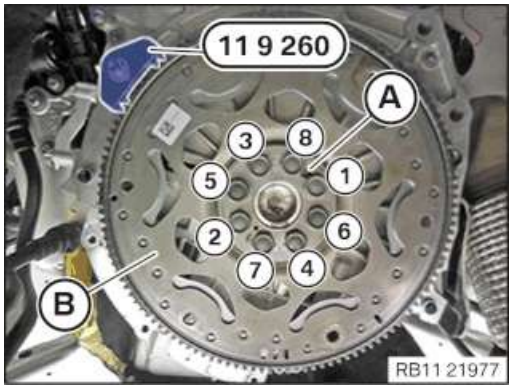
- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

- Make sure that the screw-in depth (2) of the screw tap (1) is not exceeded.

  The thread cutter (1) may not rest on the timing chain (3).



- Make sure the magnet wheel (1) is installed correctly.



- Renew screws (1) to (8).

  Parts: Bolts
- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool 0 494 034 (11 9 261) and screw the special tool 0 494 130 (11 9 264) tightly.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten flywheel bolts in sequence (1) to (8).

Flywheel to crankshaft

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

- Remove special tool 0 493 938 (11 9 260).

53 – Installing the vibration damper

RISK OF DAMAGE

Radial shaft seal damage.

When installing the vibration damper, the rotary shaft seal can be damaged.

- The special tool must be used to install the vibration damper.

TECHNICAL INFORMATION

When removing and installing or replacing the vibration damper, the rotary shaft seal must be replaced.



- Clean the sealing surface (1) from oil and contamination.

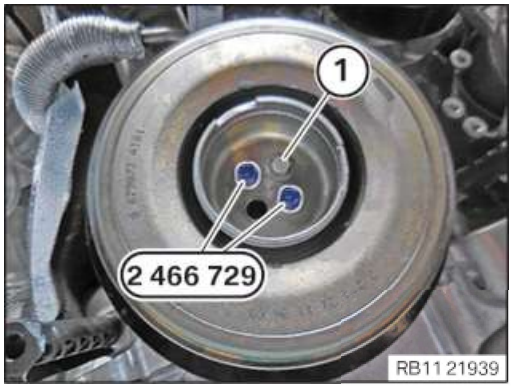


- Screw special tool 2 466 729 into the crankshaft by hand.

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- Insert vibration damper (1) into the special tool 2 466 729 and install.



- Renew the bolts (arrows).

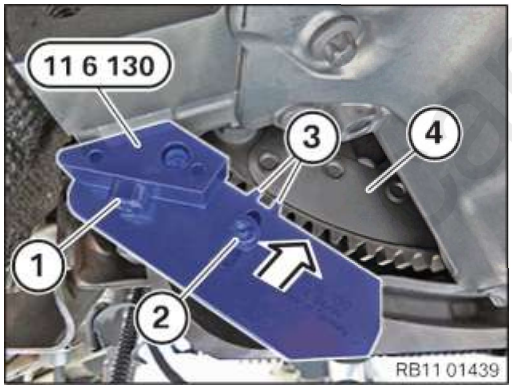
  Parts: Bolts
- Hand-tighten the bolt (1).
- Guide the special tool 2 466 729 out and remove.



- Position vibration damper (1).
- Tighten the bolts (arrows) on the vibration damper (1).

Vibration damper with belt pulley to crankshaft

M10x65	Renew screws. Tighten screws crosswise.	1. Jointing torque	40 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

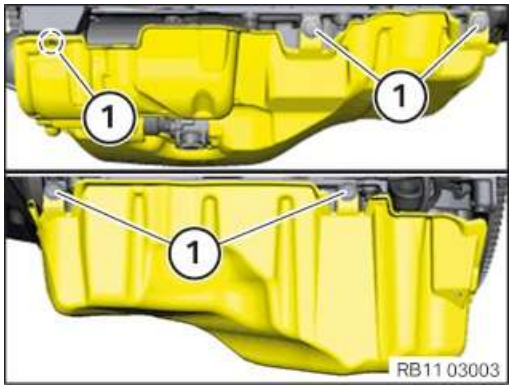


- Loosen screw (2).
- Slide the counter support with the bolt (2) down until the teeth (3) are no longer engaged in the gearing of the flywheel (4).
- Release the screw (1) and feed out and remove special tool 0 496 595 (11 6 130).

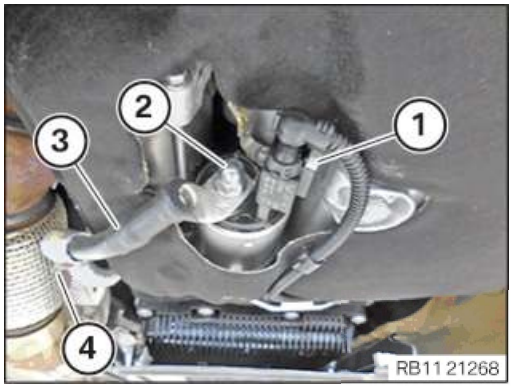
54 – Installing the acoustic cover for the oil sump



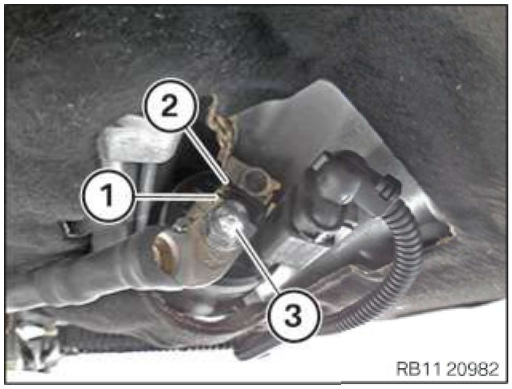
- Install acoustic cover (1) to the top front.



- Secure all expanding rivets (1).



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.
- Insert and install the positive battery cable (3).
- Secure positive battery cable (3) at the clamp (4).
- Tighten the nut (2) hand-tight.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

55 – Block the crankshaft in he TDC firing position of cylinder 1



RISK OF DAMAGE

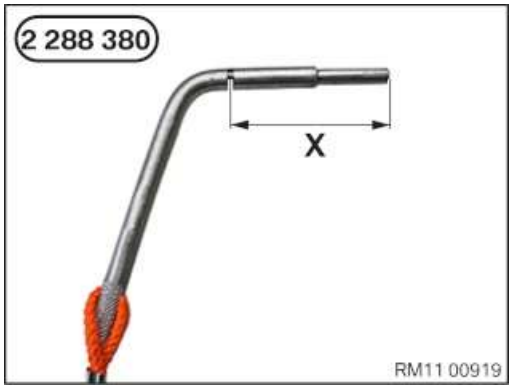
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

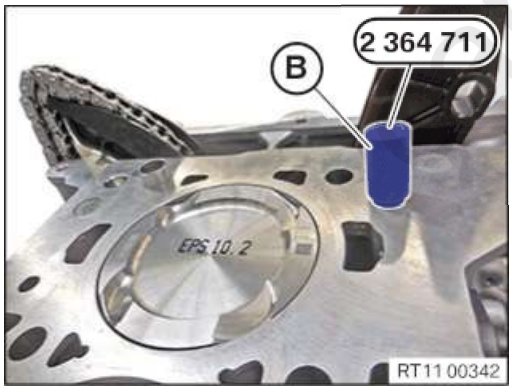


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

56 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

57 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

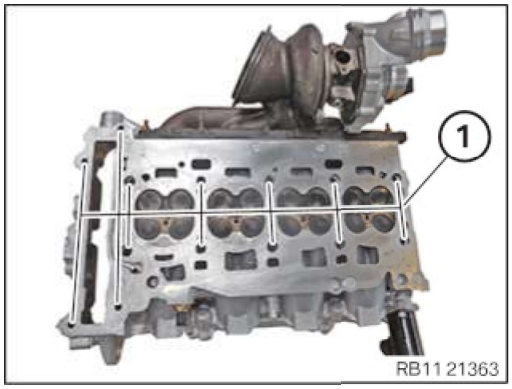
- Do not use any metal-cutting tools.



- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.

.com



CAUTION

Swirling dirt particles caused by compressed air.

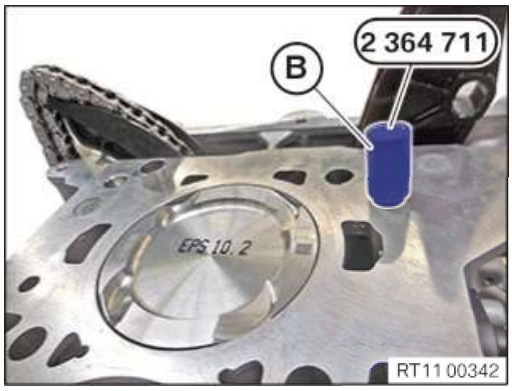
Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



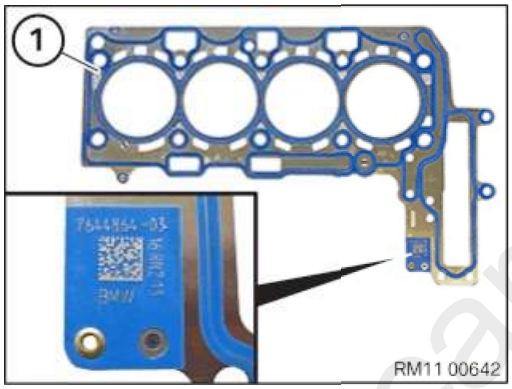
- Wear safety goggles.

- Clean all the threaded holes in the **marked** area of the crankcase with compressed air.



- Remove special tool (B) contained in the set of special tools 2 364 711.

58 – Renewing the cylinder head gasket



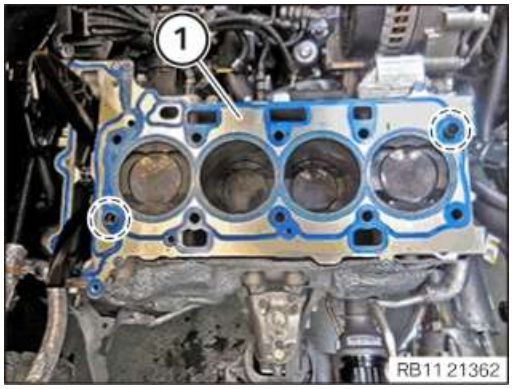
- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional thicker gasket 0.3 mm is available for service personnel.



- Check fitting sleeves (1) in the **marked** area for damage and, if necessary, renew them.

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- Guide cylinder head gasket (1) into the **marked** area and install it.

59 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

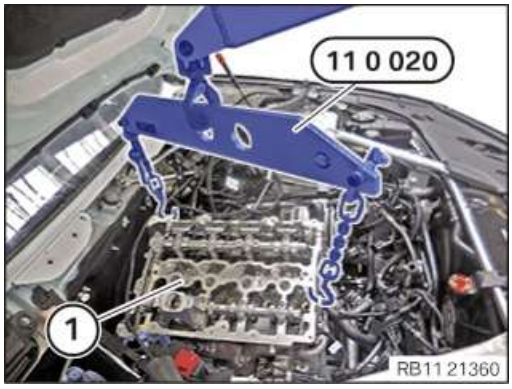
- Dry threaded holes (e.g. using compressed air).

TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



RISK OF DAMAGE

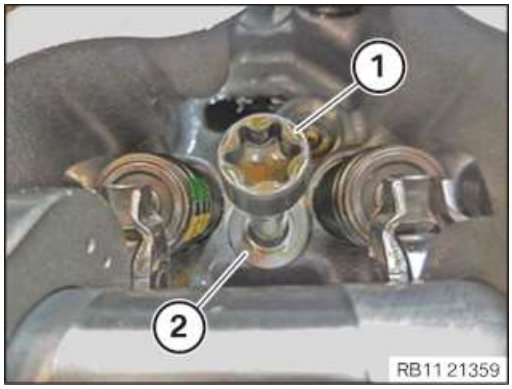
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

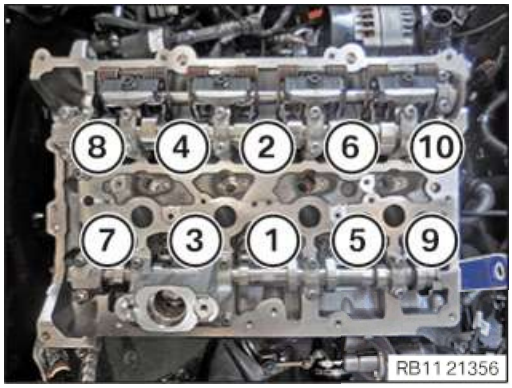
cardiagn.com



- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of engine block.
- Guide in and install cylinder head bolts (1).



TECHNICAL INFORMATION

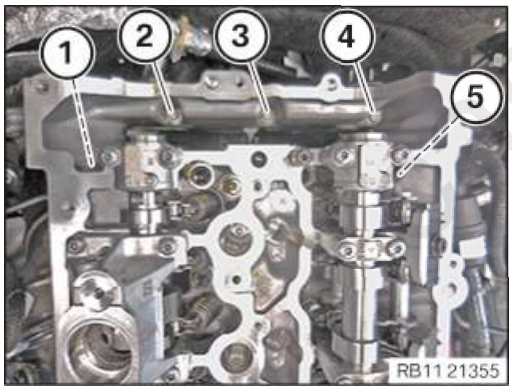
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °



- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

Cylinder head bolt to timing case cover

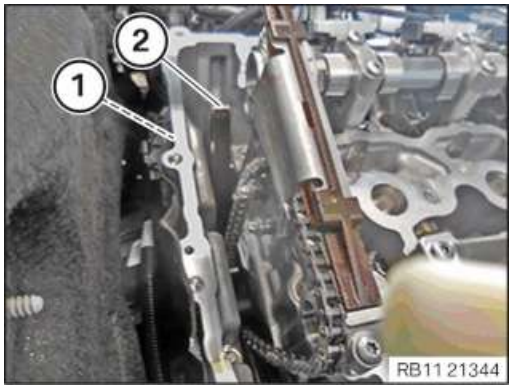
M8x40	Renew screws.	Tightening torque	19 Nm



- Renew bearing journal (1).

  Parts: Bearing journal

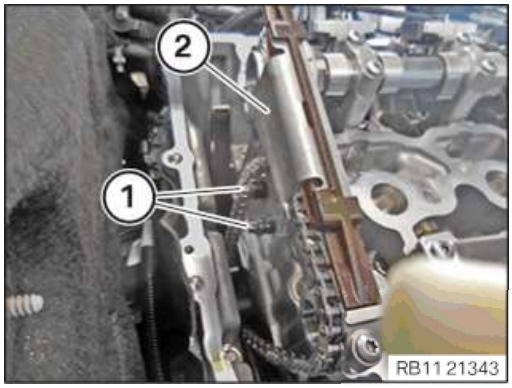
tdiagn.com



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

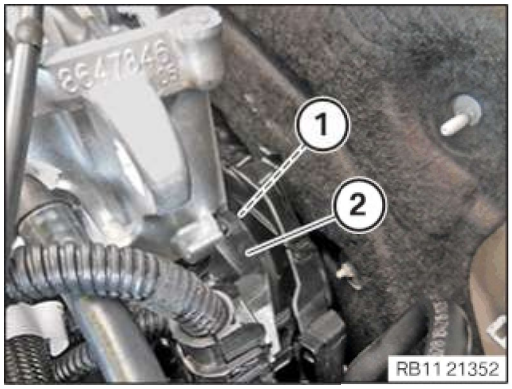
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

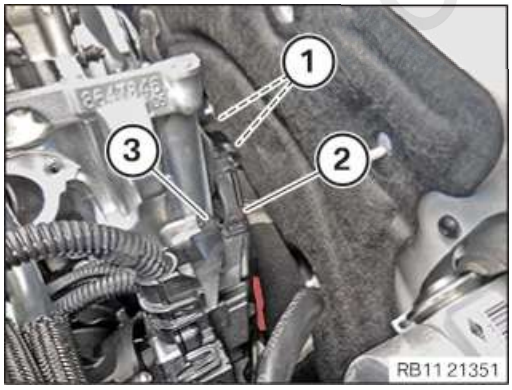
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

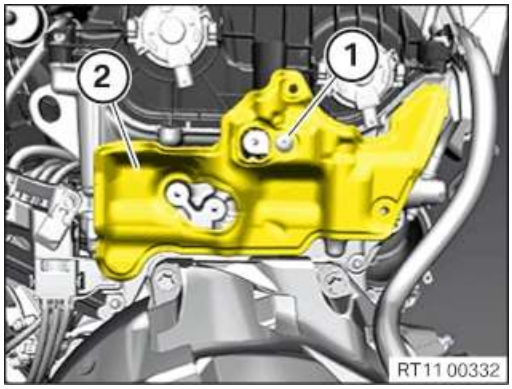
- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm

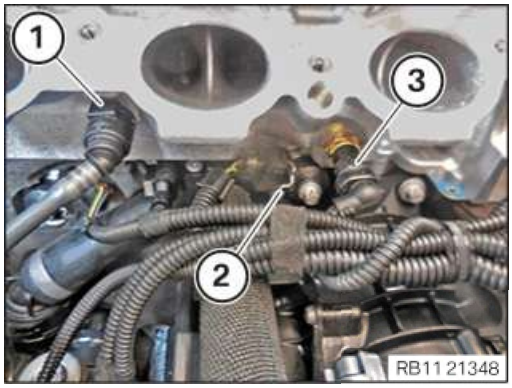
cardiagn.com



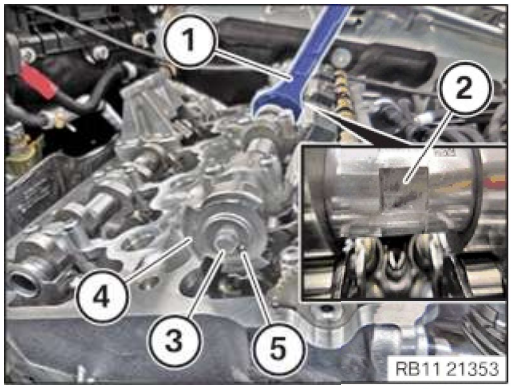
- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



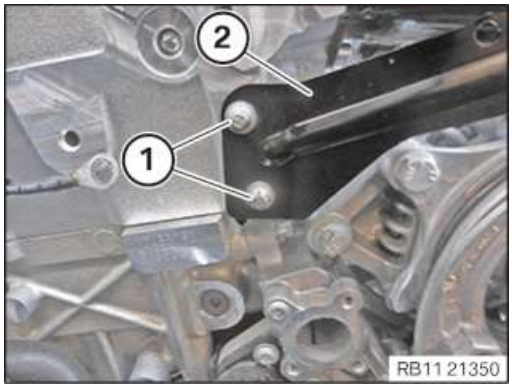
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm



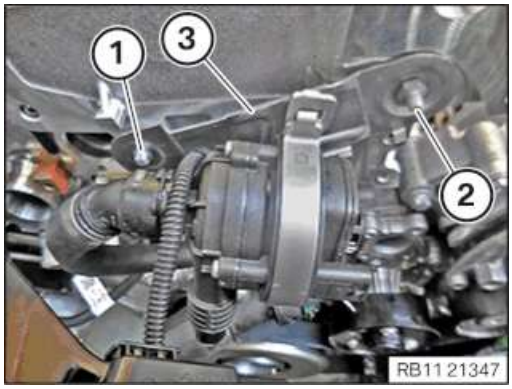
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

Holder for electrical auxiliary coolant pump on cylinder head

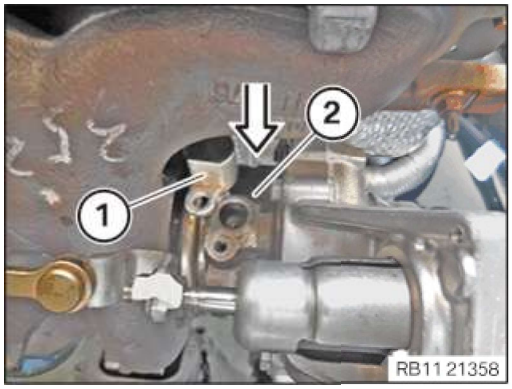
M6		Tightening torque	7 Nm



- Thread in ground cable (2) and install.
- Tighten nut (1).

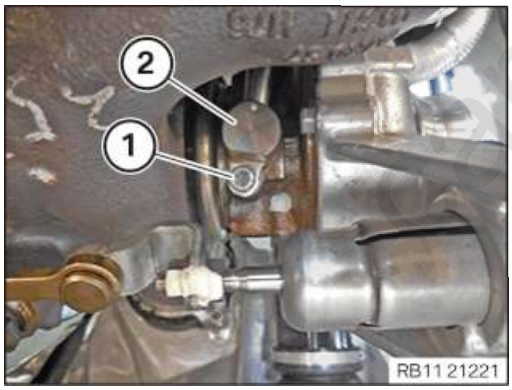
Standard screw connection M6

M6		8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

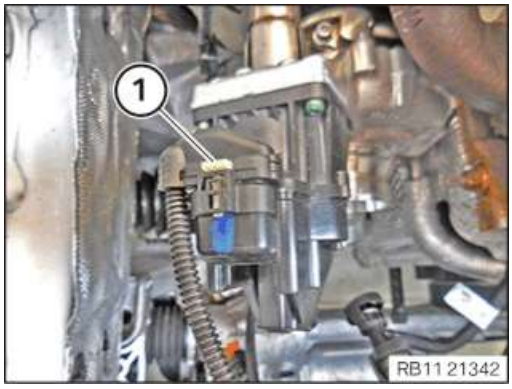
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm



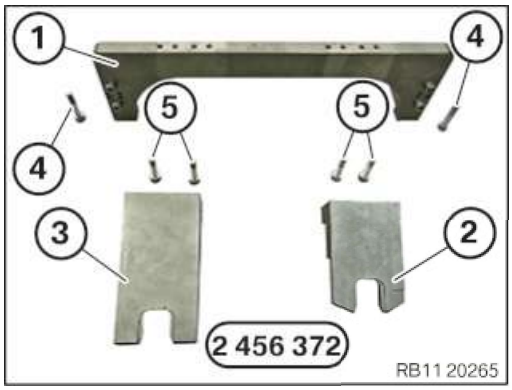
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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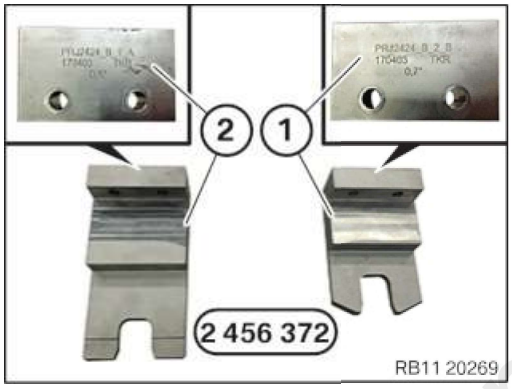
- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

60 – Adjust the camshafts with the special tool

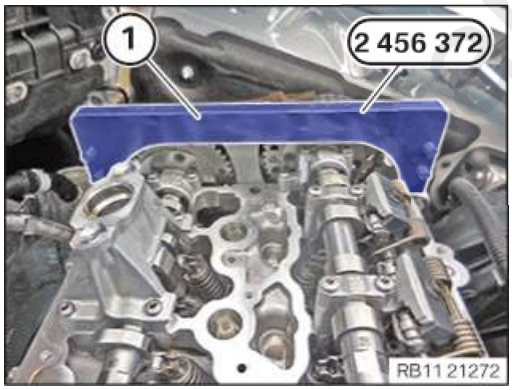


- Overview of the set of special tools 2 456 372:

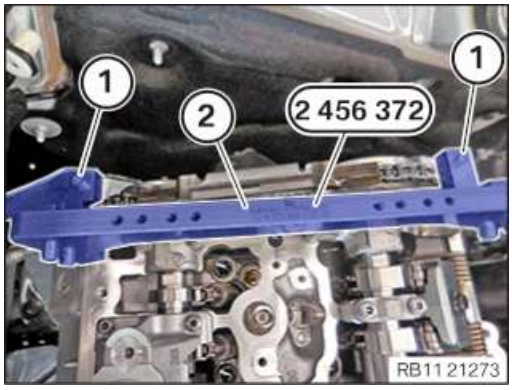
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



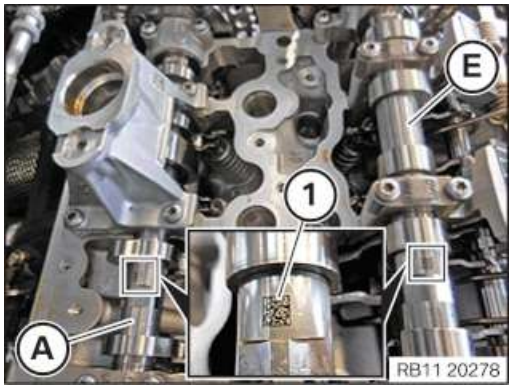
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



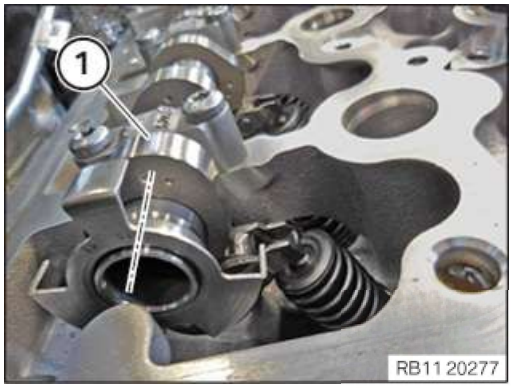
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

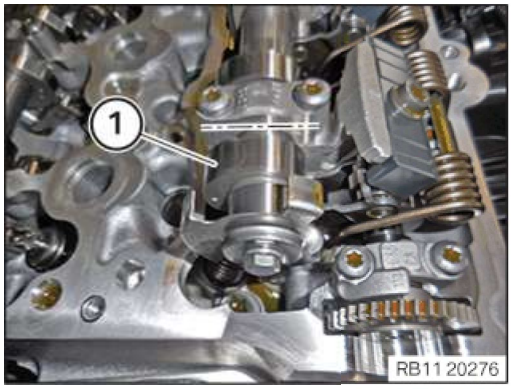
M6		Tightening torque	8 Nm



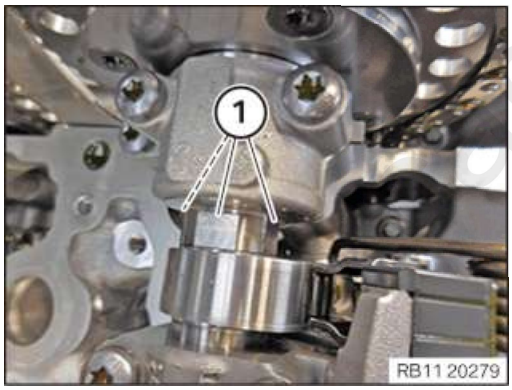
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



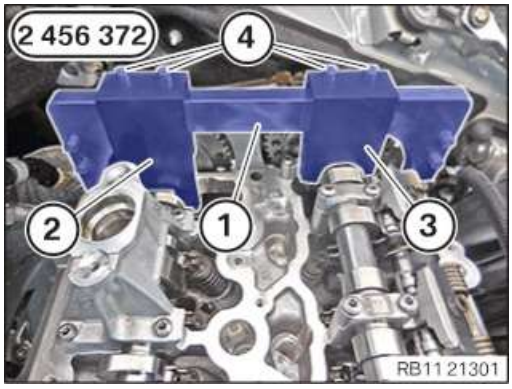
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

61 – Install exhaust camshaft adjuster

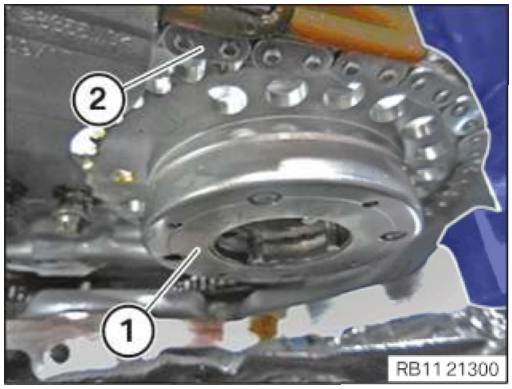
arodiagn.com

NOTICE

The figure shows the rear side of the engine.



- Keep exhaust camshaft adjuster (1) marked EX ready.



- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

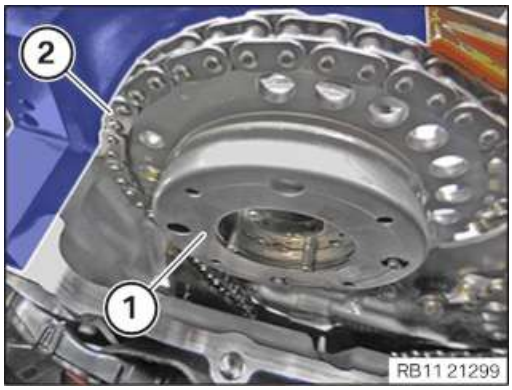
62 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.



- Keep intake adjuster (1) marked IN ready.

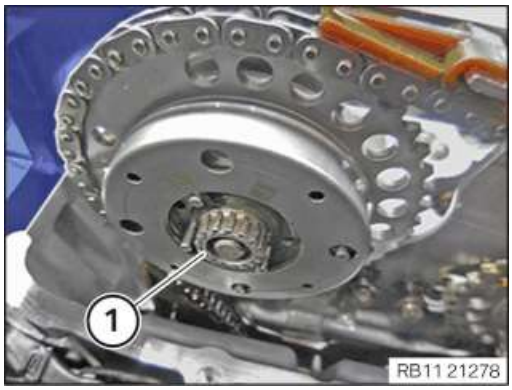


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

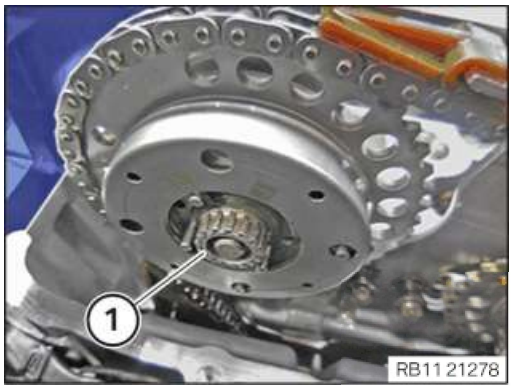
63 – Install the VANOS central valve of the intake adjuster

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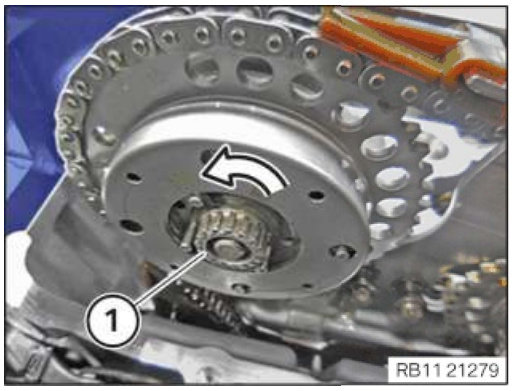
– Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.

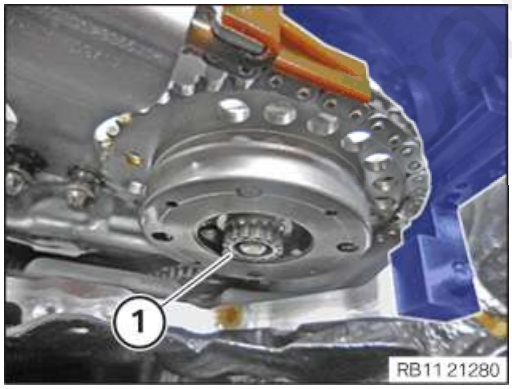


- Hand-tighten the VANOS central valve (1) of the intake adjuster.

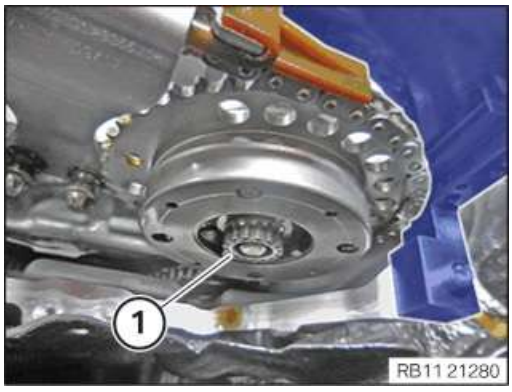


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

64 – Installing the VANOS central valve of the exhaust camshaft adjuster

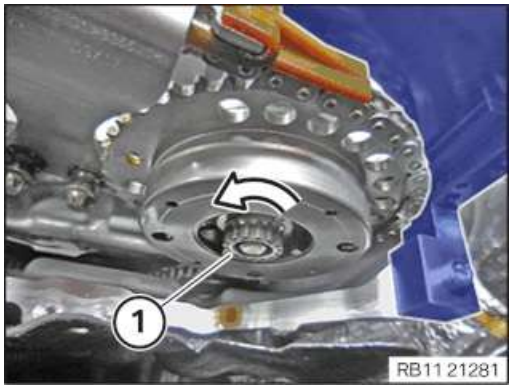


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



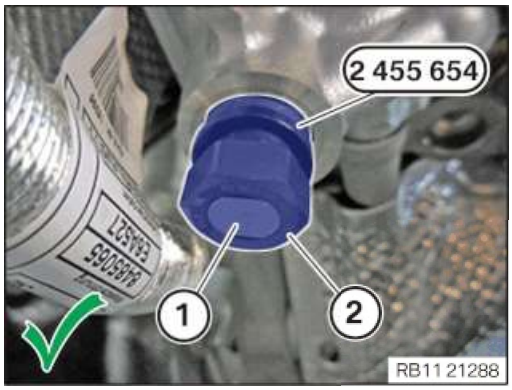
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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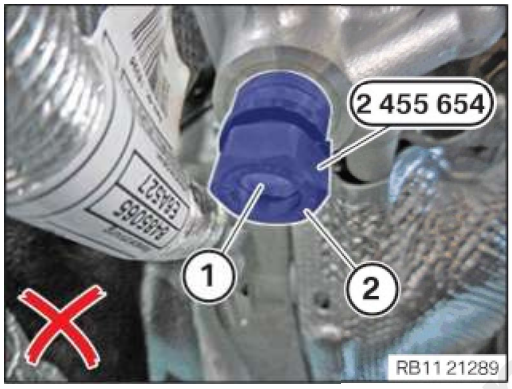
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

65 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

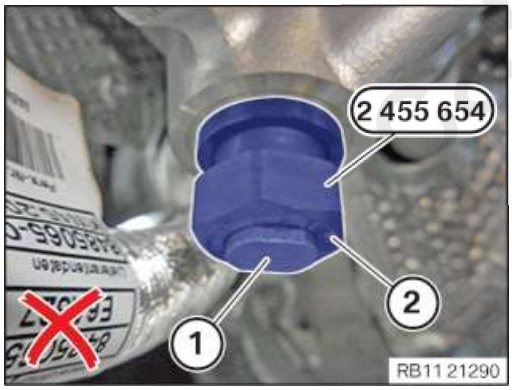
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

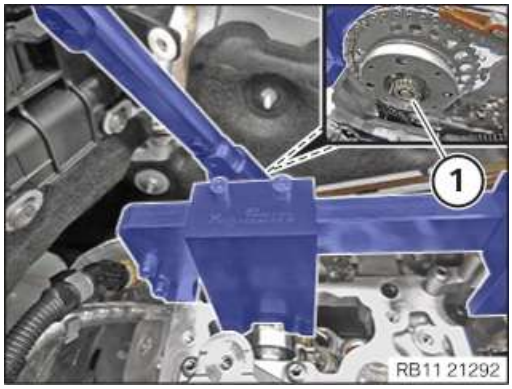
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

66 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

67 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

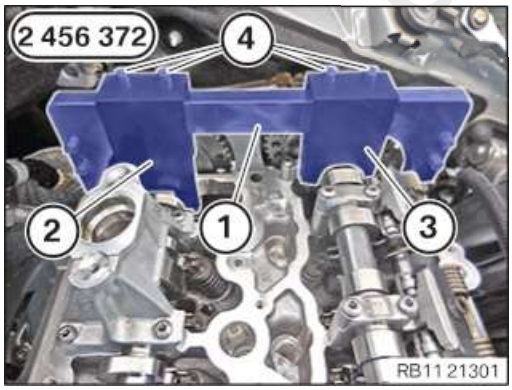


- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

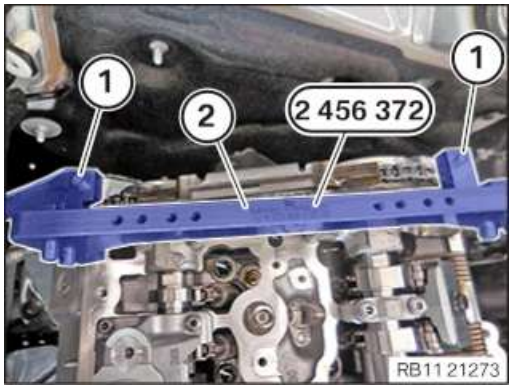
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

68 – Disassembling all special tools

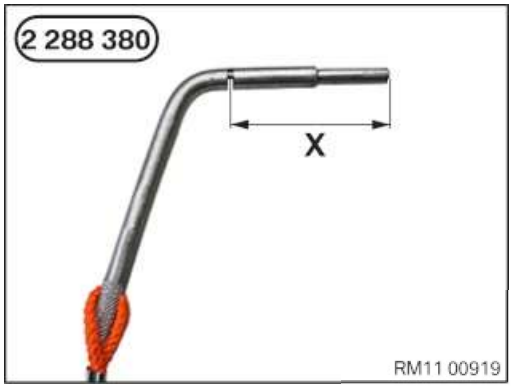


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

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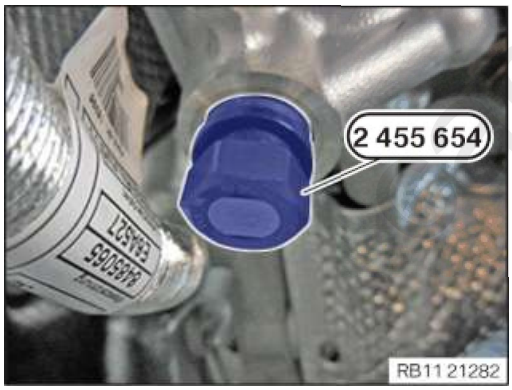
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

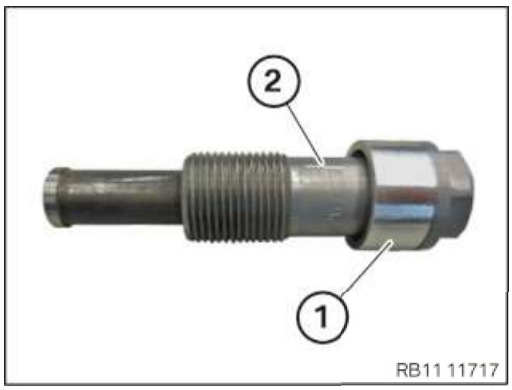
69 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

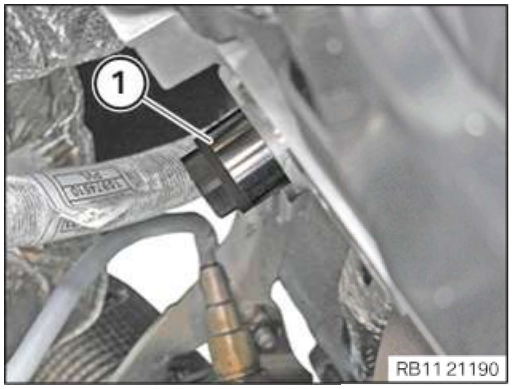


- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

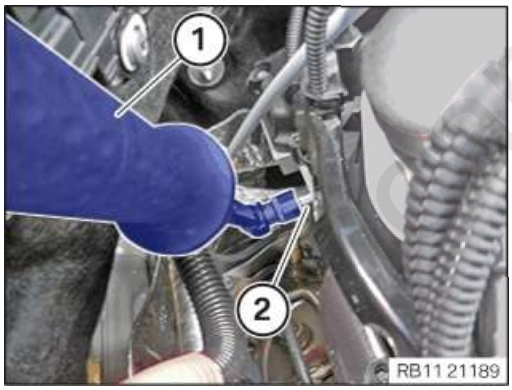


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

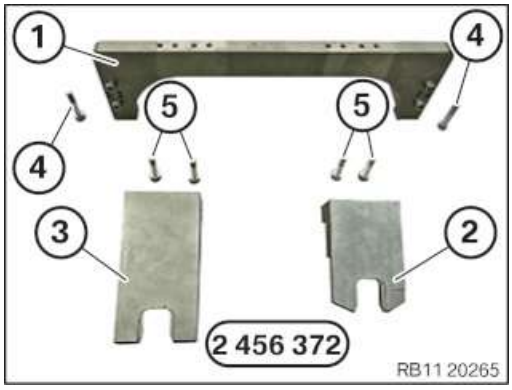


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

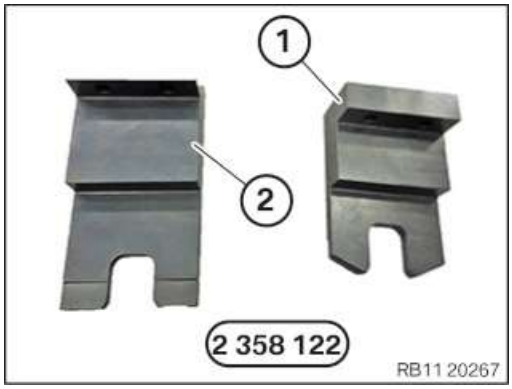
70 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



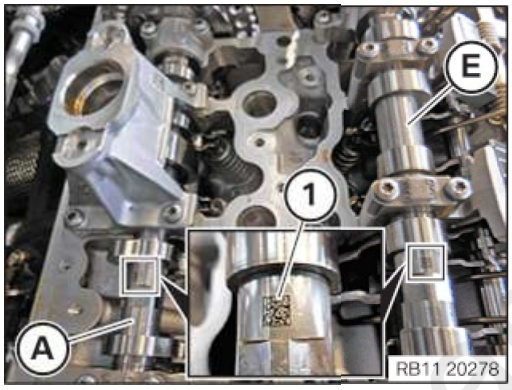
RISK OF DAMAGE

Damage to the engine.

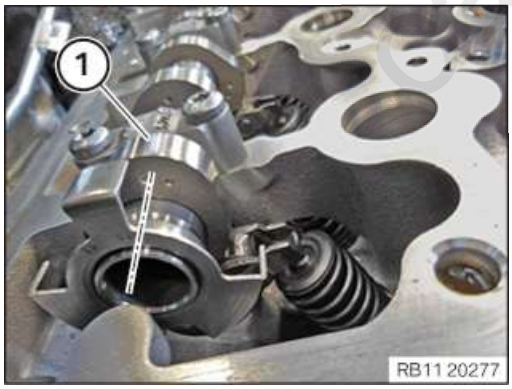
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

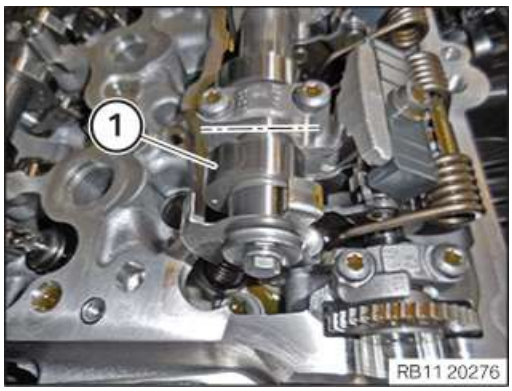
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



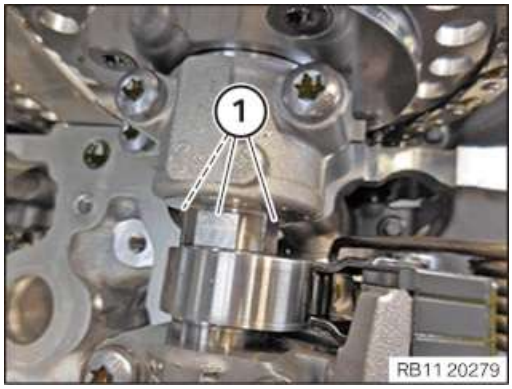
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



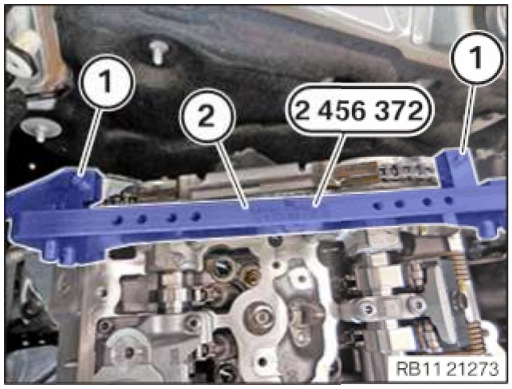
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



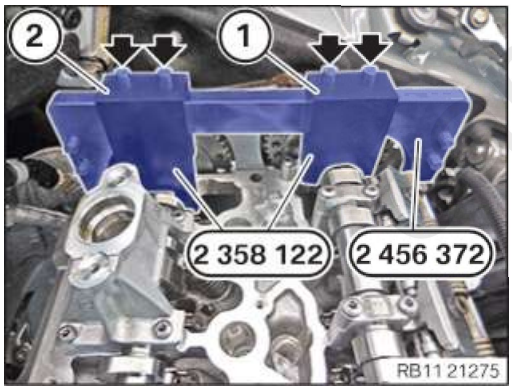
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

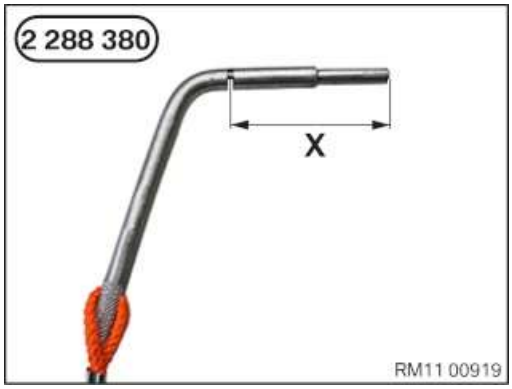
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

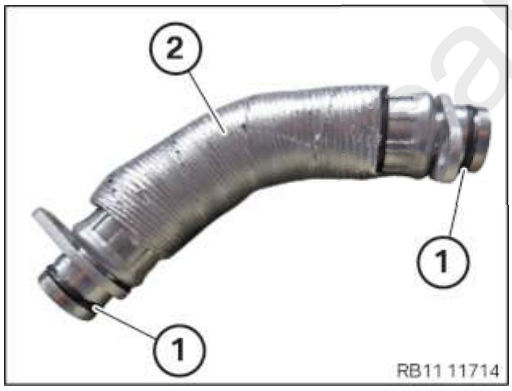


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

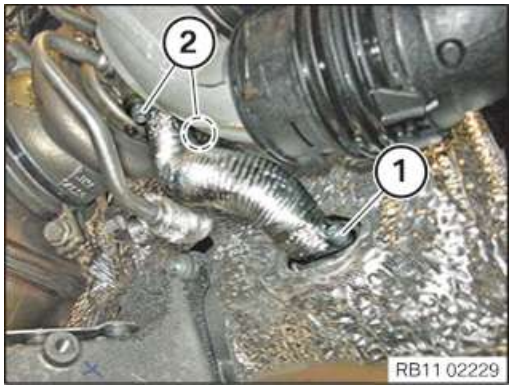
  The engine **is in the** TDC firing position of cylinder 1.

71 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

Oil return line to exhaust turbocharger/crankcase

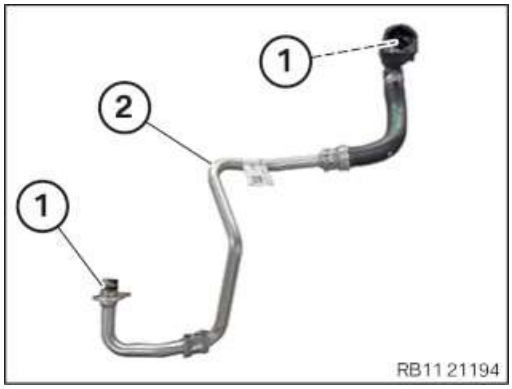
M6x14		Tightening torque	8 Nm

72 – Install the coolant return line for the exhaust turbocharger

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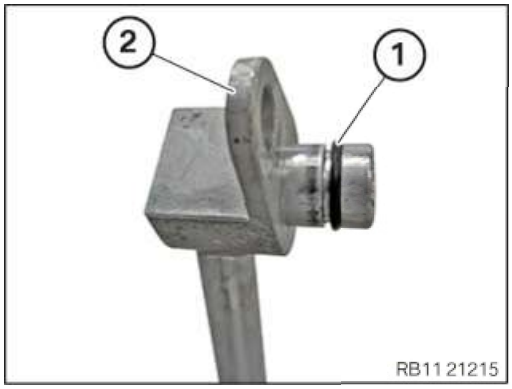
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



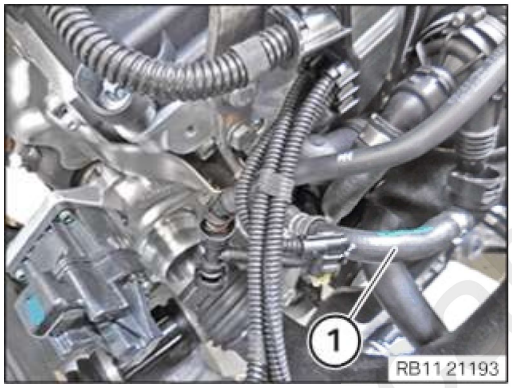
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

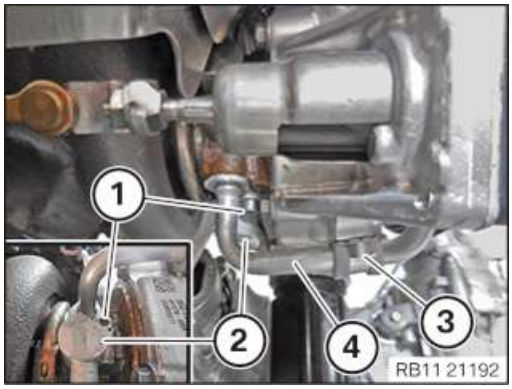
  Parts: O-ring



- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

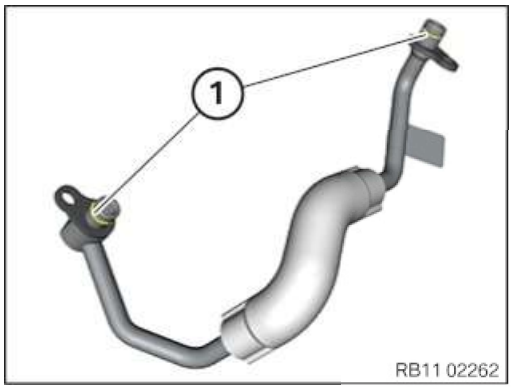
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

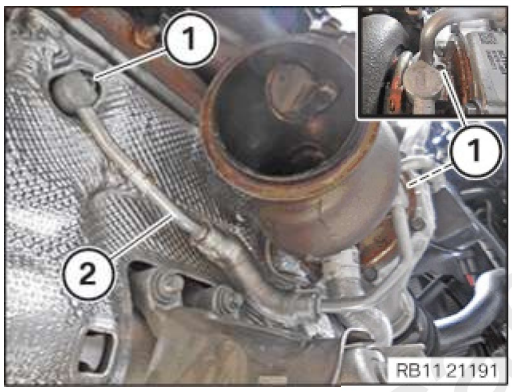
M6		Tightening torque	8 Nm

73 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

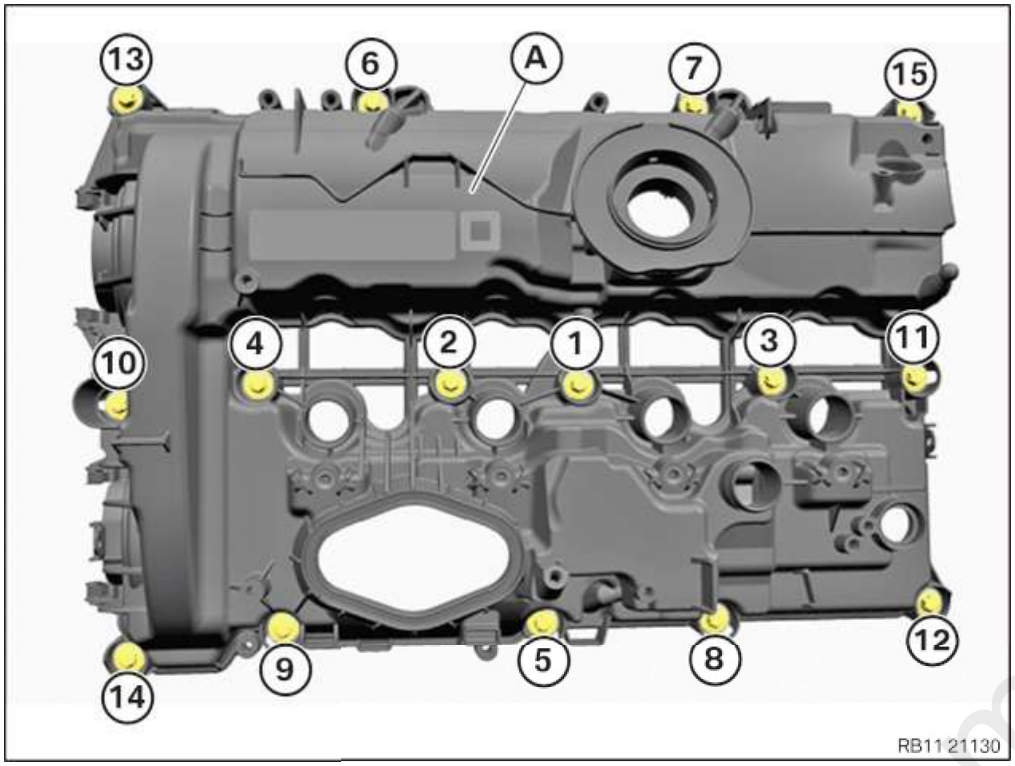
Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

74 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

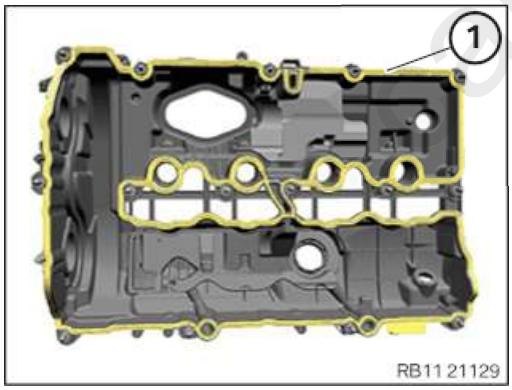
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

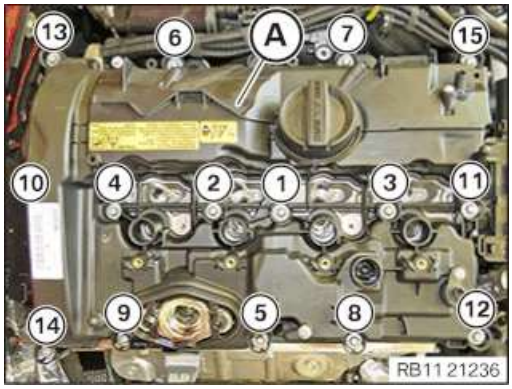
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).

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TECHNICAL INFORMATION

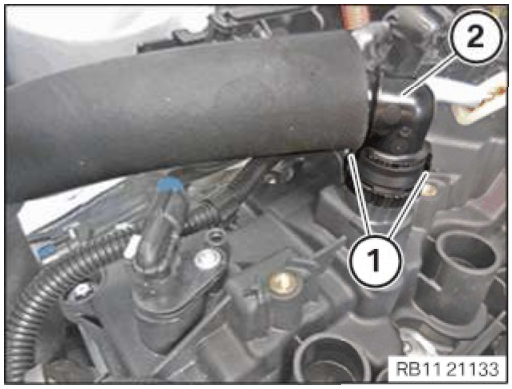
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

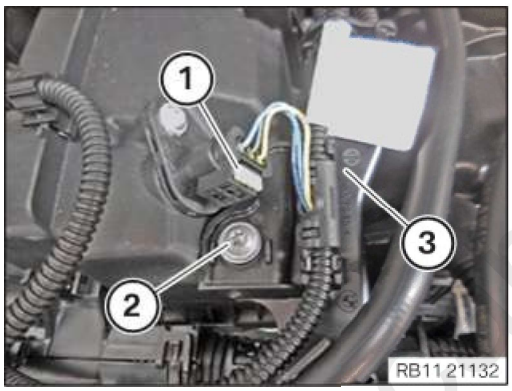
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

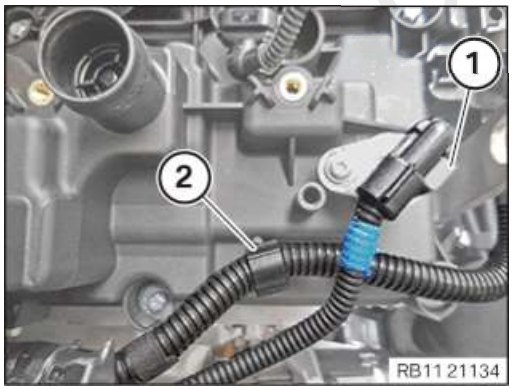


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

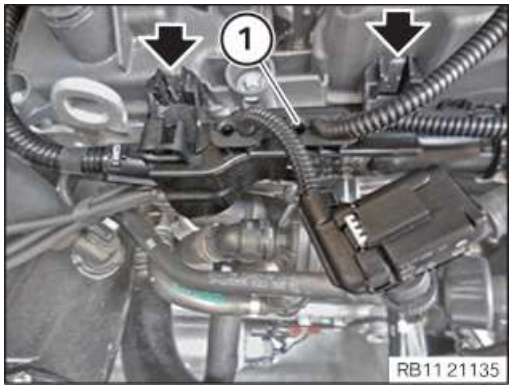
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

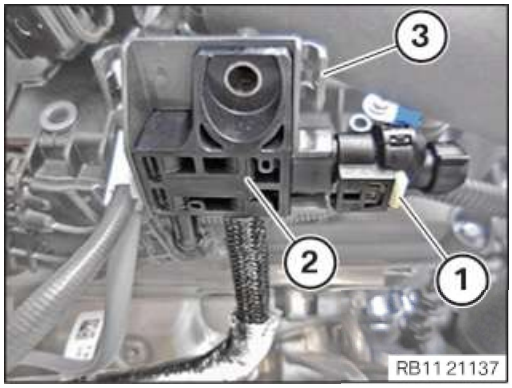


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

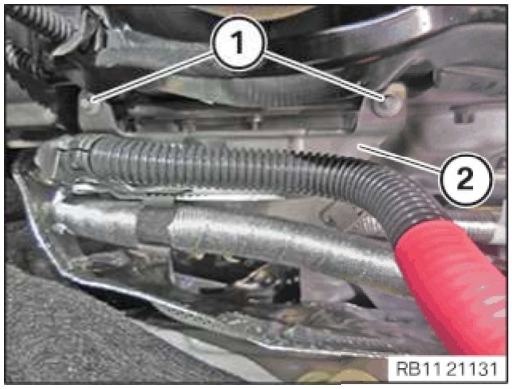
mdiagn.com



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

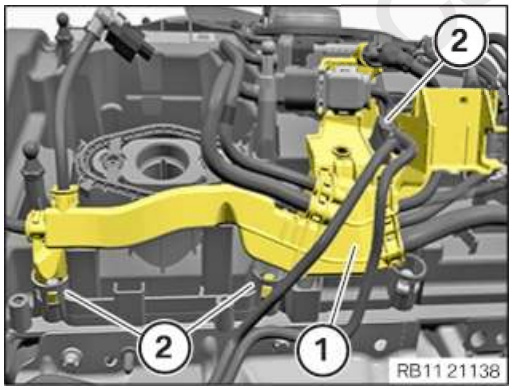
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

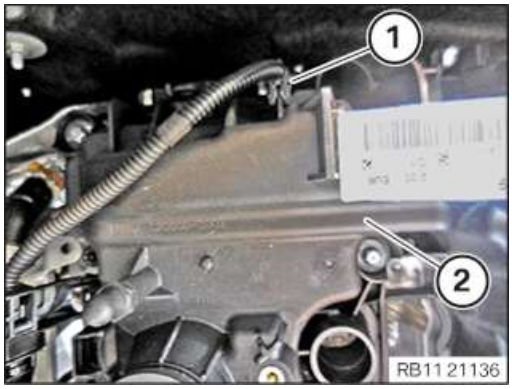
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

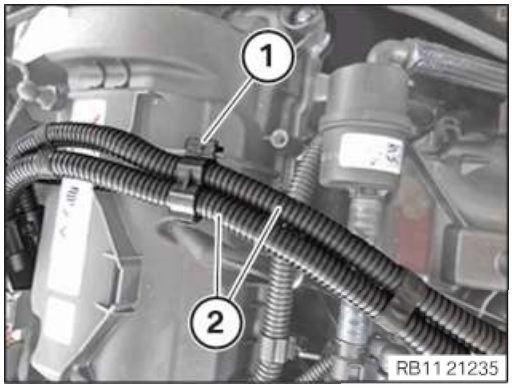


- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

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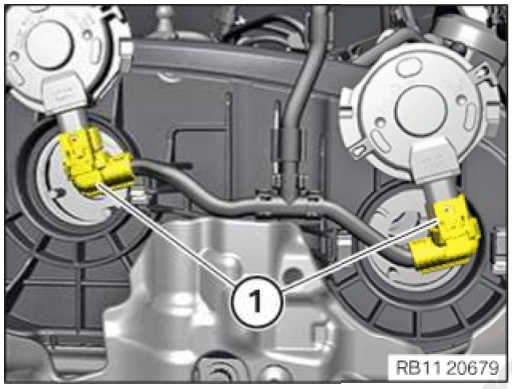


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

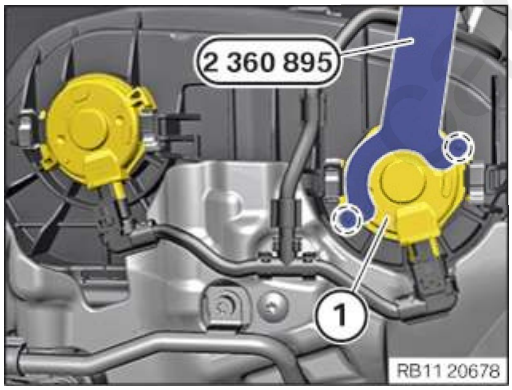
75 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

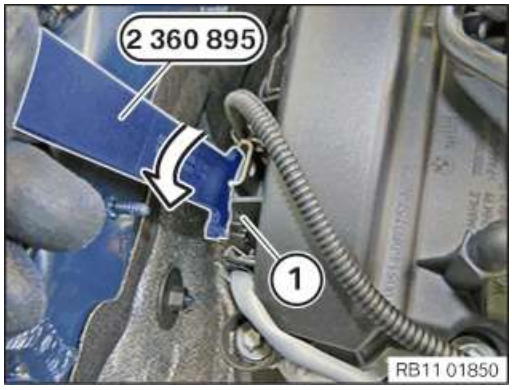
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



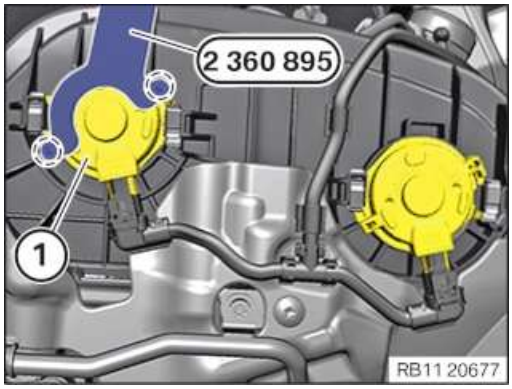
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



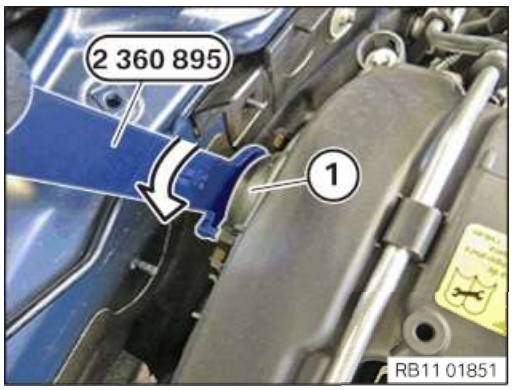
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

76 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

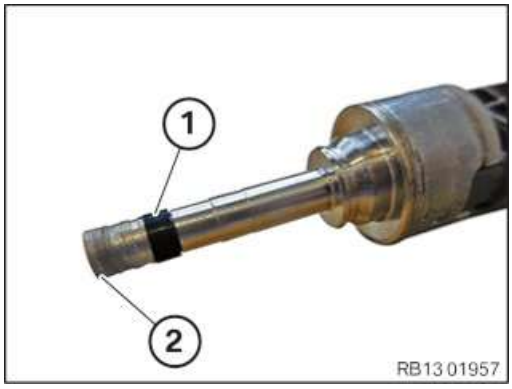
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.

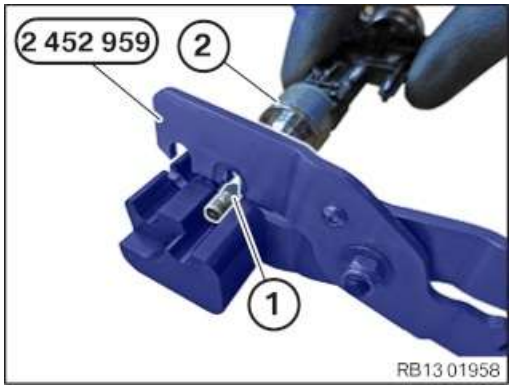


- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).

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- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

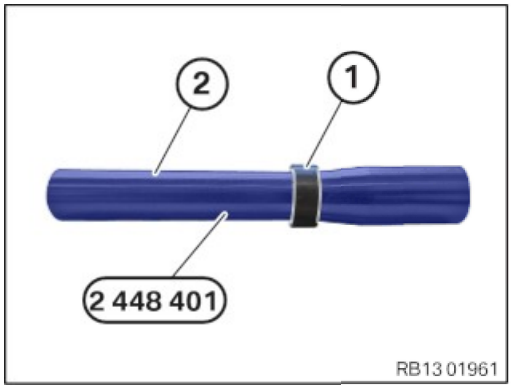


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

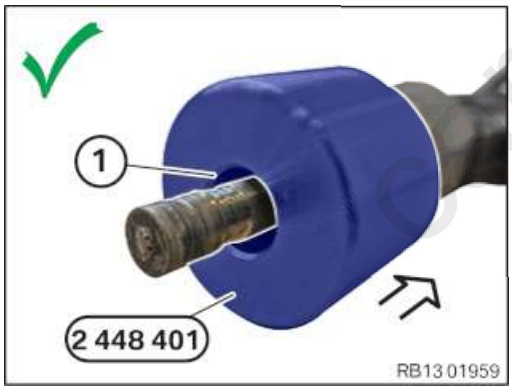
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

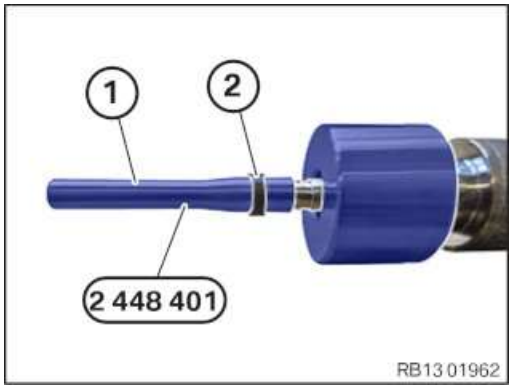
  The larger diameter of the assembly sleeve (1) must point to the injector tip.



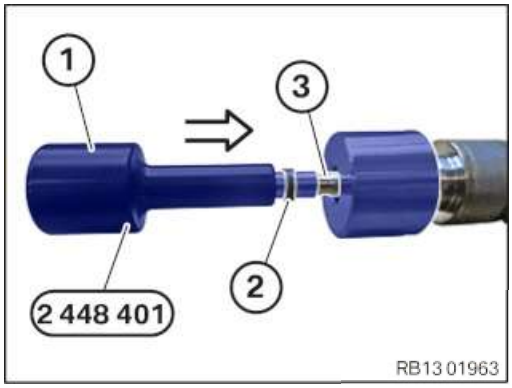
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

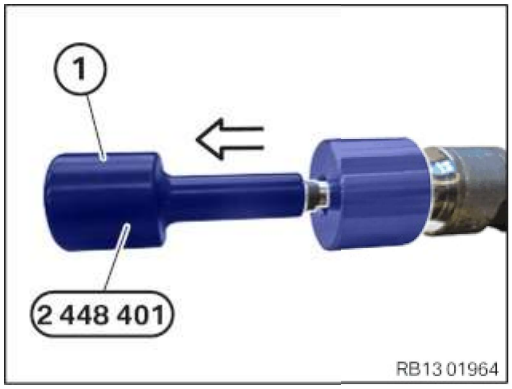
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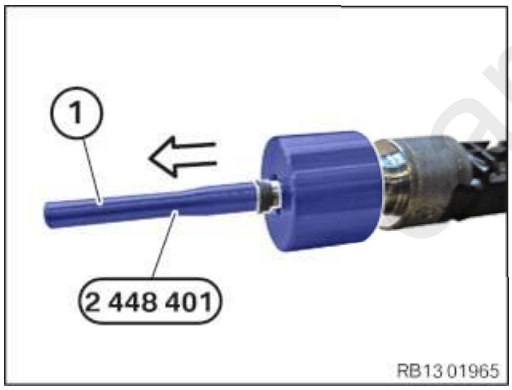
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



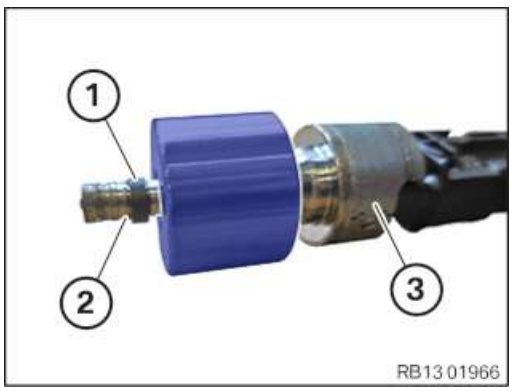
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

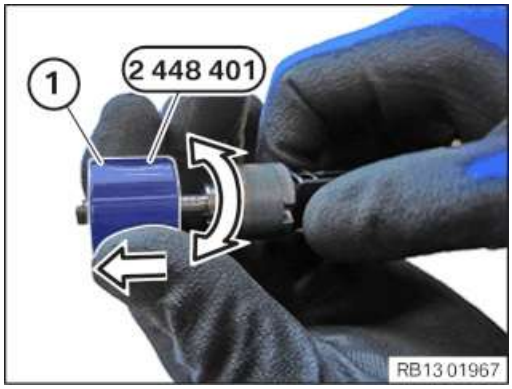


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



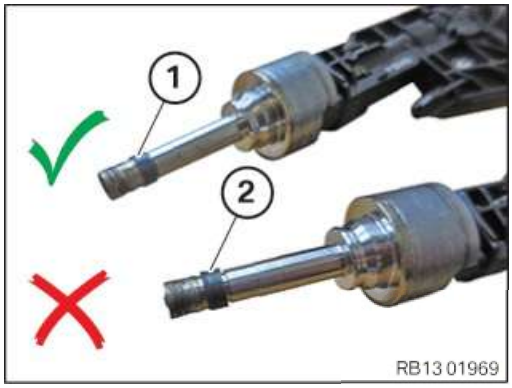
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

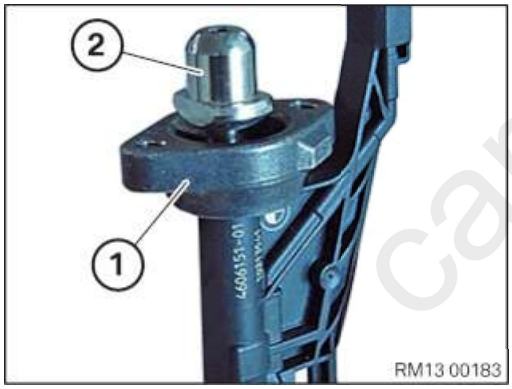


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

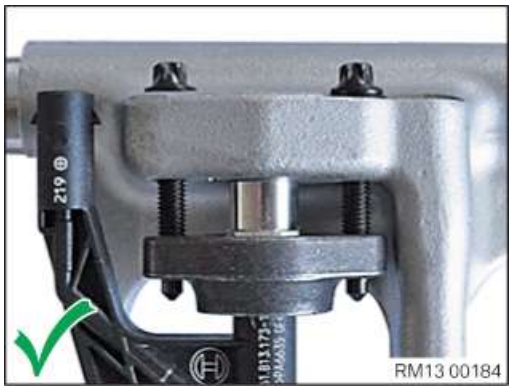
77 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



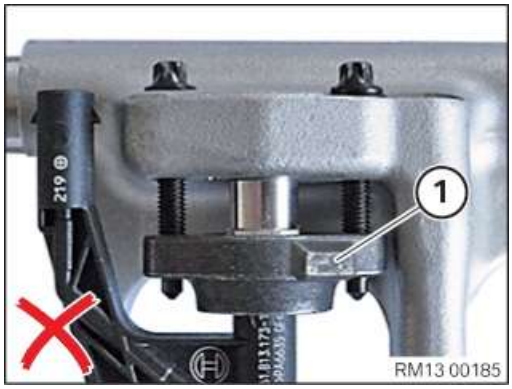
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

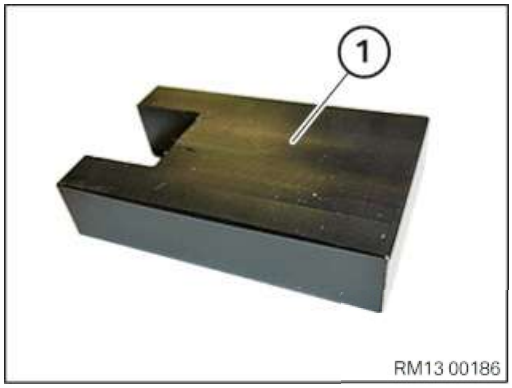
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



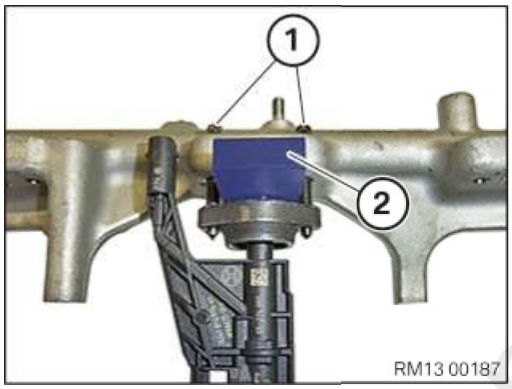
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



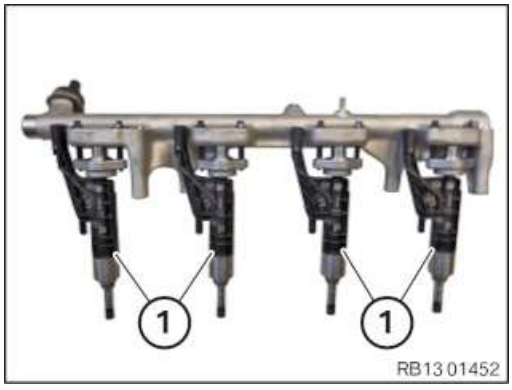
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

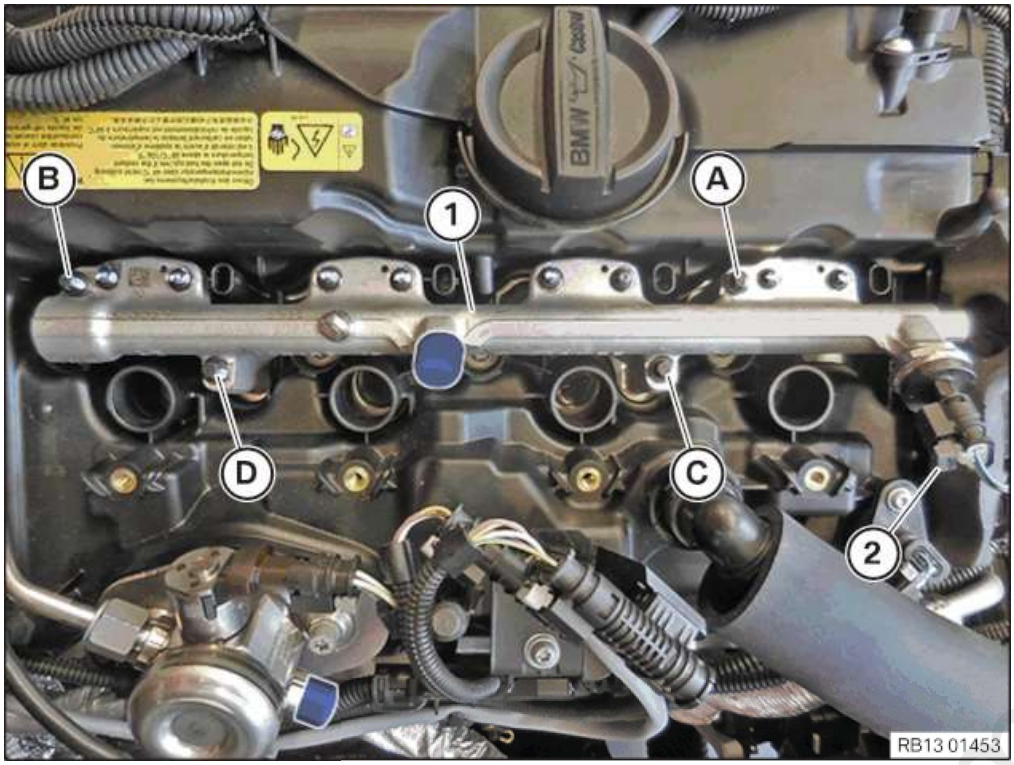


- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

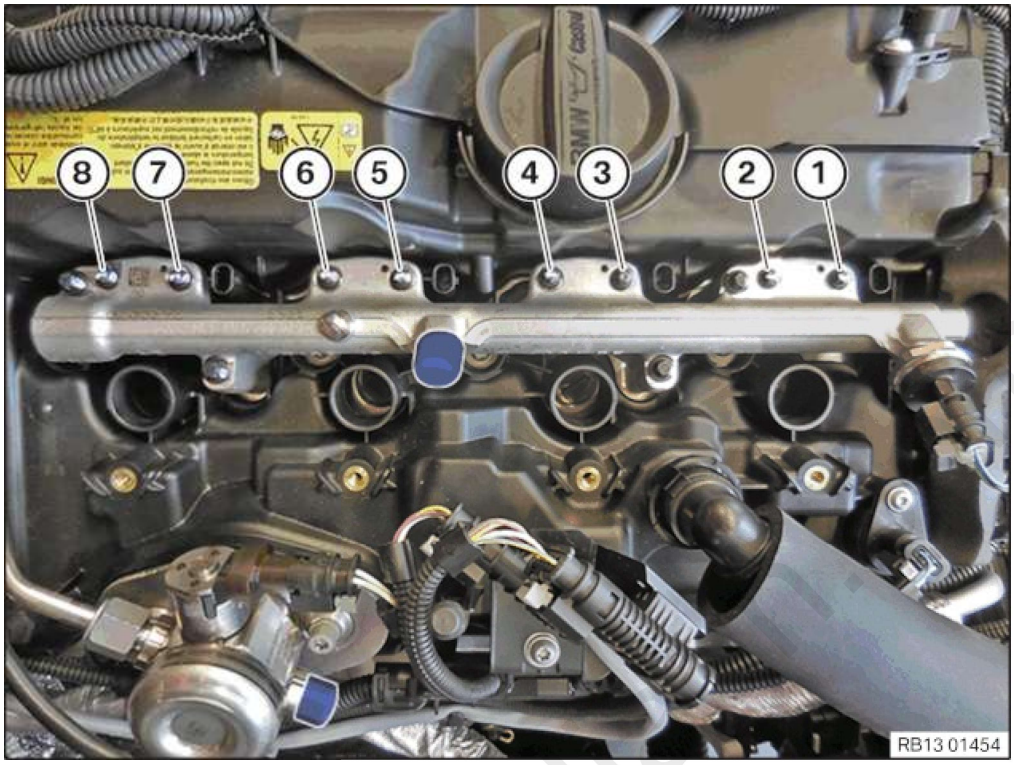
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.

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- Make sure that the rail (1) rests flat against the cylinder head.



- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

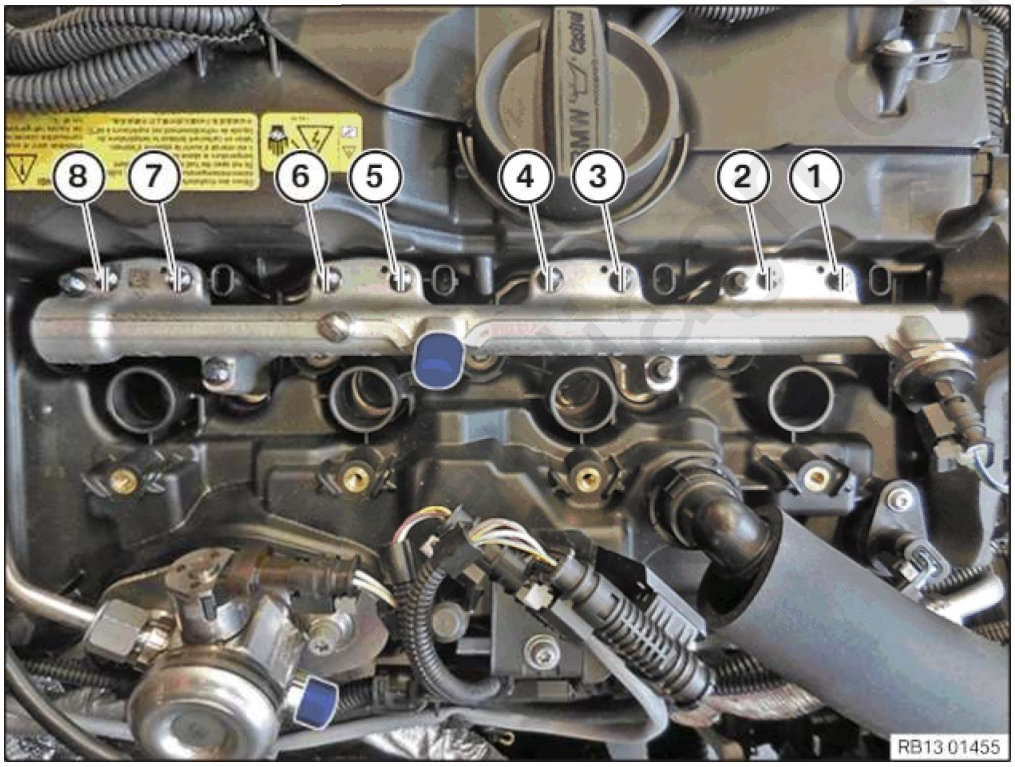
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

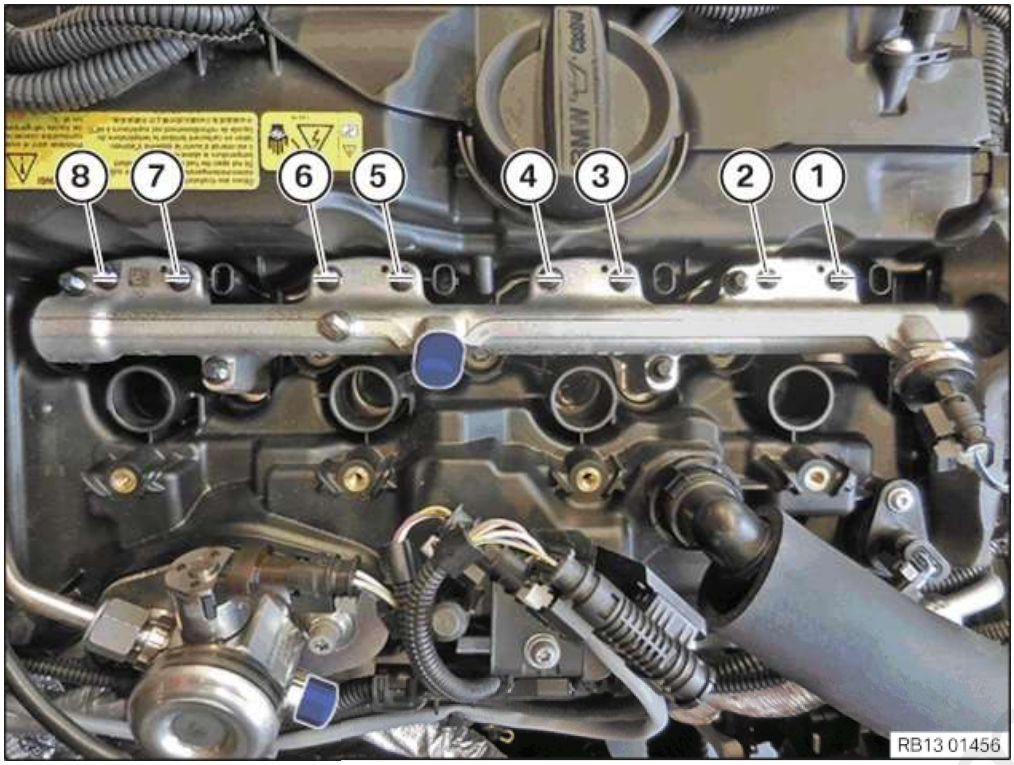
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.

- **Fuel injector 3:**
- Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
- **Fuel injector 4:**
- Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

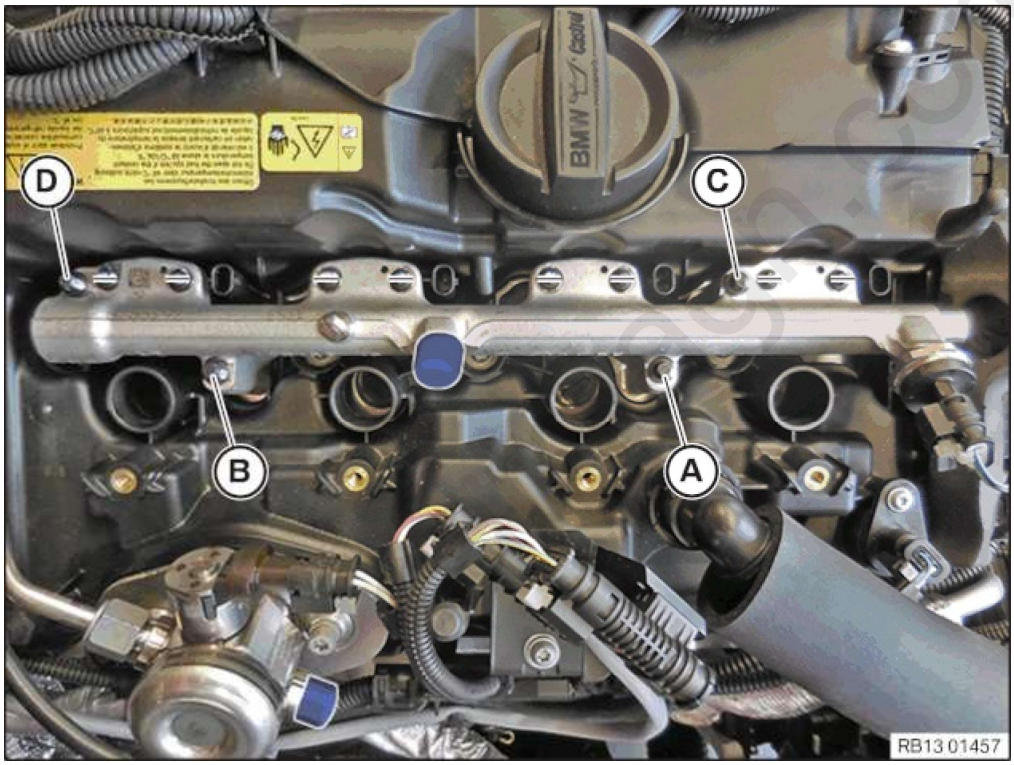


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

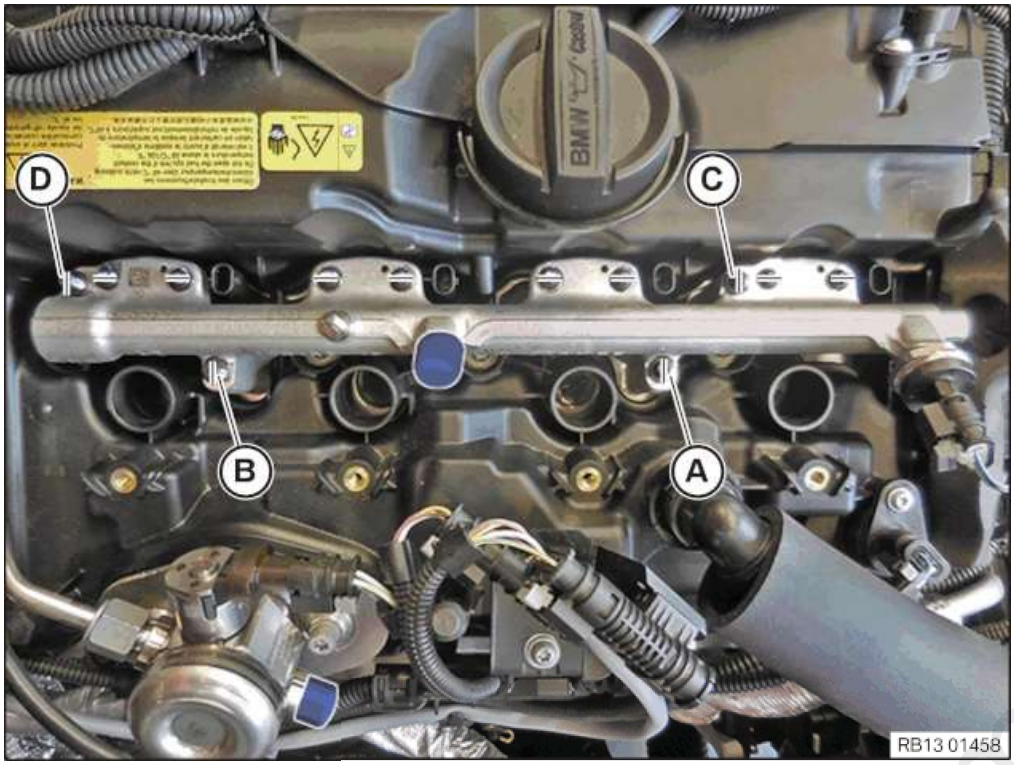
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

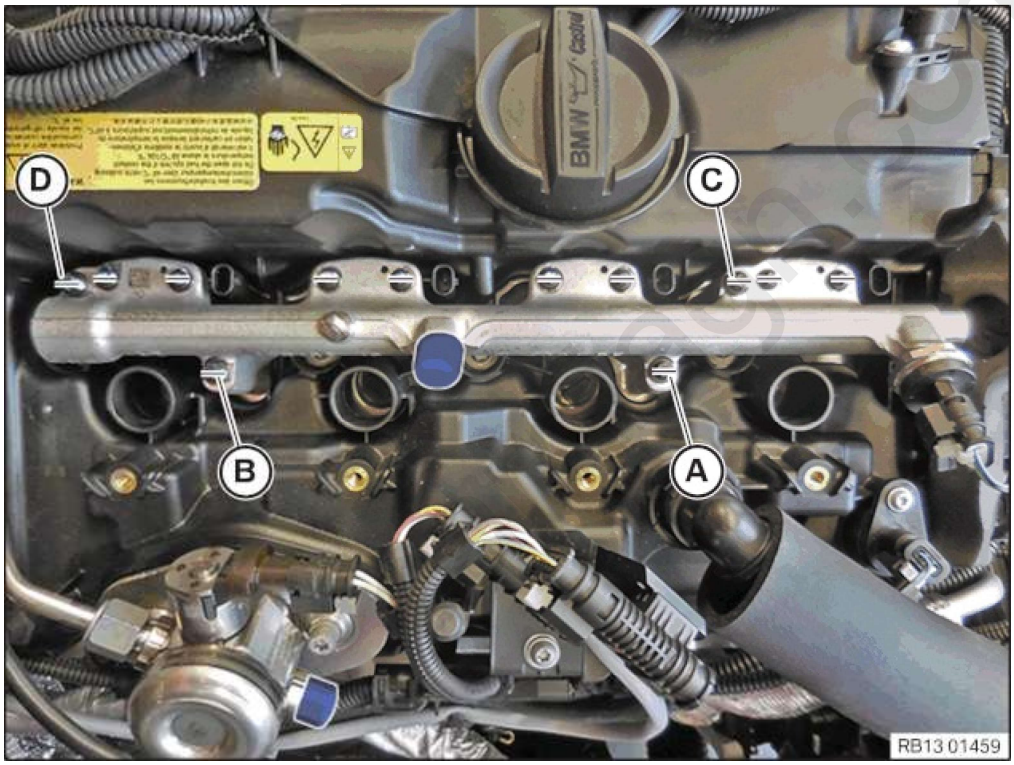
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

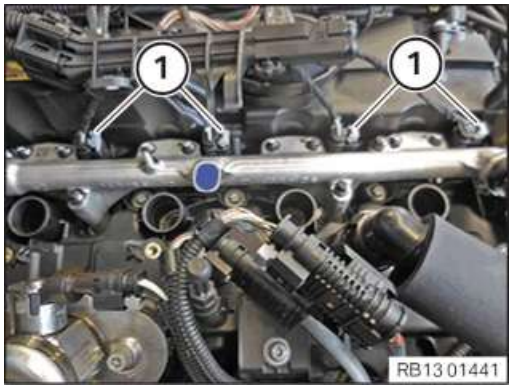


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



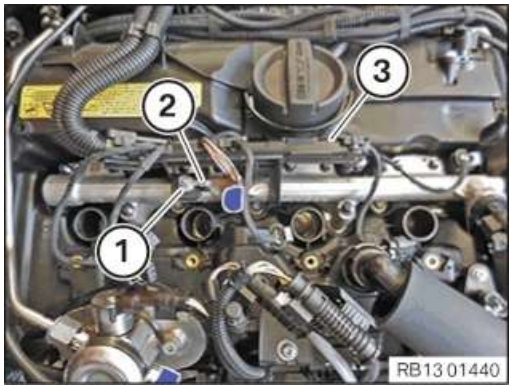
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

78 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

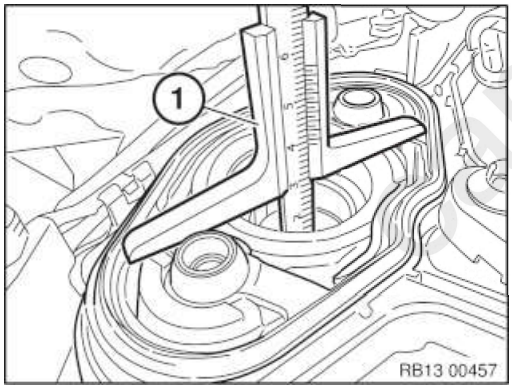
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

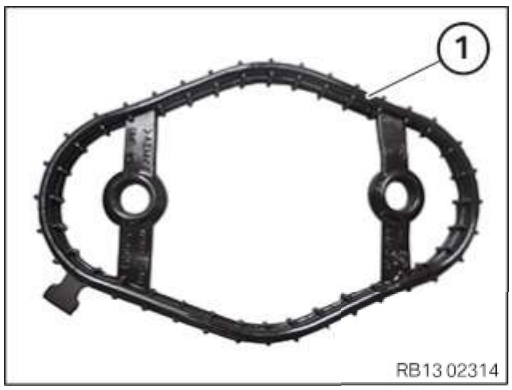
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



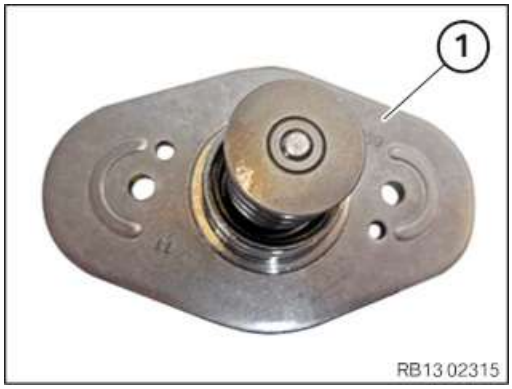
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

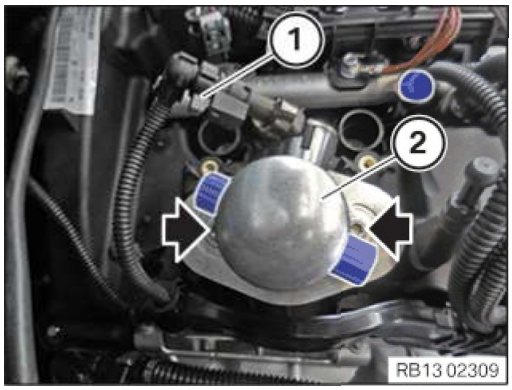
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

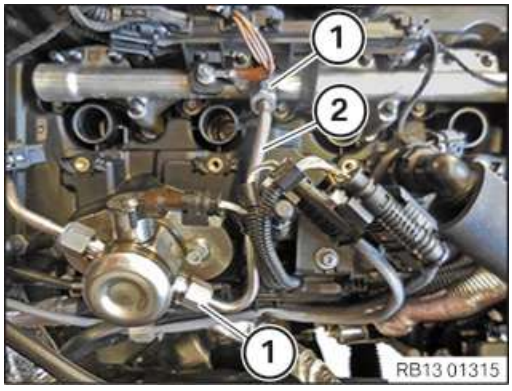
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

79 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

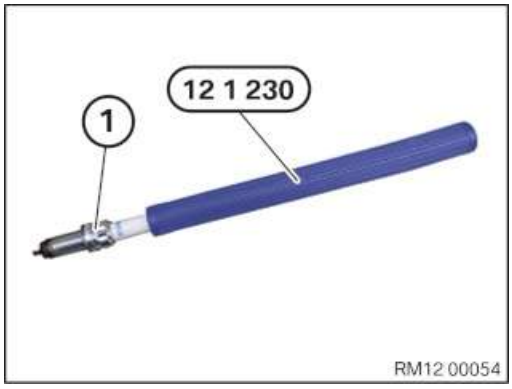
High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

80 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

M12x1.25		Tightening torque	23 Nm

81 – Installing the intake plenum

RISK OF DAMAGE

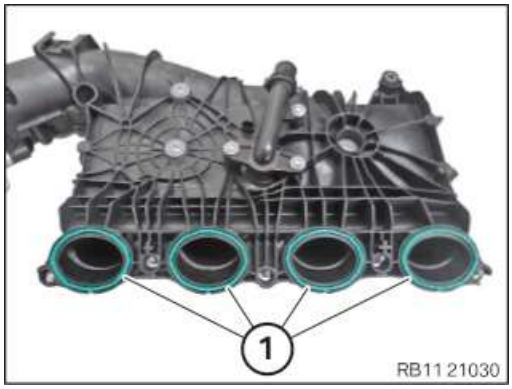
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

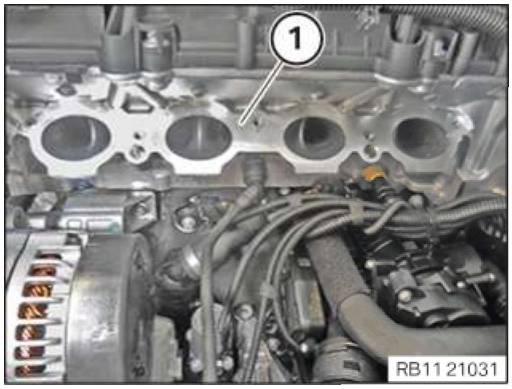
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

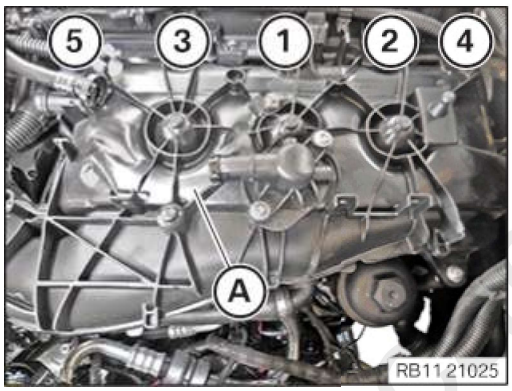


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

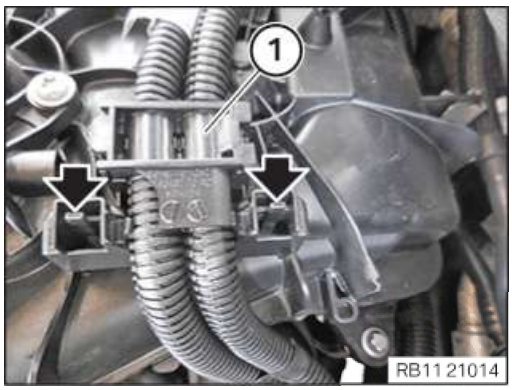
ertogen.com



- Tighten down screw (1).

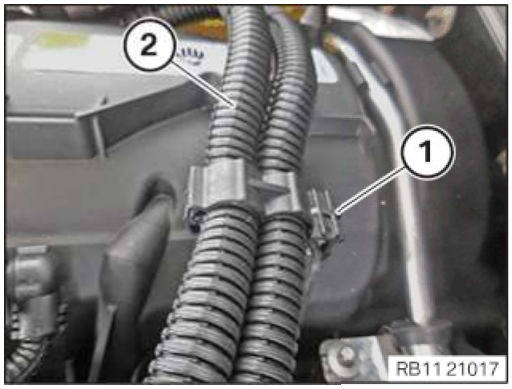
Intake plenum to support

M6X25		Tightening torque	8 Nm

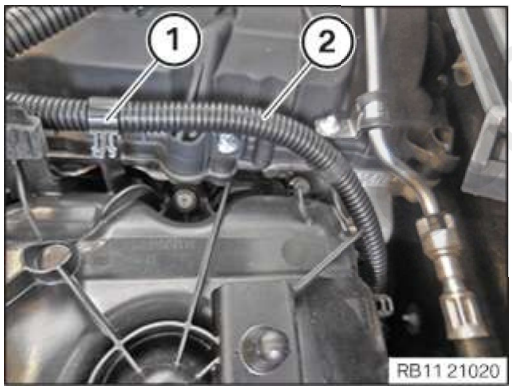


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

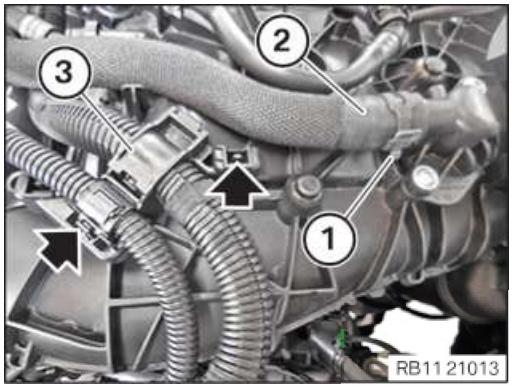
rdiagn.com



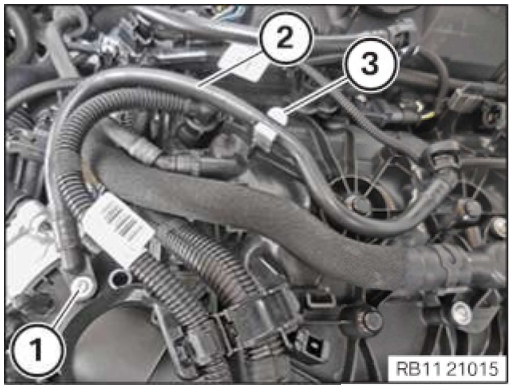
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



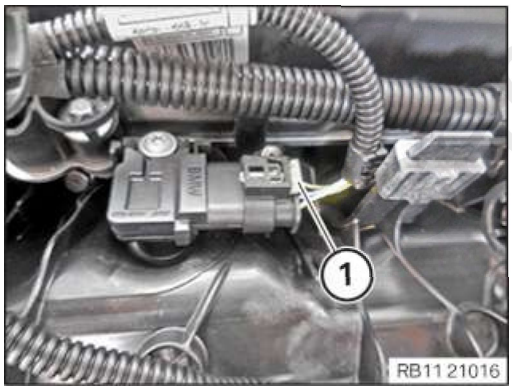
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

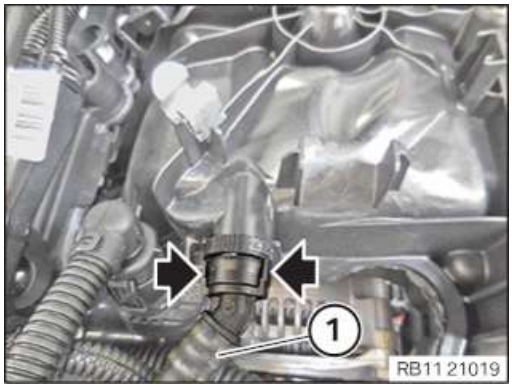
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

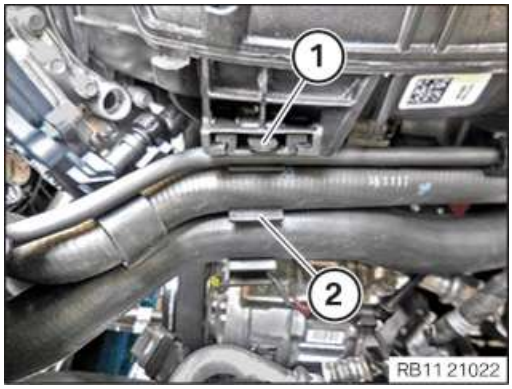
  The connector (1) must engage audibly.



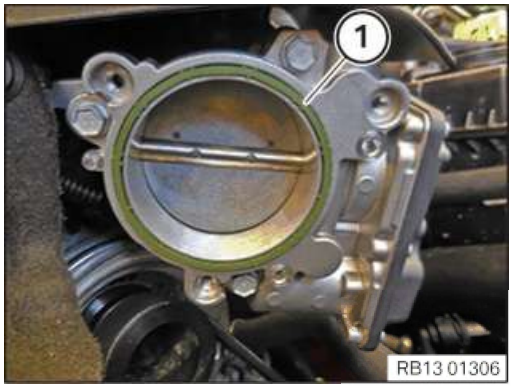
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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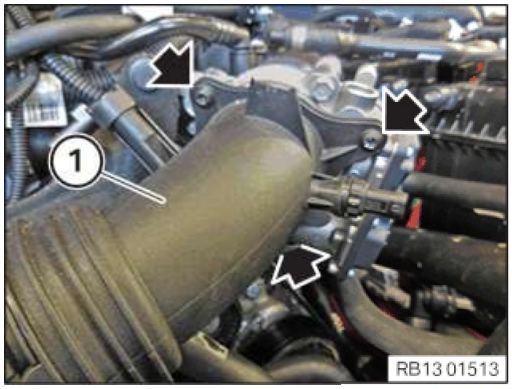


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

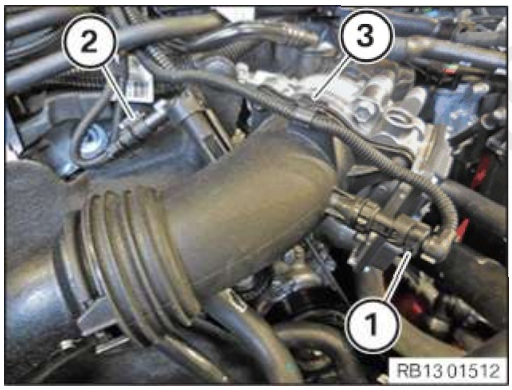
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

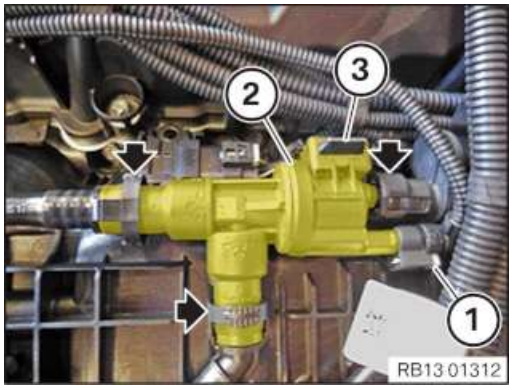
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

82 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

83 – Topping up the engine oil

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RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

TECHNICAL INFORMATION

- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

- Fill in engine oil at the oil filler neck.

Engine oil

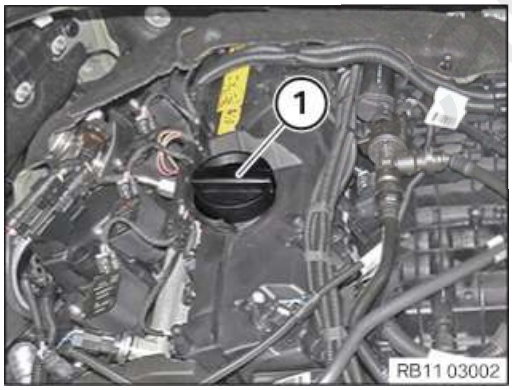
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

▸ **Installing the oil filler cap**

- Close oil filler cap (1).



84 – Remove the engine on an assembly stand

CAUTION

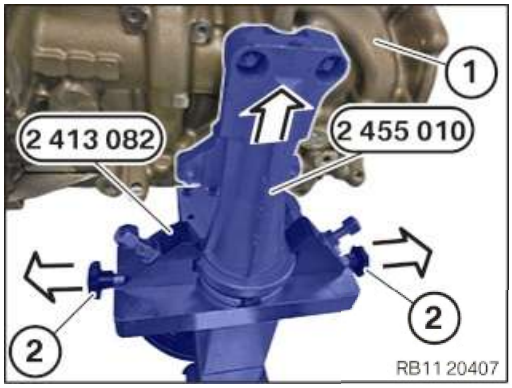
Heavy component.

Heavy components can lead to injury or damage.

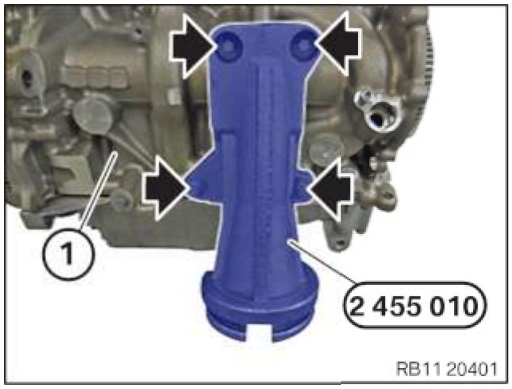
- Remove and install heavy components with the aid of another person/other persons.



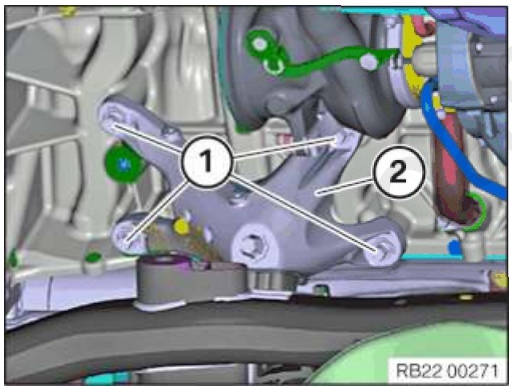
- Insert engine lifter with special tool and position engine (1).



- Unscrew the nuts on special tool .
- Detach the holder (2) in the direction of the arrow.
- Detach the engine (1) with special tool 2 455 010 out of the special tool in the direction of arrow.



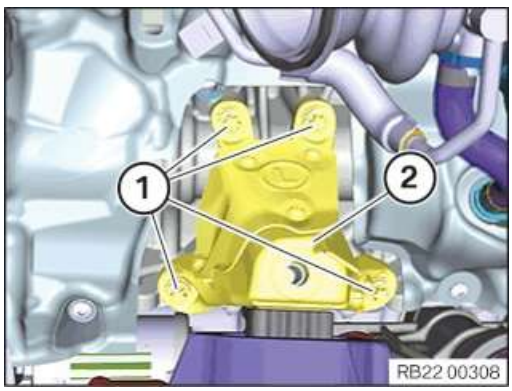
- Remove conventional screws (arrows).
- Feed out the special tool 2 455 010 on the engine (1) and remove.



- **Type: Rear-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm



- **Type: Four-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm

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- See additional information.

Additional Information

Overview of Tightening Torques

Special tool 2 455 010 to crankcase			Used in step 2
M10x30		Tightening torque	38 Nm

Special tool 11 8 930 to special tool 00 2 320			Used in step 2
M14x35		Tightening torque	160 Nm

Oil drain plug			Used in step 4
M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head			Used in step 176070
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 176070
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 26
M8		Tightening torque	21,5 Nm

Special tool 2 288 054 to crankshaft			Used in step 3740
		Tightening torque	20 Nm

Main bearing cap to crankcase			Used in step 40
M10x1.5	Renew screws.	1. Jointing torque	25 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

Gear to counterbalance shaft			Used in step 40
		1. Jointing torque	40 Nm
		2. Angle of rotation	70 °

Gear to crankcase			Used in step 40
			70 Nm

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Connecting rod bearing cap to connecting rod — Used in step 45

Renew screws.

Tighten screws crosswise.		Jointing torque	20 Nm
		1. Angle of rotation	70 °
		2. Angle of rotation	70 °

Oil deflector to crankcase — Used in step 46

M8 x 35		Renew screws.	15 Nm
			45 °

Camshaft sprocket to oil vacuum pump — Used in step 47

M8	Important - left-hand thread Renew screw.	1. Jointing torque	5 Nm
		2. Angle of rotation	90 °

Oil vacuum pump to crankcase — Used in step 48

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

Bearing journal to crankcase — Used in step 49

Bearing journal	Replace bearing journal.	Tightening torque	20 Nm

Rear timing case cover to crankcase — Used in step 50

M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °

Oil sump to crankcase — Used in step 51

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 51

M8 x 50		Tightening torque	19 Nm

Flywheel to crankshaft — Used in step 52

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

Vibration damper with belt pulley to crankshaft — Used in step 53

M10x65	Renew screws. Tighten screws crosswise.	1. Jointing torque	40 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

Battery positive lead to starter — Used in step 54

M8		Tightening torque	13,5 Nm

Cylinder head to crankcase — Used in step 59

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

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Cylinder head bolt to timing case cover — Used in step 59

M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head — Used in step 59

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head — Used in step 59

M6x16			8 Nm

Cable routing to cylinder head, rear — Used in step 59

M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head — Used in step 59

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 59

M6x16		Tightening torque	8 Nm

Manifold support for intake air to cylinder head — Used in step 59

M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head — Used in step 59

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 59

M6			8 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 59

M6x12		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 6667

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 69

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Oil return line to exhaust turbocharger/crankcase — Used in step 71

M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger — Used in step 7273

M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger — Used in step 72

M6		Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 73

M6 x 12		Tightening torque	8 Nm

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Cylinder head cover to cylinder head — Used in step 74

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 74

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 74

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 77

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 78

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 79

M14		Tightening torque	33 Nm

Spark plugs — Used in step 80

M12x1.25		Tightening torque	23 Nm

Intake plenum to cylinder head — Used in step 81

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 81

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 81

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 81

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 81

M6		Tightening torque	8 Nm

Engine support arm to engine — Used in step 84

M10		Tightening torque	38 Nm

Overview of Special Tools

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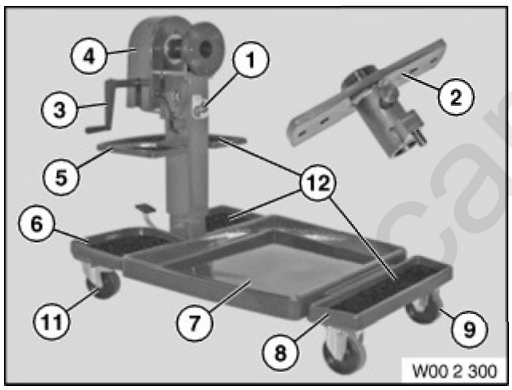
2 455 010 Engine support



Common Used in step 284

Usage	For accommodating engine on assembly stand. Engine: B3x, B4x, N47.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 495 187 (00 2 300) Assembly stand



Common Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

Consisting of

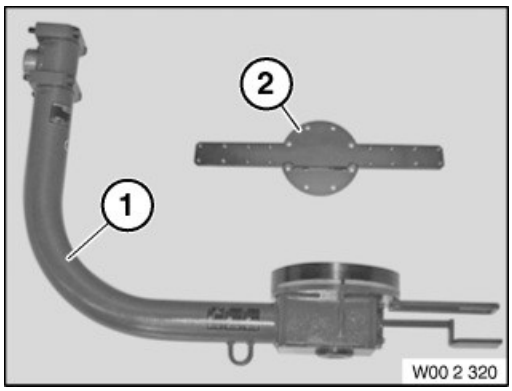
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	

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2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	
7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

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0 495 196 (00 2 320) Support arm



Common

Used in step 2

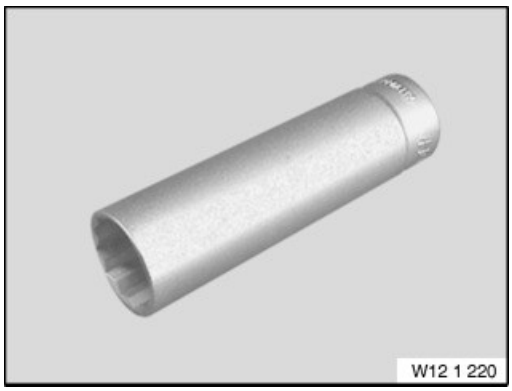
Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

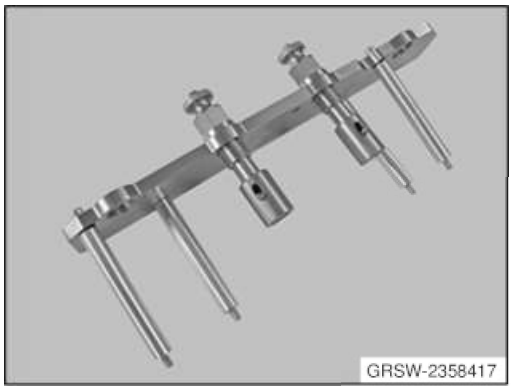
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0 495 560 (12 1 220) Socket



Common	Used in step 580
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

2 358 417 Device



Common	Used in step 8
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 8
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

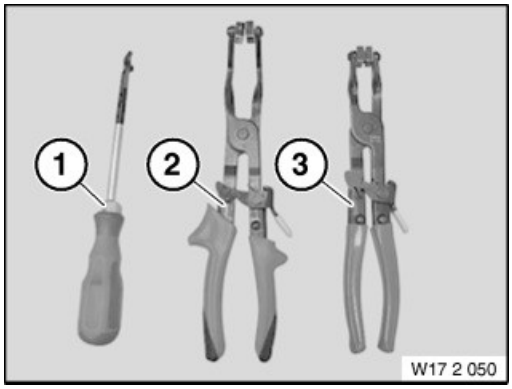
2 360 895 Pin wrench



Common	Used in step 975
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 794 (17 2 050) Pliers



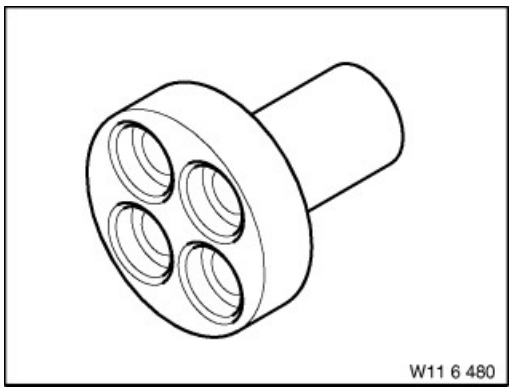
Common Used in step 1281

Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

0 493 380 (11 6 480) Connector



Common Used in step 1755687078

Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

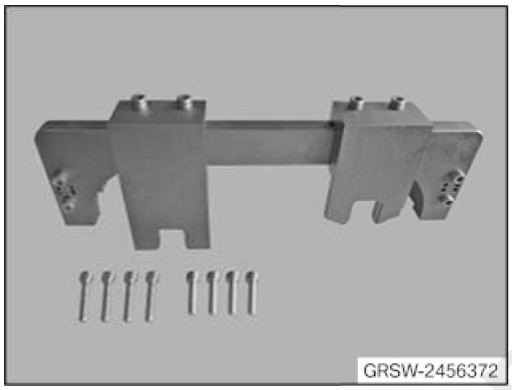
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2 288 380 Locating stud



Common	Used in step 17556870
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 1725606870
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 172570
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



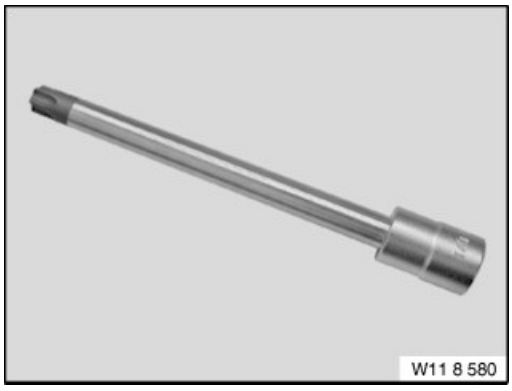
Common	Used in step 19206667
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 19206667
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

0 495 747 (11 8 580) Socket wrench



Common	Used in step 2659
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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2 220 718 Workshop crane



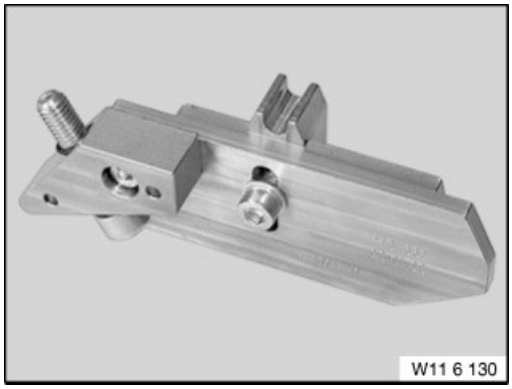
Common	Used in step 26
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

2 459 012 Holder



Common	Used in step 2659
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

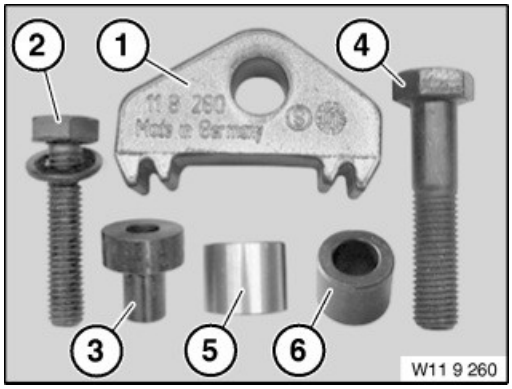
0 496 595 (11 6 130) Holder



Common	Used in step 2953
Usage	(counter support) For securing flywheel when releasing and tightening down screw connection of vibration absorber. Series: E90, E91, E92 with 4WD.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 05 09 (519)

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0 493 938 (11 9 260) Holder



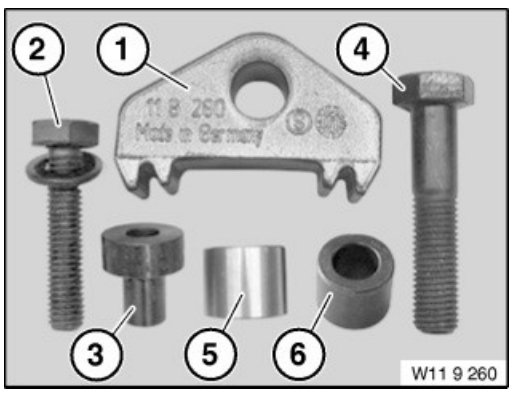
Common Used in step 3052

Usage	(Counter support with screw connection) For holding the flywheel when gearbox is removed
Included in the tool or work	
Storage location	A44
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 034 (11 9 261)		**Holder** (Individual counter support)	
2	0 494 035 (11 9 262)		**Screw** (Bolt (thread M10) with washer) For screwing counter support	
3	0 494 129 (11 9 263)		**Bush** (Bush for counter support) For counter support, for retaining flywheel when gearbox is removed Engine: N62, N73	
6	0 495 216 (11 9 266)		**Bush** For counter support, for retaining flywheel when gearbox is removed Engine: M57TU2	
4	0 494 130 (11 9 264)		**Screw** (Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed	
5	0 494 793 (11 9 265)		**Bush**	

0 494 130 (11 9 264) Screw

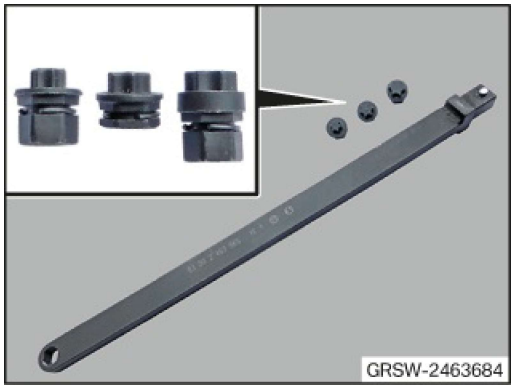


Common Used in step 3052

Usage	(Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed
Included in the tool or work	0 493 938
Storage location	A44
Replaced by	
In connection with	
SI-Number	

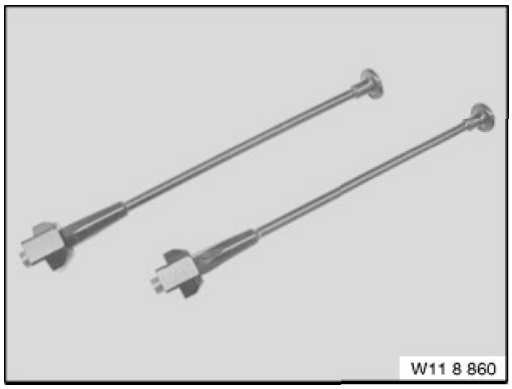
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2 463 965 Socket wrench



Common	Used in step 34
Usage	with T30, T40 and torx 45
Included in the tool or work	
Storage location	B6
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 496 144 (11 8 860) Assembly tool



Common	Used in step 3645
Usage	For installing piston with connecting rod in crankcase.
Included in the tool or work	
Storage location	A23
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

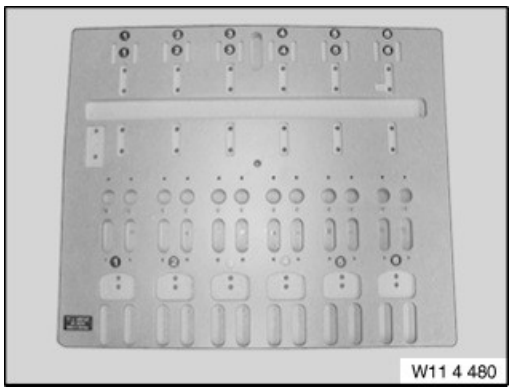
2 288 054 Gauge



Common	Used in step 3740
Usage	For positioning the counterbalance shafts during installation.
Included in the tool or work	
Storage location	C56
Replaced by	
In connection with	
SI-Number	01 06 14 (076)

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0 495 105 (11 4 480) oddments tray



Common

Used in step 37

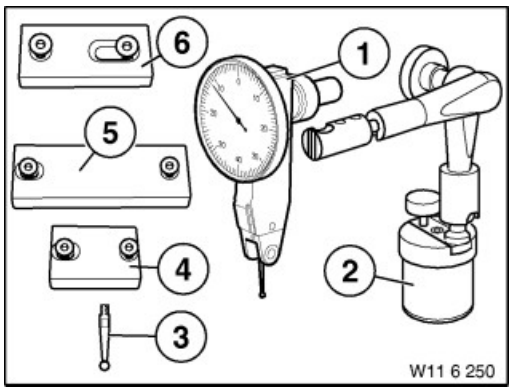
Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

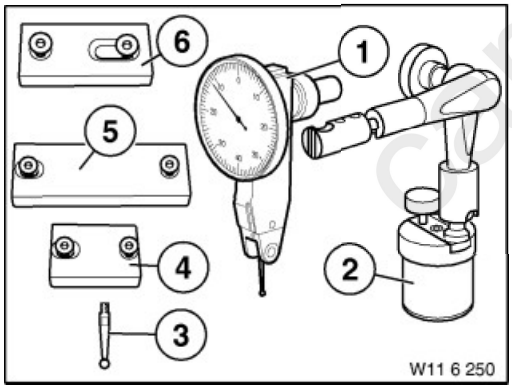
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0 493 144 (11 6 251) Dial gauge



Common	Used in step 4041
Usage	(Dial gauge) With 0.8 mm measuring range in each direction
Included in the tool or work	0 493 143
Storage location	
Replaced by	
In connection with	
SI-Number	

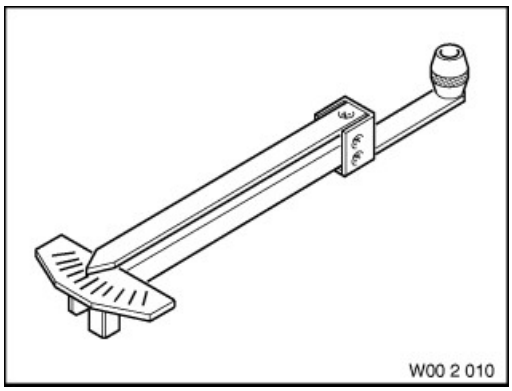
0 493 145 (11 6 252) Tripod



Common	Used in step 4041
Usage	(Small hydraulic tripod with magnetic base)
Included in the tool or work	0 493 143
Storage location	
Replaced by	
In connection with	
SI-Number	

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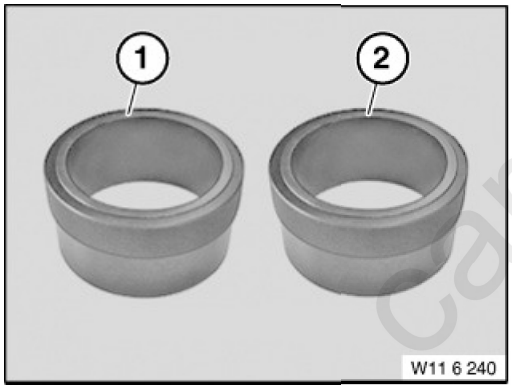
0 490 130 (00 2 010) Measurement aid



Common Used in step 42

Usage	(Coefficient of friction meter) For adjusting the steering box (measurement possible in both directions) and for checking and adjusting the bevel pinion and crown wheel bearing in all final drives
Included in the tool or work	
Storage location	X9
Replaced by	
In connection with	
SI-Number	

0 495 373 (11 6 240) Bush



Common Used in step 45

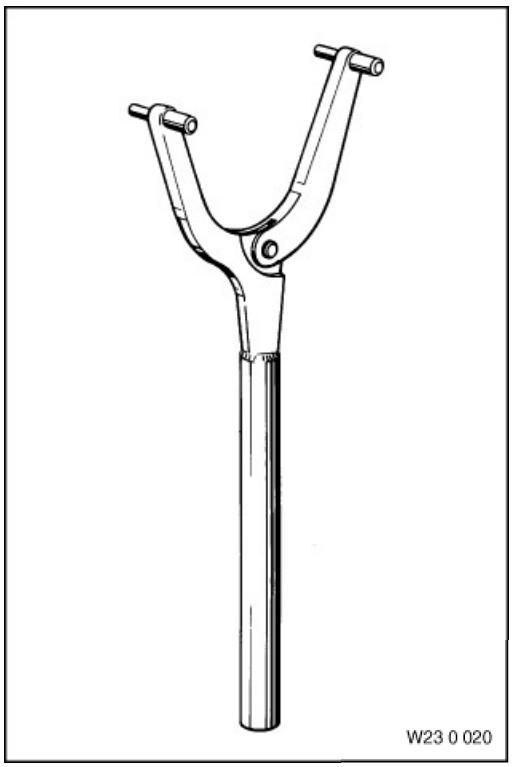
Usage	(Assembly bush set) For fitting pistons (diameter 82 mm) with connecting rod into the crankcase. Engine: N52B25
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 06 (244)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 527 (11 6 242)		**Bush** (assembly bush 82.25 mm)	
1	0 495 526 (11 6 241)		**Bush** (assembly bush 82.00 mm)	

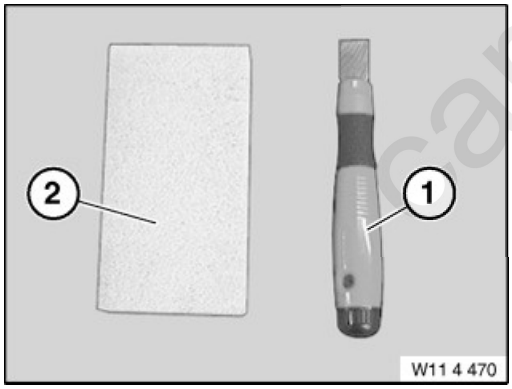
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0 491 440 (23 0 020) Holder



Common	Used in step 47
Usage	(counter support) For all three- and four-hole flanges when releasing and tightening down
Included in the tool or work	
Storage location	B4
Replaced by	
In connection with	
SI-Number	

0 495 102 (11 4 470) Tool



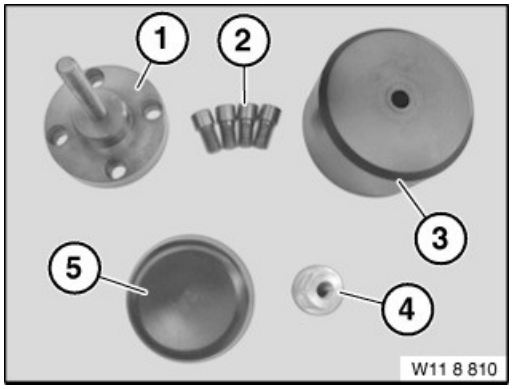
Common	Used in step 5051
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

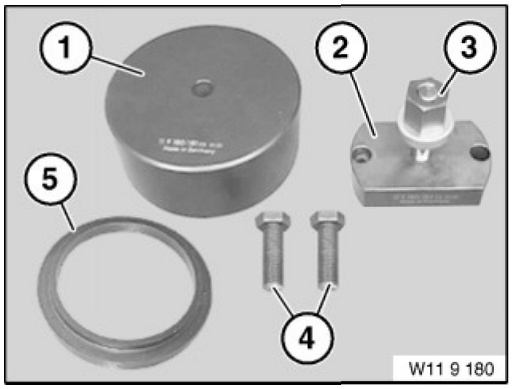
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0 496 137 (11 8 815) Holding sleeve



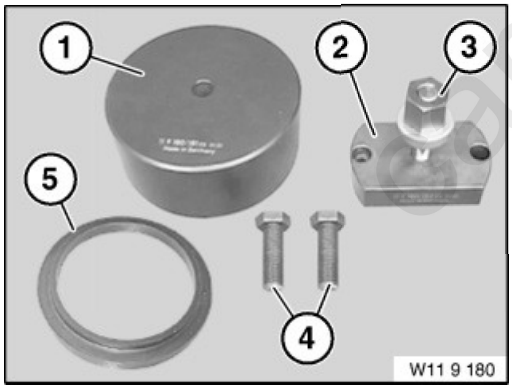
Common	Used in step 50
Usage	(Slip sleeve) Liquidation of existing inventory and then available only via complete tool set 11 8 810 = 83 30 0 496 132 - status 09.12.2011
Included in the tool or work	0 496 132
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 494 029 (11 9 182) Synchronising key



Common	Used in step 50
Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 494 031 (11 9 184) Screw



Common	Used in step 50
Usage	(screws (2 x))
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

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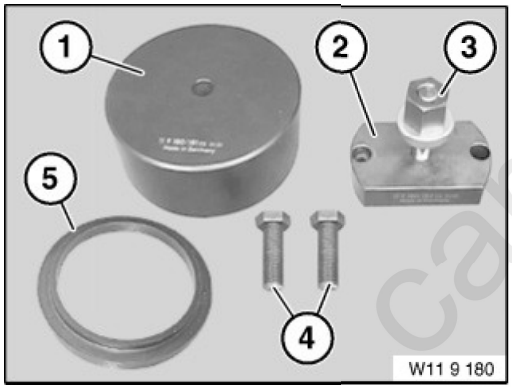
2 360 215 Adapter



Common Used in step 50

Usage	For installing the rear radial shaft seal. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B56
Replaced by	
In connection with	11 9 180 = 0493881
SI-Number	01 13 14 (098)

0 493 881 (11 9 180) Tool



Common Used in step 50

Usage	(pulling tool) For pulling radial shaft seal into engine block, rear
Included in the tool or work	
Storage location	C26
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 028 (11 9 181)		**Bush**	
2	0 494 029 (11 9 182)		**Synchronising key**	
3	0 494 030 (11 9 183)		**Nut**	
4	0 494 031 (11 9 184)		**Screw** (screws (2 x))	
5	0 496 660 (11 9 185)		**Ring** For installation shaft seal - rim offset 6.6 mm (N55).	

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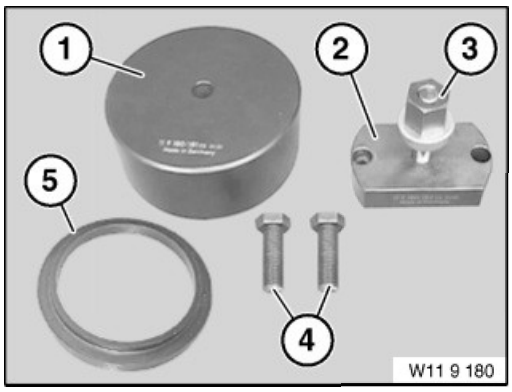
0 494 028 (11 9 181) Bush



Common Used in step 50

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

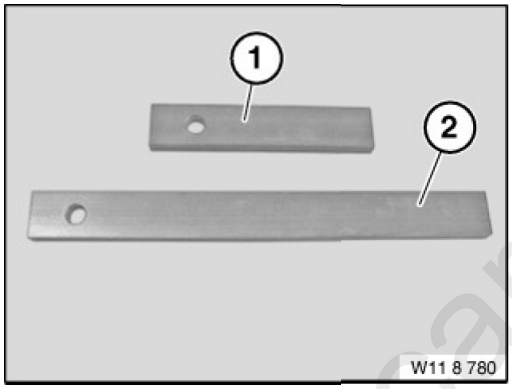
0 494 030 (11 9 183) Nut



Common Used in step 50

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 496 120 (11 8 780) Plate



Common Used in step 51

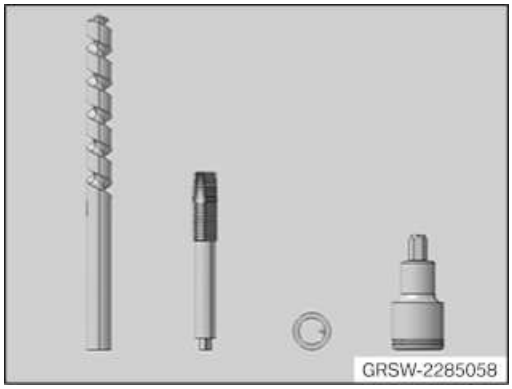
Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

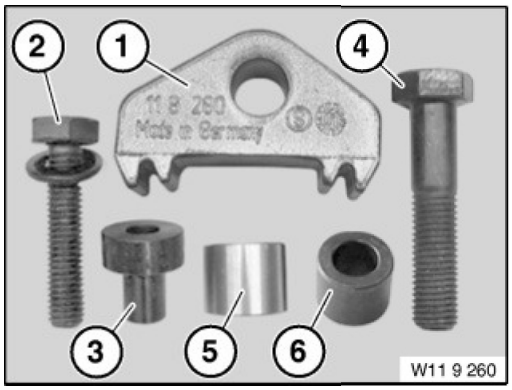
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2 285 058 Tool set



Common	Used in step 52
Usage	
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 14 (069)

0 494 034 (11 9 261) Holder



Common	Used in step 52
Usage	(Individual counter support)
Included in the tool or work	0 493 938
Storage location	
Replaced by	
In connection with	
SI-Number	

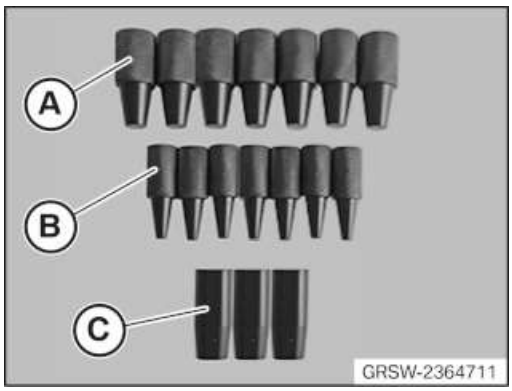
2 466 729 Fitting aid



Common	Used in step 53
Usage	For the installation of the vibration damper. Engine: B48, B58. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	
SI-Number	01 07 18 (545)

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2 364 711 Plug



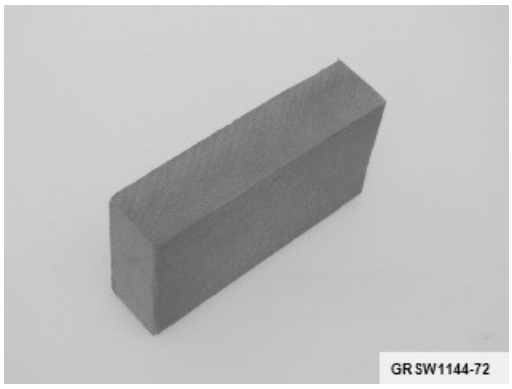
Common	Used in step 5657
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

0 495 103 (11 4 471) Scraper



Common	Used in step 57
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

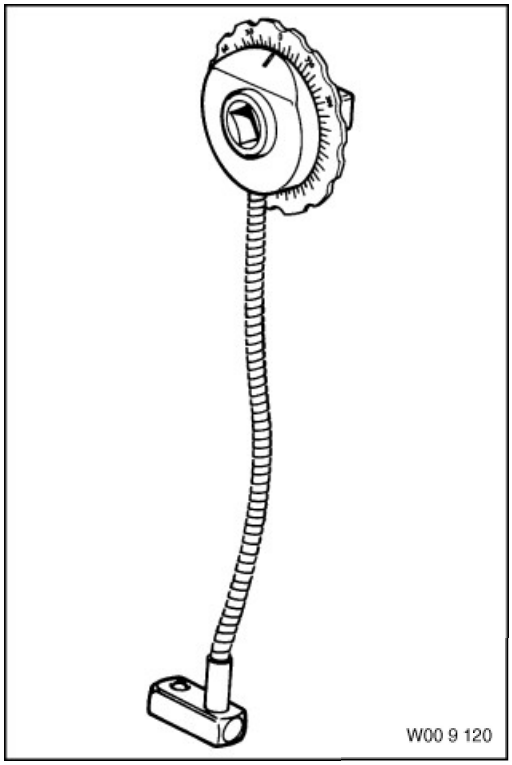
0 495 104 (11 4 472) Extractor



Common	Used in step 57
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

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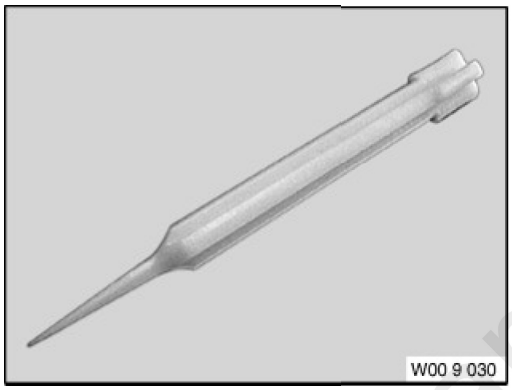
0 490 504 (00 9 120) Torque angle measuring dial



Common Used in step 59

Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common Used in step 597273

Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

2 455 654 Tensioning tool



Common Used in step 6568

Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 452 959 Pliers



Common	Used in step 76
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 76
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

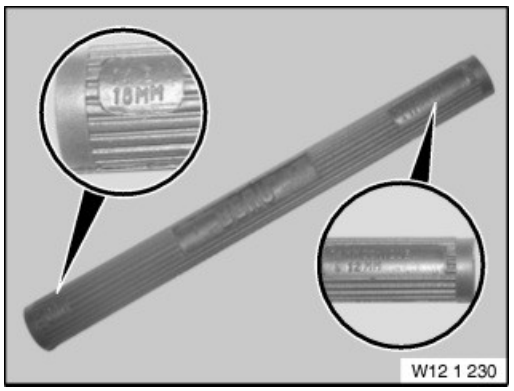
2 358 022 Gauge



Common	Used in step 77
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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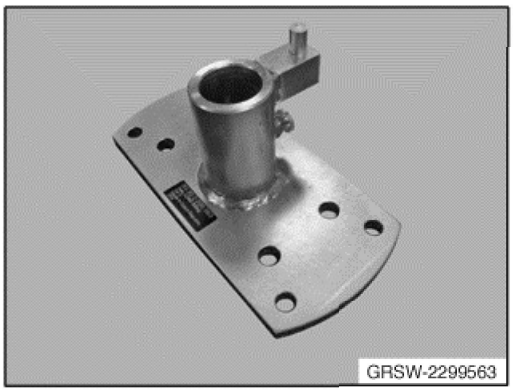
0 496 065 (12 1 230) Fitting aid



Common	Used in step 80
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

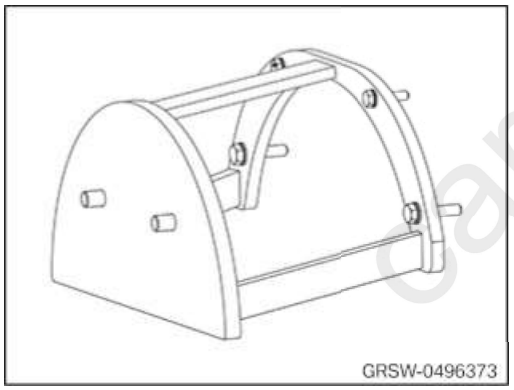
Replacement tools:

2 299 563 Adapter



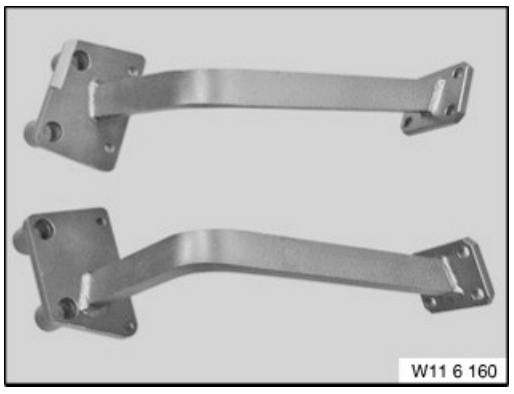
Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 373 (11 5 420) Plate



Common	Used in step 2
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 496 680 (11 6 160) Support



Common	Used in step 2
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

Overview Technical Data

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Axial play of crankshaft — Used in step 4041

min. 0,060 mm
max. 0,250 mm

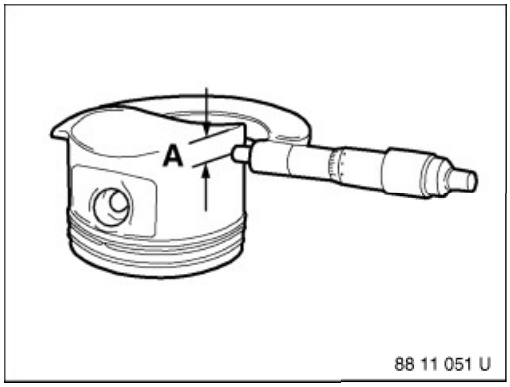
Maximum permitted torque of the crankshaft — Used in step 42

max. 2 Nm

Piston diameter — Used in step 43

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Cylinder bore B38/B46/B48/B58 — Used in step 44

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Height of the sealing bead — Used in step 50

2,0 mm ... 2,5 mm

Engine oil — Used in step 83

Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Engine oil B48B20O1/B46B20O1 — Used in step 83

Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Screw-in depth of thread cutter — Used in step 52

Screw-in depth	18 mm

Links

Functional descriptions	Used in step
Petrol particulate filter	83

General repair instructions	Used in step

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11 00 ... Overview of consumables (Electronic Parts Catalogue)	5051

Repair instructions	Used in step
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
31 10 001 Completely removing and installing front axle with engine and transmission	185
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11 00 050 Removing and installing engine	185
11 00 050 Remove and install engine	185
11 00 050 Remove and install engine	185
11 00 050 Remove and install engine	185
11 00 050 Removing and installing the engine with a double-clutch transmission (DKG)	185
11 00 050 Remove and install engine	185
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11 00 050 Remove and install engine	185
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11 00 050 Remove and install engine	185
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine \PREMIUM	185
11 00 050 Removing and installing/replacing engine (N63)	185
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
11 00 050 Remove and install engine	185
11 00 050 Remove and install engine (Automatic)	185
11 00 050 Remove and install engine (Automatic)	185
11 00 050 Remove and install engine	185
11 00 050 Remove and install engine	185
11 00 050 Remove and install engine (Automatic)	185
11 00 050 Remove and install engine (Automatic)	185
11 00 050 Remove and install engine	185
11 00 050 Remove and install engine	185
11 00 050 Remove and install engine	185
11 00 050 Remove and install engine	185
11 00 050 Removing and installing the engine with a double-clutch transmission (DKG)	185
11 00 050 Remove and install engine	185
13 53 ... Clean the cylinder head around the injectors due to grit / dust	8
61 13 ... Unlocking and disconnecting different plug connections	81074
61 35 ... Notes on ESD protection (Electro Static Discharge)	8911
61 35 ... Notes on ESD protection (Electro Static Discharge)	911

Operating materials	**Used in step**
3.0 Technically appropriate engine oils for BMW Group engines	83

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11 21 140 Replace crankshaft guide bearing shells (B48)

Attention!

Replace main bearing bolts.

There must be no oil in the blind holes **(risk of cracking)**.

Do not wash off bolt coating.

Incorrect assembly of the bearing caps will result in damage to the crankcase.



Attention!

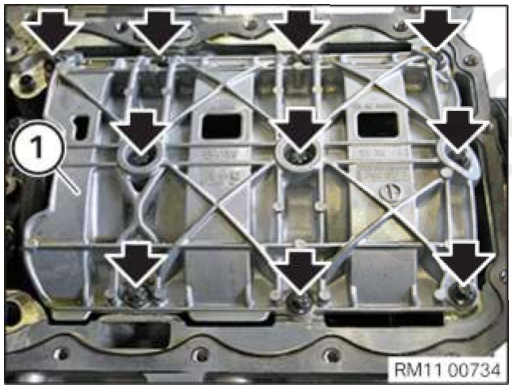
The guide bearing is located at the 3. bearing seat.

Installation note:
Bearing shell (1) with lubricating groove must be fitted in upper section of crankcase.

Bearing shell (2) without lubricating groove must be installed in lower section of crankcase.

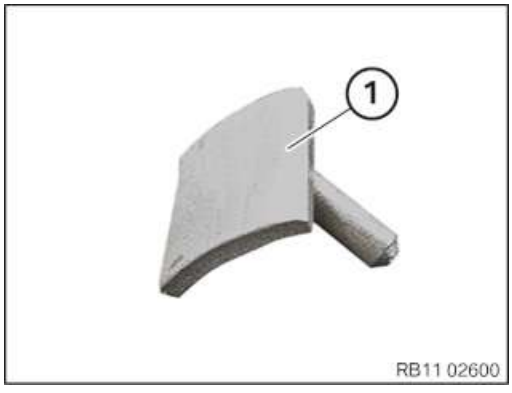
Necessary preliminary tasks:

- Remove oil sump



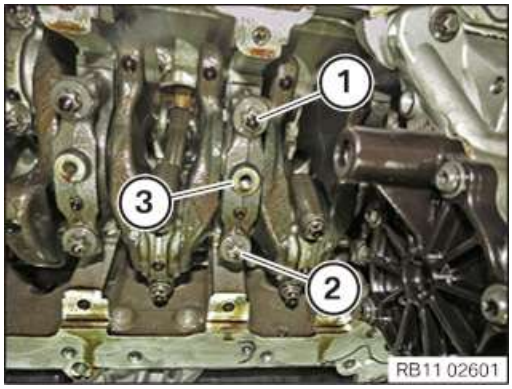
Unscrew all bolts.

Remove reinforcement (1).

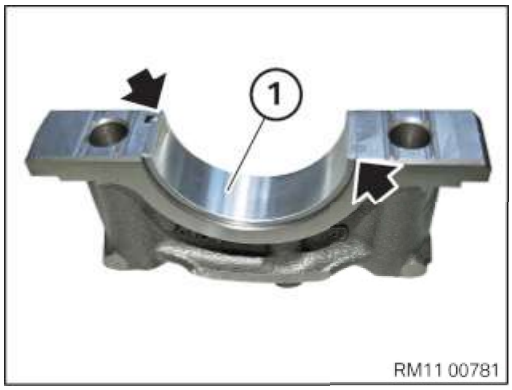


Special tool (1) is included in the delivery specification of the bearing shells.

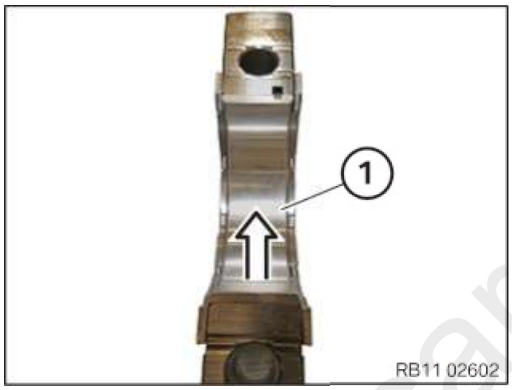
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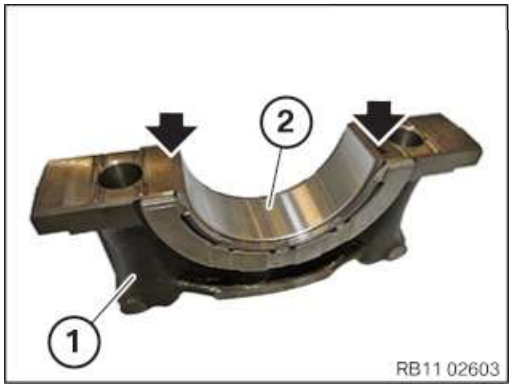
Loosen main bearing bolts 1 and 2 from main bearing cap (3).



Remove standard main bearing shell (1) without lubricating groove from the bearing cap (see arrows).

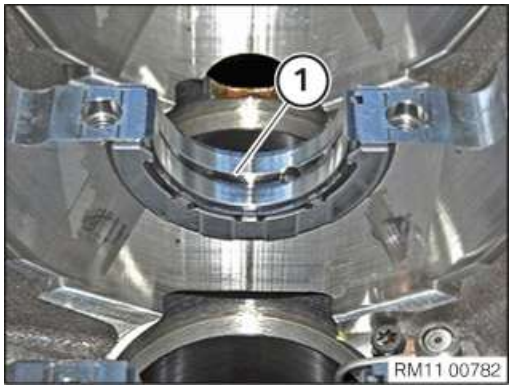


Insert new guide bearing shell (1) without lubricating groove in direction of arrow.



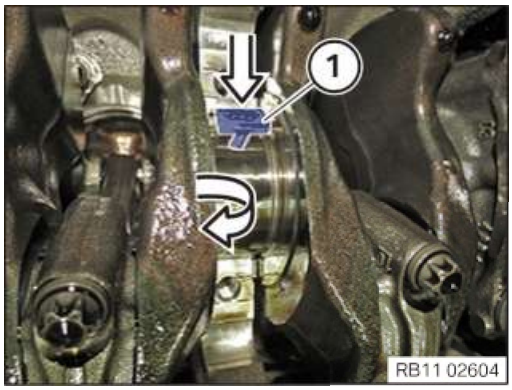
Insert thrust bearing lid (1) with a new guide bearing shell (2) precisely into the bearing cap (see arrows).

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Note:
Thrust bearing (1) on the crankshaft is installed at bearing position 3.

Observe combination of bearing colours according to the table.

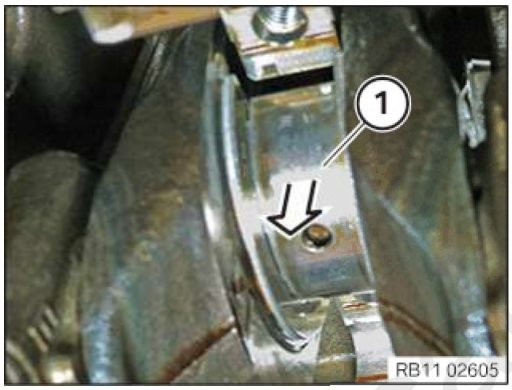


Attention!

The provided special tool (1) is required to dismount and install the guide bearing.

Insert special tool (1) into the oil hole of the crankshaft (see arrow).

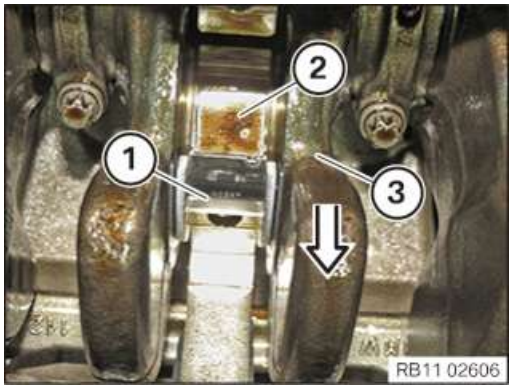
Carefully twist the crankshaft in direction of engine rotation getting assistance by a second person



Twist crankshaft to the extent that the guide bearing (1) can be removed from the crankshaft.

Installation note:
Installation of guide bearing in reverse sequence.

The crankshaft needs to be twisted further to ensure the special tool is in the right position.



Remove guide bearing with lubricating groove from the enclosure.

Position guide bearing (1) with lubricating groove on the crankshaft.

Attention!

Pay attention to guide lug on guide bearing.

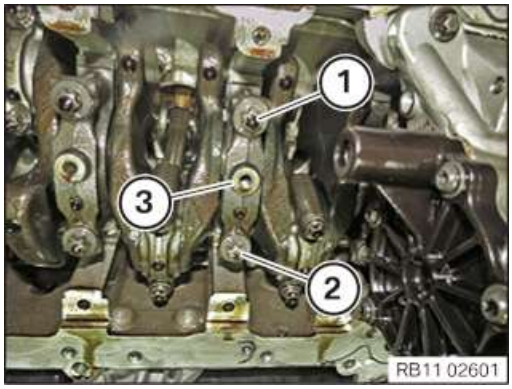
Oil the crankshaft and the bearing shells.

Turn the crankshaft (3) back in counterclockwise direction.

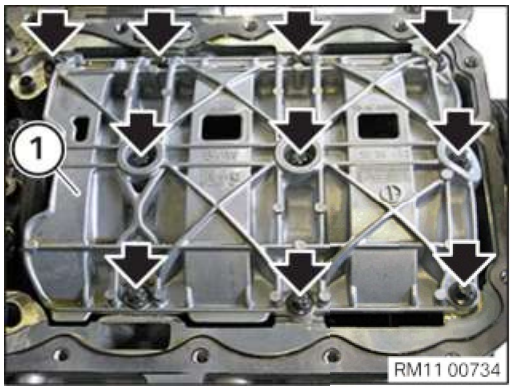
The special tool (2) slides the guide bearing (1) in position (guide lug).

Remove special tool (2).

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Secure main bearing bolts (1 and 2).
Tightening torque: 11 11 1 AZ



Parts: Renew screws.
Install reinforcement (1).
Tighten down all screws.
Tightening torque: 11 41 3AZ.

Required follow-up work:
Assemble engine.

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11 21 ... Replace lower crankshaft guide bearing shells (B48)

Attention!

Replace main bearing bolts.

There must be no oil in the blind holes **(risk of cracking)**.

Do not wash off bolt coating.

Incorrect assembly of the bearing caps will result in damage to the crankcase.



Attention!

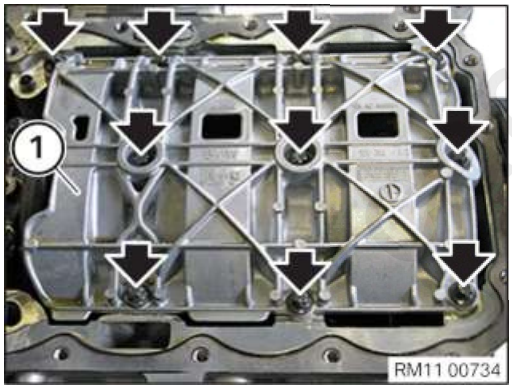
The guide bearing is located at the 3. bearing seat.

Installation note:
Bearing shell (1) with lubricating groove must be fitted in upper section of crankcase.

Bearing shell (2) without lubricating groove must be installed in lower section of crankcase.

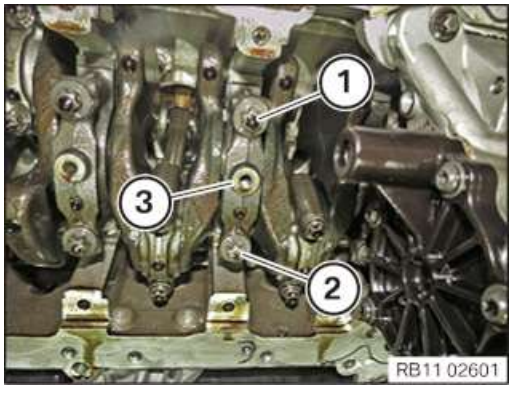
Necessary preliminary tasks:

- Remove oil sump



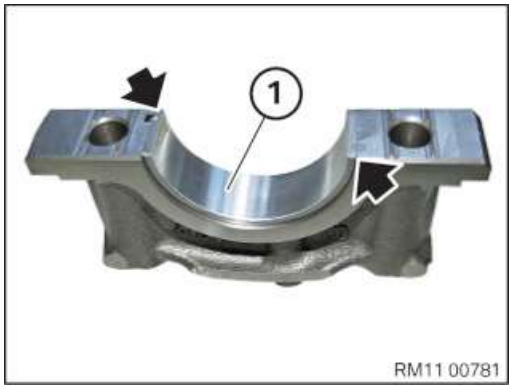
Unscrew all bolts.

Remove reinforcement (1).

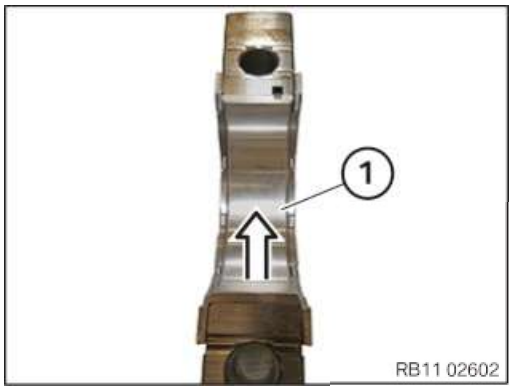


Loosen main bearing bolts 1 and 2 from main bearing cap (3).

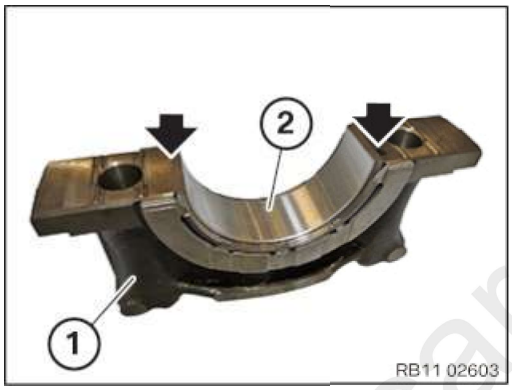
bmwdiagn.com



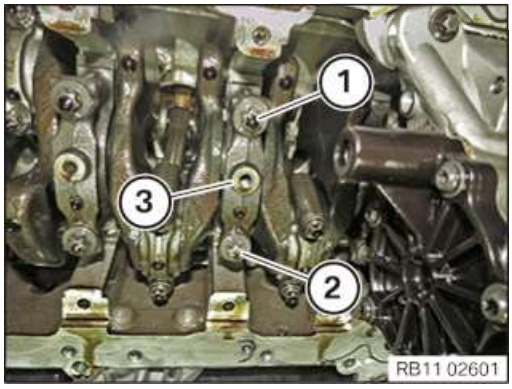
Remove standard main bearing shell (1) without lubricating groove from the bearing cap (see arrows).



Insert new guide bearing shell (1) without lubricating groove in direction of arrow.



Insert thrust bearing lid (1) with a new guide bearing shell (2) precisely into the bearing cap (see arrows).

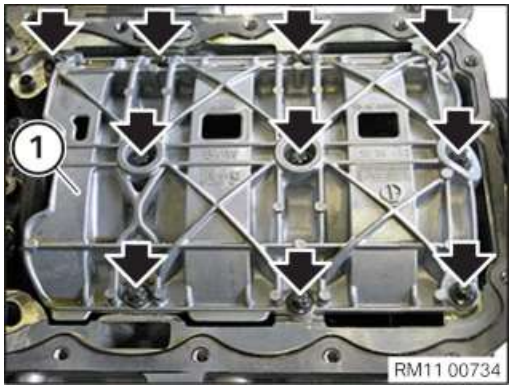


Join main bearing cap (3).

Screw in the main bearing bolts (1 and 2).

Tightening torque: 11 11 1 AZ

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Parts: Renew screws.

Install reinforcement (1).

Tighten down all screws.

Tightening torque: 11 41 3AZ.

Required follow-up work:

Assemble engine.

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This documentation refers to special tools that were not yet available when going to press.

11 21 001 Replacing crankshaft

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Removing engine



- See additional information.

2 – Mount engine on assembly stand

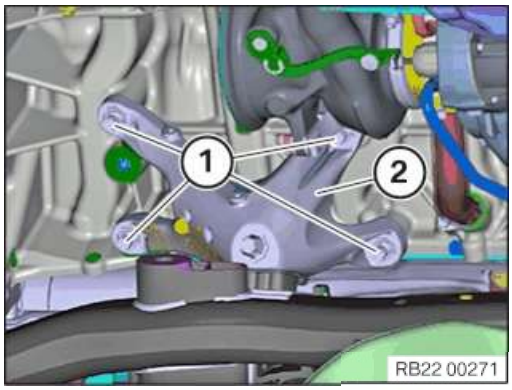
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CAUTION

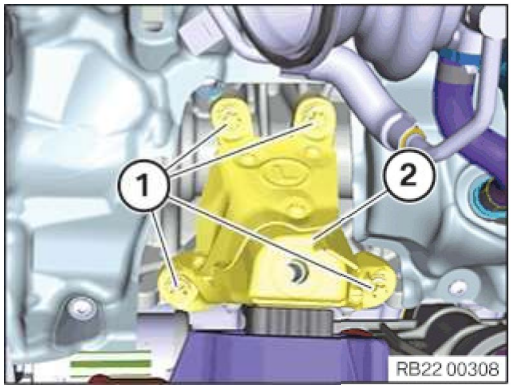
Heavy component.

Heavy components can lead to injury or damage.

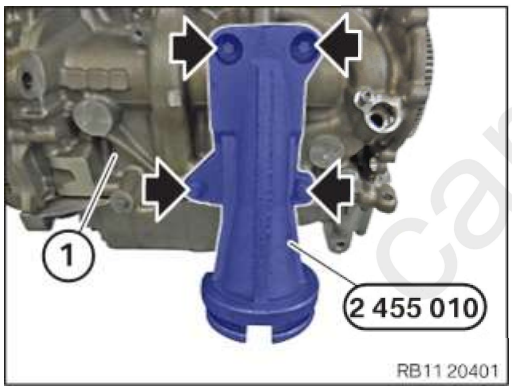
- Remove and install heavy components with the aid of another person/other persons.



- **Type: Rear-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



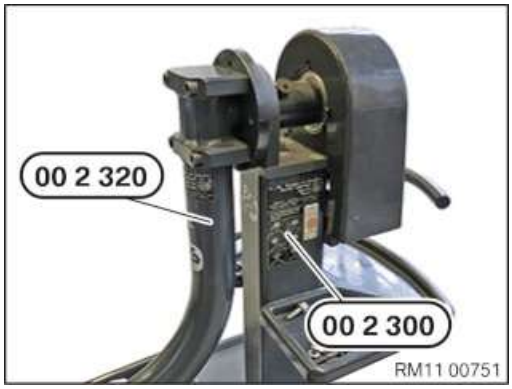
- **Type: Four-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



- Position the special tool 2 455 010 on the engine (1).
- Position the standard bolts **M10x30**.
- Tighten the standard bolts (arrows).

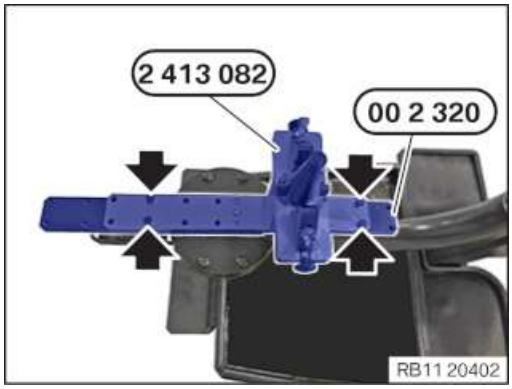
Special tool 2 455 010 to crankcase

M10x30		Tightening torque	38 Nm



- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).

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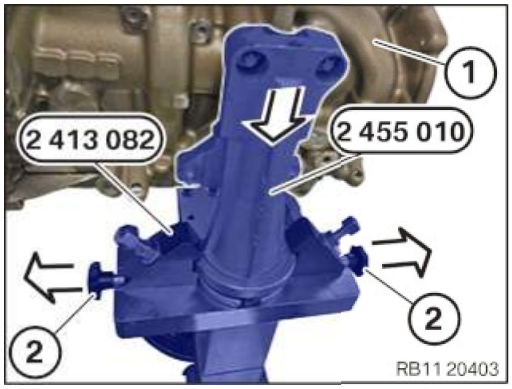
- Screw the special tool to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

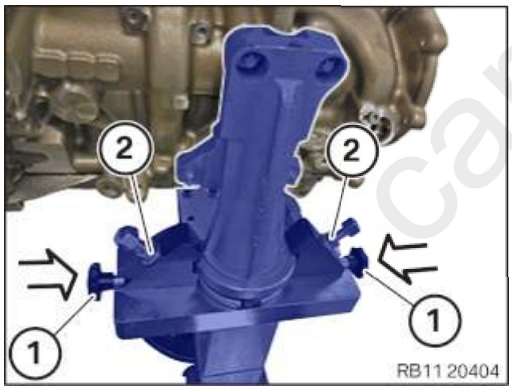
M14x35		Tightening torque	160 Nm



- Position the engine lifter with the special tool and the engine on the special tool 0 495 187 (00 2 300).



- Detach the holder (2) in the direction of the arrow.
- Position the engine (1) with the special tool 2 455 010 in the direction of the arrow on the special tool .



- Lock the holder (1) in direction of arrow.
- Tighten nuts (2).

3 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

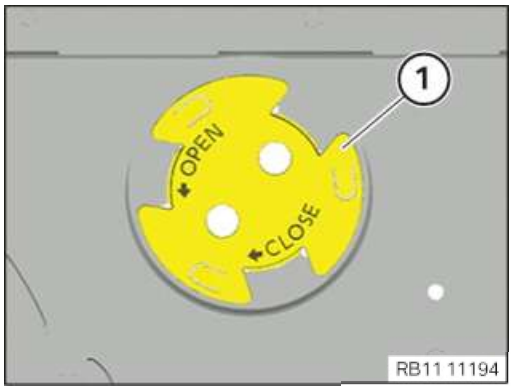
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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).



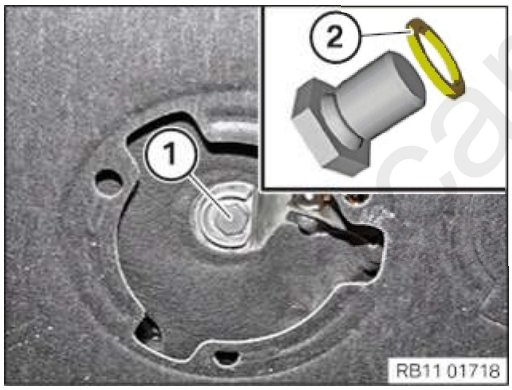
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

4 – Tightening the oil drain plug

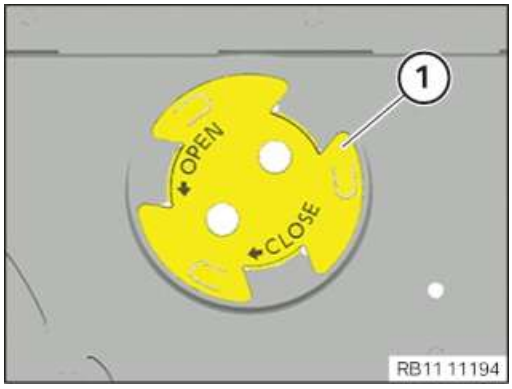


- Renew sealing ring (2).

  Parts: Sealing ring
- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

M12x16	Renew the sealing ring.	Tightening torque	25 Nm



- Install service cap (1).

5 – Removing all spark plugs

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

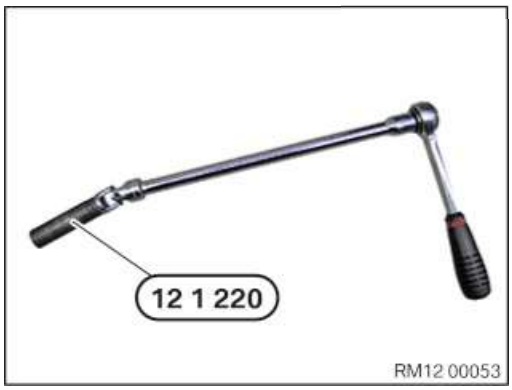
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

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- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

6 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

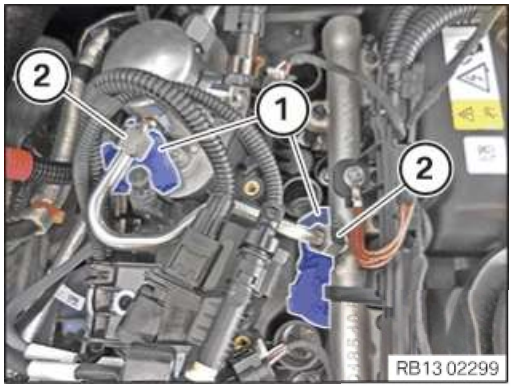
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

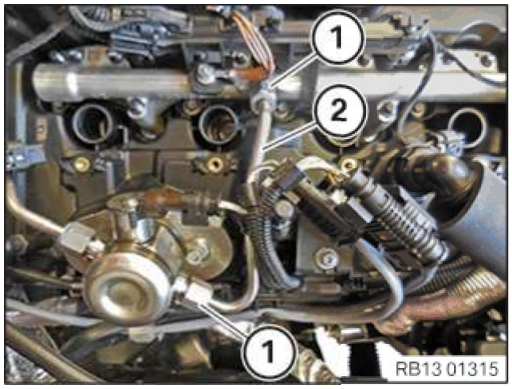
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- Have the special tool ready.



- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

7 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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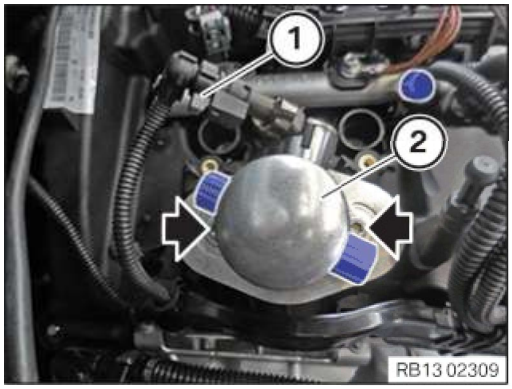
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

8 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

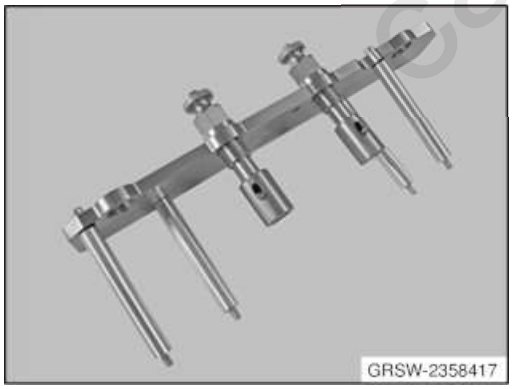
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Prepare special tool .

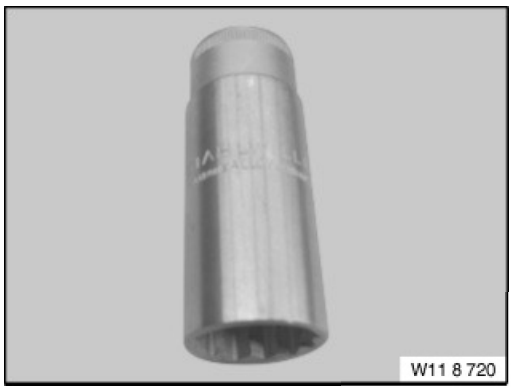


- Prepare special tool 2 358 417.

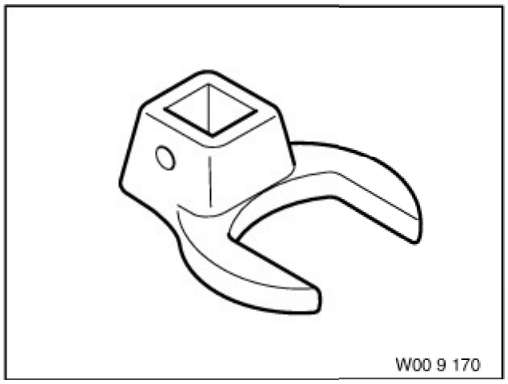
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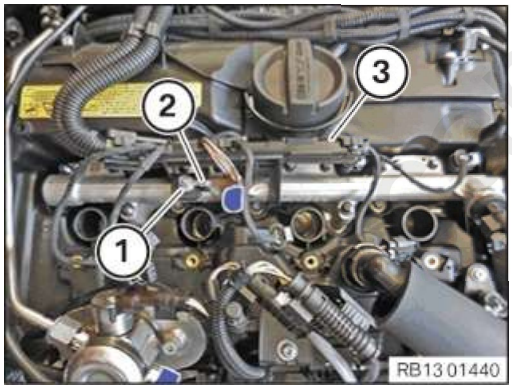
- Prepare special tool .



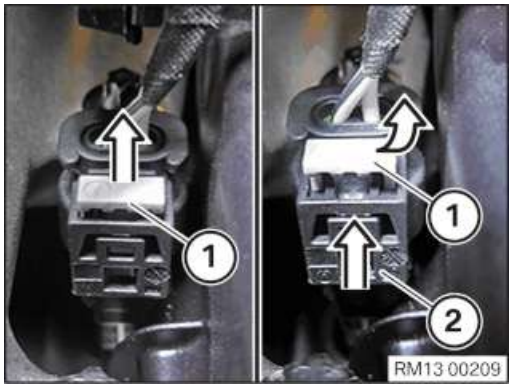
- Prepare special tool 0 496 106 (11 8 720).



- Prepare special tool .

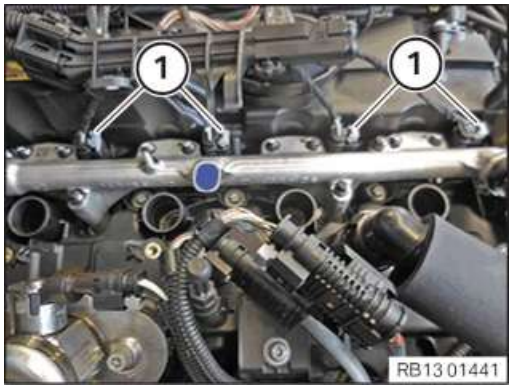


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.



- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.

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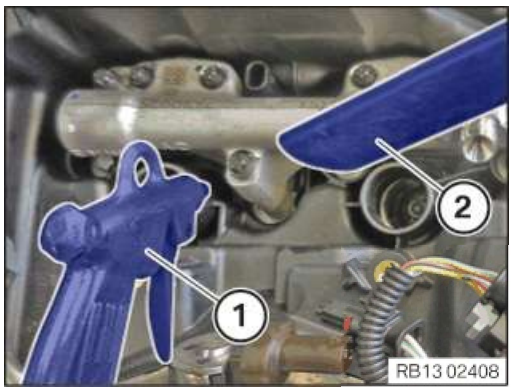
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

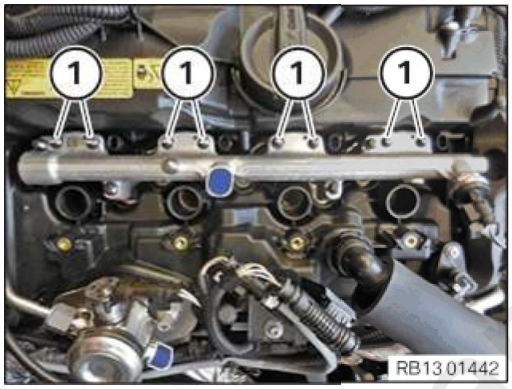


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

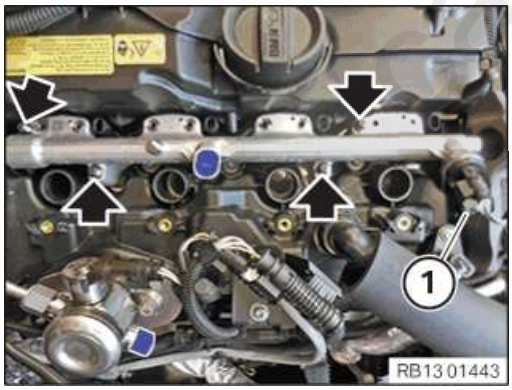
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

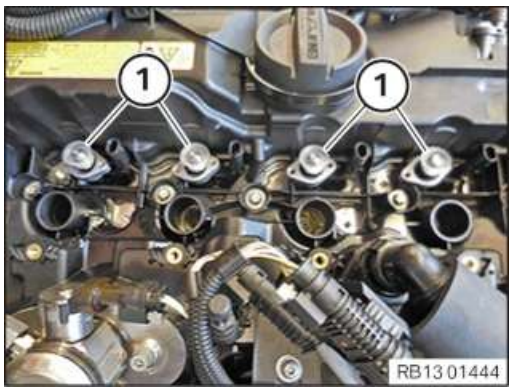


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

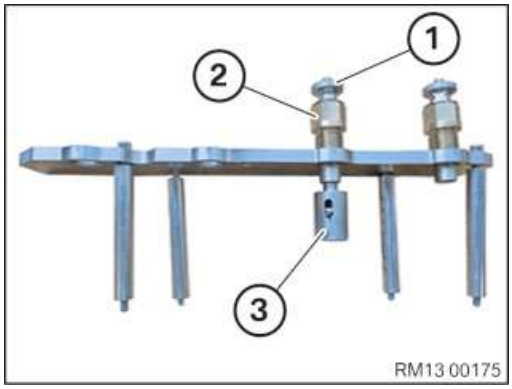
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

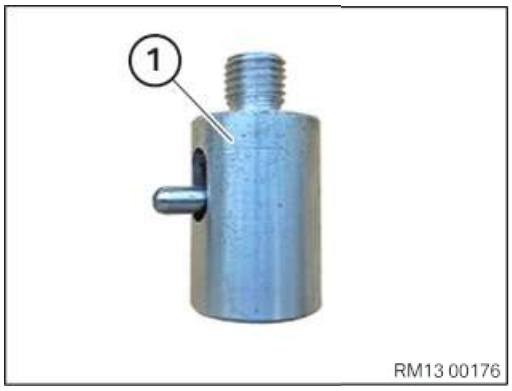
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

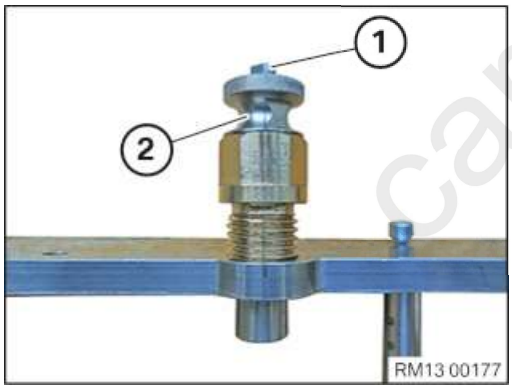
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

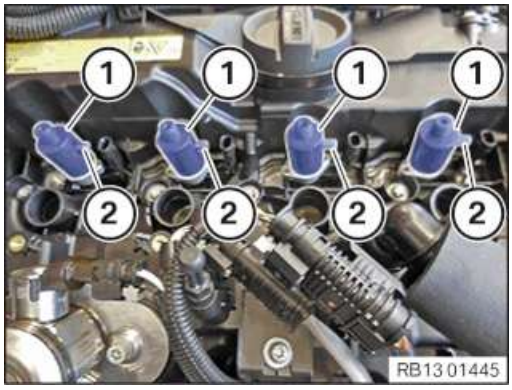
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



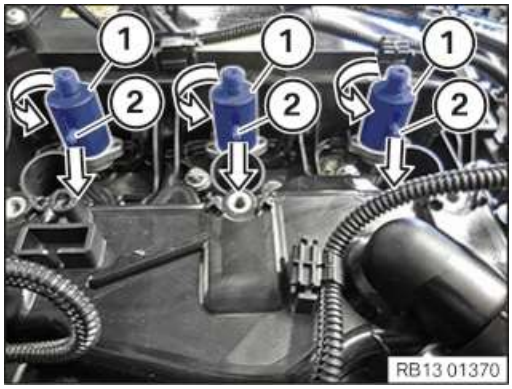
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



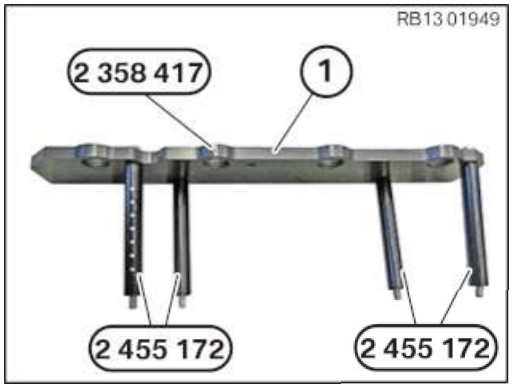
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

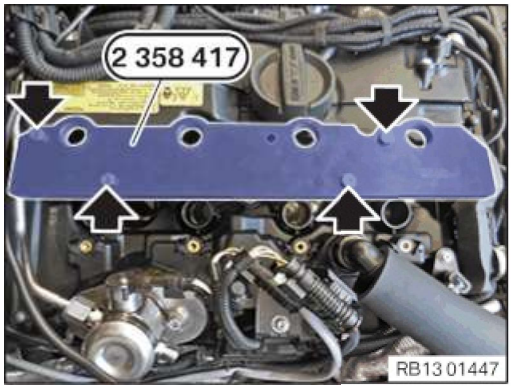
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



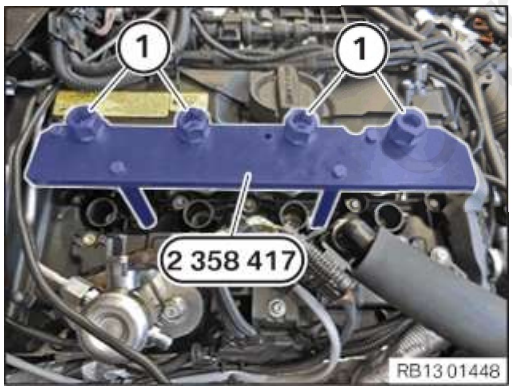
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

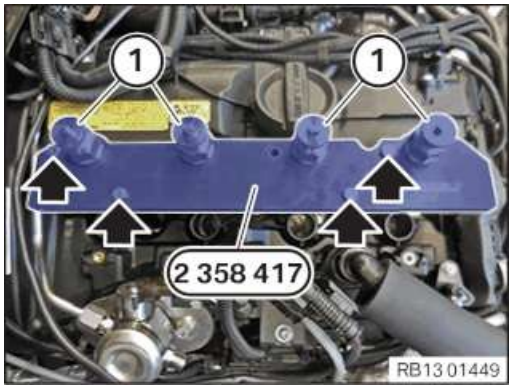
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

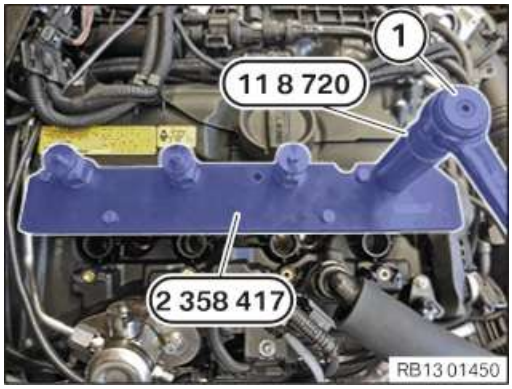
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

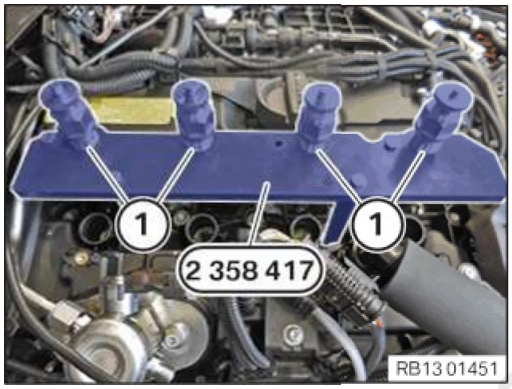


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

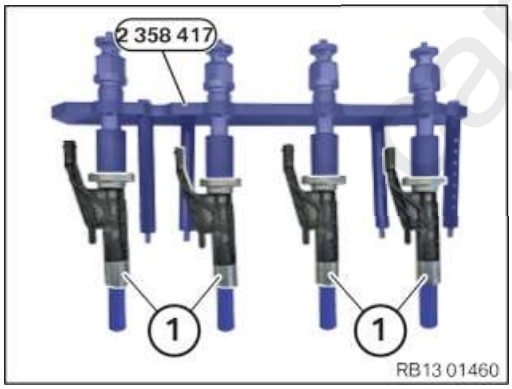
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

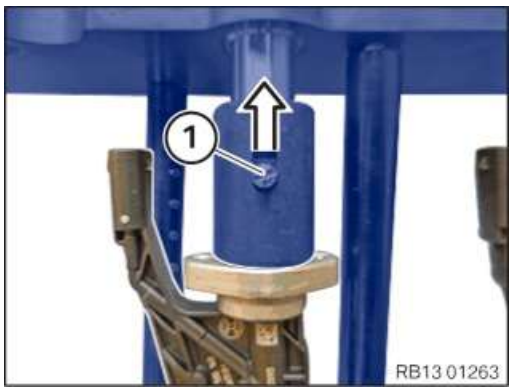


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

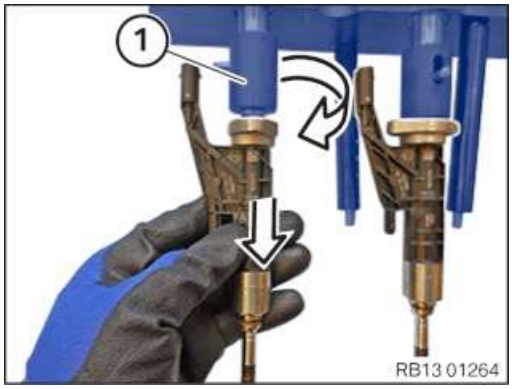


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

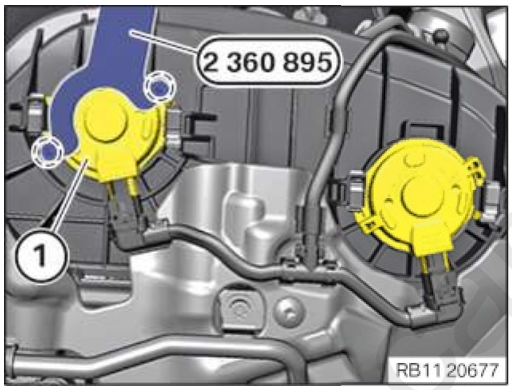
9 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

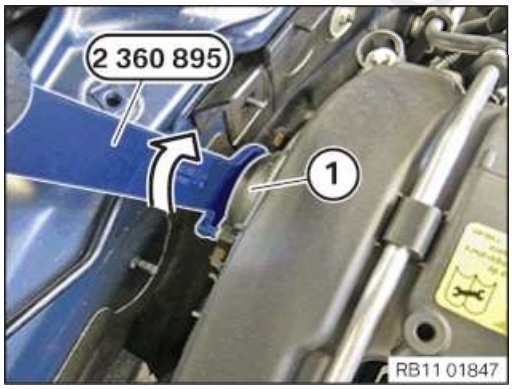
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



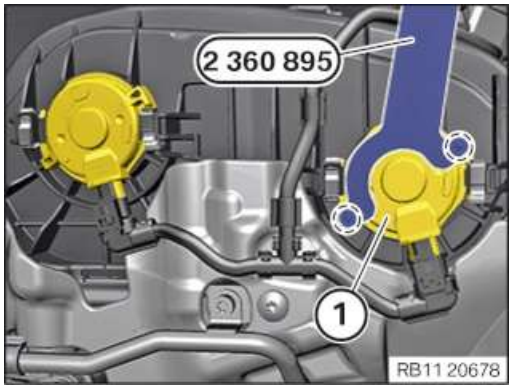
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



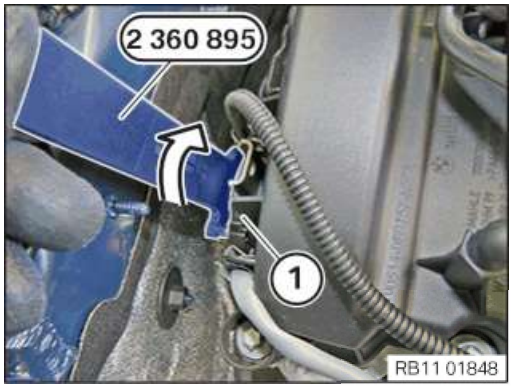
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



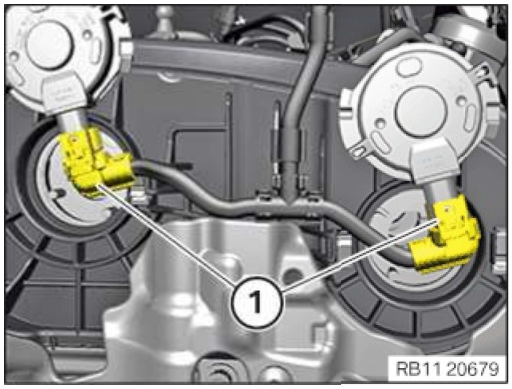
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

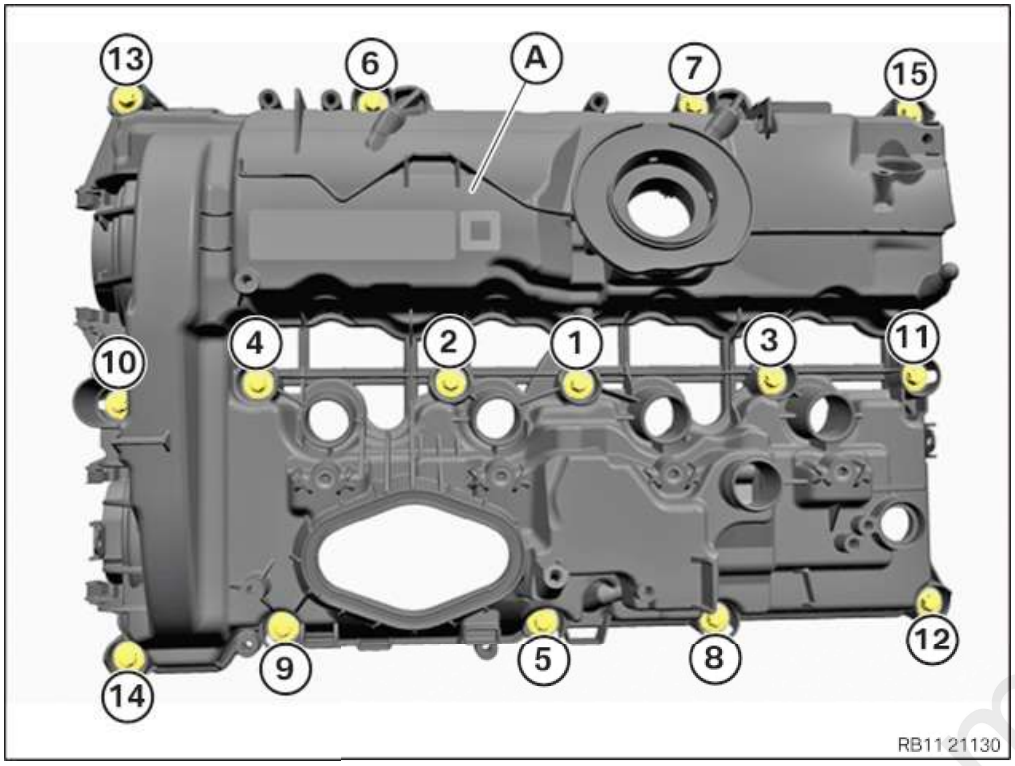
The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

10 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

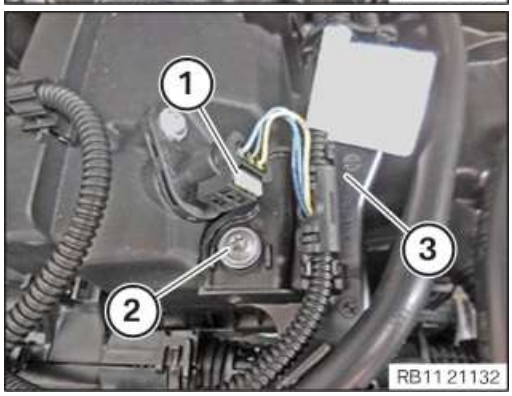
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

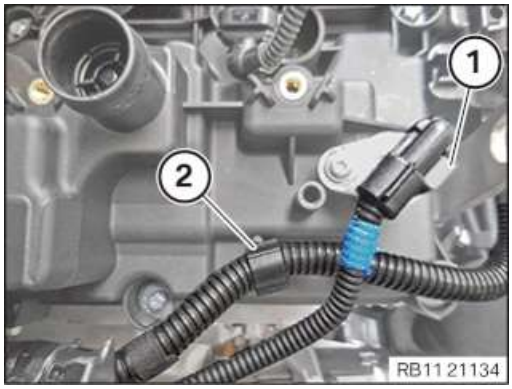
- Do not pull on the wires when disconnecting connectors and plug connections.



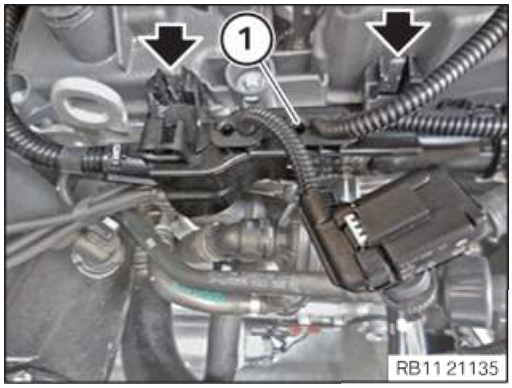
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



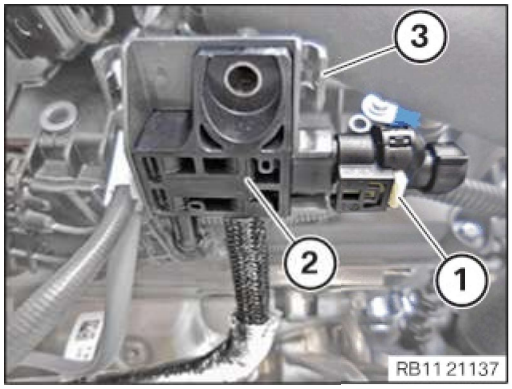
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



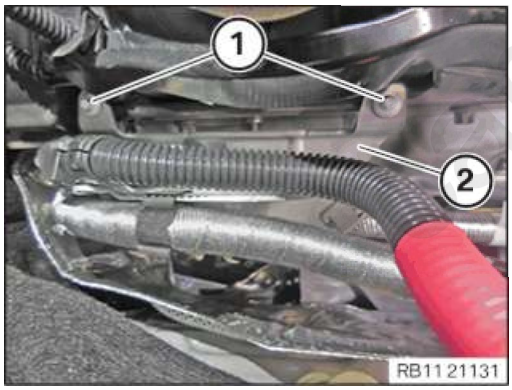
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



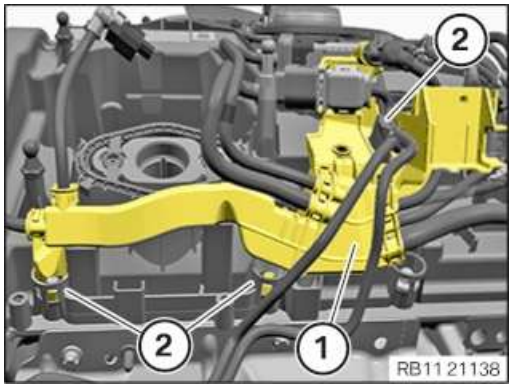
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.

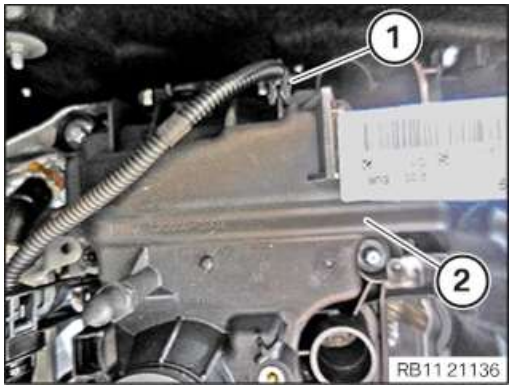


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

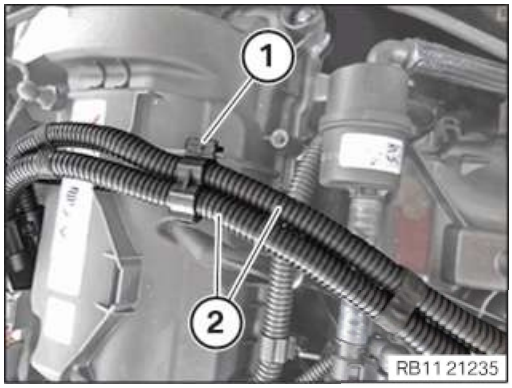


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

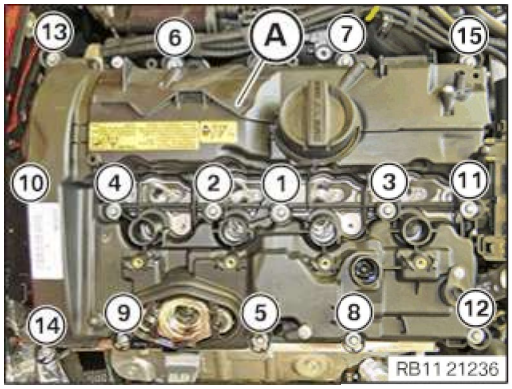
ardiagn.com



- Loosen clamp (1).



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

11 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

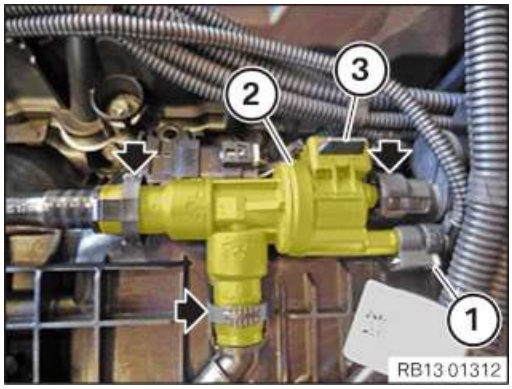
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

12 – Removing the intake plenum

RISK OF DAMAGE

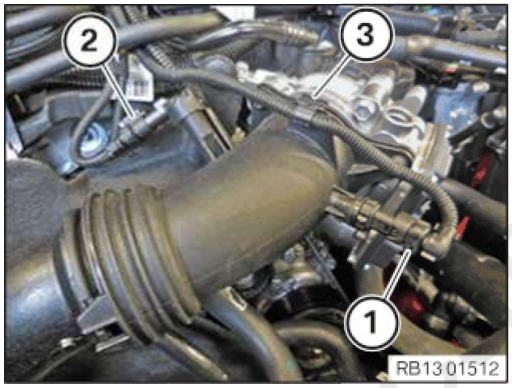
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

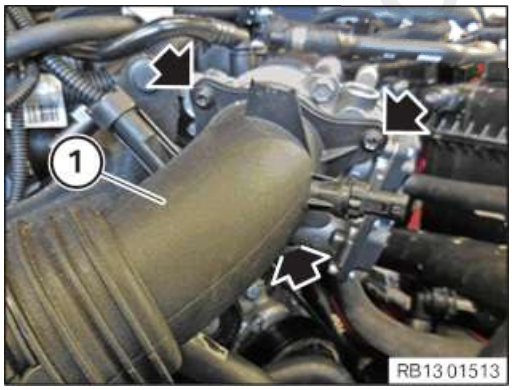
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

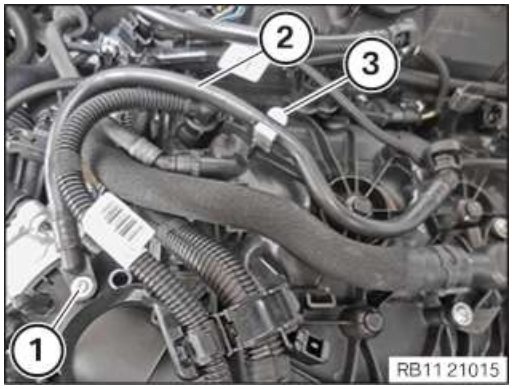
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



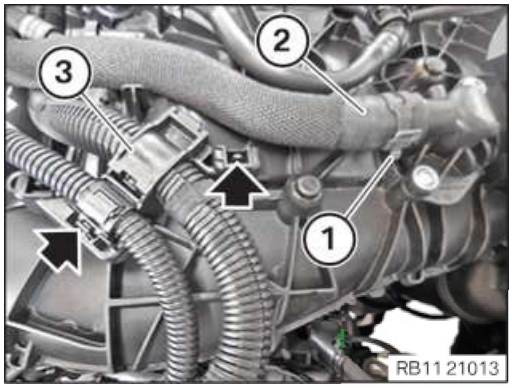
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



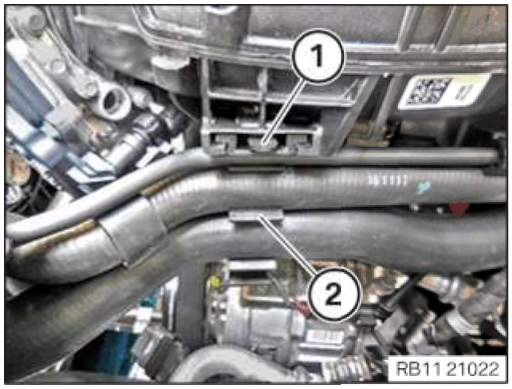
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



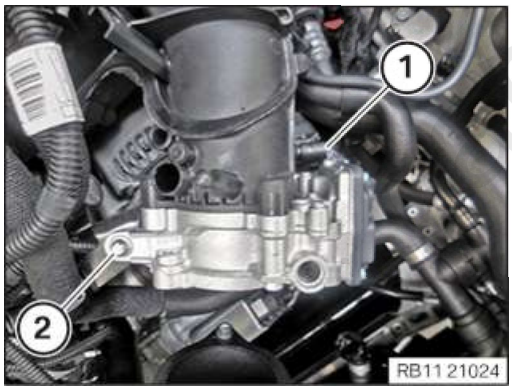
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



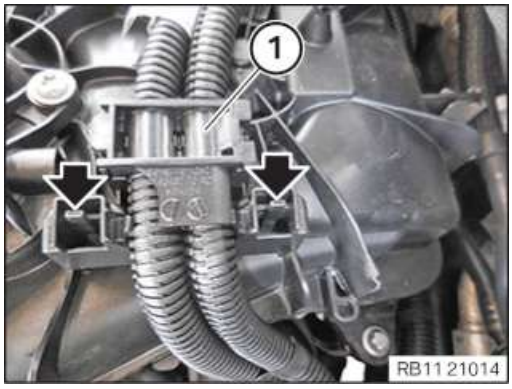
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

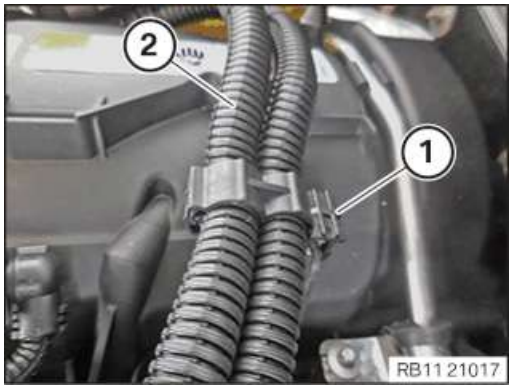


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

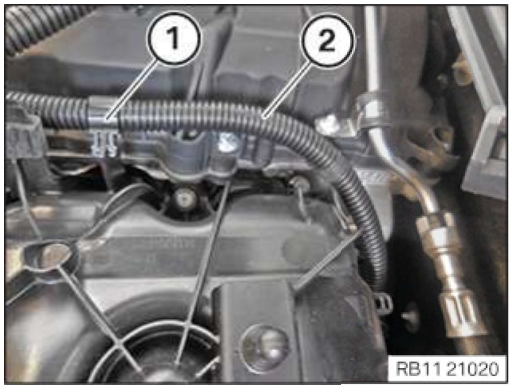
mdiagn.com



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



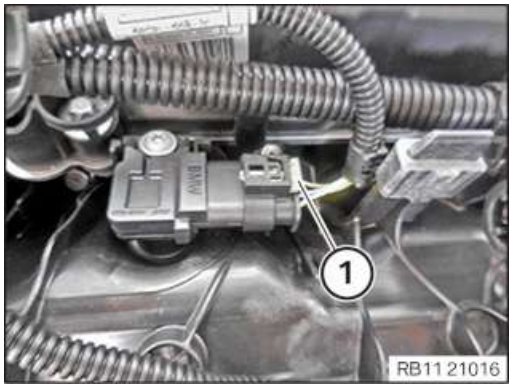
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

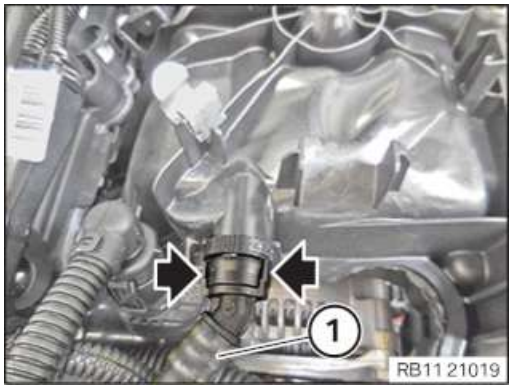


- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

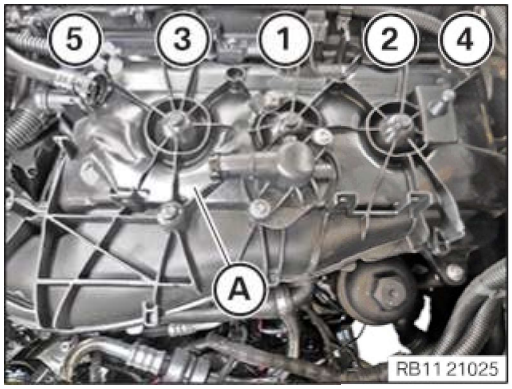
rdiagn.com



- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

13 – Remove the heat shield on the cylinder head

WARNING

Hot surfaces.

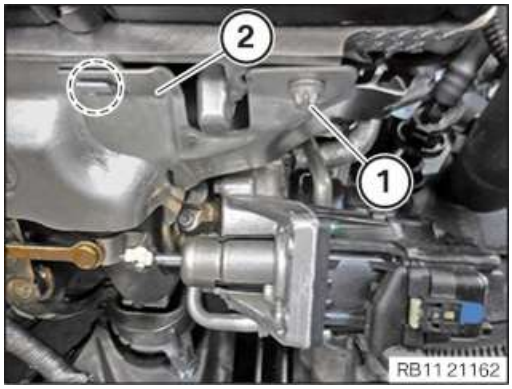
Risk of burning!

- Perform all work only on components that have cooled down.

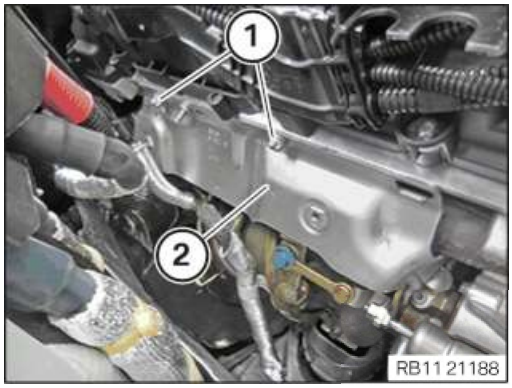


- Loosen screw (1).

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- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

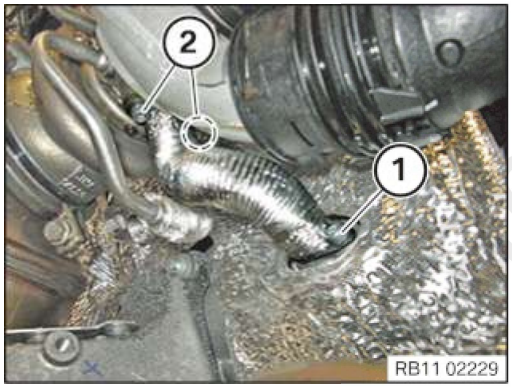


- Loosen screws (1).
- Feed out and remove the heat shield (2).

14 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

15 – Remove the coolant return line for the exhaust turbocharger

WARNING

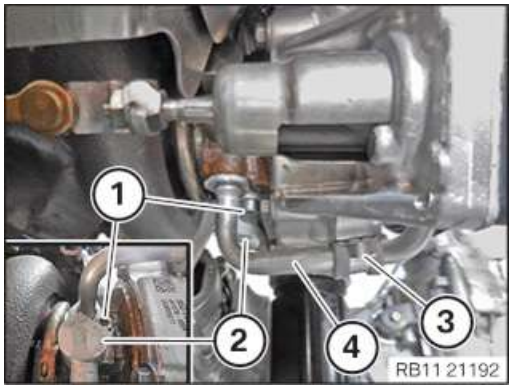
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

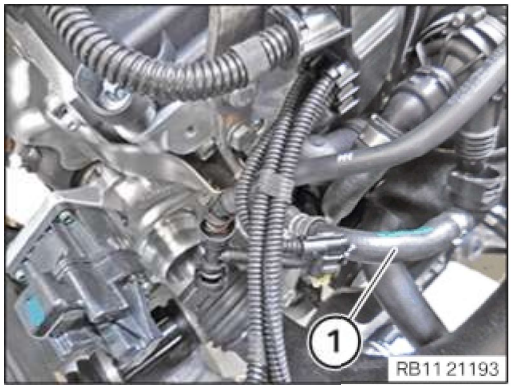
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

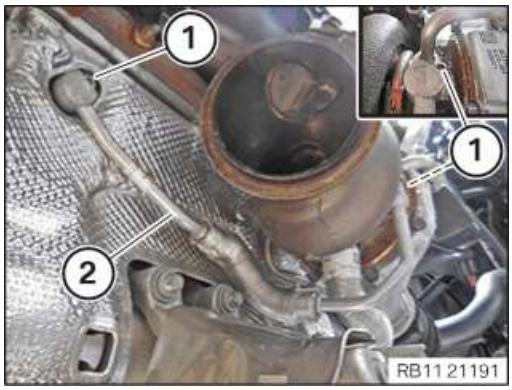


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

16 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

17 – Block the engine with the special tool in TDC firing position

cardiagn.com



- Thread the sealing cap (1) out and remove.



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

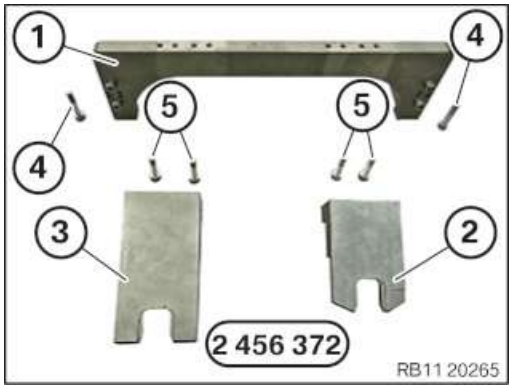


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

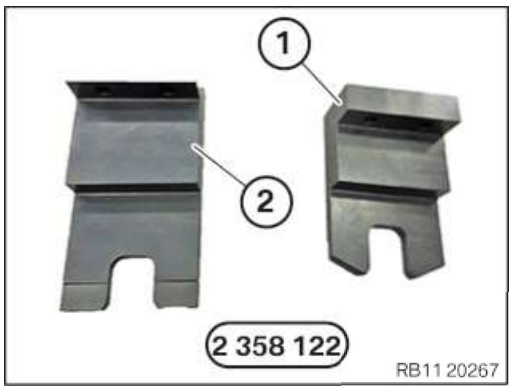
  The engine is in the TDC firing position of cylinder 1.

erdiagn.com



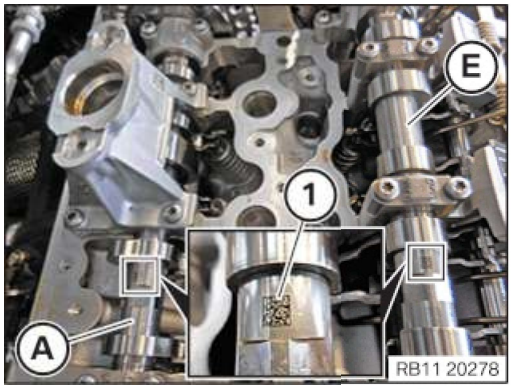
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

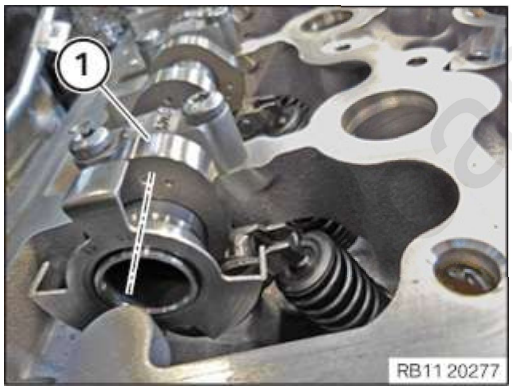


- Overview of the test gauges from the set of special tools 2 358 122:

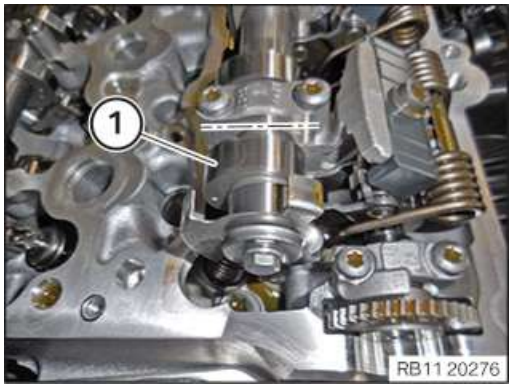
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

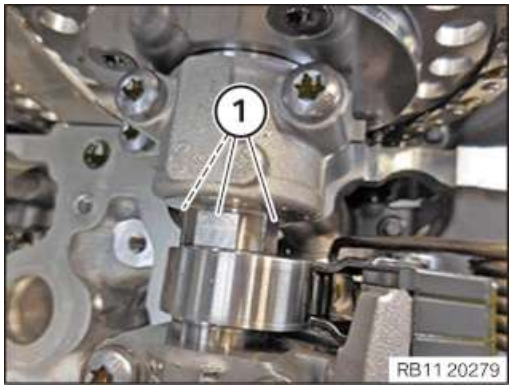


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

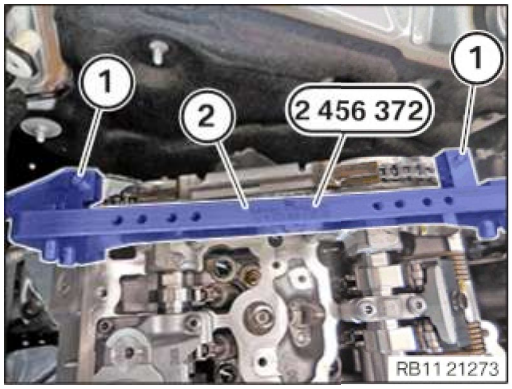
ardiagn.com



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



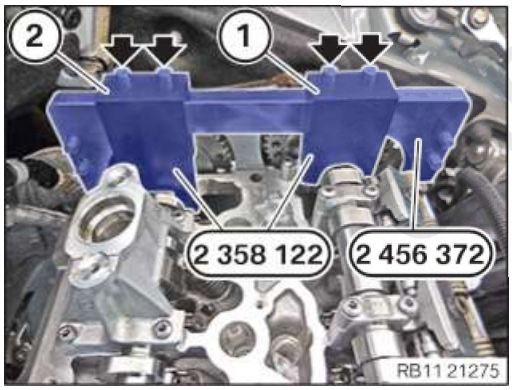
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

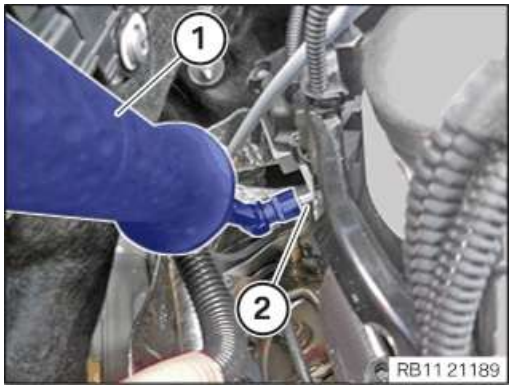
M6		Tightening torque	8 Nm

18 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

diagn.com



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

19 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

The figure shows the rear side of the engine.

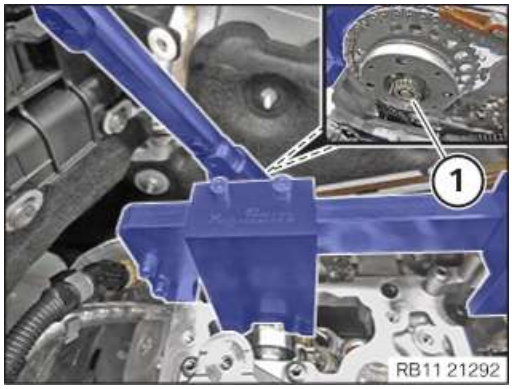
- Release the VANOS central valve (1) of the intake adjuster.

20 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

carsdiagn.com

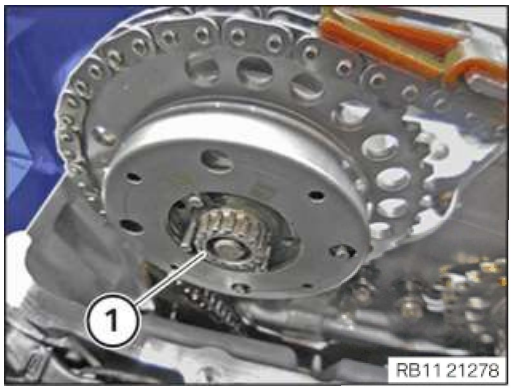


NOTICE

The figure shows the rear side of the engine.

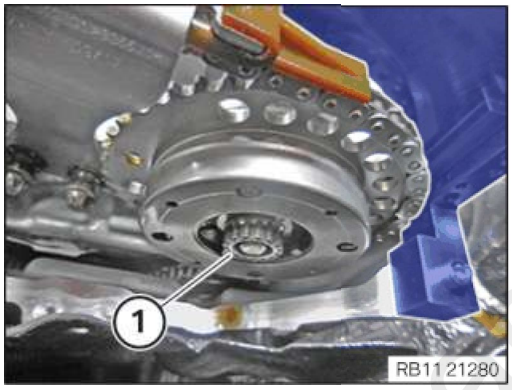
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

21 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

22 – Remove the VANOS central valve of the exhaust camshaft adjuster



- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

23 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.



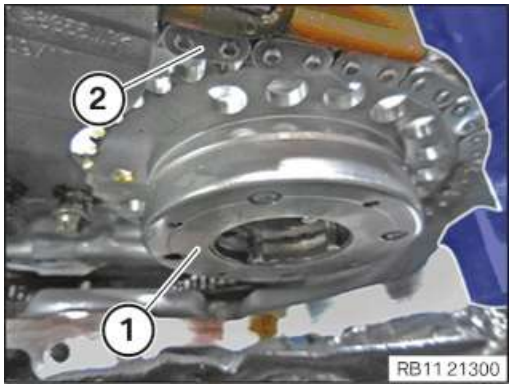
- Guide out the intake adjuster (1) from the timing chain (2) and remove.

24 – Remove exhaust camshaft adjuster

cardiagn.com

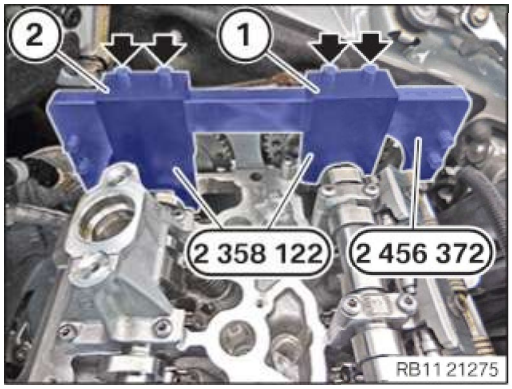
NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

25 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

26 – Remove cylinder head.

CAUTION

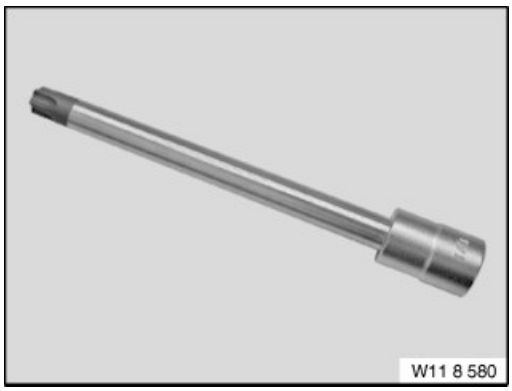
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

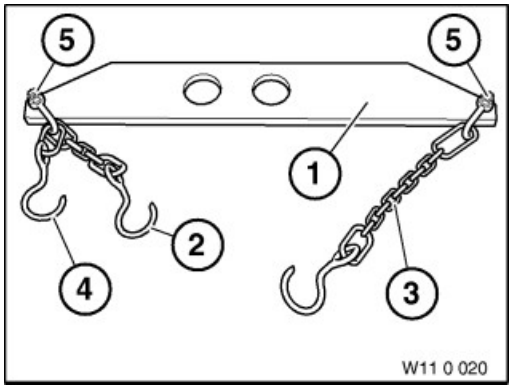
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Prepare special tool 0 495 747 (11 8 580).

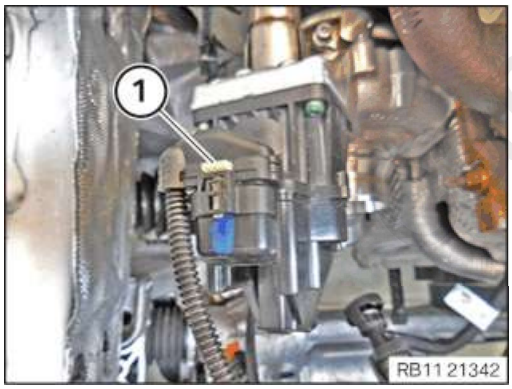
cardiagn.com



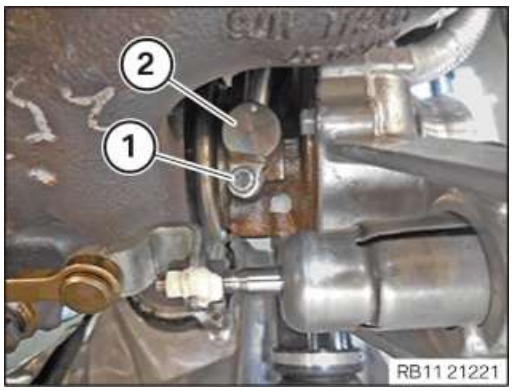
- Prepare special tool .



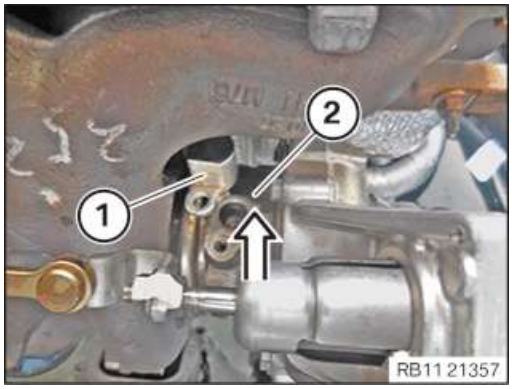
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.



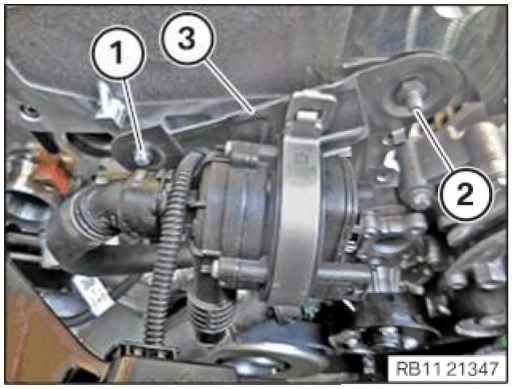
- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.



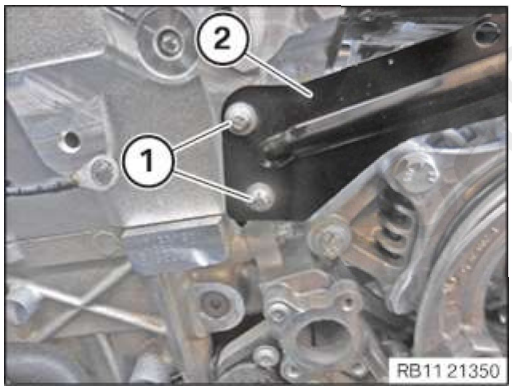
- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.

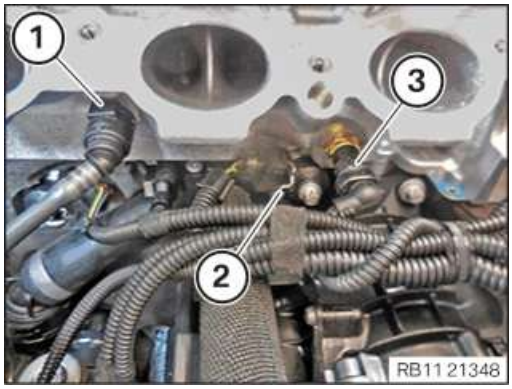


- Loosen screws (1).
- Thread out holder (2) and set aside.

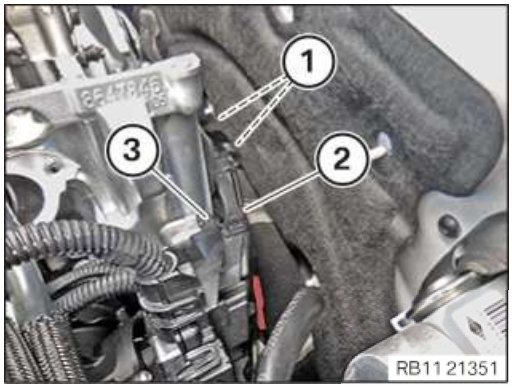


- Unlock plug connection (1) and disconnect.

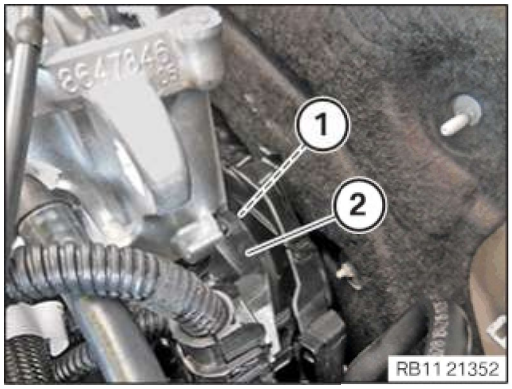
rdiagn.com



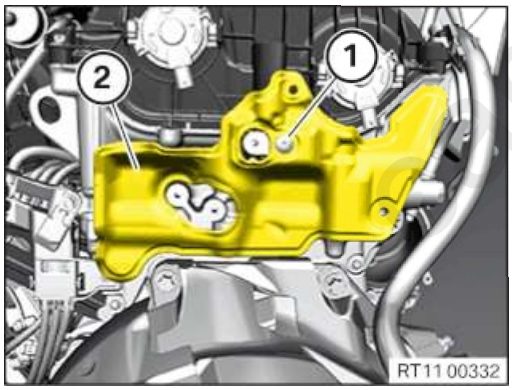
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



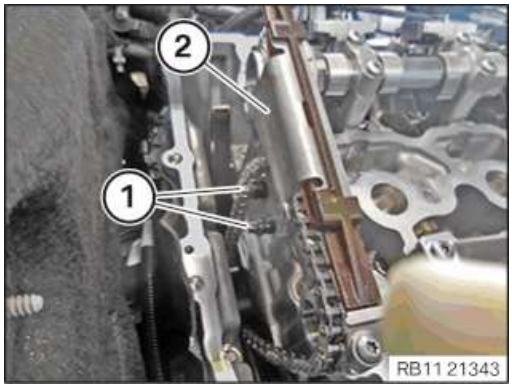
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



NOTICE

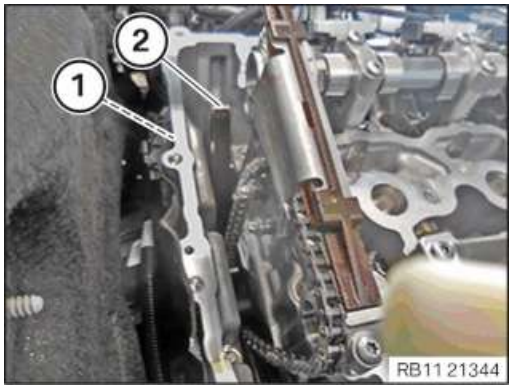
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

carsdiagn.com



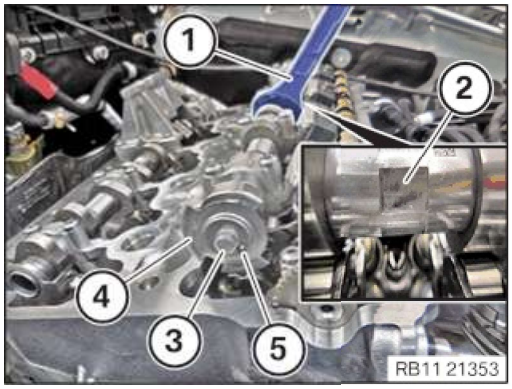
- Release the bearing journal (1) from the guide rail (2).



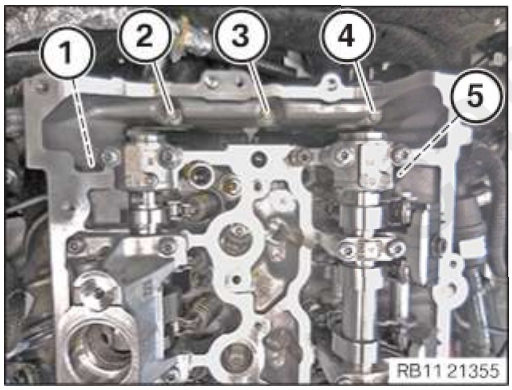
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm



- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.

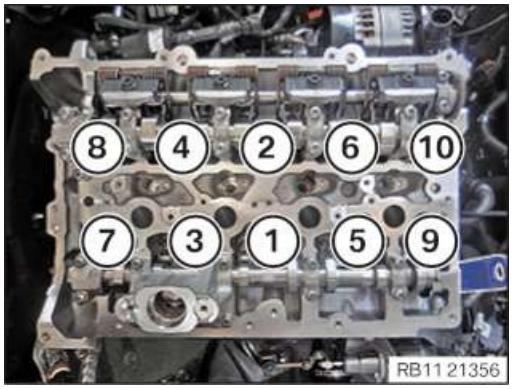


- Loosen the cylinder head bolts in the sequence from (5) to (1).

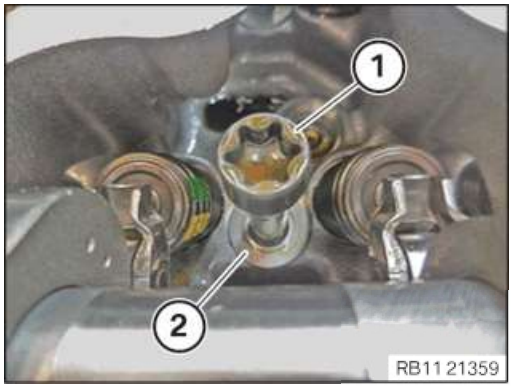


- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

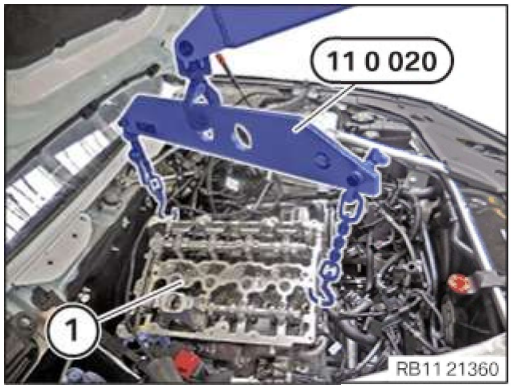
tdiagn.com



- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to the guide rails.

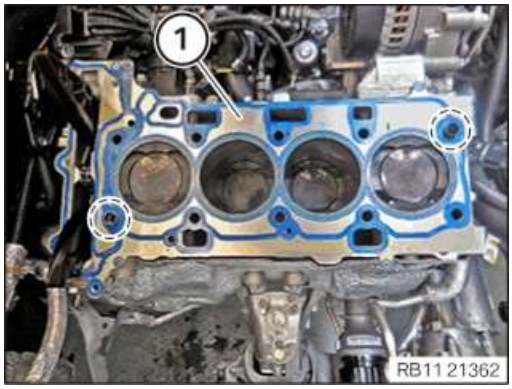
Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Attach special tool to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an **auxiliary person**, the workshop crane and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

27 – Removing the cylinder head gasket

carmagn.com

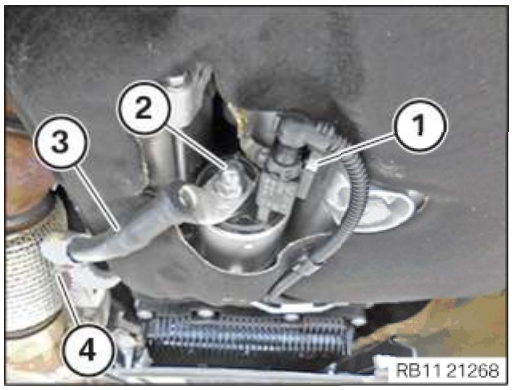


- Guide out and remove cylinder head gasket (1) in the **marked** area.

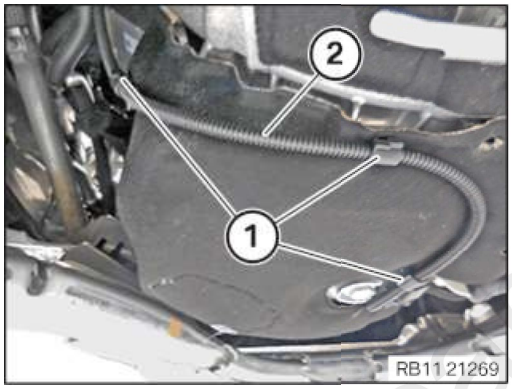
28 – Removing the acoustic cover of the oil sump

Prerequisite

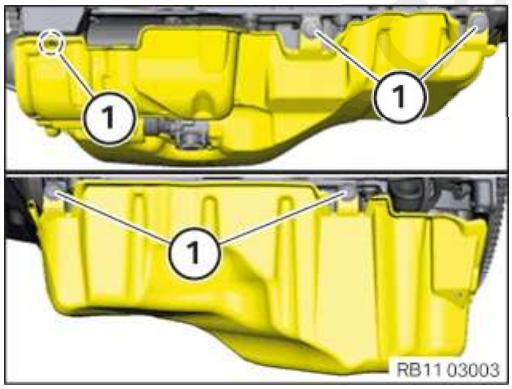
Disconnect all negative battery cables.



- Unlock and loosen connector (1).
- Loosen nut (2).
- Guide the positive battery cable (3) out of the clamp (4) and lay to one side.



- Unlock and loosen the clamps (1).
- Guide out the wiring harness section of automatic transmission (2) and set it aside.

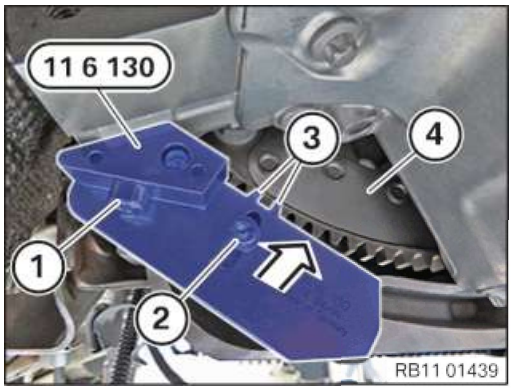


- Detach all expanding rivets (1).



- Guide out acoustic cover (1) downwards to the rear and remove it.

29 – Removing the vibration damper



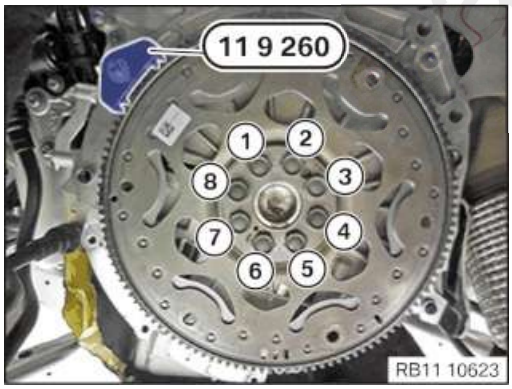
- Position the special tool 0 496 595 (11 6 130) and secure it on the timing case cover using the bolt (1).

  The special tool 0 496 595 (11 6 130) must lie flat on the transmission housing.
- If necessary, turn the engine in the direction of rotation until the teeth (3) engage completely in the gearing of the flywheel (4).
- Slide the counter support with the bolt (2) up until the teeth (3) engage completely in the gearing of the flywheel.
- Tighten down screw (2).



- Unscrew the bolts (arrows) on the vibration damper (1).
- Feed out and remove the vibration damper (1).

30 – Removing flywheel



- Fasten the flywheel with the special tool 0 493 938 (11 9 260) and tighten with the special tool 0 494 130 (11 9 264).
- Loosen screws (1-8).

31 – Remove oil sump

RISK OF DAMAGE

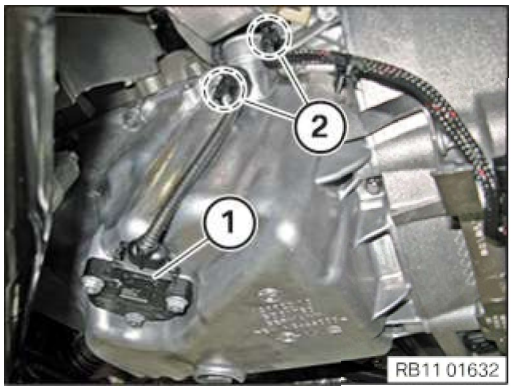
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

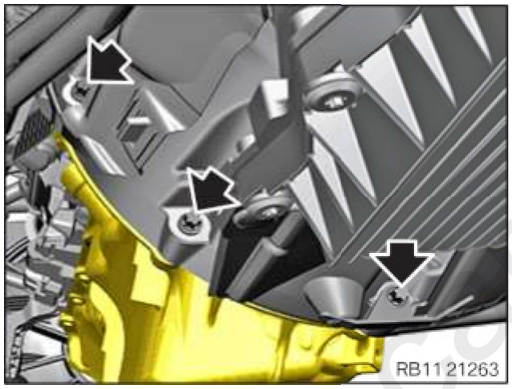
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

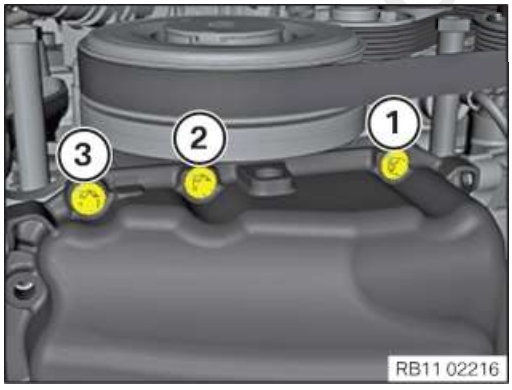
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Unlock and loosen connector (1).
- Release the cable from the clips (2) of the oil sump.

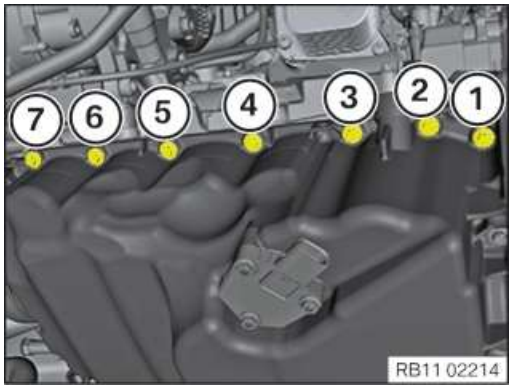


- Unscrew the transmission bolts (arrows).

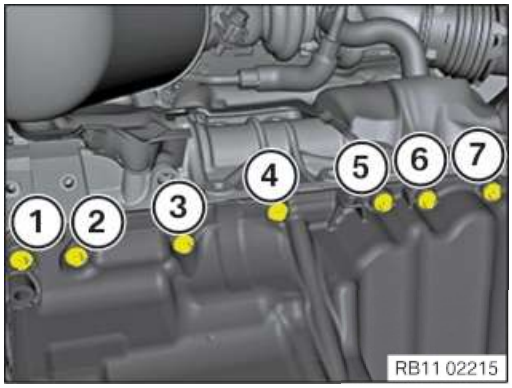


- Loosen screws (1), (2) and (3).

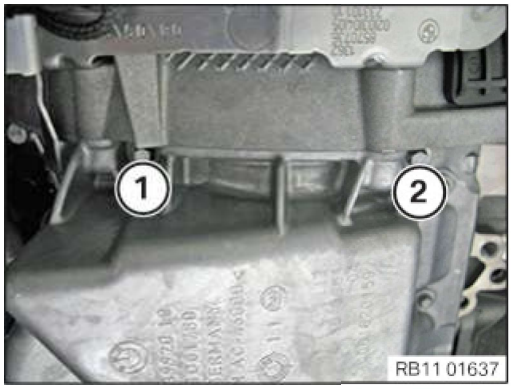
carsdiagn.com



- Loosen screws (1) to (7).



- Loosen screws (1) to (7).



- Loosen screws (1) and (2).



TECHNICAL INFORMATION

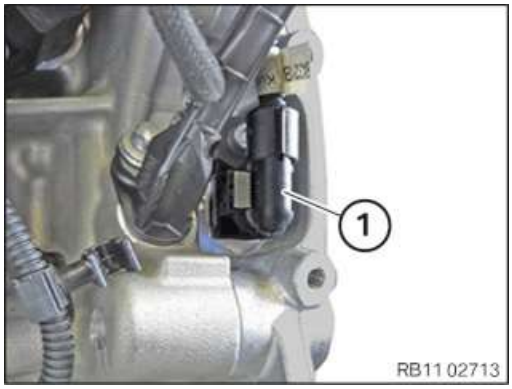
Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump in the **marked** areas using suitable tools (1).

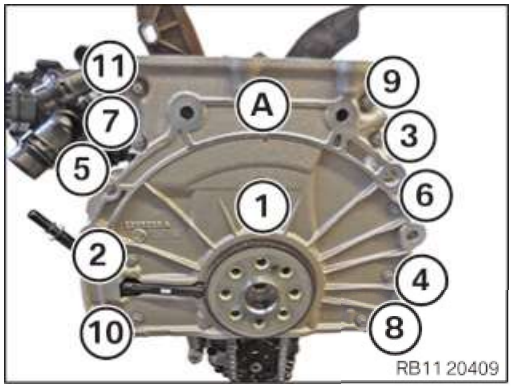


- Guide out the oil sump (1) downwards to the rear and remove.

32 – Remove rear timing case cover



- Unlock the connector (1) and pull it off the crankshaft sensor.



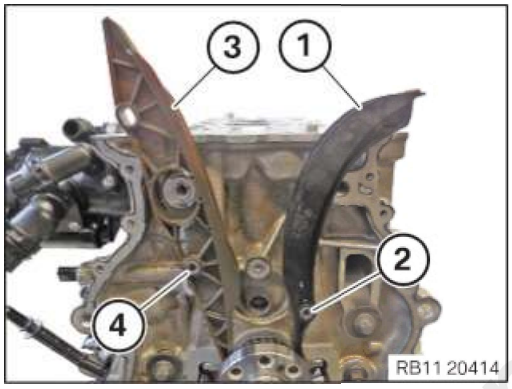
- Loosen screws in the order (11) to (1).

TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

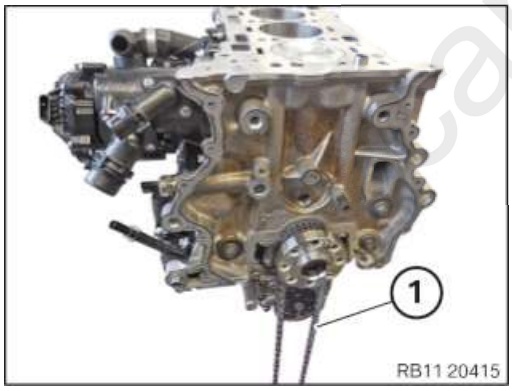
- Carefully loosen and remove the timing case cover (A).

33 – Removing timing chain



- Thread the tensioning rail (1) out of the bearing journal (2) and remove.

  The bearing journal does not have to be removed.
- Loosen the bearing journals (4).
- Guide out the guide rail (3) and remove.



- Guide out the timing chain (1) and remove.

34 – Remove the oil vacuum pump

RISK OF DAMAGE

Contaminant or foreign body.

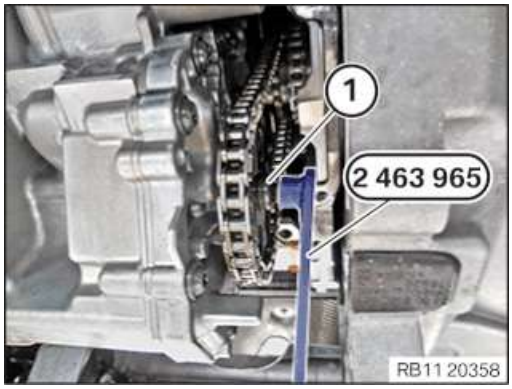
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

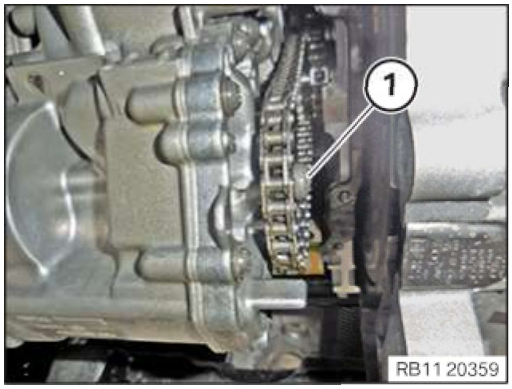
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TECHNICAL INFORMATION

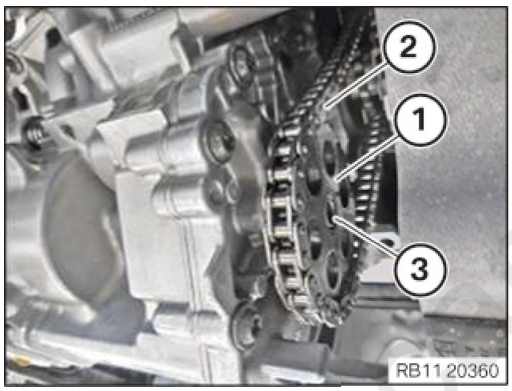
The thread is a left-hand thread.



- Release bolt (1) with the special tool 2 463 965.



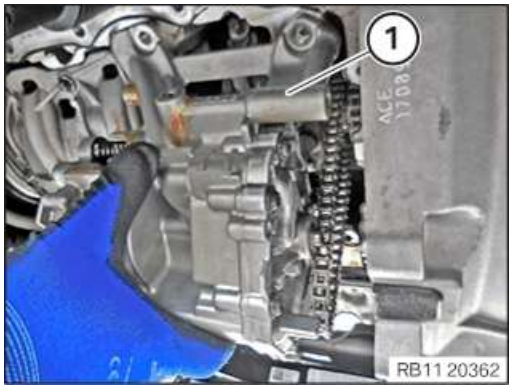
- Thread out the bolt (1) and remove it.



- Detach the camshaft sprocket (1) from the oil vacuum pump (3).
- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.

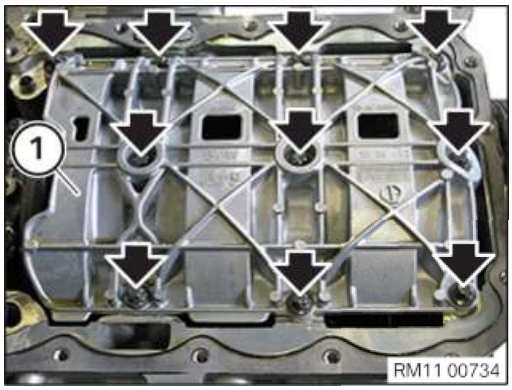


- Loosen screws (1).



- Feed out the oil vacuum pump (1) and remove it.

35 – Removing the oil deflector



- Release all bolts (arrows).
- Remove the oil deflector (1).

36 – Removing all pistons with connecting rod

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the piston with connecting rod**

TECHNICAL INFORMATION

Piston, gudgeon pin, connecting rod and connecting rod bearing shells are matched to each other and balanced.

Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

TECHNICAL INFORMATION

The connecting rods of the engine are balanced and are matched to each other.

A single connecting rod is not permitted to be replaced. Always replace all connecting rods.

▹ **Detach the lower connecting rod bearing**

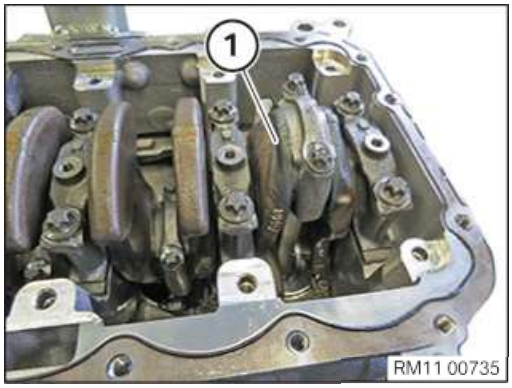
cardiagn.com

RISK OF DAMAGE

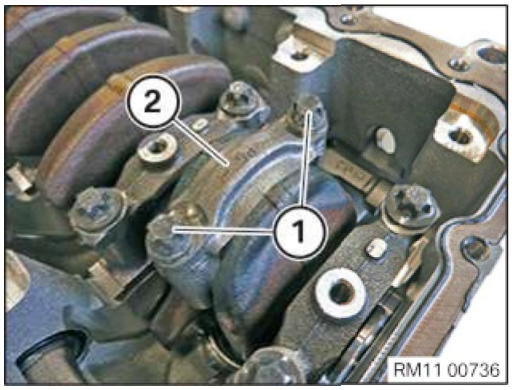
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.



- Turn the crankshaft until the connecting rod bearing journal (1) reaches a vertical position.



RISK OF DAMAGE

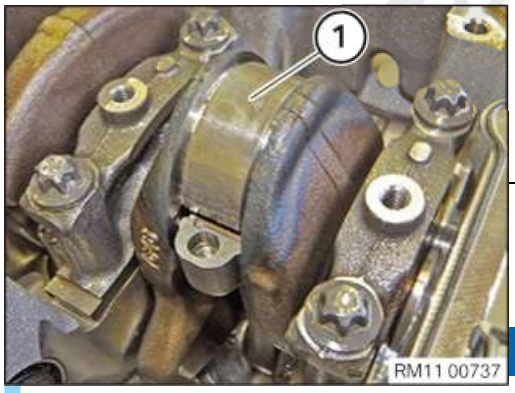
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Unscrew the connecting rod bolts (1).
- Remove the connecting rod bearing cap (2) and put to one side in the correct order.

  Make sure that the connecting rod bearing cap (2) can be re-installed in the correct position.



RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

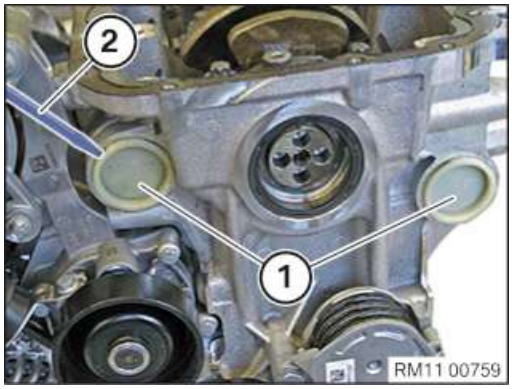
- Always install all bearing shells and bearing supports in the same position from which they were removed.

In the following operations, the engine is rotated by 180 degrees. The bottom points up.

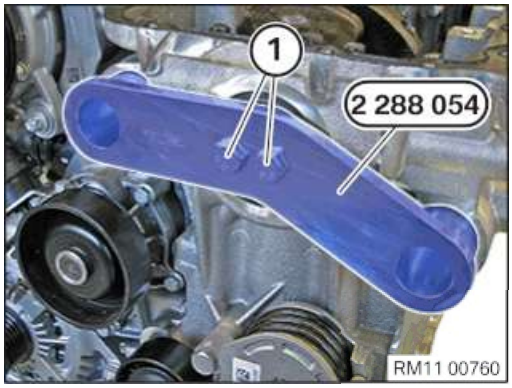
- Remove the connecting rod bearing (1).

  Make sure that the connecting rod bearing (1) can be re-installed in the correct position.

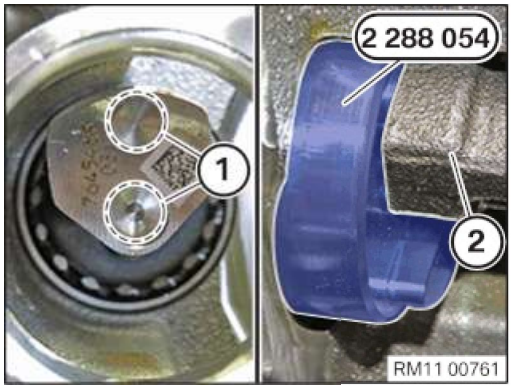
◁



- Remove bolt and sealing cap (1) with seal (2) from intake side connecting rod eye.



- Rotate the crankshaft counterclockwise to the TDC of the first cylinder.
- Mount the special tool 2 288 054 and abut the bolts (1).



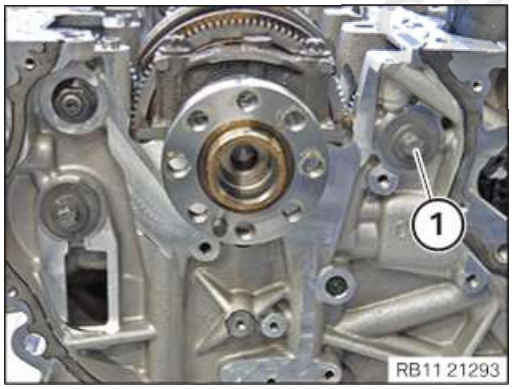
NOTICE

The description is for one component only. The procedure is identical for all further components.

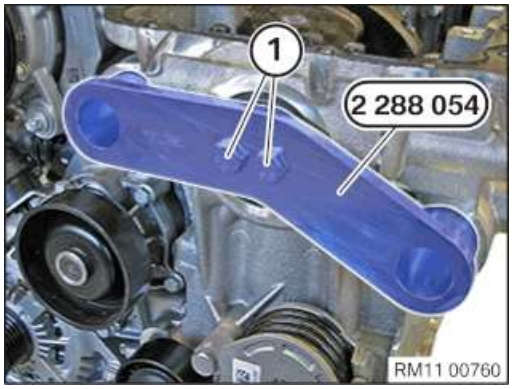
- Make sure the special tool 2 288 054 is correctly fitted in the guides (1) of the counterbalance shafts (2).
- If necessary, turn the crankshaft slightly.
- Tighten special tool 2 288 054.

Special tool 2 288 054 to crankshaft

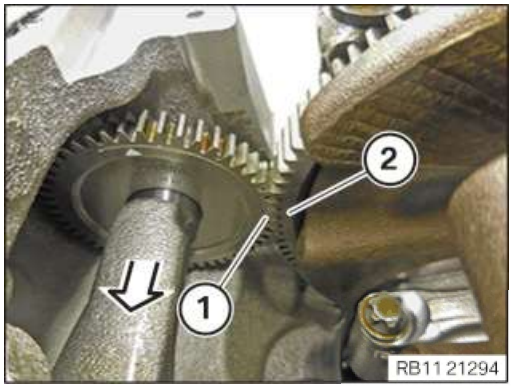
		Tightening torque	20 Nm



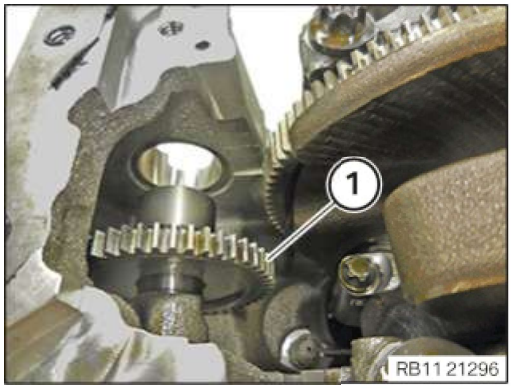
- Loosen screws (1) on the counterbalance shaft on the intake side.



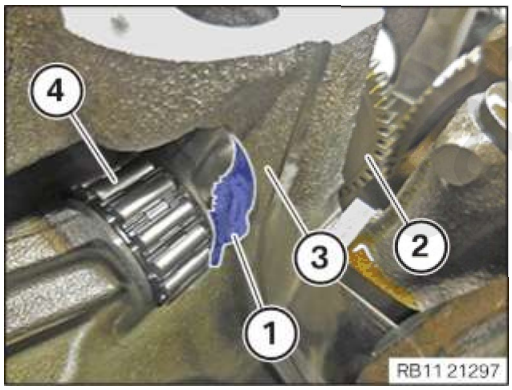
- Loosen screws (1).
- Guide the special tool 2 288 054 out and remove.



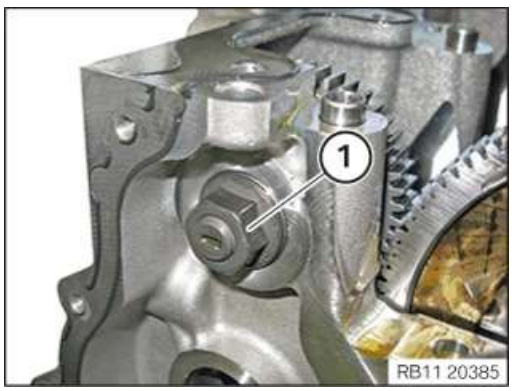
- Guide out counterbalance shaft (1) on the intake side from crankshaft (2) in the **direction of the arrow**.



- **Carefully** place aside counterbalance shaft (1) on the intake side.

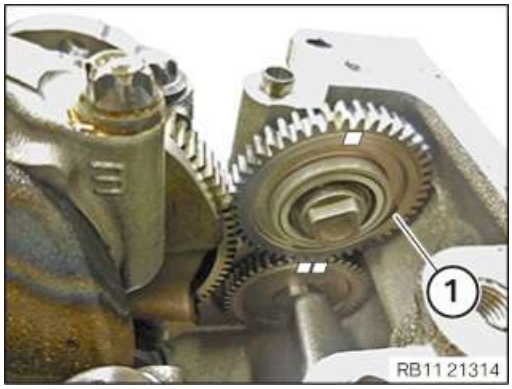


- Position a clean lint-free cleaning rag (1) between counterbalance shaft (2) on the intake side and crankcase (3).
- Ensure that needle bearing (4) is not **damaged**.



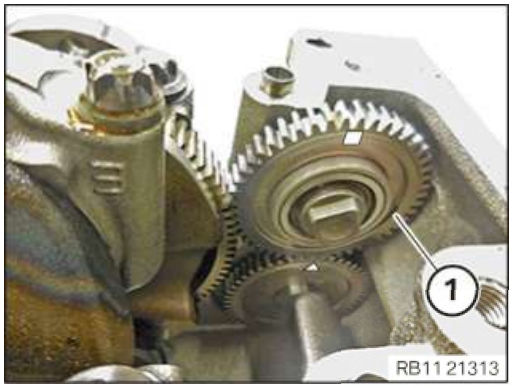
- Unfasten nut (1).

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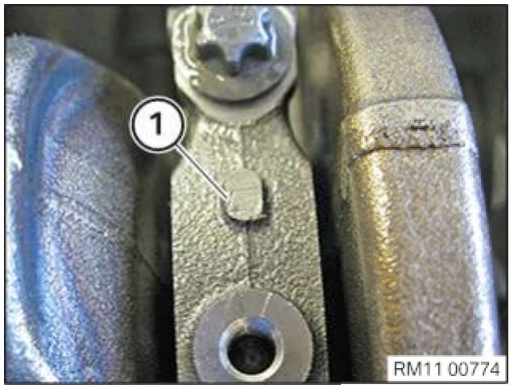
- **Vehicles up to year of manufacture until 07/16**

  Thread out the intermediate wheel (1) and remove.



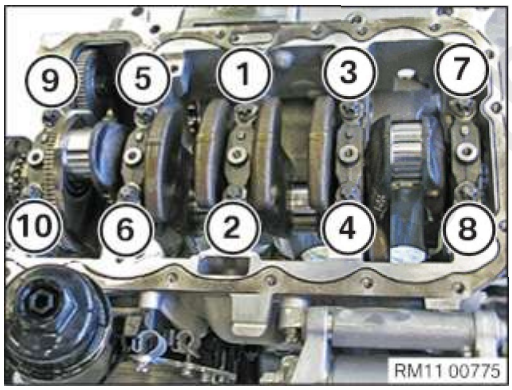
- **Vehicles up to year of manufacture from 07/16**

  Thread out the intermediate wheel (1) and remove.

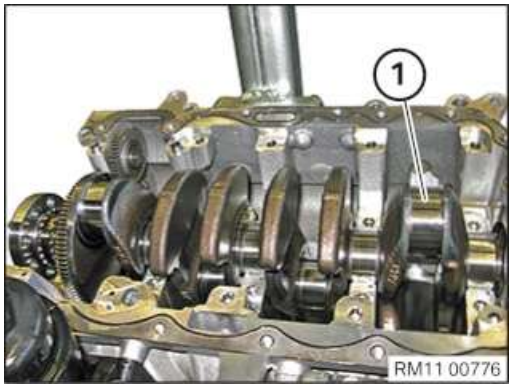


- Observe the numbering (1) of the main bearing caps.

  The mounting orientation must be maintained.



- Loosen screws in the order (10) to (1).
- Place the main bearing cap neatly into the special tool 0 495 105 (11 4 480) .



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide out and remove crankshaft (1).

38 – Determining the classification of the crankshaft main bearing shell

TECHNICAL INFORMATION

Main bearing shells and guide bearing shells are classified via colours or numbers.

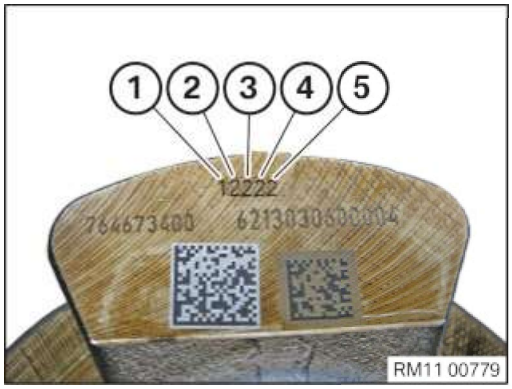
The classification of main bearing shells and guide bearing shells is changed to a classification, exclusively based on numbers. The classification based on colours is deleted.



- Read the code letter on the **crankcase** and enter it in the table.

  K = Clutch side

  The item numbers (5) to(1) describe the bearing seats 5 to 1. The **code** is located on the **crankshaft bearing caps**.



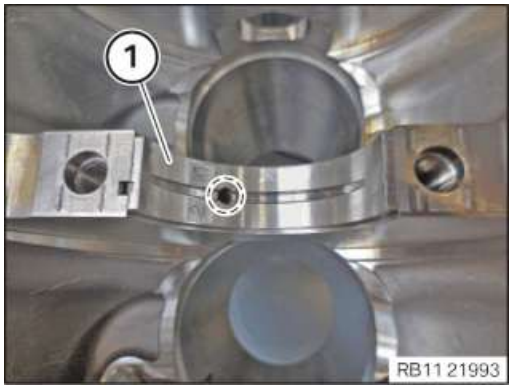
- Read the identification numbers on the **crankshaft** and enter in the table.

  The item numbers (1) to(5) describe the bearing seats 1 to 5. The **code** is located on the **crankshaft bearing caps**.

- Enter the code letters of the **crankcase**.
- Enter the identification numbers of the **crankshaft**.

	Code letters on crankcase	**Code letters/identification numbers** on the crankshaft
Bearing seat 1		
Bearing seat 2		
Bearing seat 3		
Bearing seat 4		
Bearing seat 5		

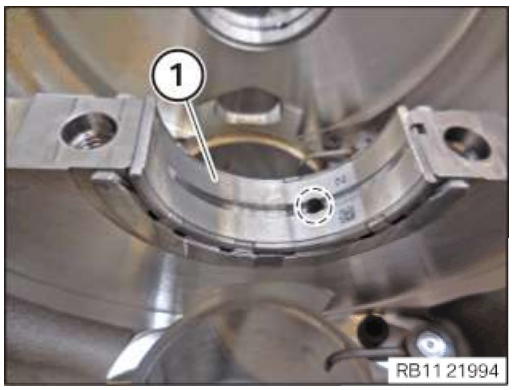
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- Using the table, determine the respective correct main bearing shell with lubricating groove (1) for the crankcase.

  The main bearing shells are classified by **colours** or **numbers**.

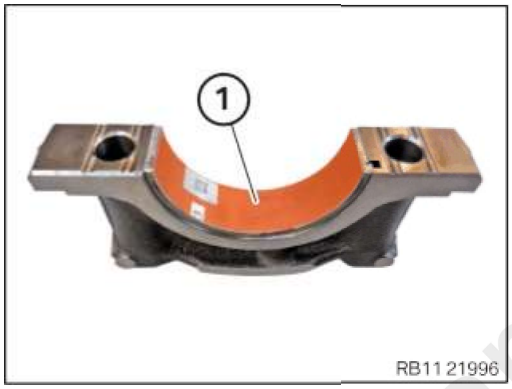
	A	B	C
1	Classification 1 (blue)	Classification 2 (green)	Classification 2 (green)
2	Classification 1 (blue)	Classification 2 (green)	Classification 3 (brown)
3	Classification 2 (green)	Classification 2 (green)	Classification 3 (brown)



- Using the table, determine the respective correct guide bearing shell with lubricating groove (1) for the crankcase.

  The guide bearing shells are classified by **colours** or **numbers**.

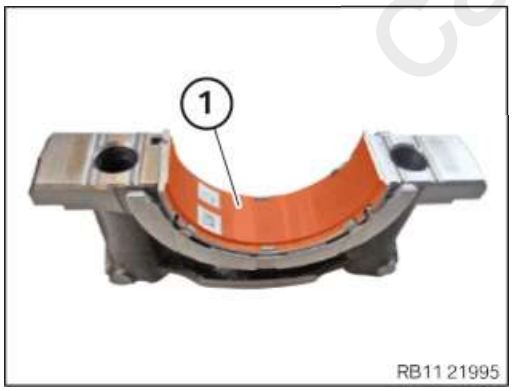
	A	B	C
1	Classification 1 (blue)	Classification 2 (green)	Classification 2 (green)
2	Classification 1 (blue)	Classification 2 (green)	Classification 3 (brown)
3	Classification 2 (green)	Classification 2 (green)	Classification 3 (brown)



- Using the table, determine the correct main bearing shell without lubricating groove (1) for the respective crankcase bearing cap.

  The main bearing shells are classified by **colours** or **numbers**.

	A	B	C
1	Classification 1 (blue)	Classification 1 (blue)	Classification 2 (green)
2	Classification 2 (green)	Classification 2 (green)	Classification 2 (green)
3	Classification 2 (green)	Classification 3 (brown)	Classification 3 (brown)

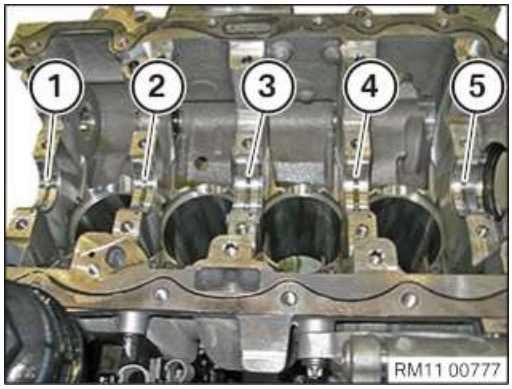


- Using the table, determine the correct guide bearing shell without lubricating groove (1) for the respective crankcase bearing cap.

  The guide bearing shells are classified by **colours** or **numbers**.

	A	B	C
1	Classification 1 (blue)	Classification 1 (blue)	Classification 2 (green)
2	Classification 2 (green)	Classification 2 (green)	Classification 2 (green)
3	Classification 2 (green)	Classification 3 (brown)	Classification 3 (brown)

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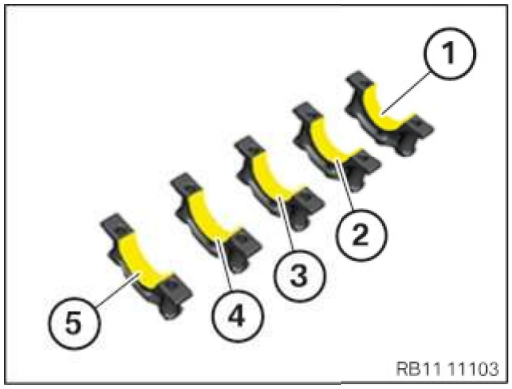


- Renew crankshaft main bearing shells (1) to (5) (with lubricating groove) in the crankcase.

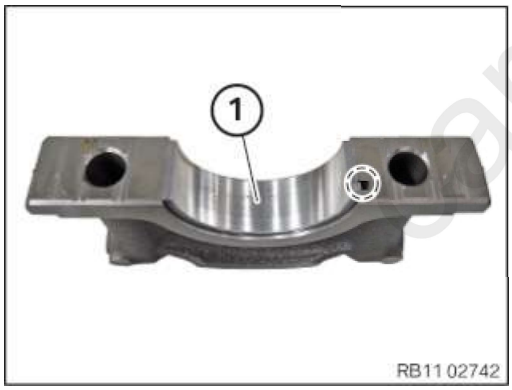
  Note: The thrust bearing of the crankshaft is installed at bearing position (3).



- Make sure the crankshaft main bearing shell (1) is correctly installed with the guide lug in the highlighted area.

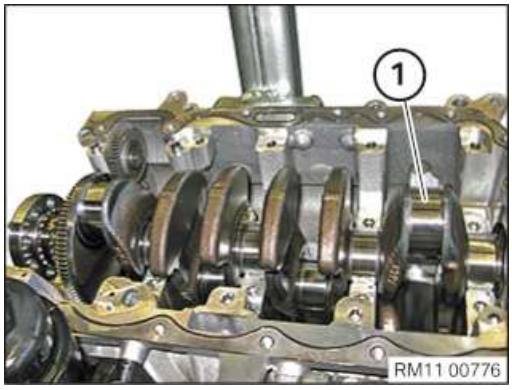


- Renew the crankshaft main bearing shells (1) to (5) (without lubricating groove) on the crankshaft bearing caps.



- Make sure the crankshaft main bearing shell (1) is correctly installed with the guide lug in the highlighted area.

40 – Installing the crankshaft



CAUTION

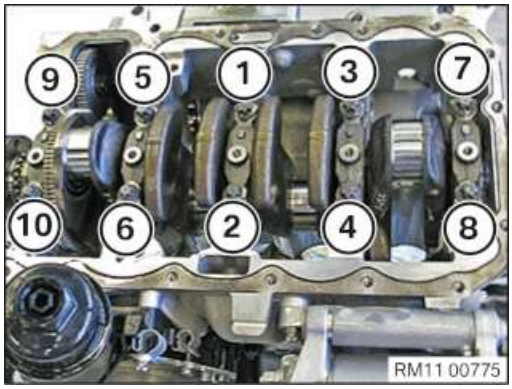
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide in and install crankshaft (1).

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TECHNICAL INFORMATION

The crankshaft bearing cap, main bearing shell and guide bearing shell are aligned with each other.

Always install the crankshaft bearing cap, main bearing shells and guide bearing shells in the cylinder from which they were removed.

- Observe numbering on the main bearing cap.
- Position the main bearing cap.
- Tighten the screws in the following sequence: (1) - (10).

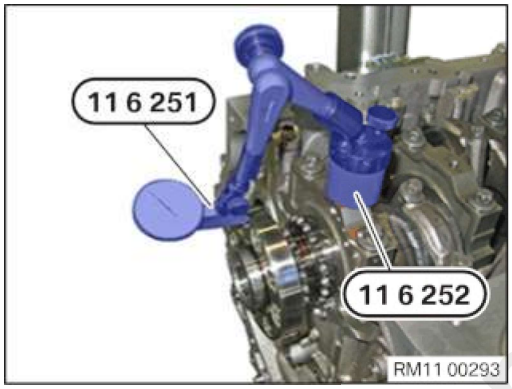
Main bearing cap to crankcase

M10x1.5	Renew screws.	1. Jointing torque	25 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

▸ **Check the crankshaft side clearance**

Check

- Attach the dial gauge 0 493 144 (11 6 251) with the tripod 0 493 145 (11 6 252) to the engine.



Axial play of crankshaft

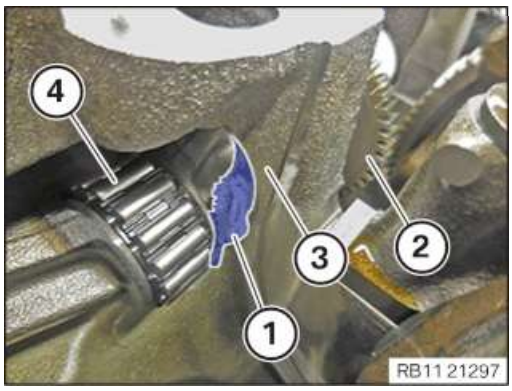
	min. 0,060 mm
	max. 0,250 mm

Result

» The side clearance has been exceeded.

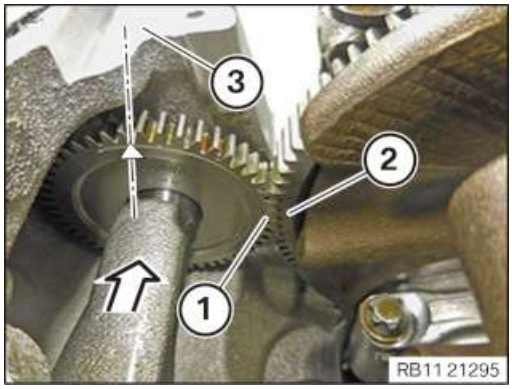
Measure

- Renew worn components.

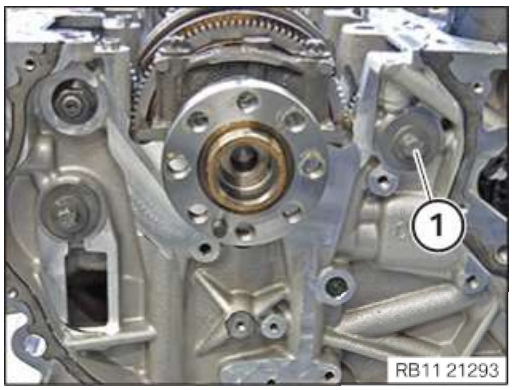


- Guide out lint-free cleaning rag (1) between counterbalance shaft (2) on the intake side and crankcase (3) and remove it.
- Ensure that needle bearing (4) is **not** damaged.

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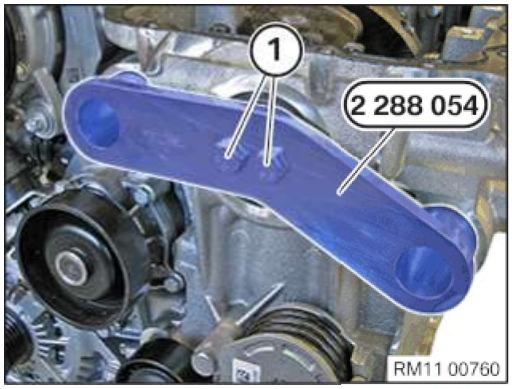


- Bring or adjust crankshaft (2) to the **TDC position** .
- Position counterbalance shaft (1) on the intake side in the **direction of the arrow** on crankshaft (2).
- The mark on gear (1) on the intake side of the counterbalance shaft must point **upwards**, **perpendicular** to the sealing surface of oil sump (3).

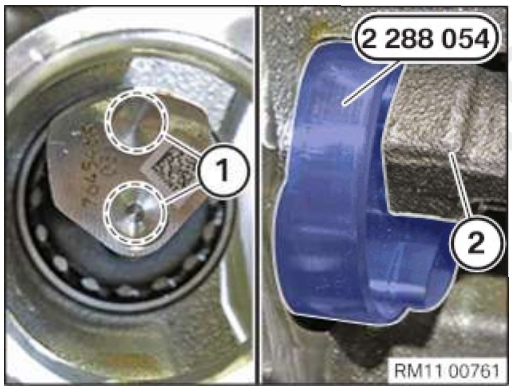


- Renew the screw (1).

  Parts: Screw
- Screw screw (1) into the counterbalance shafts on the intake side.
- Do **not** tighten screw (1) since otherwise the counterbalance shafts can no longer be positioned in the next step.



- Rotate the crankshaft to the **TDC of the first cylinder**.
- Mount the special tool 2 288 054 and abut the bolts (1).



NOTICE

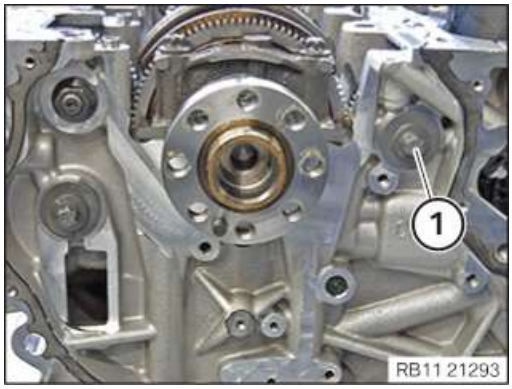
The description is for one component only. The procedure is identical for all further components.

- Make sure the special tool 2 288 054 is correctly fitted in the guides (1) of the counterbalance shafts (2).
- If necessary, turn the crankshaft slightly.
- Tighten special tool 2 288 054.

Special tool 2 288 054 to crankshaft

		Tightening torque	20 Nm

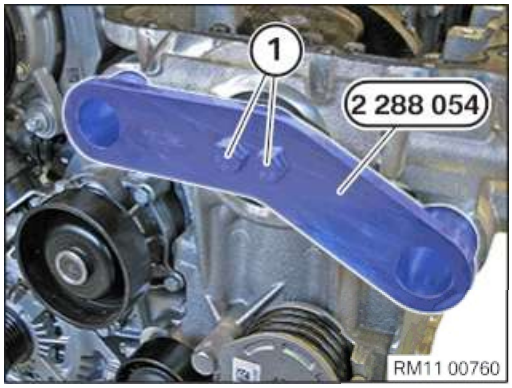
mdiagn.com



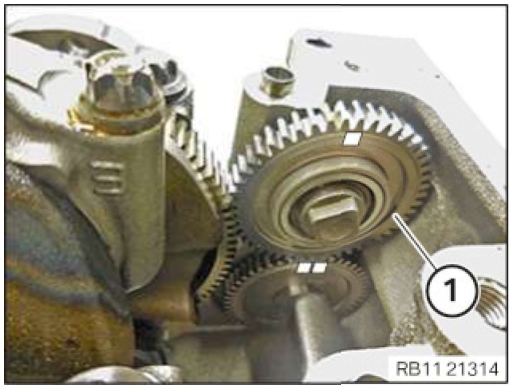
- Tighten screw (1) of the counterbalance shaft on the intake side.

Gear to counterbalance shaft

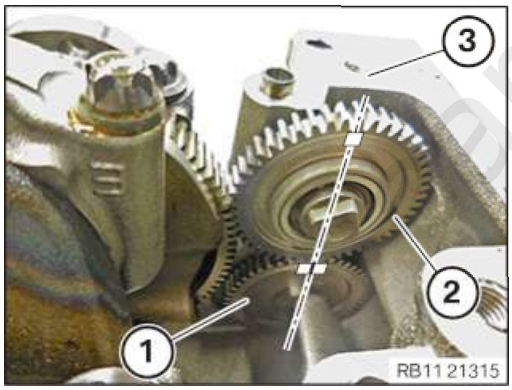
		1. Jointing torque	40 Nm
		2. Angle of rotation	70 °



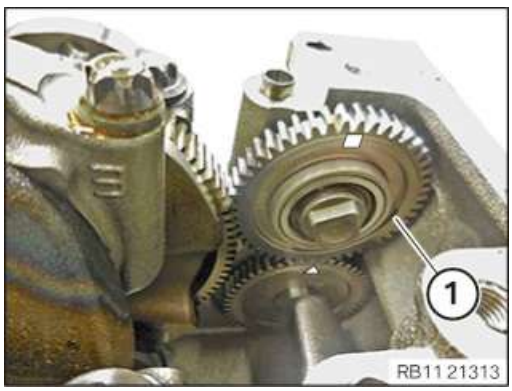
- Loosen screws (1).
- Guide the special tool 2 288 054 out and remove.



- **Vehicles up to year of manufacture 07/16**
- Guide in and install intermediate wheel (1).

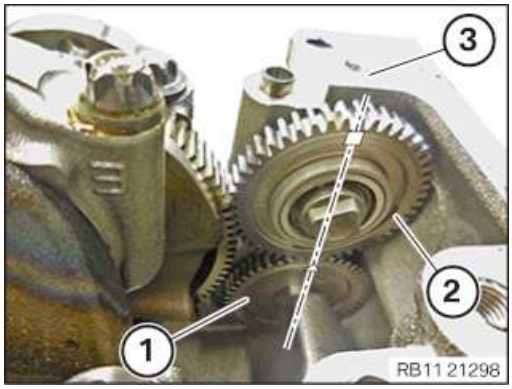


- **Vehicles up to year of manufacture 07/16**
- The marks on gear (1) and also on intermediate wheel (2) must point **upwards**, **perpendicular** to the sealing surface of oil sump (3).
- Mark on intermediate wheel (2) of the counterbalance shaft on the exhaust side: a square.
- Mark on gear (1) of the counterbalance shaft on the exhaust side: two squares.

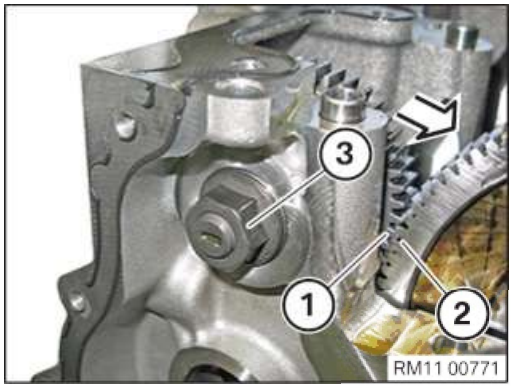


- **Vehicles from year of manufacture 07/16**
- Guide in and install intermediate wheel (1).

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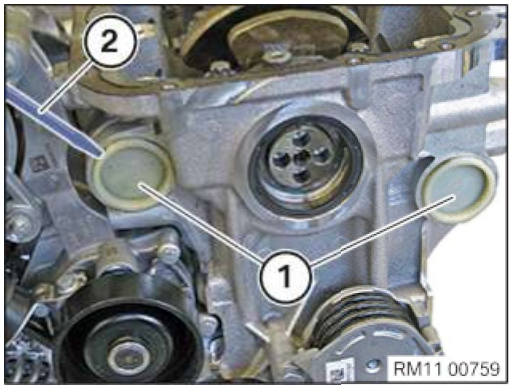
- **Vehicles from year of manufacture 07/16**
- The marks on gear (1) and also on intermediate wheel (2) must point **upwards**, **perpendicular** to the sealing surface of oil sump (3).
- Mark on intermediate wheel (2) of the counterbalance shaft on the exhaust side: a square.
- Mark on gear (1) of the counterbalance shaft on the exhaust side: a triangle.



- Move intermediate wheel (1) in the **direction of the arrow** to gear (2) of the crankshaft.
- Tighten nut (3).

Gear to crankcase

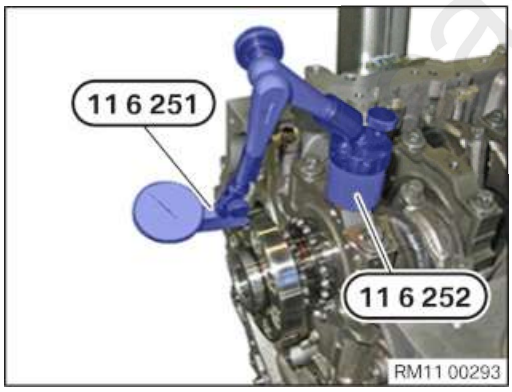
			70 Nm



- Renew the sealing cap (1).

  Parts: Sealing cap
- Make sure the O-rings of the sealing cap (1) are fitted correctly.
- Mount both sealing caps (1).

41 – Check the crankshaft side clearance



Check

- Attach the dial gauge 0 493 144 (11 6 251) with the tripod 0 493 145 (11 6 252) to the engine.

Axial play of crankshaft

	min. 0,060 mm
	max. 0,250 mm

Result

» The side clearance has been exceeded.

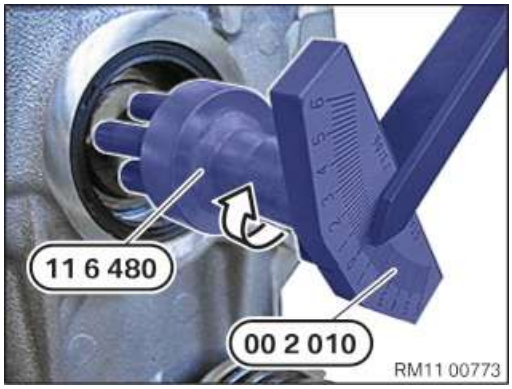
Measure

- Renew worn components.

42 – Check the coefficient of friction for the crankshaft

Check

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- Turn the crankshaft clockwise with the special tool 0 490 130 (00 2 010) and compare the reading on the scale to the maximum permitted torque.

Maximum permitted torque of the crankshaft

	max. 2 Nm

Result

» The maximum permitted torque is exceeded.

Measure

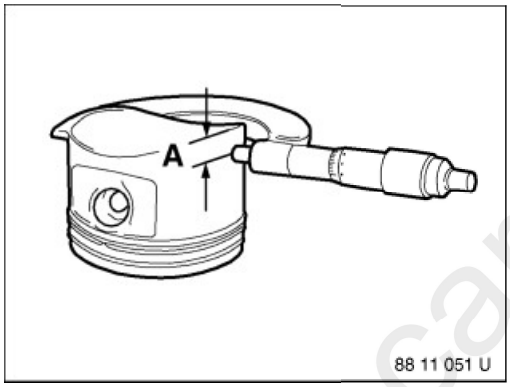
- Correct the radial clearance.

POSTPROCESSES

43 – Measuring piston

NOTICE

The description is for one component only. The procedure is identical for all further components.



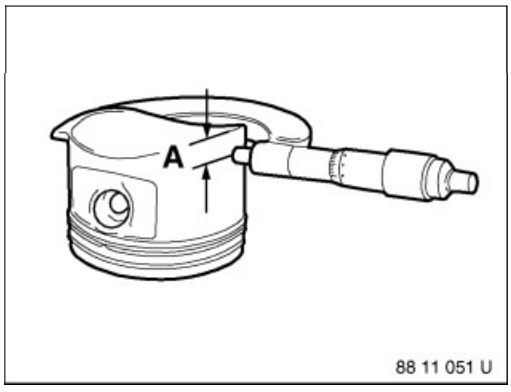
Check

- Position measuring bolt in area (A) and measure piston installation clearance transversely to gudgeon pin.

Piston diameter

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Result

» Piston does not correspond to the specifications.

Measure

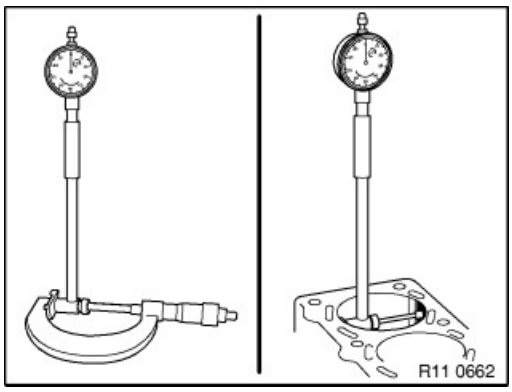
- Renew the piston.

44 – Measuring a cylinder

Prerequisite

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Cylinder barrel is cleaned.



Check

- Carry out a measurement at all cylinders.
- Adjusting measuring screw to nominal dimension of cylinder bore.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

- Insert internal measuring device into measuring screw and set to zero.
- With the internal measuring device, measure the cylinder at the following points and check the deviations from the nominal dimension.
  - Lower third of the cylinder bore in direction of travel,
  - Lower third of the cylinder bore transversely to direction of travel,
  - Middle third of the cylinder bore in direction of travel,
  - Middle third of the cylinder bore transversely to direction of travel,
  - Upper third of the cylinder bore in direction of travel,
  - Upper third of the cylinder bore transversely to direction of travel.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Result

» Cylinder does not correspond to the specifications.

Measure

- Renew the crankcase.

45 – Installing all pistons with connecting rod

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Installing piston with connecting rod**

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RISK OF DAMAGE

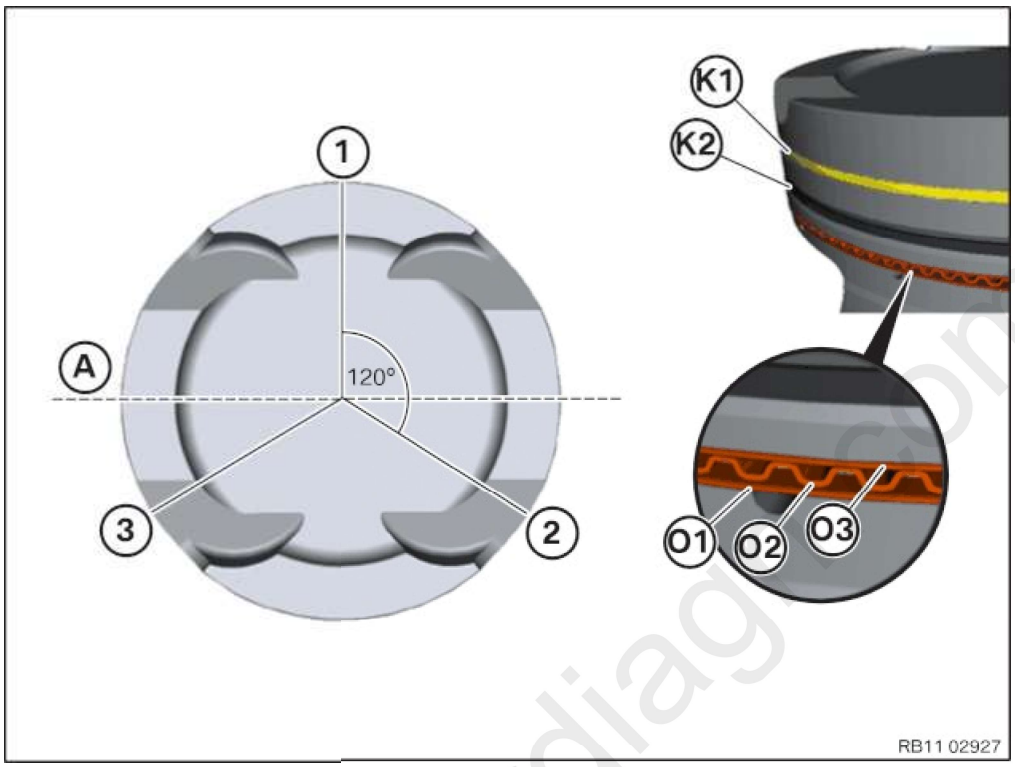
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

▷ **Aligning piston rings**

Aligning piston rings



1 12 o'clock position

2 4 o'clock position

3 8 o'clock position

A Axis of gudgeon pin

K1 Upper piston ring

K2 Middle piston ring

O1 Lower oil scraper ring

O2 Spring

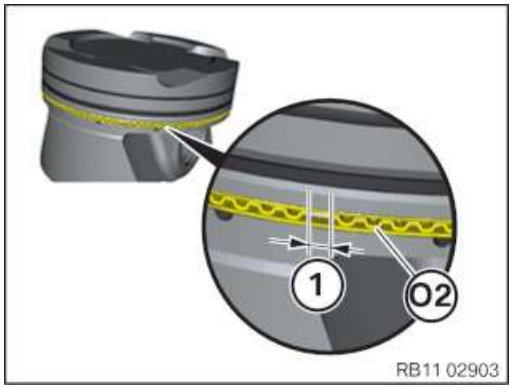
O3 Upper oil scraper ring

- Align the contact points of all piston rings rotated by 120° each.

  Do not position contact points over axis of gudgeon pin (A).

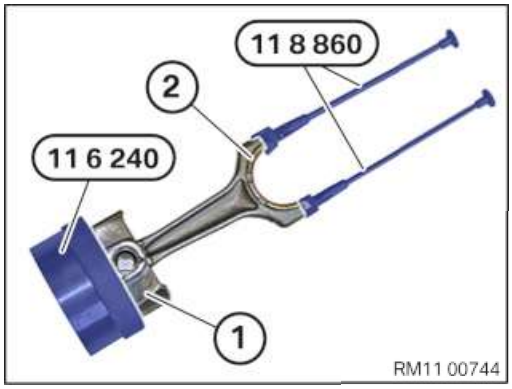
Piston ring	Align at the following position
Lower oil scraper ring (O3)	Align at the 12 o'clock position (1)
Spring (O2)	Align at the 4 o'clock position (2)
Upper oil scraper ring (O1)	Align at the 8 o'clock position (3)
Middle piston ring (K2)	Align at the 12 o'clock position (1)
Upper piston ring (K1)	Align at the 4 o'clock position (2)

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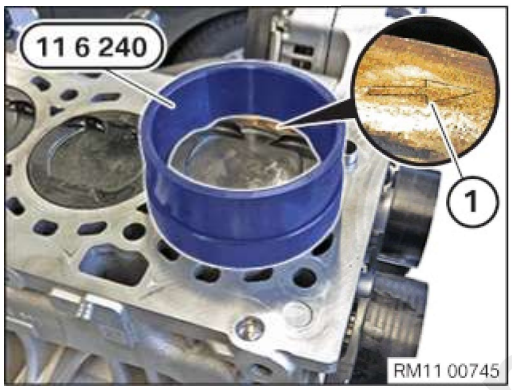


- Make sure that contact point (1) does not overlap spring (O2).

◁



- Coat the pistons (1) and piston rings lightly with oil.
- Insert the pistons (1) with the piston rings into the bush 0 495 373 (11 6 240).
- Screw special tool 0 496 144 (11 8 860) on at large connecting rod eye (2).



- Align the piston so that the arrow (1) points to cylinder 1.
- Insert the piston with the connecting rod into the special tool 0 495 373 (11 6 240) and guide it into the cylinder.

RISK OF DAMAGE

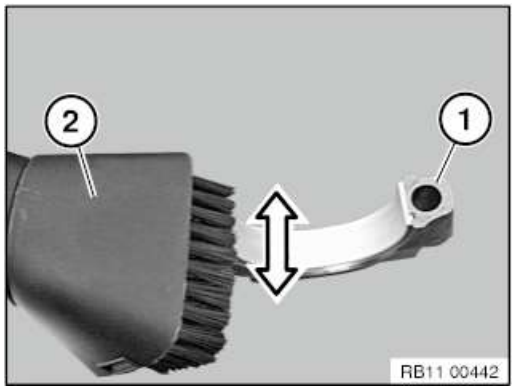
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

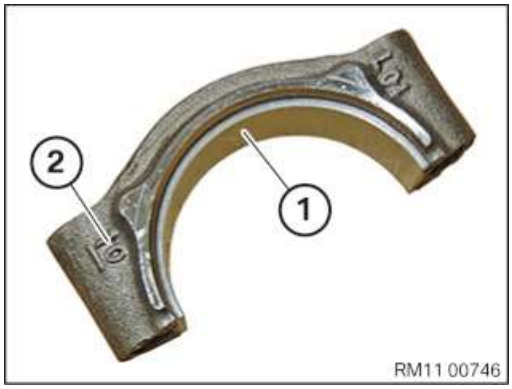
- Push in piston by hand with only little force. Do not use striking tools.

▷ **Install the lower connecting rod bearing**

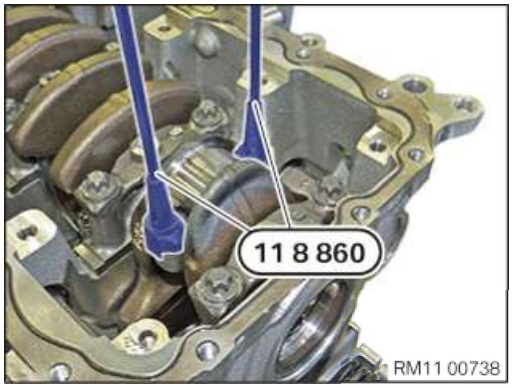


- Vacuum the connecting rod bearing shell and cracked surface (1) with a vacuum cleaner (2).

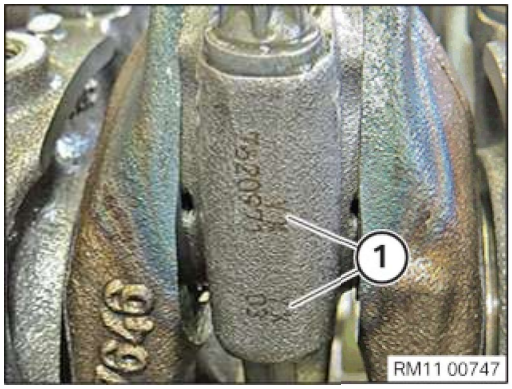
carlagn.com



- Insert the connecting rod bearing shell (1) into the connecting rod bearing cap (2).
- Apply a light coat of oil to the connecting rod bearing shell (1).



- If necessary, screw the assembly tool 0 496 144 (11 8 860) into the large connecting rod eye.
- Pull the connecting rod up to the connecting rod bearing journal.



RISK OF DAMAGE

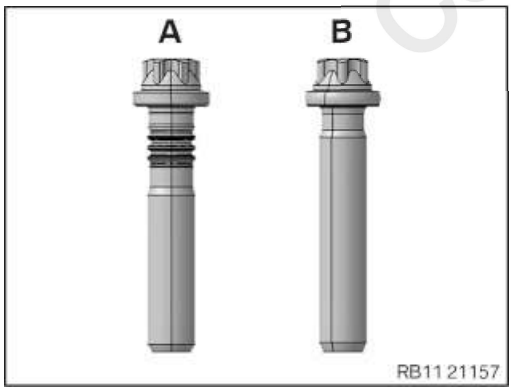
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

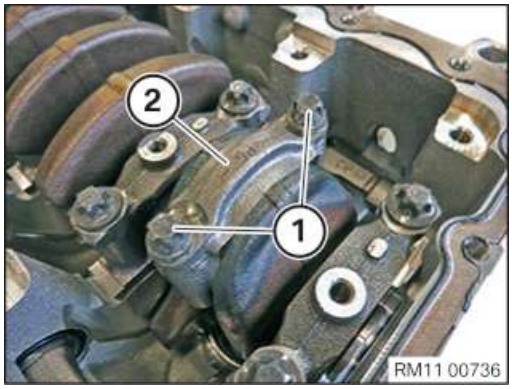
- Attach the connecting rod bearing caps to the connecting rod until the designations (1) match.

  Make sure that the connecting rod bearing (2) is attached to the same connecting rod that it was detached from.



- A mixed installation of connecting rod bolts (A) and (B) on a connecting rod bearing cap is **not** permitted.

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TECHNICAL INFORMATION

When installing new connecting rod bolts, ensure that two identical connecting rod bolts are used on one connecting rod bearing cap.

A mixed installation of different connecting rod bolts on one connecting rod bearing cap is not permitted.

- Renew screws (1).
- Tighten the screws.

  Make sure that the connecting rod bearing cap (2) rests completely on the connecting rod.

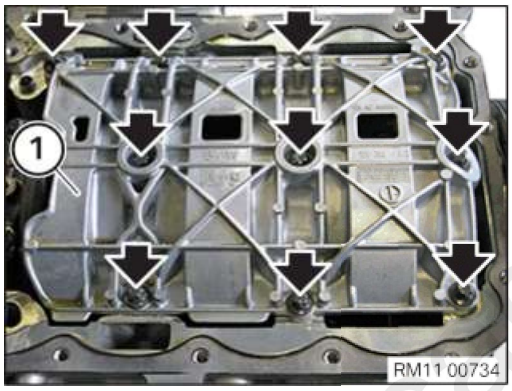
Connecting rod bearing cap to connecting rod

Renew screws.

Tighten screws crosswise.	Jointing torque	20 Nm
	1. Angle of rotation	70 °
	2. Angle of rotation	70 °

◁

46 – Installing the oil deflector



- Install the oil deflector (1).
- Renew screws.

  Parts: Bolts
- Tighten all bolts cross-wise.

Oil deflector to crankcase

M8 x 35		Renew screws.	15 Nm
			45 °

47 – Oil vacuum pump preparation

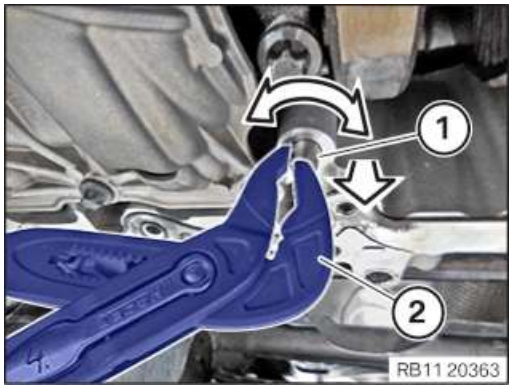
RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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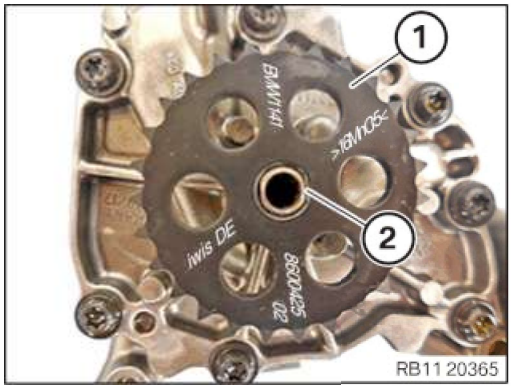


- Remove the centring sleeves (1) in direction of arrow using conventional tools (2).
- Renew the centring sleeves (1).

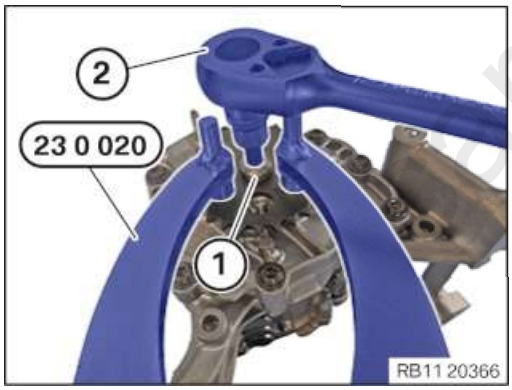
  Parts: Centring sleeves



- Insert and install new centring sleeves (1) on the oil vacuum pump (2).



- Insert and install the camshaft sprocket (1) on the oil vacuum pump (2).
- Make sure the **labelling** on the camshaft sprocket points to the **front**.



TECHNICAL INFORMATION

The thread is a left-hand thread.

- Insert and install the new screw (1).
- Hold camshaft sprocket with special tool 0 491 440 (23 0 020) and tighten screw (1) with conventional tools (2).

Note: Carry out work with a second person assisting.

Camshaft sprocket to oil vacuum pump

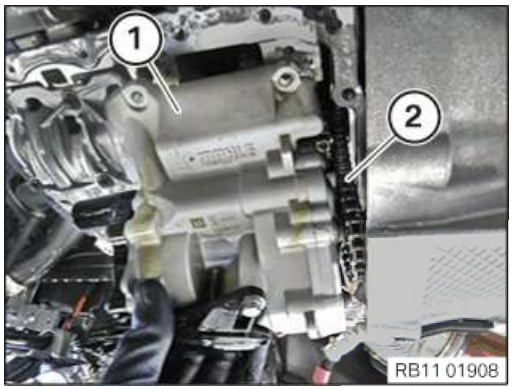
M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °



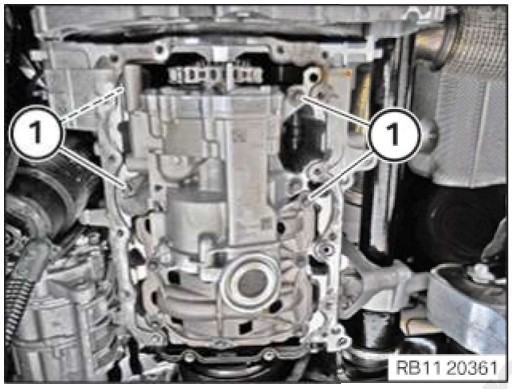
- Make sure the sealing ring (1) is installed correctly.

  The sealing ring (1) must not be damaged or missing.

48 – Install the oil vacuum pump



- Feed the oil vacuum pump (1) into the drive chain (2) and position it.

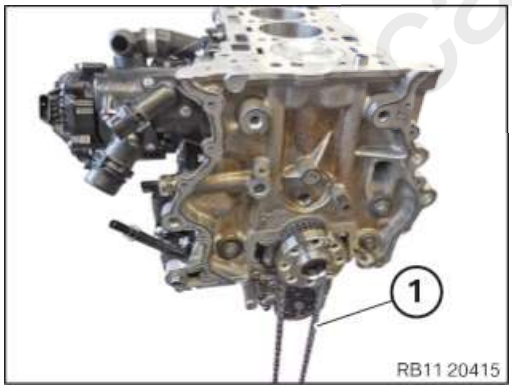


- Tighten the new bolts (1).

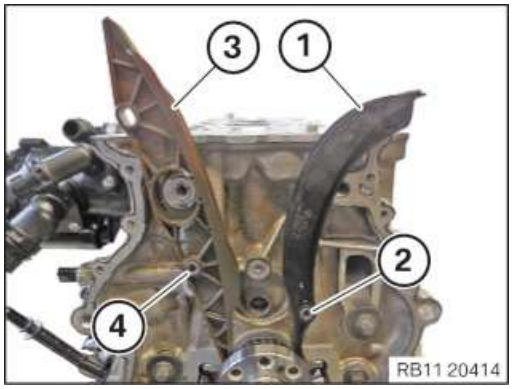
Oil vacuum pump to crankcase

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

49 – Installing timing chain



- Insert and install the timing chain (1).



- Insert and install the tensioning rail (1) on the bearing journal (2).
- Insert and install the guide rail (3).
- Renew bearing journal (4).

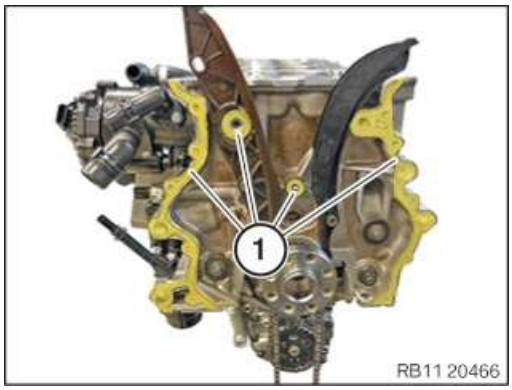
  Parts: Bearing journal
- Tighten the bearing journals (4).

Bearing journal to crankcase

Bearing journal	Replace bearing journal.	Tightening torque	20 Nm

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50 – Install the rear timing case cover



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

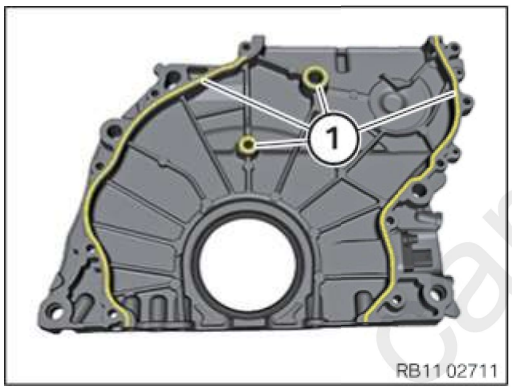
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove sealing residue in this area (1) using special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

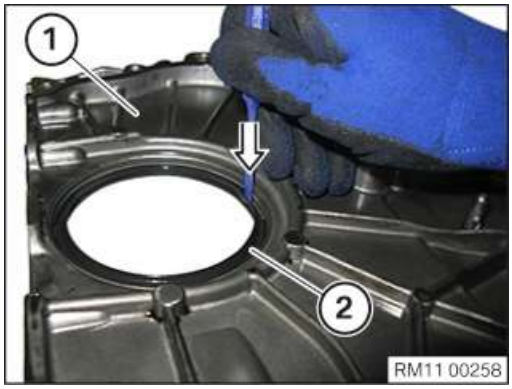
The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove sealing residue in this area (1) using special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

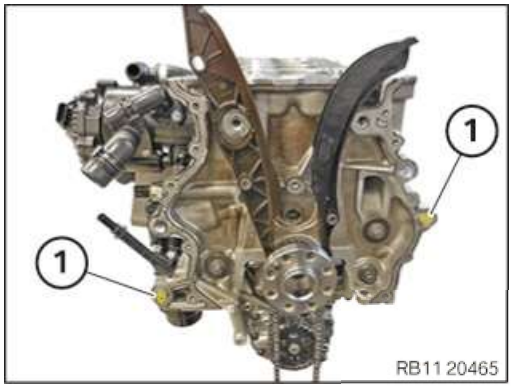
Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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- Position the timing case cover (1) underneath.
- Position the inner punch in the crankshaft sealing ring (2).
- Remove the crankshaft sealing ring (2) outward in the direction of the arrow.



- Check the fitting sleeves (1) for damage and renew, if necessary.
- Check for correct fit of fitting sleeves(1).



- Have the special tool ready.



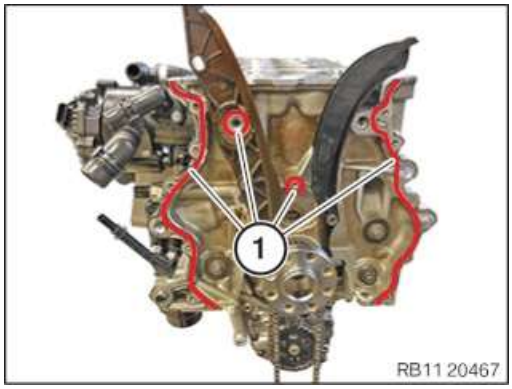
TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

carmanuals.com



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound in area (1)along the inner edge.

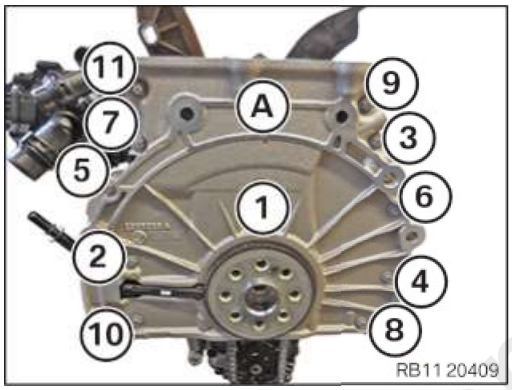
Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

2,0 mm ... 2,5 mm

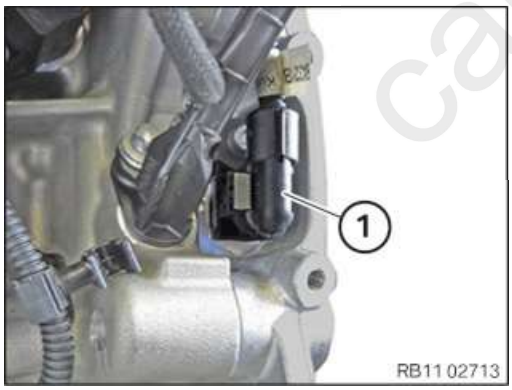


- Renew screws (1) to (11).

  Parts: Bolts
- Carefully mount the timing case cover (A).
- Tighten screws in the order (1) to (11).

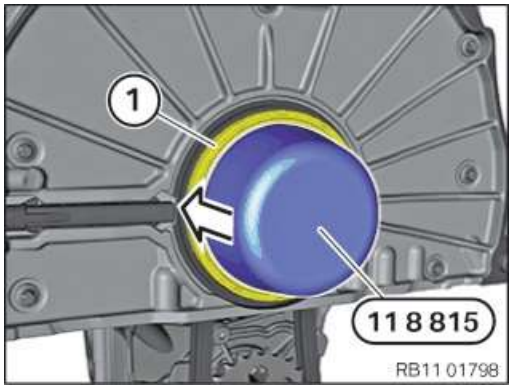
Rear timing case cover to crankcase

M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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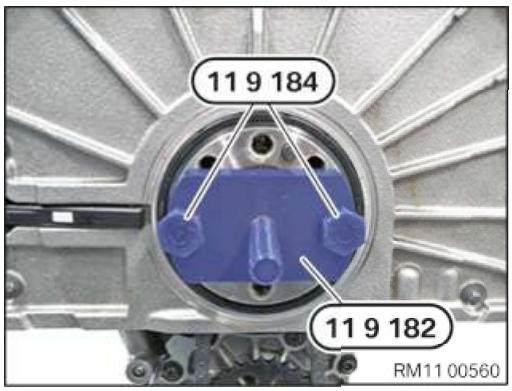
RISK OF DAMAGE

Radial shaft seal damage.

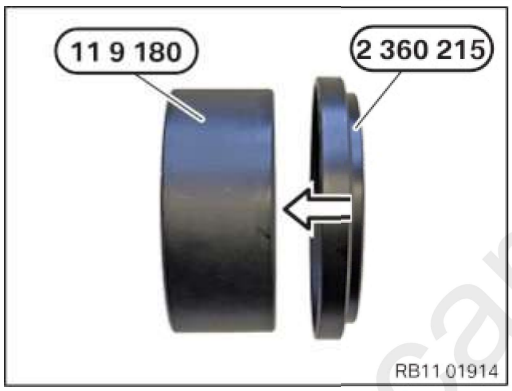
Touching the sealing lip (inner) and applying oil to the radial shaft seal will lead to its destruction.

- Do not touch the sealing lip (inner) of the radial shaft seal.
- Do not apply oil to the radial shaft seal.
- Install the radial shaft seal dry.

- Preassemble special tool 0 496 137 (11 8 815) on crankshaft.
- Carefully slide the new crankshaft sealing ring (1) straight off the special tool 0 496 137 (11 8 815) using a rotational movement until the new crankshaft sealing ring is positioned parallel on the timing case cover.



- Secure special tool 0 494 029 (11 9 182) to the crankshaft using special tool 0 494 031 (11 9 184).

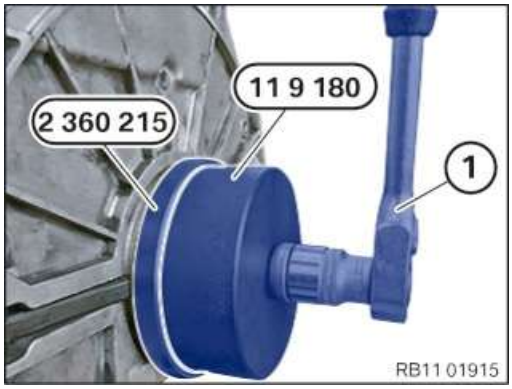


- Connect special tool 2 360 215 onto special tool 0 493 881 (11 9 180).



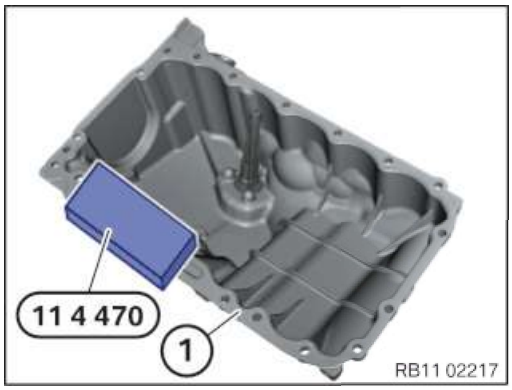
- Pull in the new crankshaft sealing ring with special tools 0 494 028 (11 9 181) and 2 360 215 together with the special tool 0 494 030 (11 9 183).

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- Screw in the new crankshaft sealing ring with the tool (1) to the stop.

51 – Refitting sump



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the rough seal remains on the sealing surface (1) of the crankcase with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



- Have the special tool ready.



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

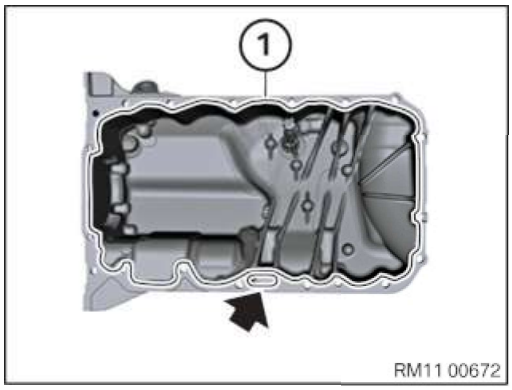
- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

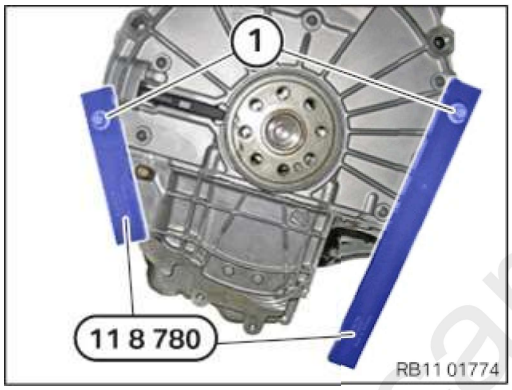


TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound along the line (1) with a thickness of 2 mm to 2.5 mm.

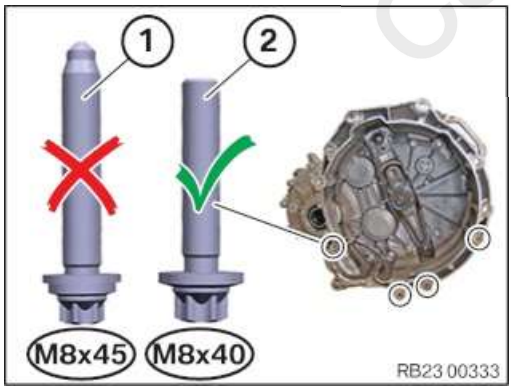
  Apply the sealing compound along the inner edge.
- Completely encircle the oil return orifice (arrow) with the sealing compound.



TECHNICAL INFORMATION

The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with engine block.
- If necessary, renew fitting sleeves.



RISK OF DAMAGE

Component damage caused by incorrect screw length.

The use of screws with the incorrect screw length can damage the component.

- Check for correct screw length.
- Re-install screws that correspond to the original screw length.

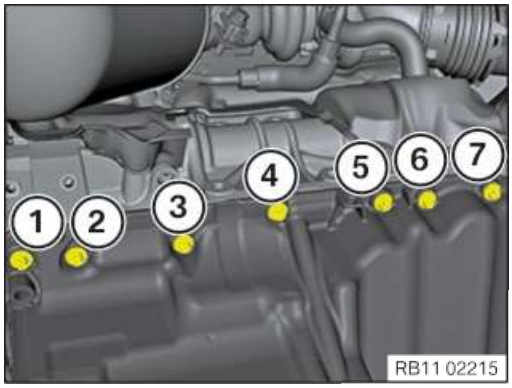
- Ensure that the **correct** screw (2) (M8x40) is used for mounting the oil sump on the transmission.

  The screw (1) (mounting bolt of the starter motor) may **never** be used for mounting the oil sump.

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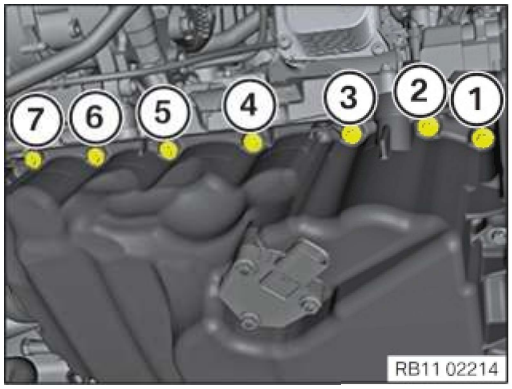
- Install oil sump (1) to top front.
- **Hand-tighten** all oil sump screws but do not tighten completely.



- Tighten the screws (1) to (7).

Oil sump to crankcase

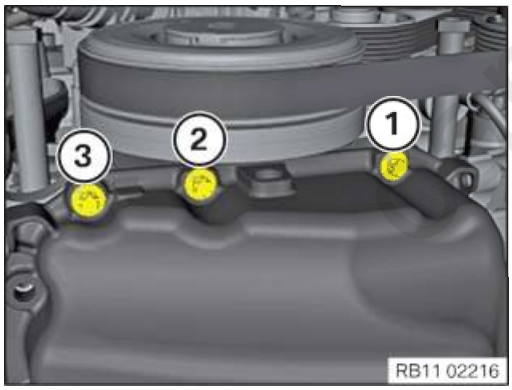
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1) to (7).

Oil sump to crankcase

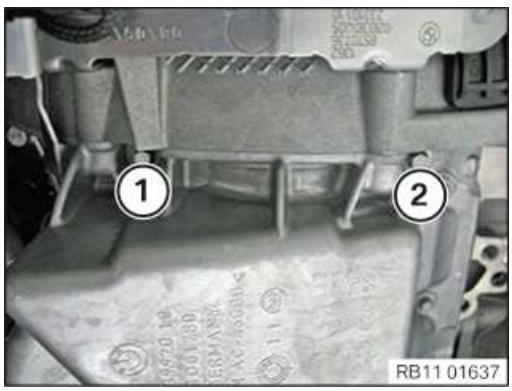
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1), (2) and (3).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

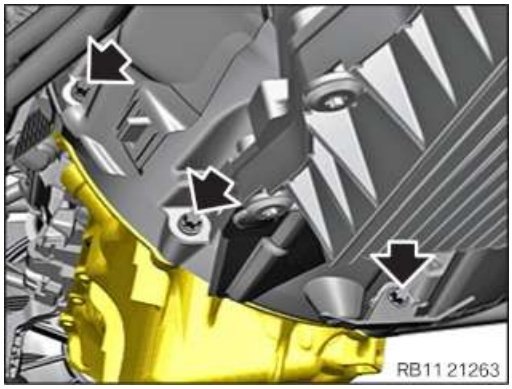


- Tighten down screws (1) and (2).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

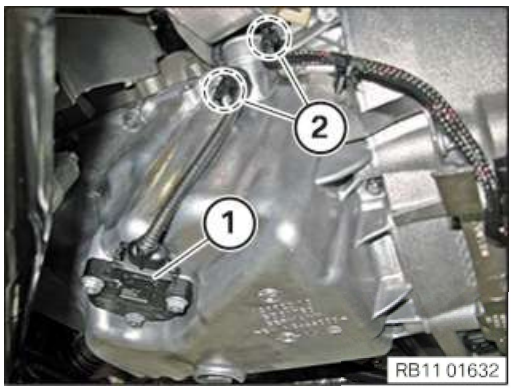
rdiagn.com



- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm



- Fasten cable on the clips (2) from the oil sump.
- Connect and lock the connector (1).
- Make sure the connector 1 engages audibly.

52 – Installing the flywheel



TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).



- Use the set of special tools 2 285 058.

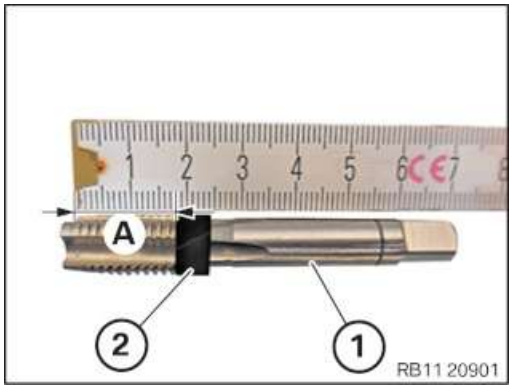
Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool



- Assemble tool set.

Number	Description
1	Tool holder
2	Thread cutter M12X1,5

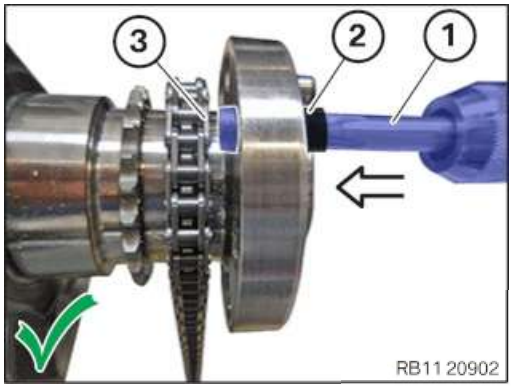
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- Mark the screw-in depth (A) on thread cutter (1) from the set of special tools 2 285 058 with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm



NOTICE

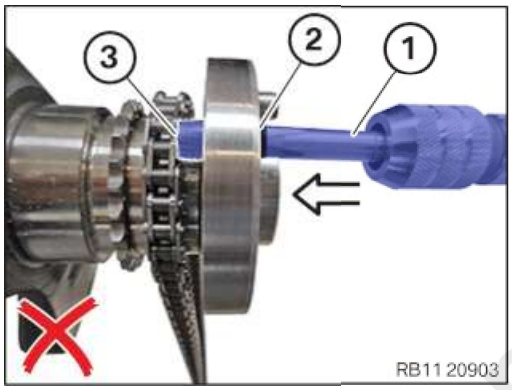
To provide a better overview: Shown with engine removed.

- Screw in the thread cutter (1) from the set of special tools 2 285 058 in direction of arrow up to the screw-in depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).



TECHNICAL INFORMATION

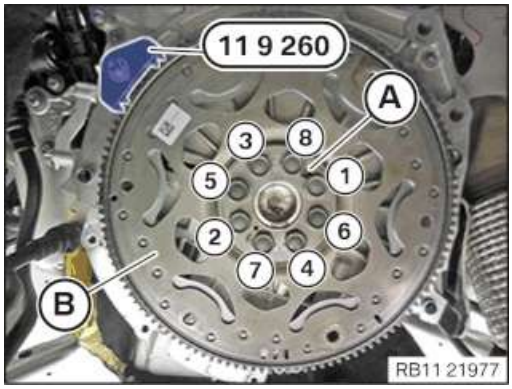
- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

- Make sure that the screw-in depth (2) of the screw tap (1) is not exceeded.

  The thread cutter (1) may not rest on the timing chain (3).



- Make sure the magnet wheel (1) is installed correctly.



- Renew screws (1) to (8).

  Parts: Bolts
- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool 0 494 034 (11 9 261) and screw the special tool 0 494 130 (11 9 264) tightly.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten flywheel bolts in sequence (1) to (8).

Flywheel to crankshaft

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

- Remove special tool 0 493 938 (11 9 260).

53 – Installing the vibration damper

RISK OF DAMAGE

Radial shaft seal damage.

When installing the vibration damper, the rotary shaft seal can be damaged.

- The special tool must be used to install the vibration damper.

TECHNICAL INFORMATION

When removing and installing or replacing the vibration damper, the rotary shaft seal must be replaced.



- Clean the sealing surface (1) from oil and contamination.

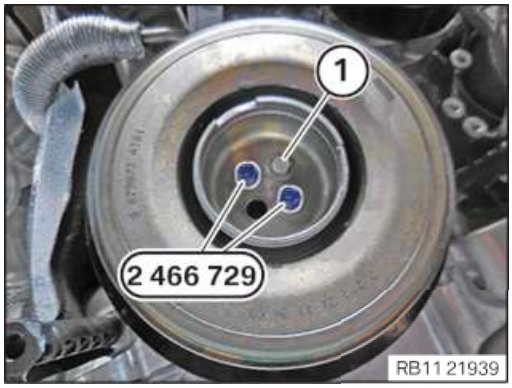


- Screw special tool 2 466 729 into the crankshaft by hand.

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- Insert vibration damper (1) into the special tool 2 466 729 and install.



- Renew the bolts (arrows).

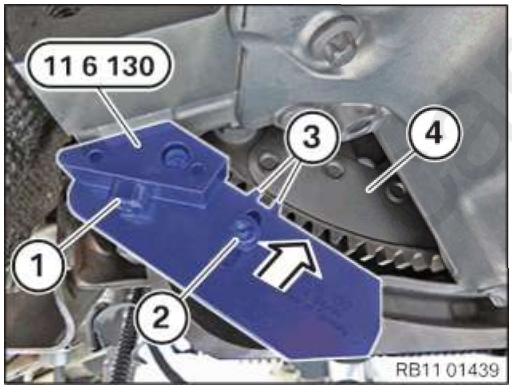
  Parts: Bolts
- Hand-tighten the bolt (1).
- Guide the special tool 2 466 729 out and remove.



- Position vibration damper (1).
- Tighten the bolts (arrows) on the vibration damper (1).

Vibration damper with belt pulley to crankshaft

M10x65	Renew screws. Tighten screws crosswise.	1. Jointing torque	40 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

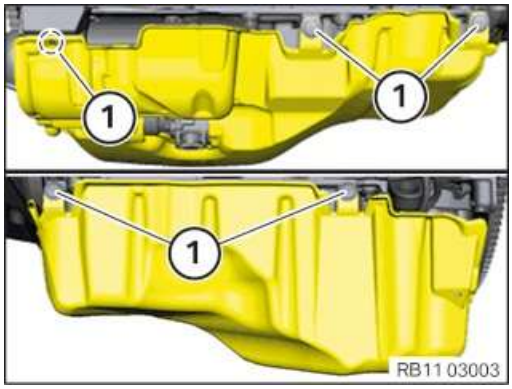


- Loosen screw (2).
- Slide the counter support with the bolt (2) down until the teeth (3) are no longer engaged in the gearing of the flywheel (4).
- Release the screw (1) and feed out and remove special tool 0 496 595 (11 6 130).

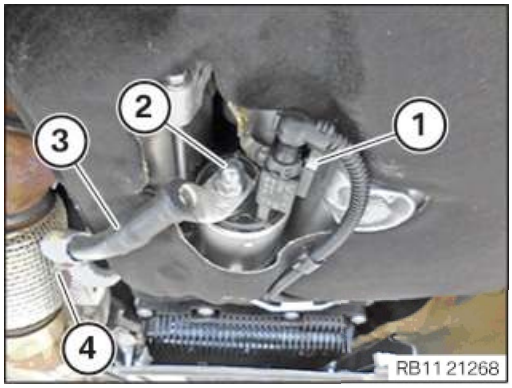
54 – Installing the acoustic cover for the oil sump



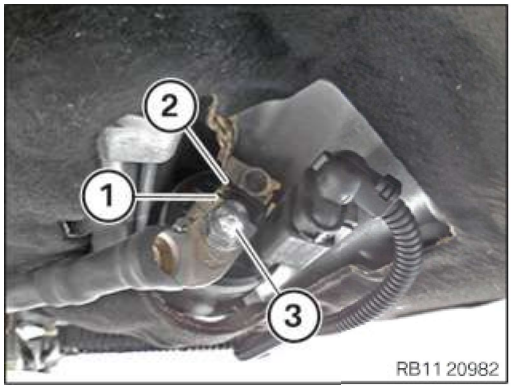
- Install acoustic cover (1) to the top front.



- Secure all expanding rivets (1).



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.
- Insert and install the positive battery cable (3).
- Secure positive battery cable (3) at the clamp (4).
- Tighten the nut (2) hand-tight.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

55 – Block the crankshaft in he TDC firing position of cylinder 1



RISK OF DAMAGE

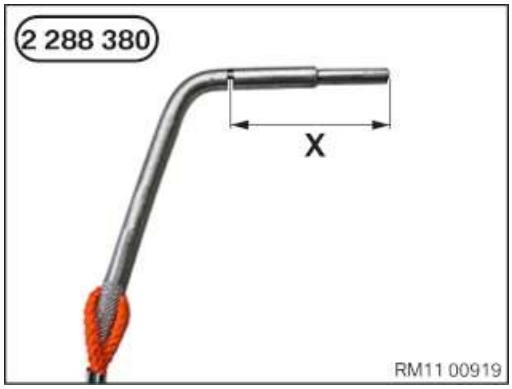
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

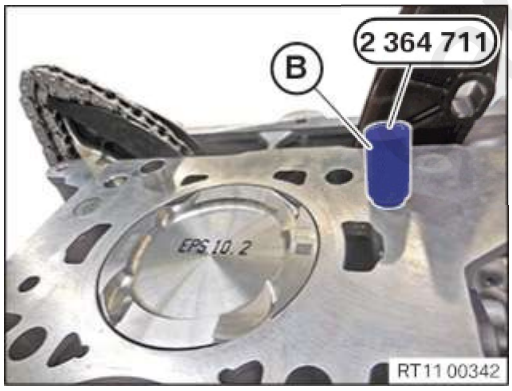


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

56 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

57 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

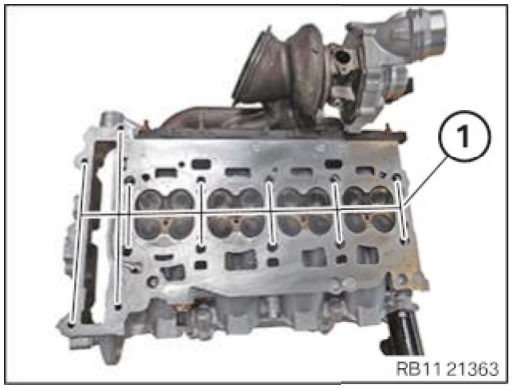
- Do not use any metal-cutting tools.



- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.

.com



CAUTION

Swirling dirt particles caused by compressed air.

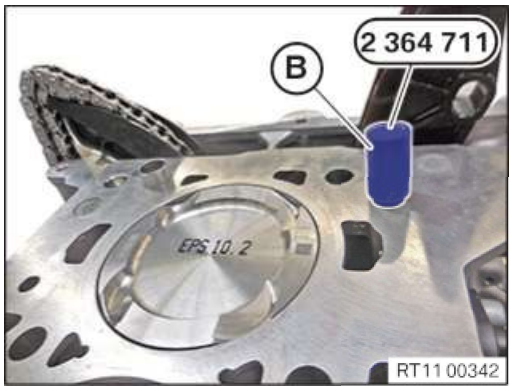
Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



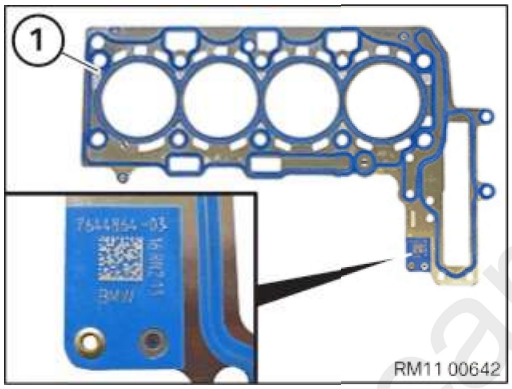
- Wear safety goggles.

- Clean all the threaded holes in the **marked** area of the crankcase with compressed air.



- Remove special tool (B) contained in the set of special tools 2 364 711.

58 – Renewing the cylinder head gasket



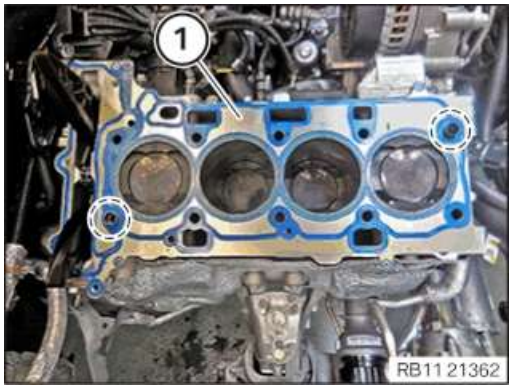
- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional thicker gasket 0.3 mm is available for service personnel.



- Check fitting sleeves (1) in the **marked** area for damage and, if necessary, renew them.

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- Guide cylinder head gasket (1) into the **marked** area and install it.

59 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

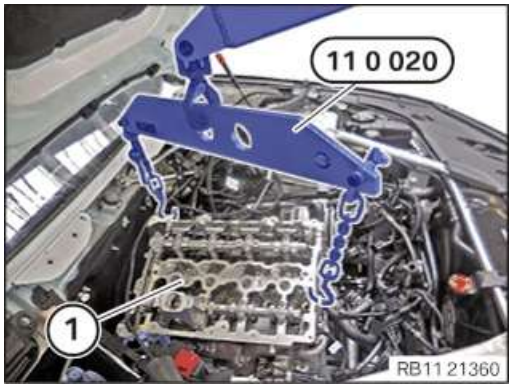
- Dry threaded holes (e.g. using compressed air).

TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



RISK OF DAMAGE

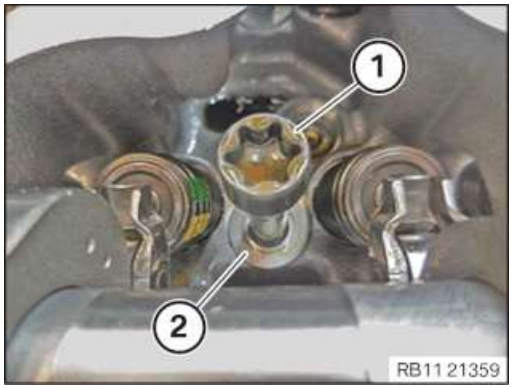
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

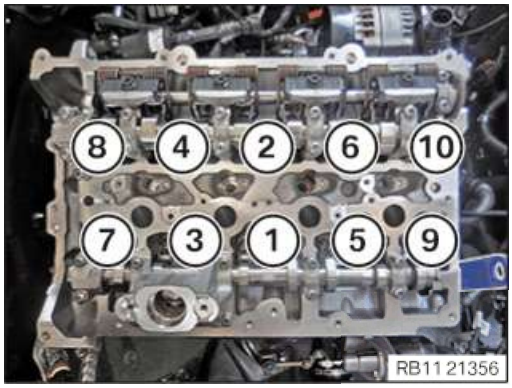
cardiagn.com



- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of engine block.
- Guide in and install cylinder head bolts (1).



TECHNICAL INFORMATION

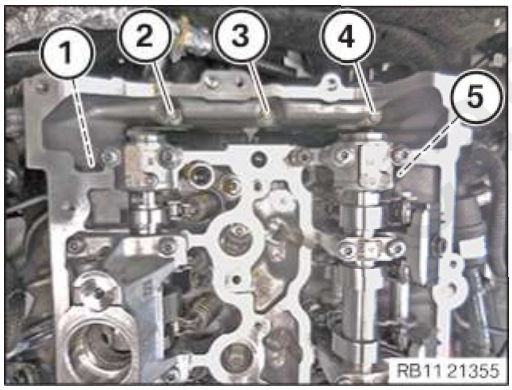
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °



- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

Cylinder head bolt to timing case cover

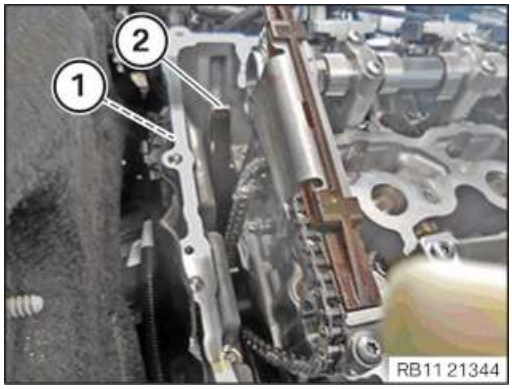
M8x40	Renew screws.	Tightening torque	19 Nm



- Renew bearing journal (1).

  Parts: Bearing journal

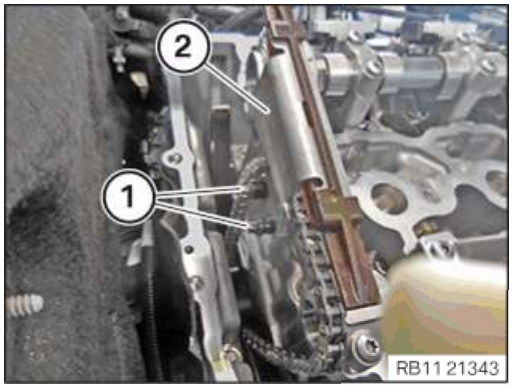
tdiagn.com



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

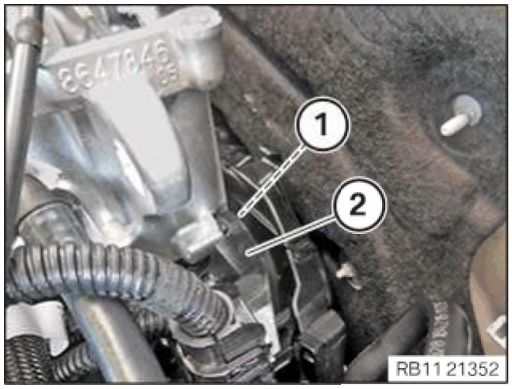
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

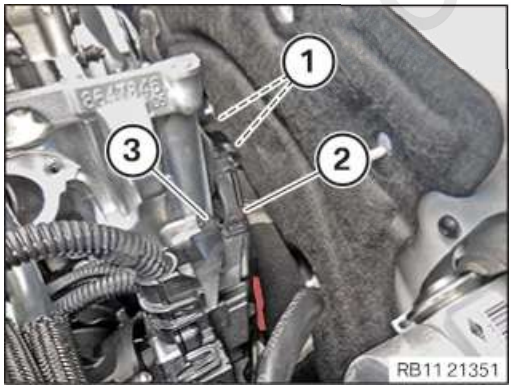
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

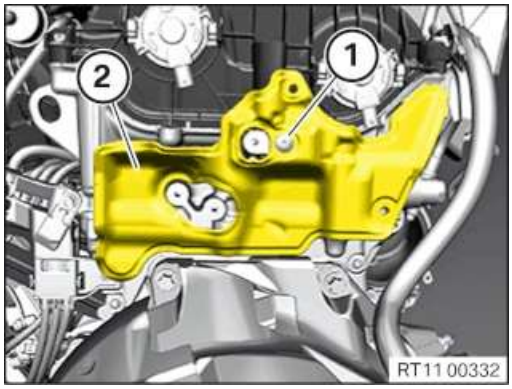
- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm

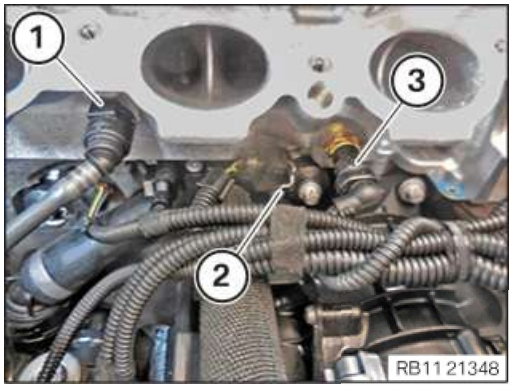
cardiagn.com



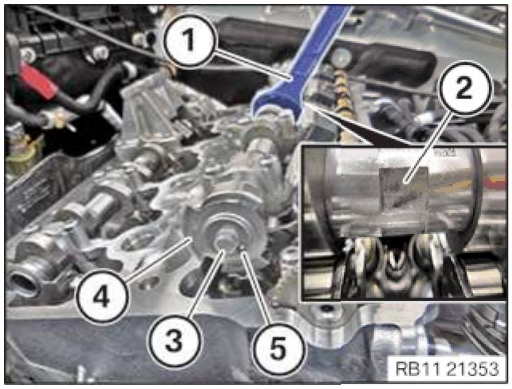
- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



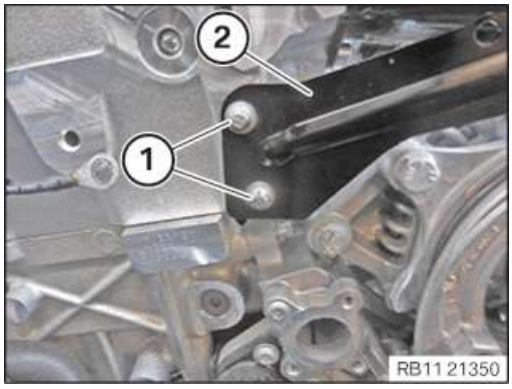
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm



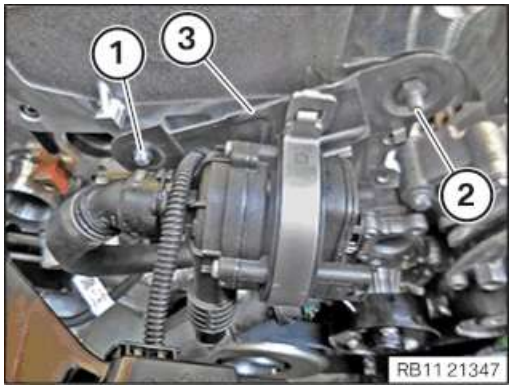
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

Holder for electrical auxiliary coolant pump on cylinder head

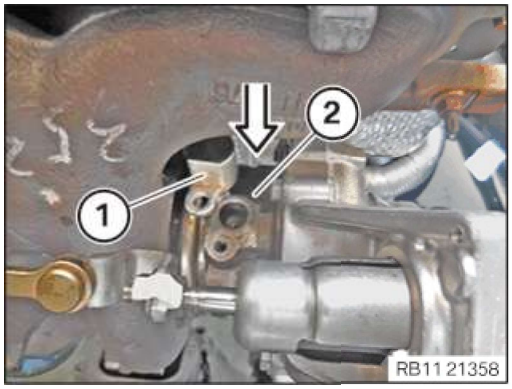
M6		Tightening torque	7 Nm



- Thread in ground cable (2) and install.
- Tighten nut (1).

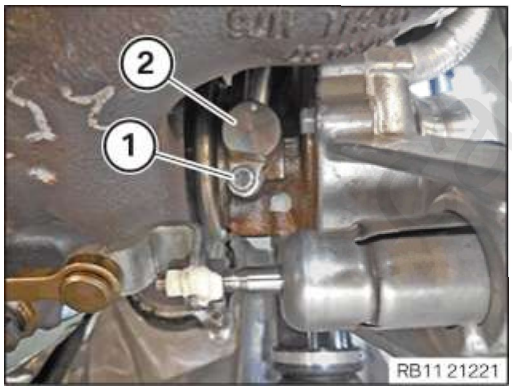
Standard screw connection M6

M6		8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

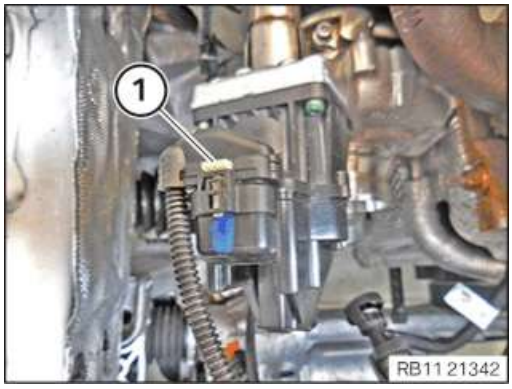
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm



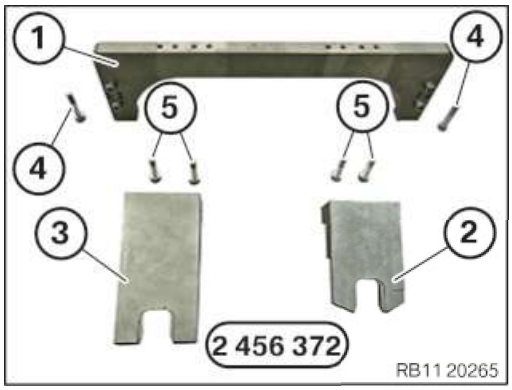
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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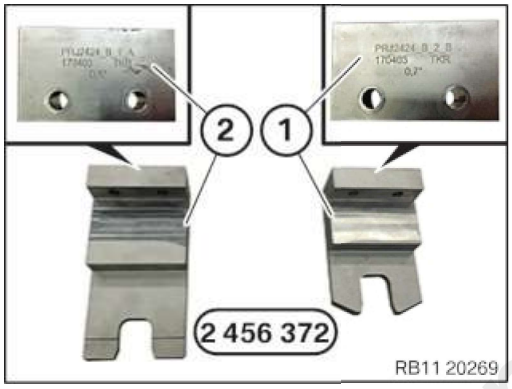
- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

60 – Adjust the camshafts with the special tool

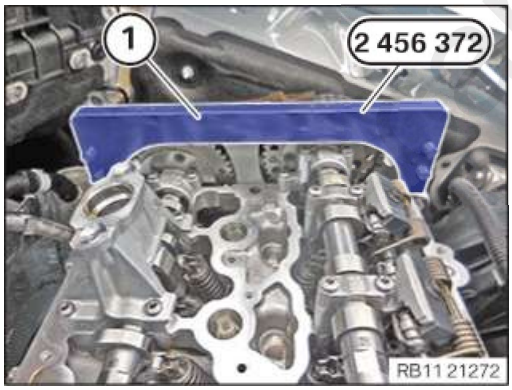


- Overview of the set of special tools 2 456 372:

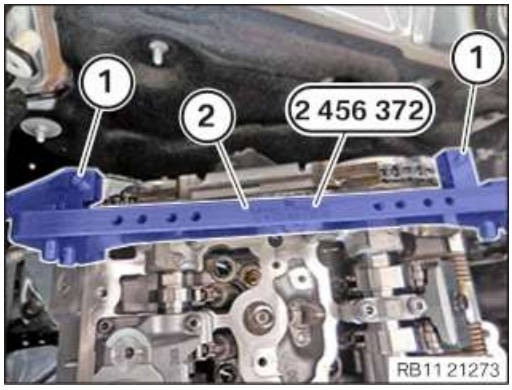
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



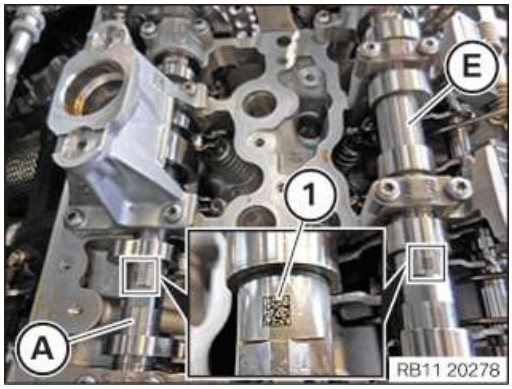
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



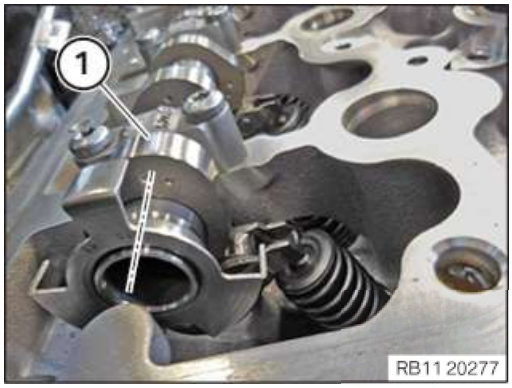
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

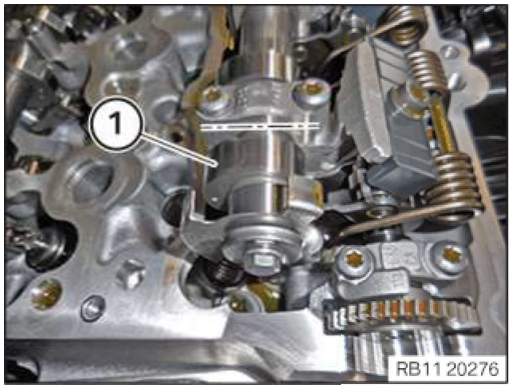
M6		Tightening torque	8 Nm



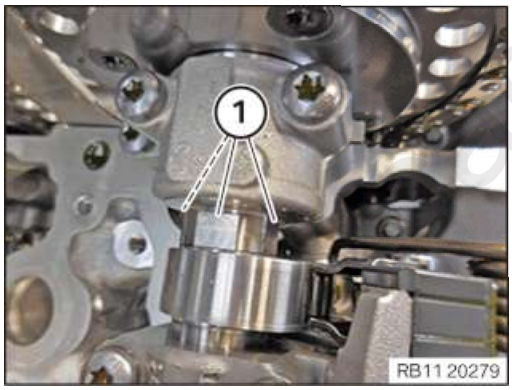
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



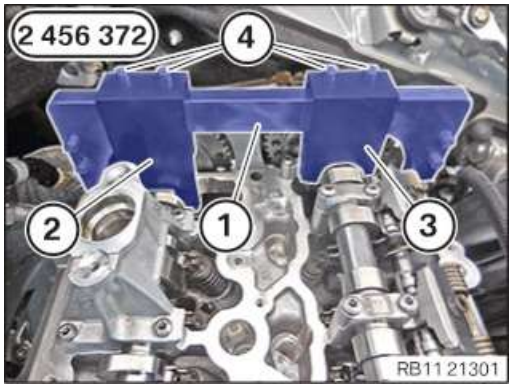
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

61 – Install exhaust camshaft adjuster

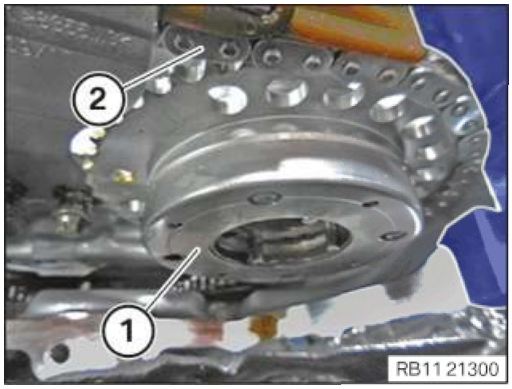
arodiagn.com

NOTICE

The figure shows the rear side of the engine.



- Keep exhaust camshaft adjuster (1) marked EX ready.



- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

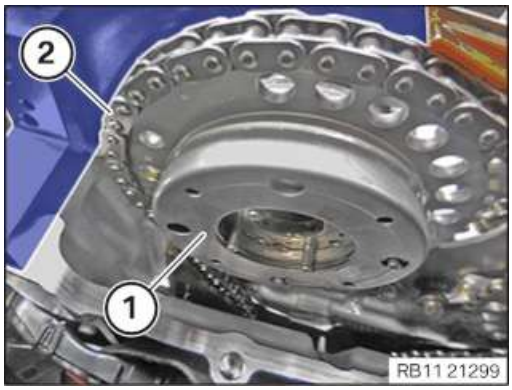
62 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.



- Keep intake adjuster (1) marked IN ready.

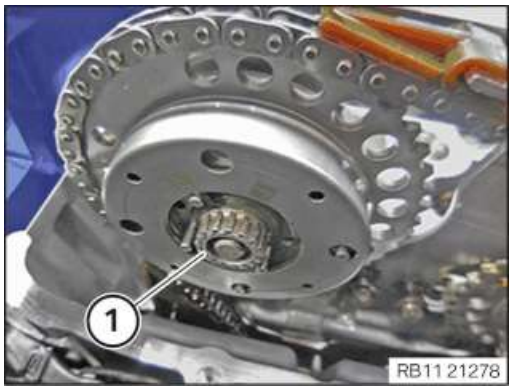


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

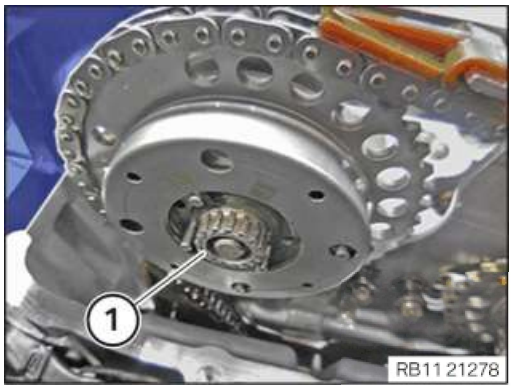
63 – Install the VANOS central valve of the intake adjuster

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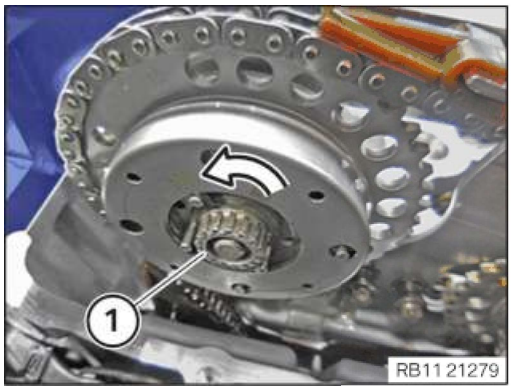
– Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.

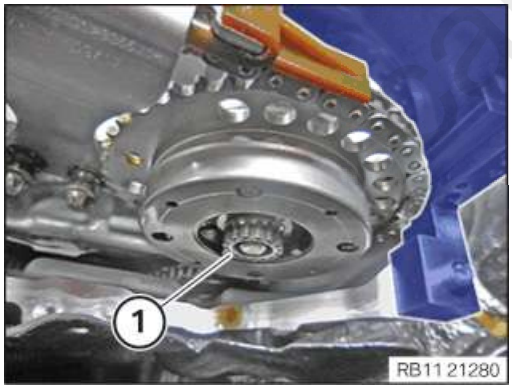


- Hand-tighten the VANOS central valve (1) of the intake adjuster.

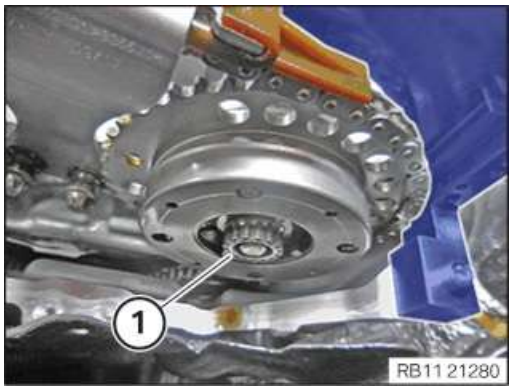


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

64 – Installing the VANOS central valve of the exhaust camshaft adjuster

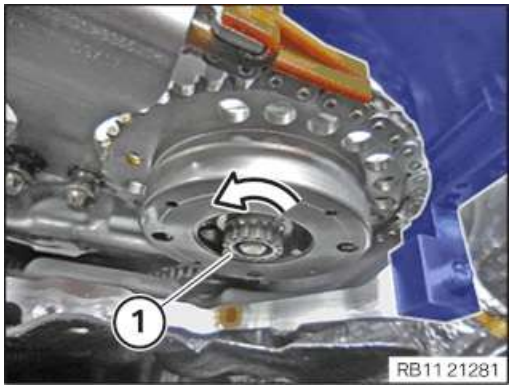


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



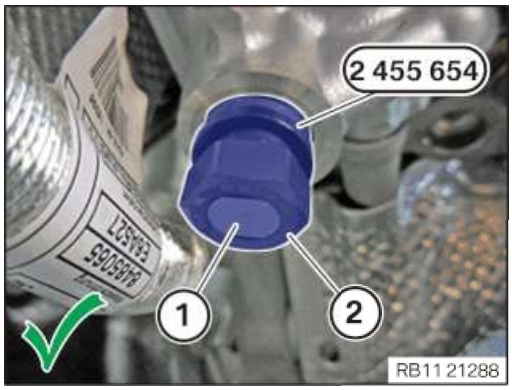
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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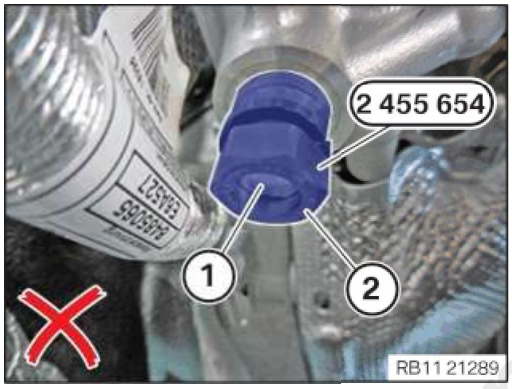
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

65 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

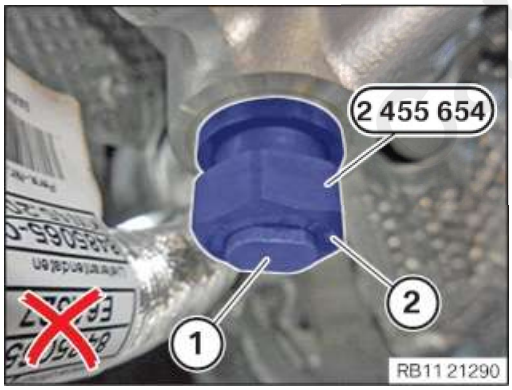
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

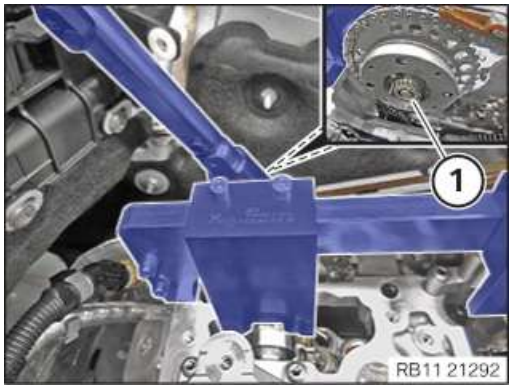
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

66 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

67 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

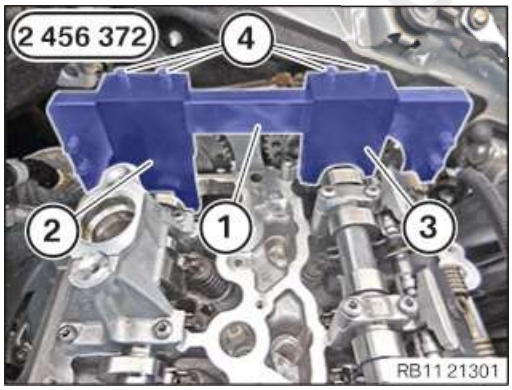


- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

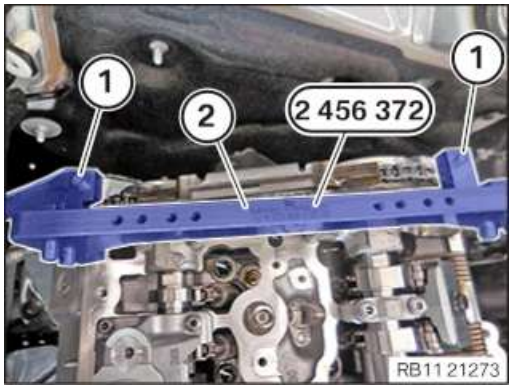
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

68 – Disassembling all special tools

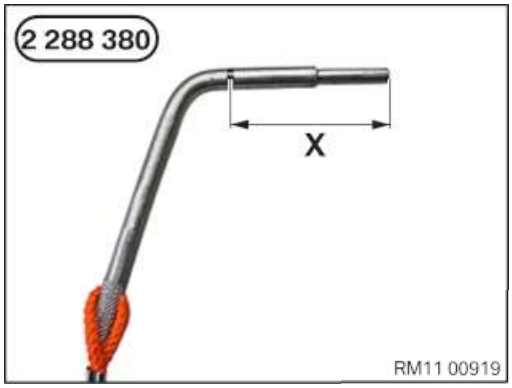


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

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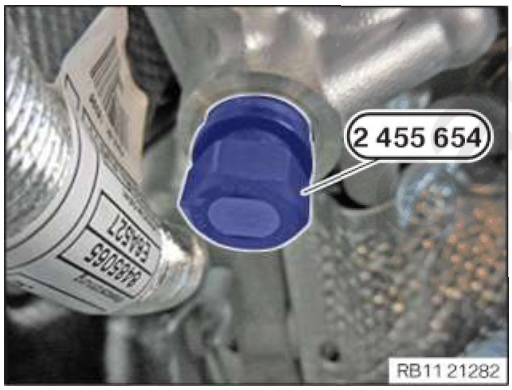
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

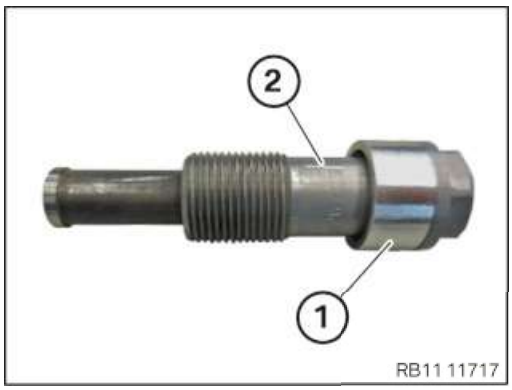
69 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

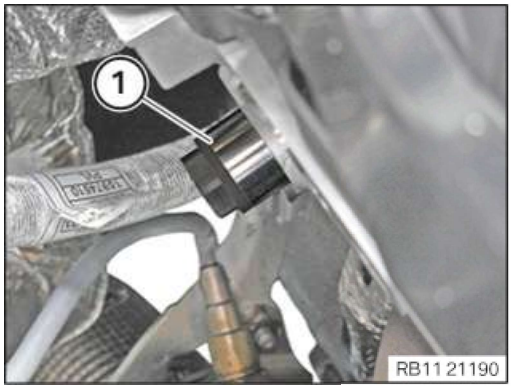


- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

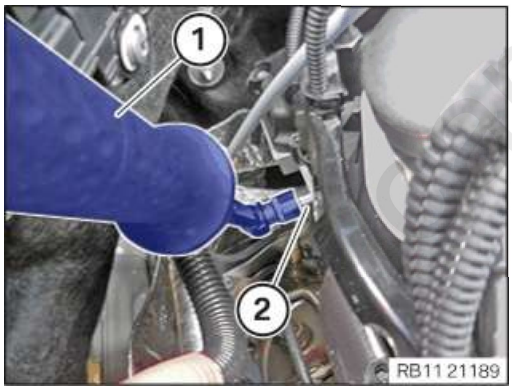


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

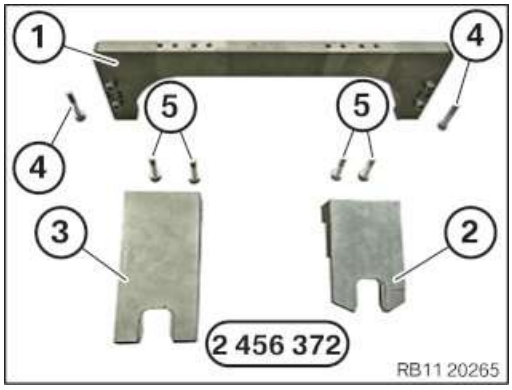


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

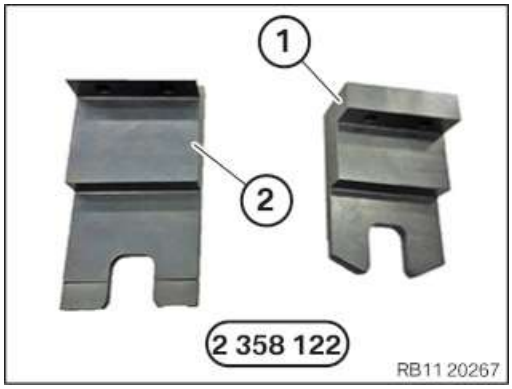
70 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

carjdiagn.com



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



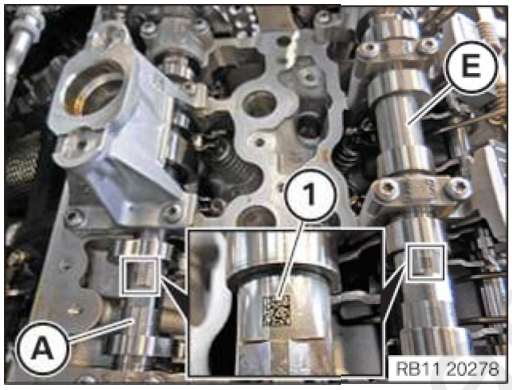
RISK OF DAMAGE

Damage to the engine.

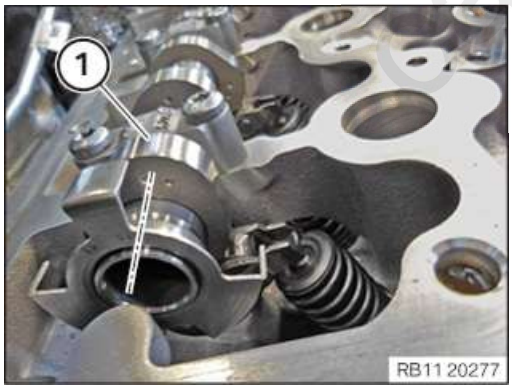
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

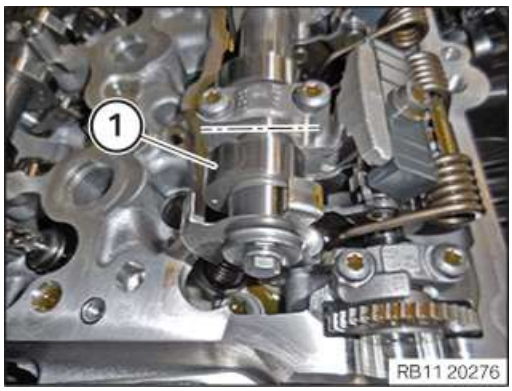
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



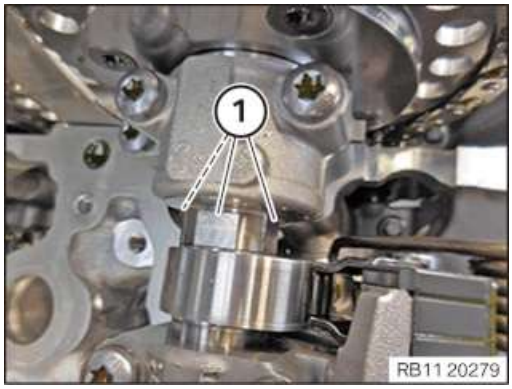
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



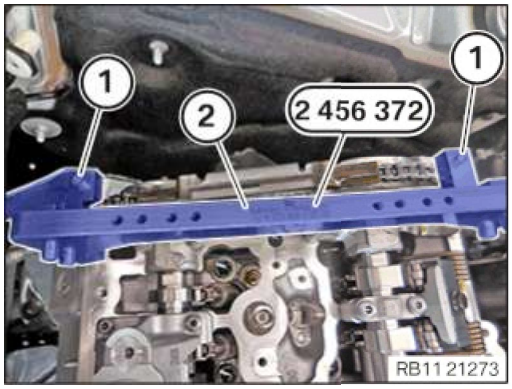
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



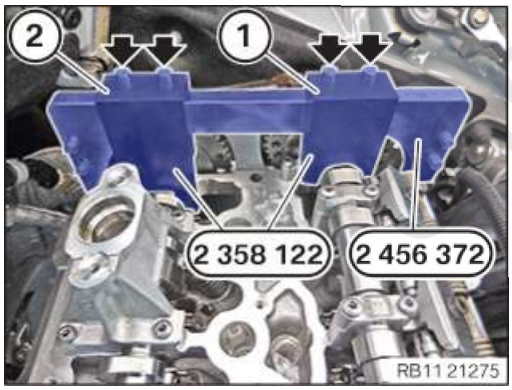
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

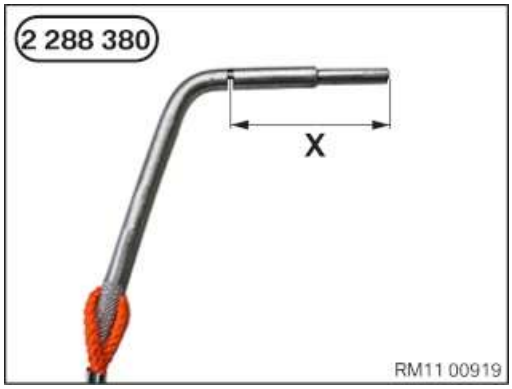
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

rdiagn.com



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

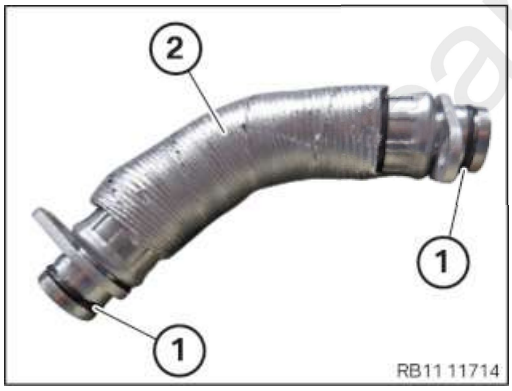


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

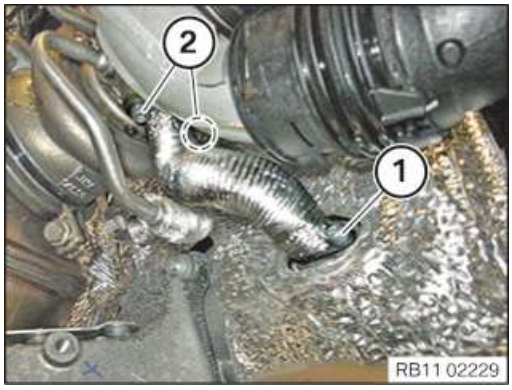
  The engine **is in the** TDC firing position of cylinder 1.

71 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

Oil return line to exhaust turbocharger/crankcase

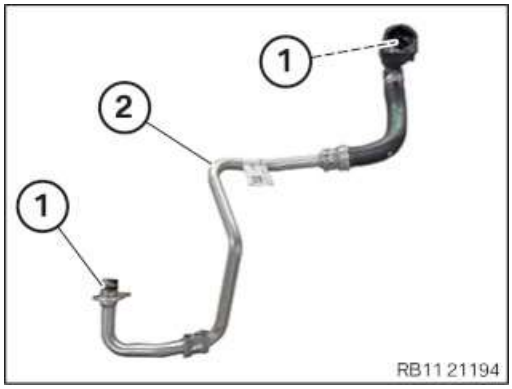
M6x14		Tightening torque	8 Nm

72 – Install the coolant return line for the exhaust turbocharger

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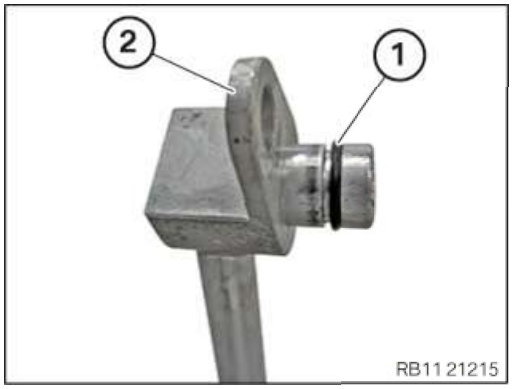
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



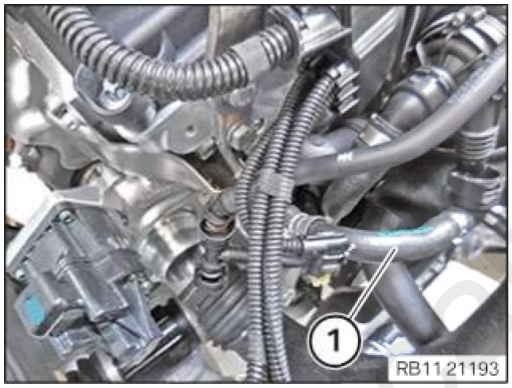
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

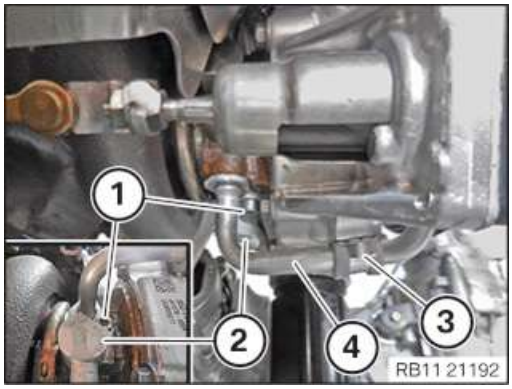
  Parts: O-ring



- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

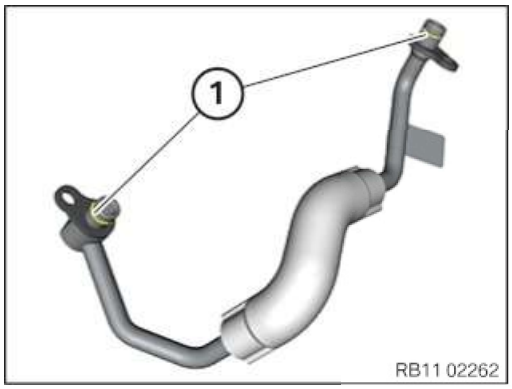
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

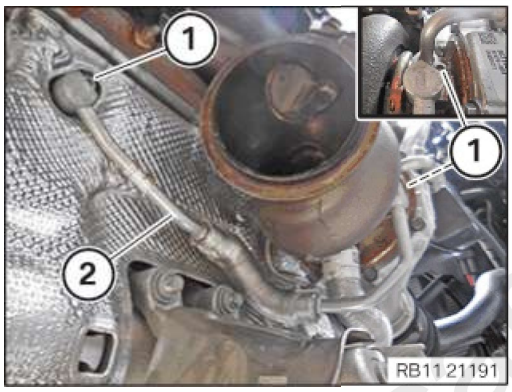
M6		Tightening torque	8 Nm

73 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

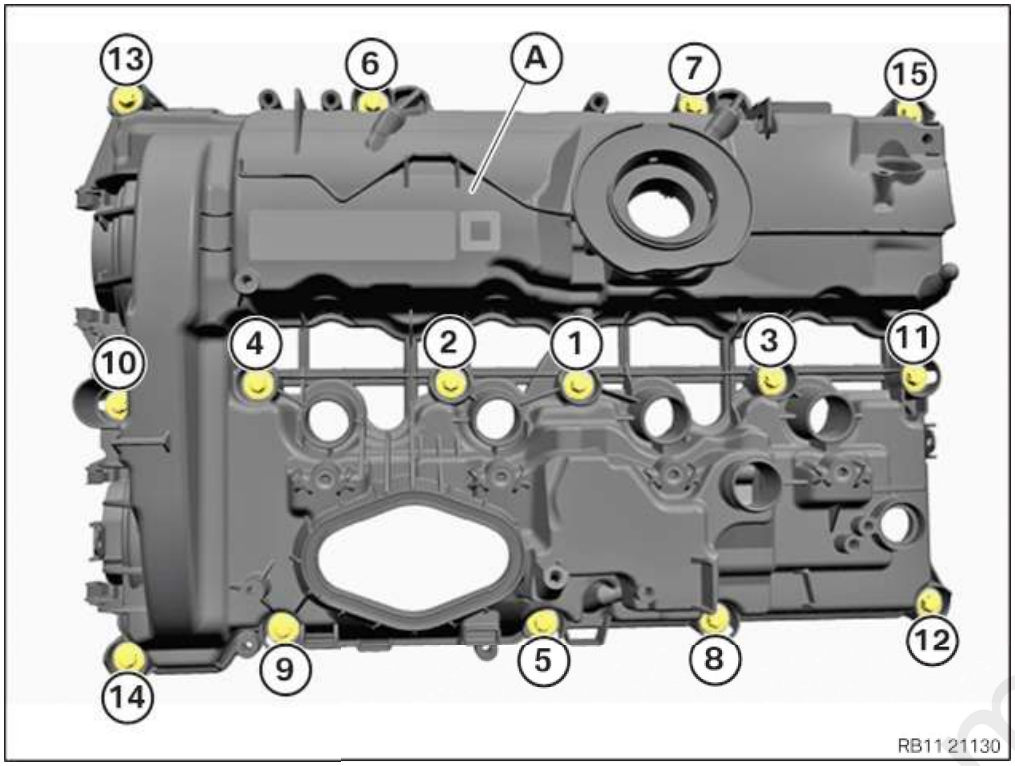
Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

74 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

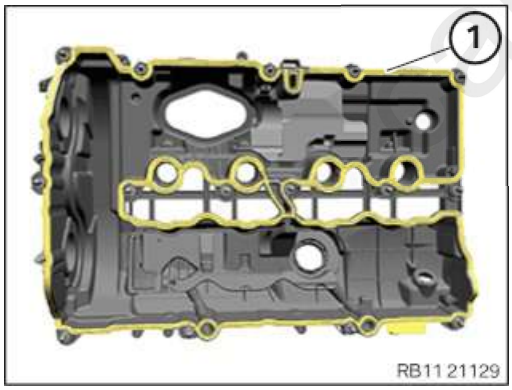
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

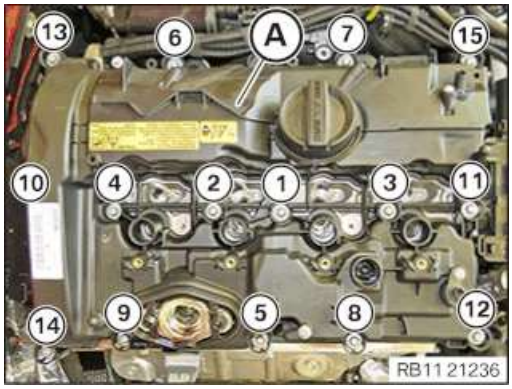
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).

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TECHNICAL INFORMATION

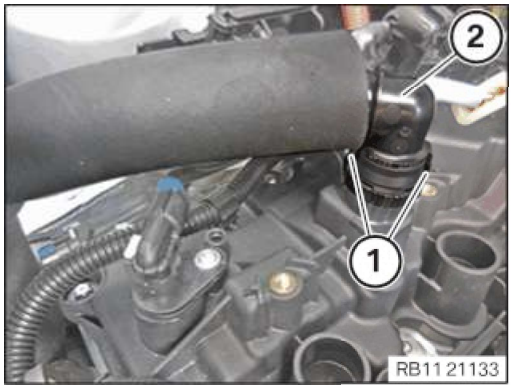
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

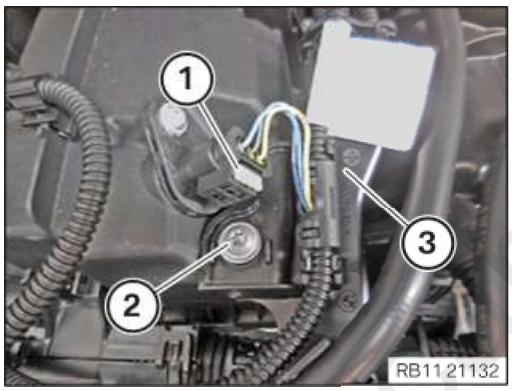
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

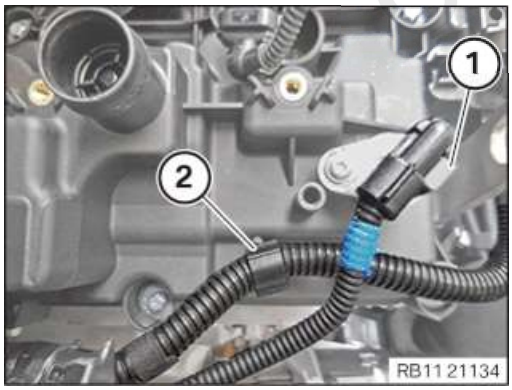


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

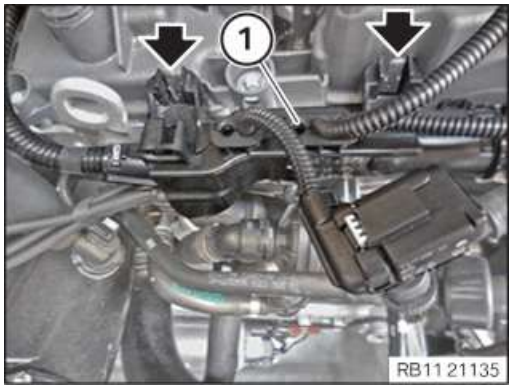
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

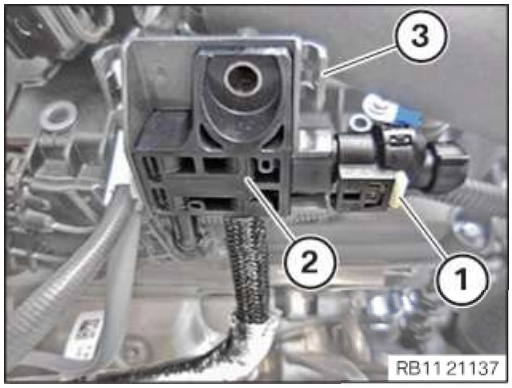


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

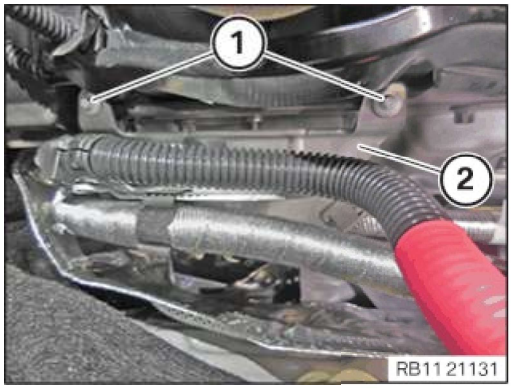
mdiagn.com



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

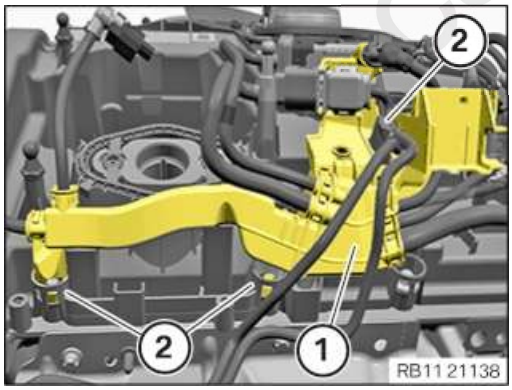
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

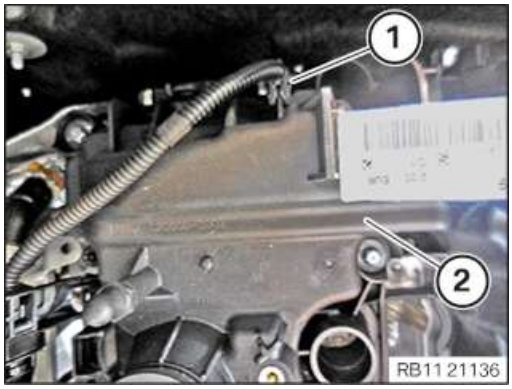
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

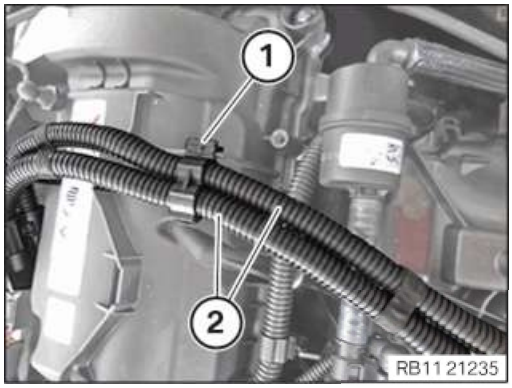


- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

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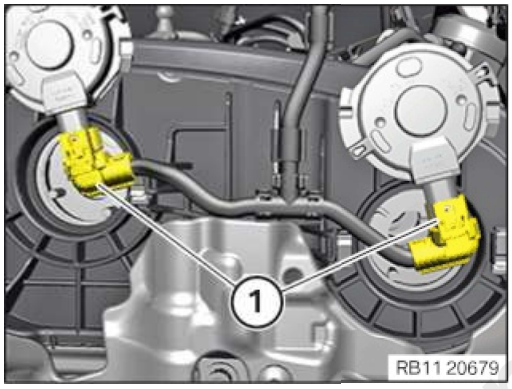


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

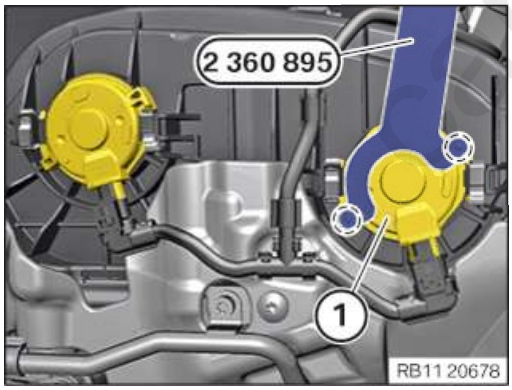
75 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

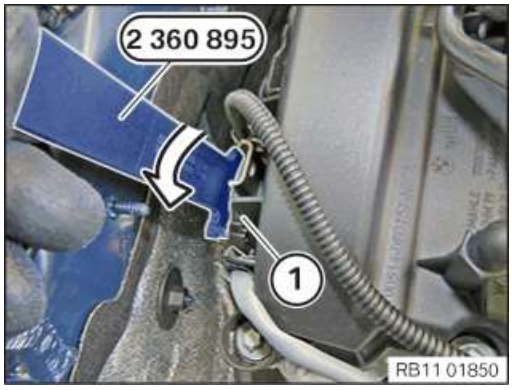
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



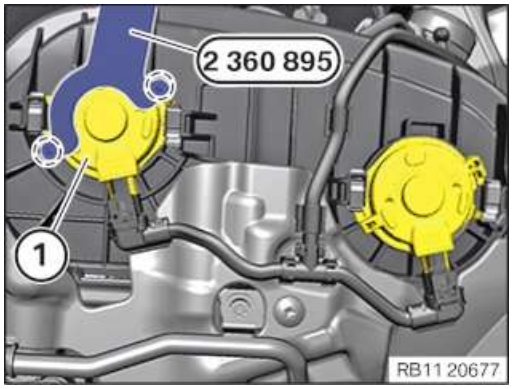
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



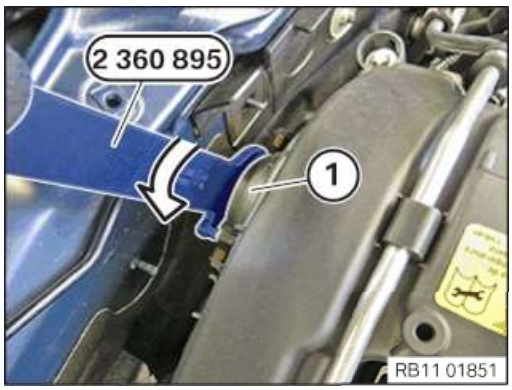
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

76 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

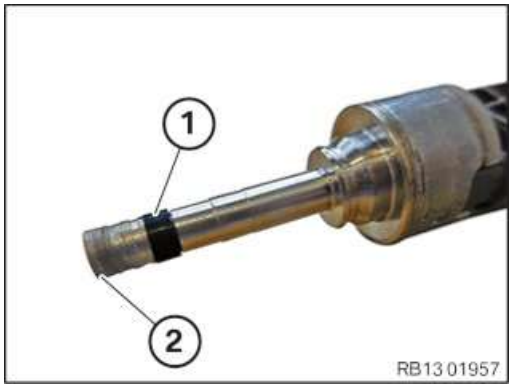
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.

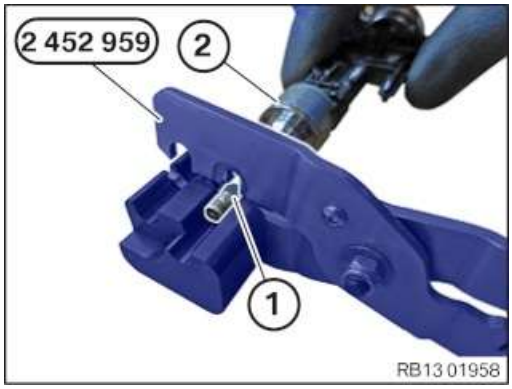


- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).

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- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

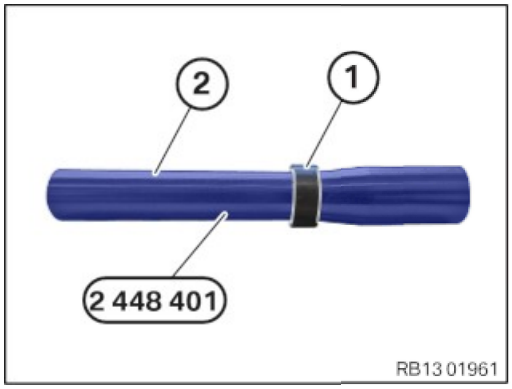


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

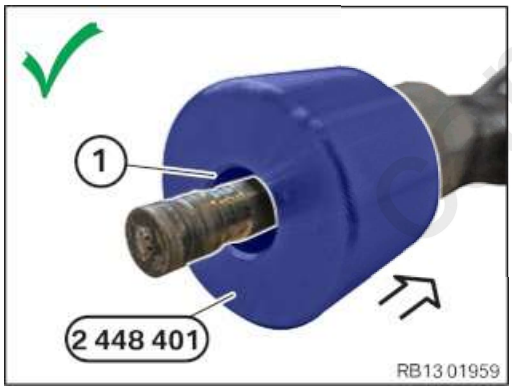
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

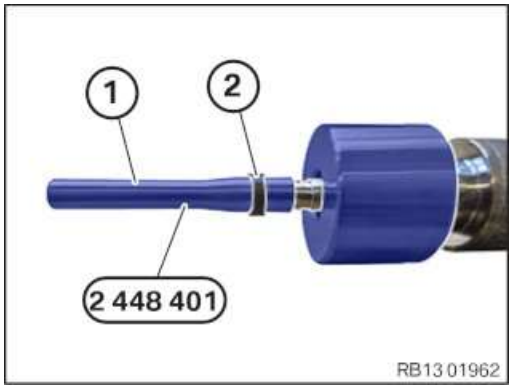
  The larger diameter of the assembly sleeve (1) must point to the injector tip.



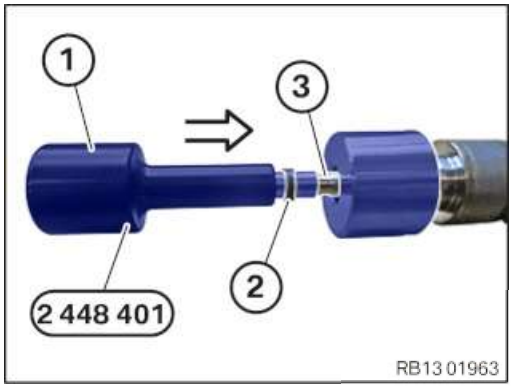
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

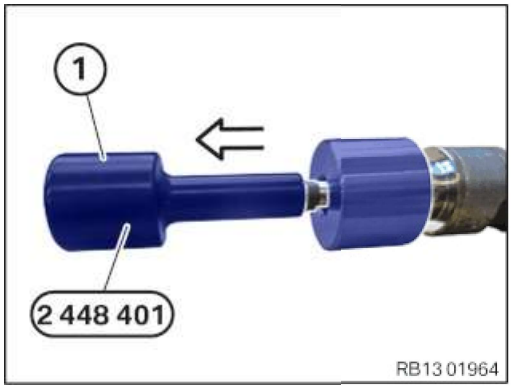
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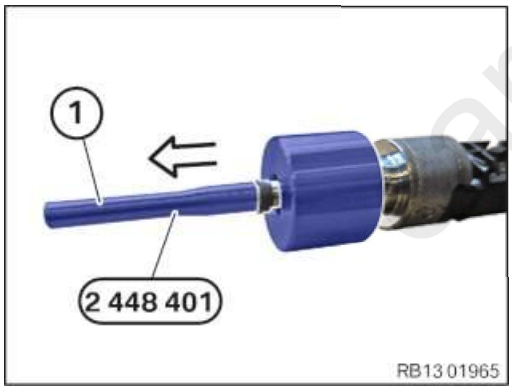
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



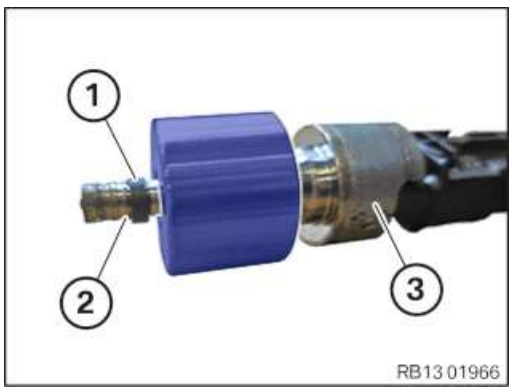
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

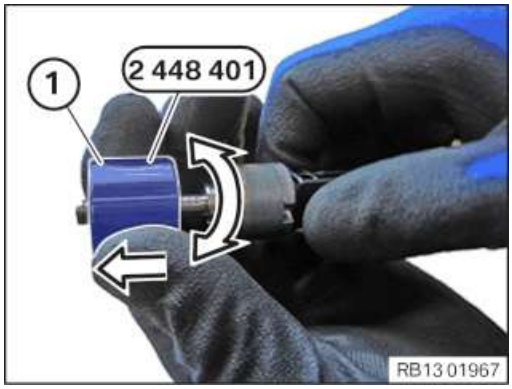


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



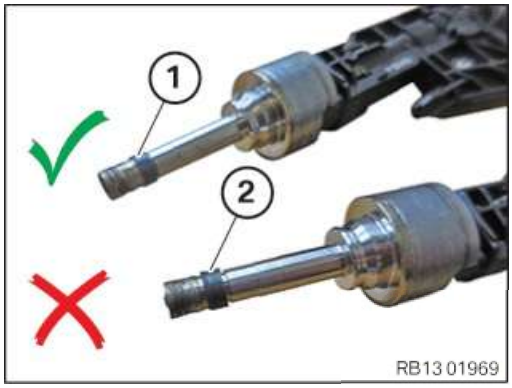
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

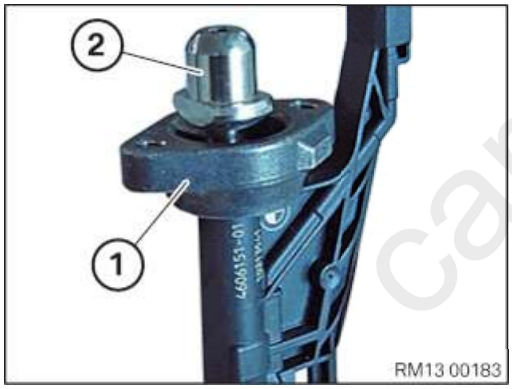


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

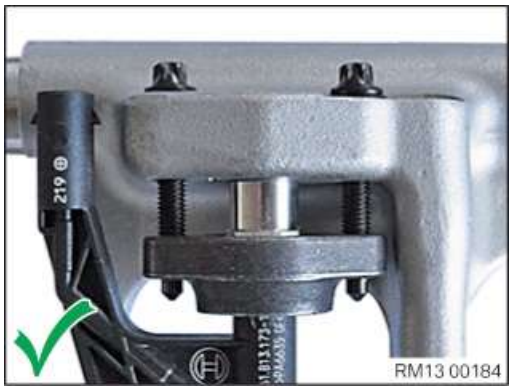
77 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



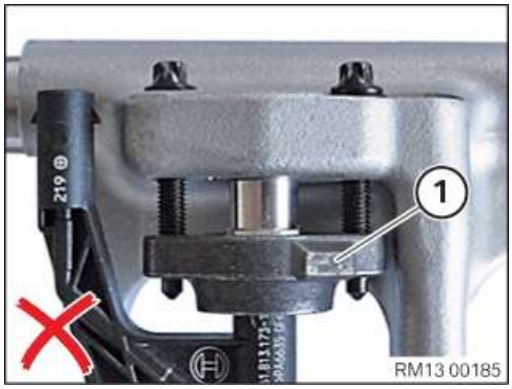
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

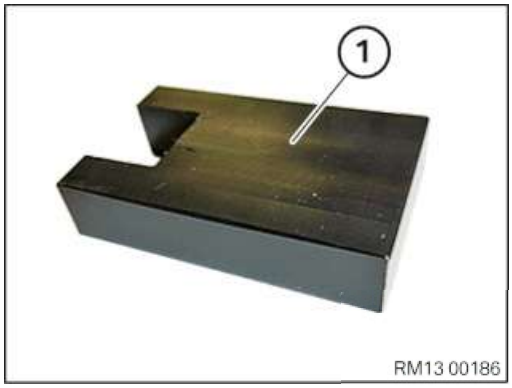
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



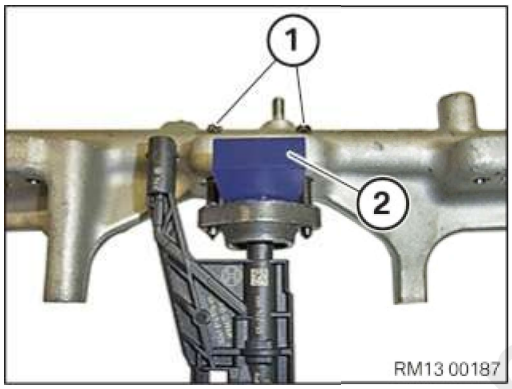
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



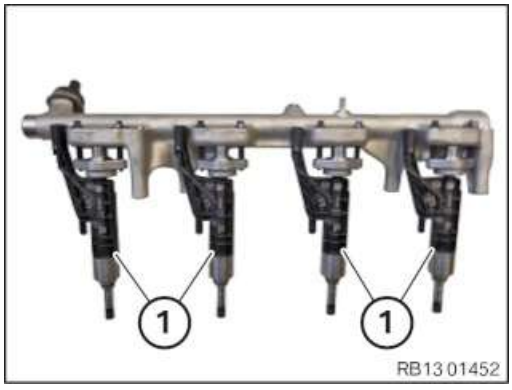
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

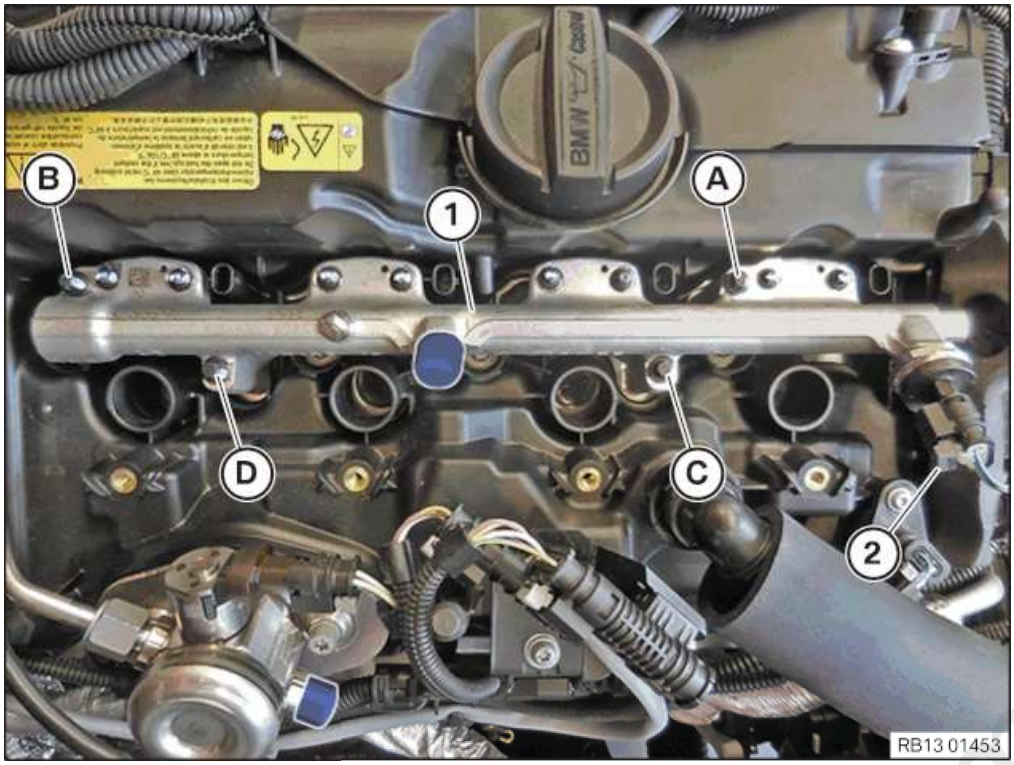


- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

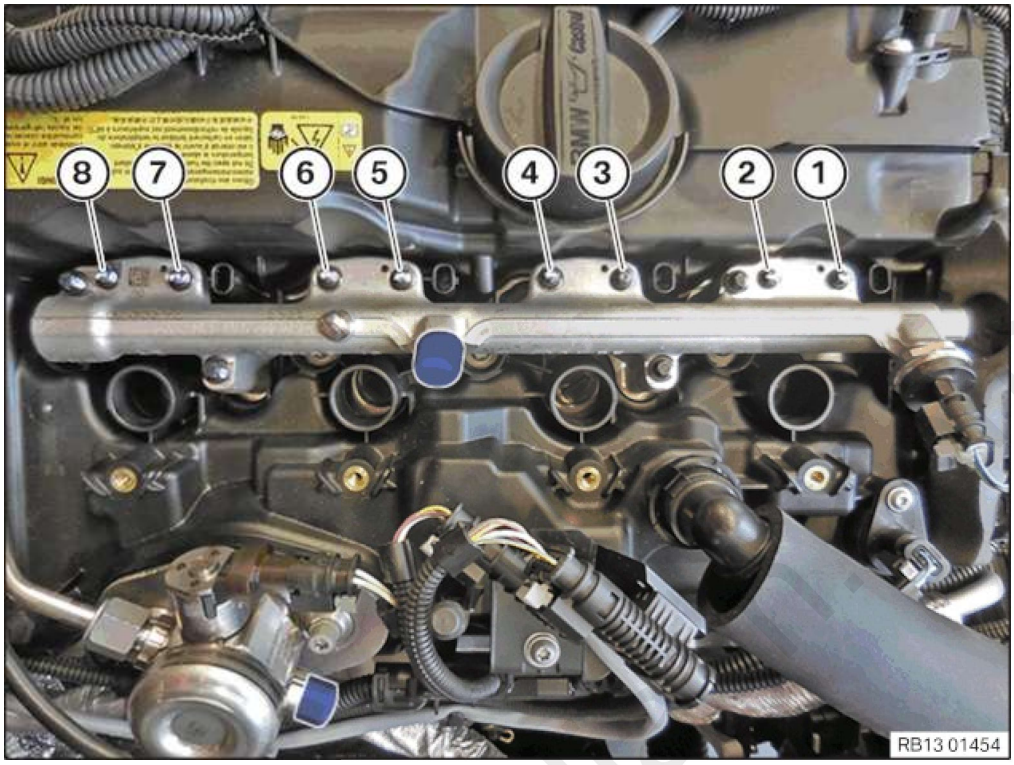
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.

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- Make sure that the rail (1) rests flat against the cylinder head.



- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

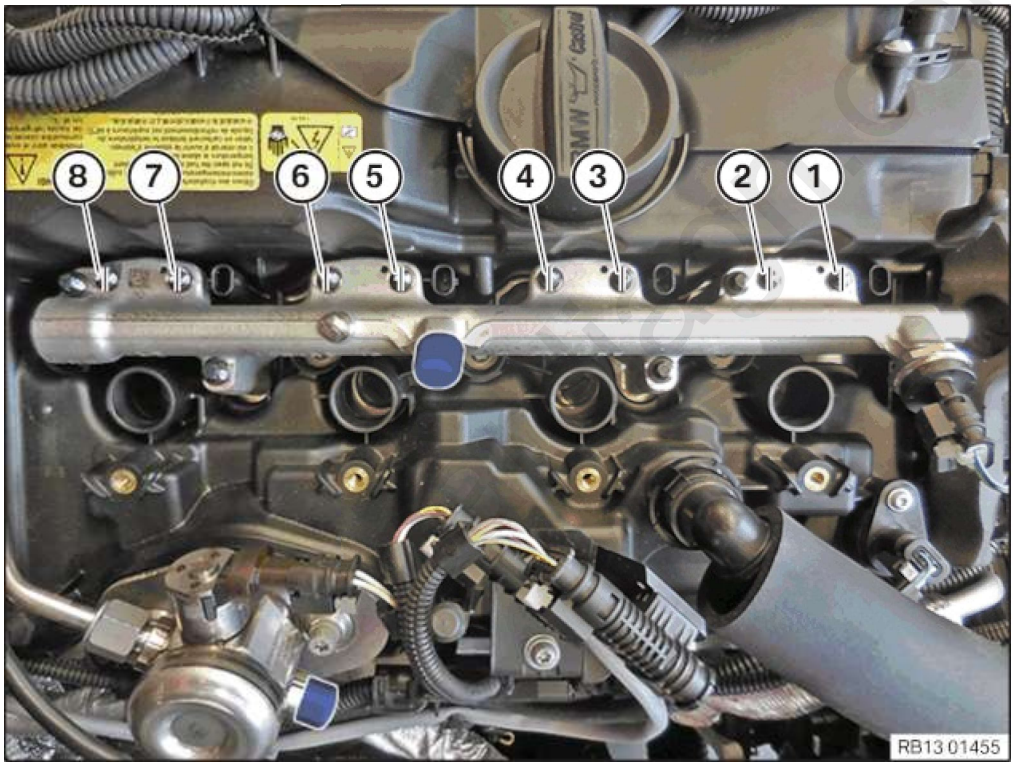
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

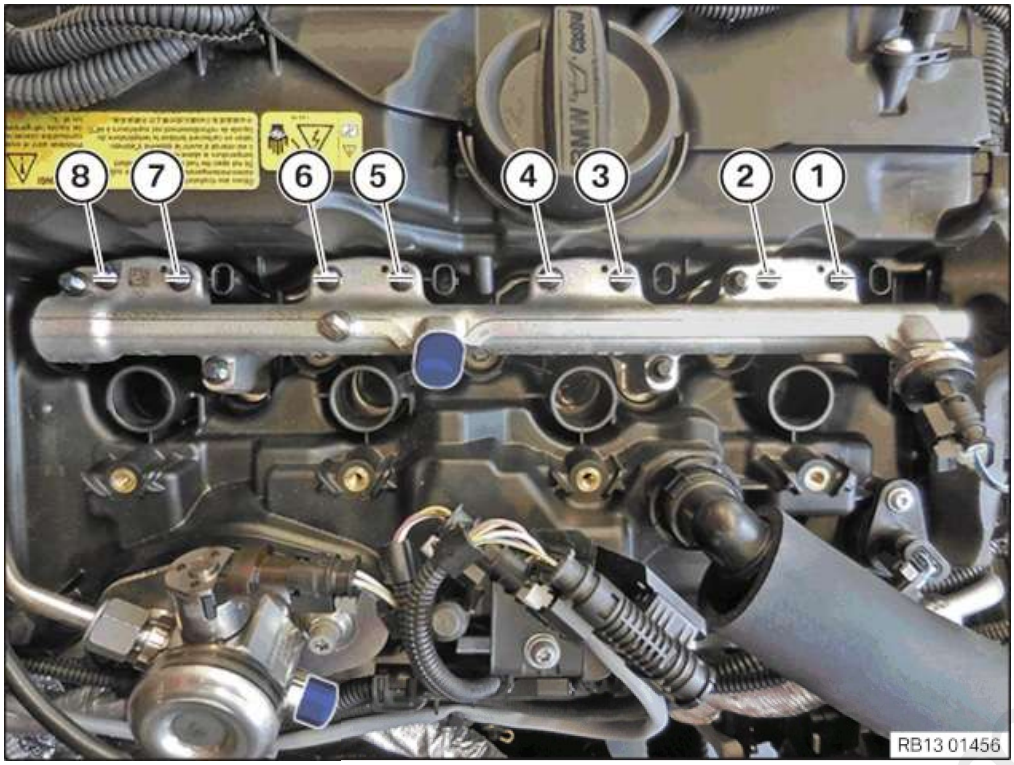
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.

- **Fuel injector 3:**
- Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
- **Fuel injector 4:**
- Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

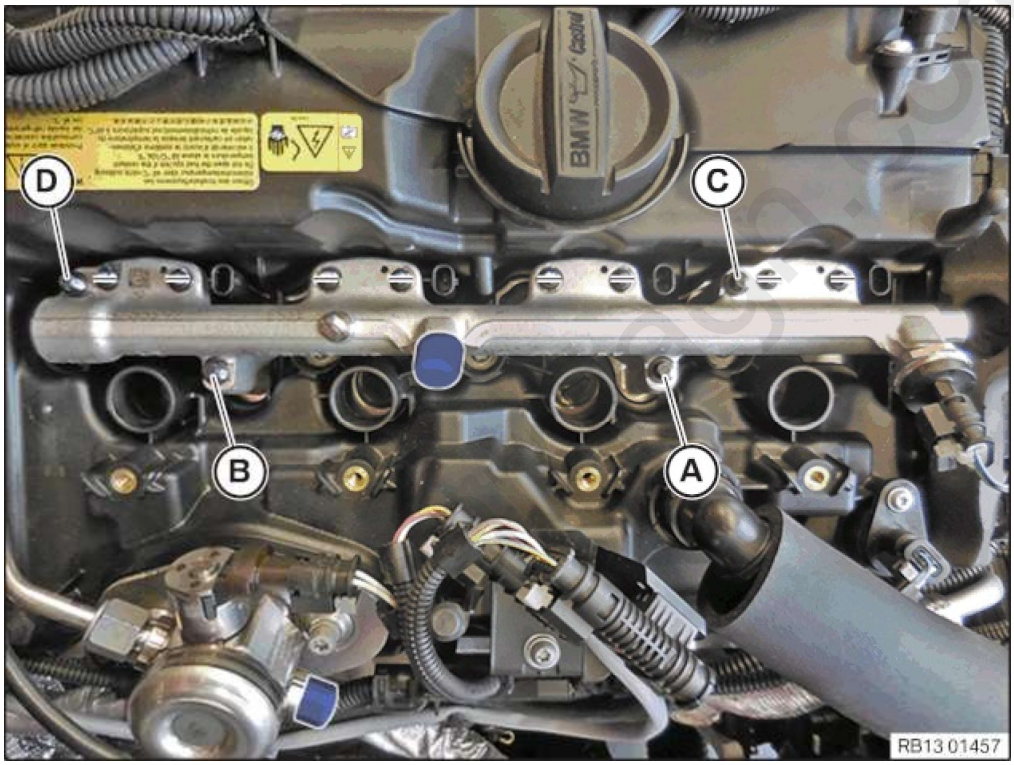


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

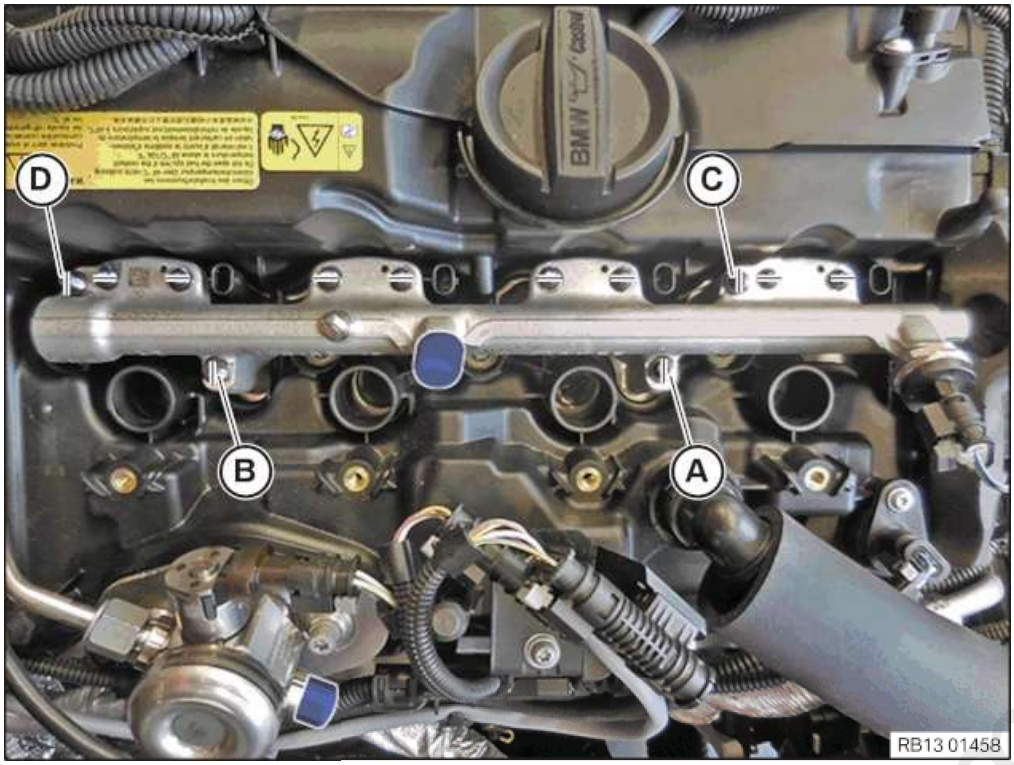
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

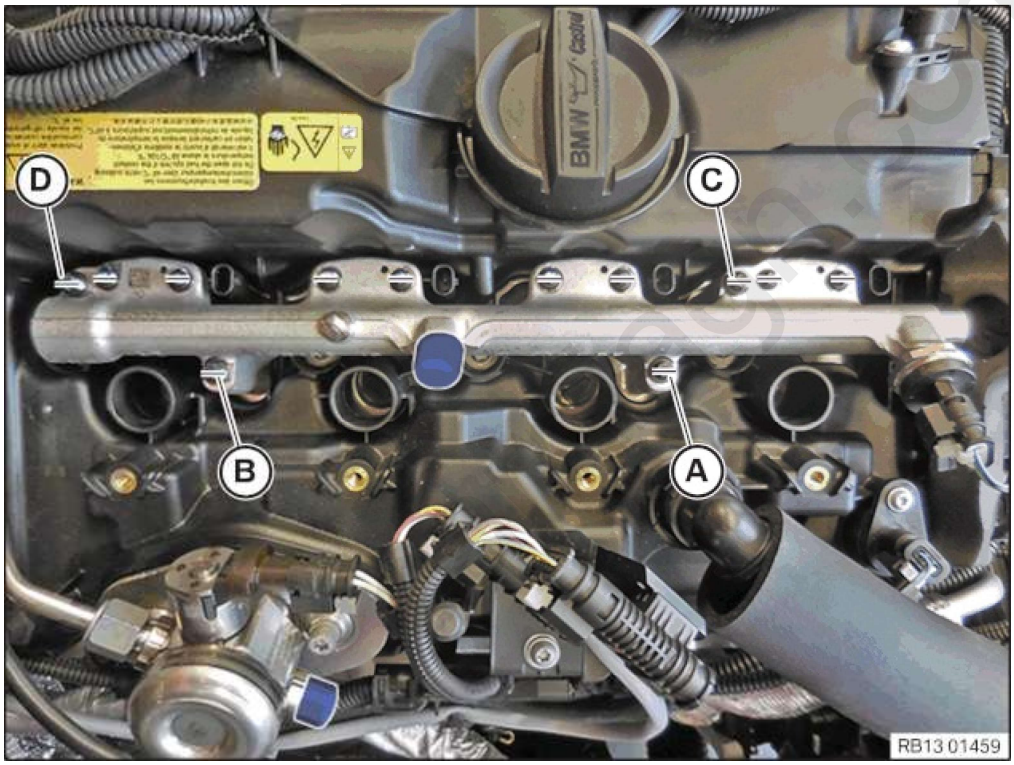
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

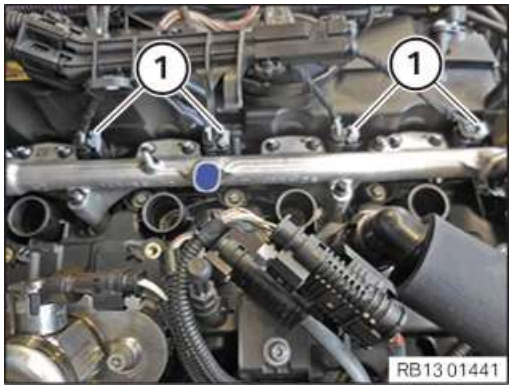


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



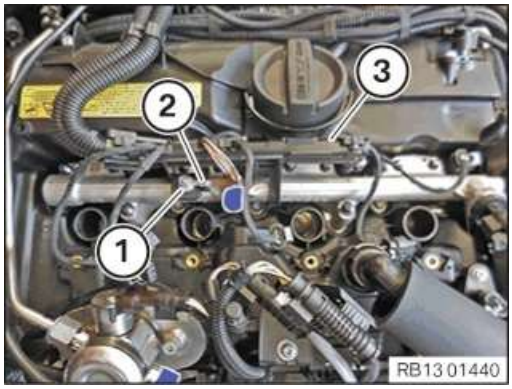
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

78 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

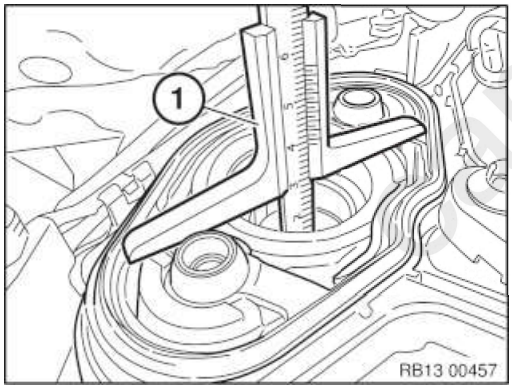
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

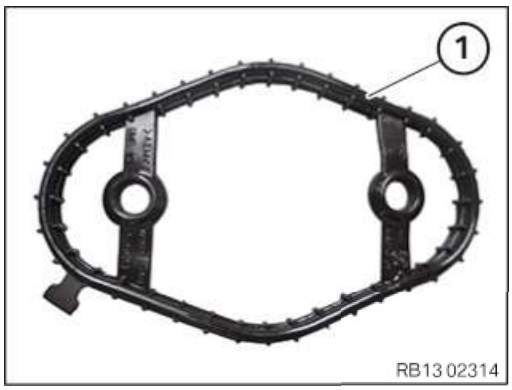
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



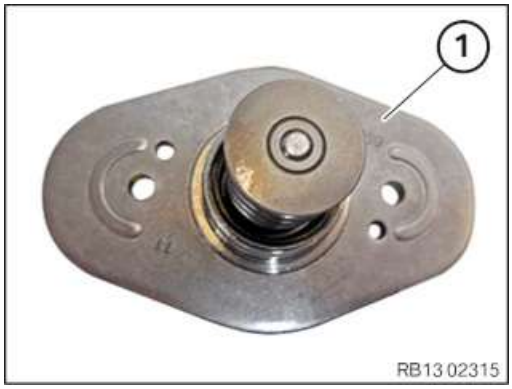
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

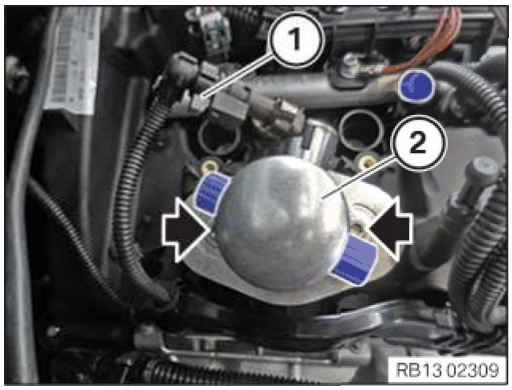
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

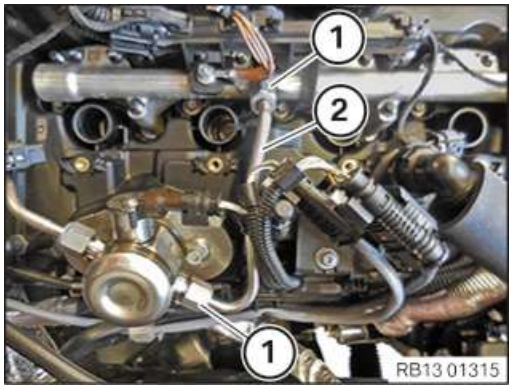
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

79 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

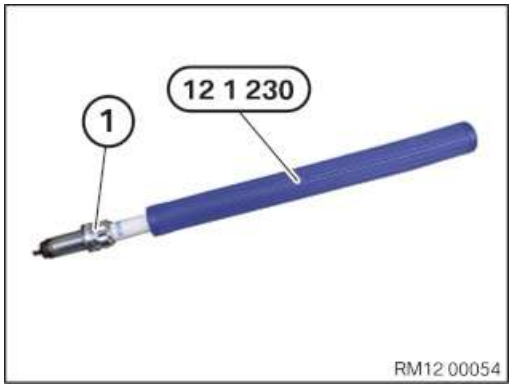
High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

80 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

M12x1.25		Tightening torque	23 Nm

81 – Installing the intake plenum

RISK OF DAMAGE

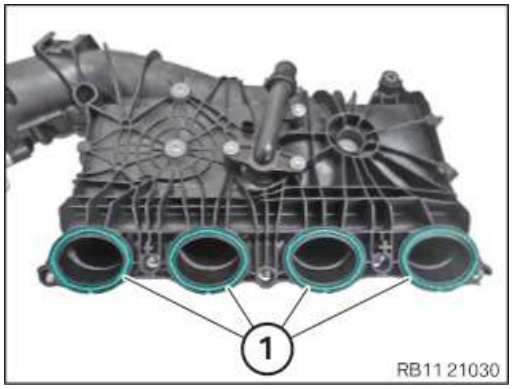
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

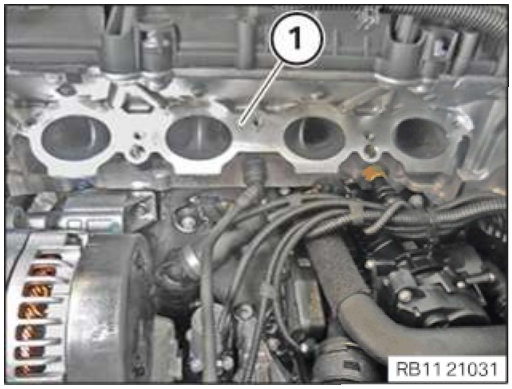
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

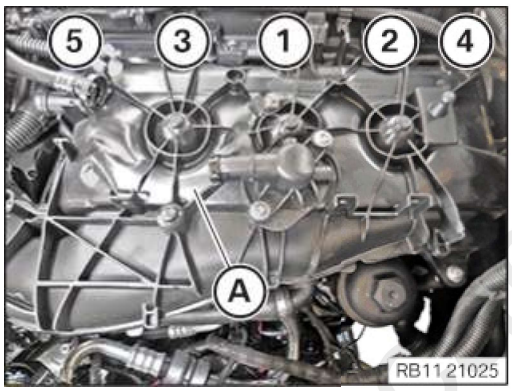


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

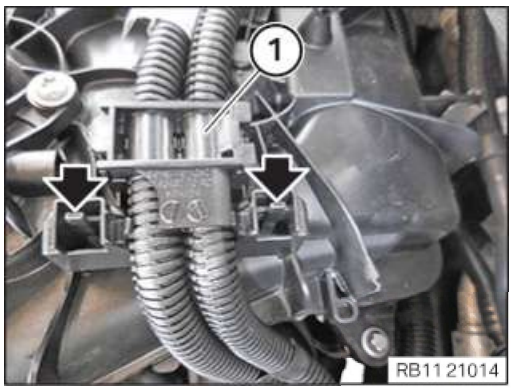
ertogen.com



- Tighten down screw (1).

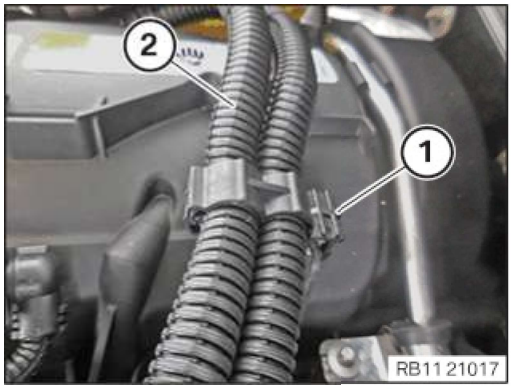
Intake plenum to support

M6X25		Tightening torque	8 Nm

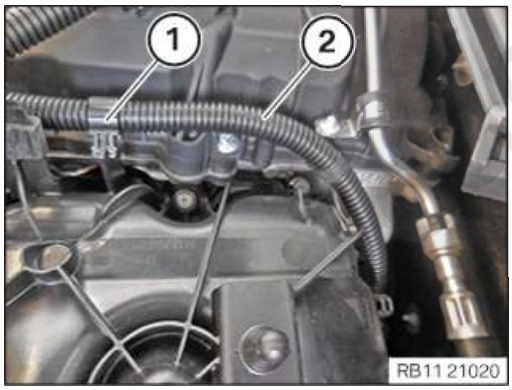


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

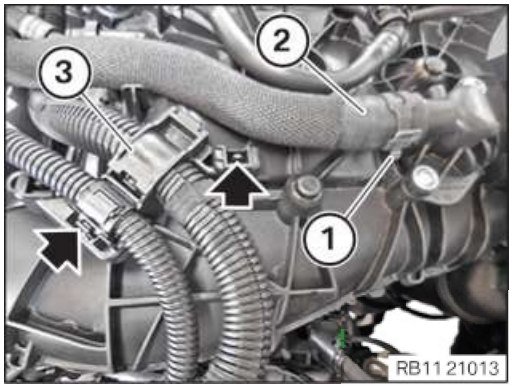
rdiagn.com



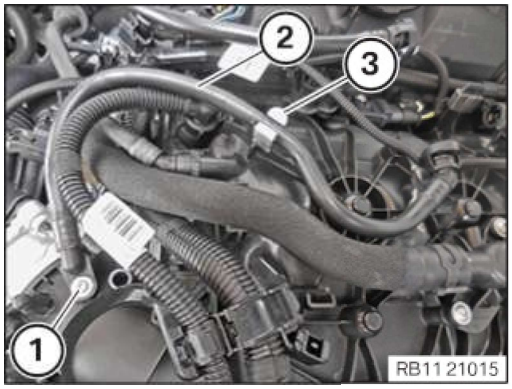
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



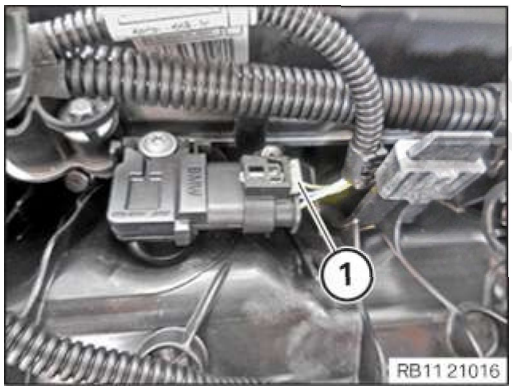
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

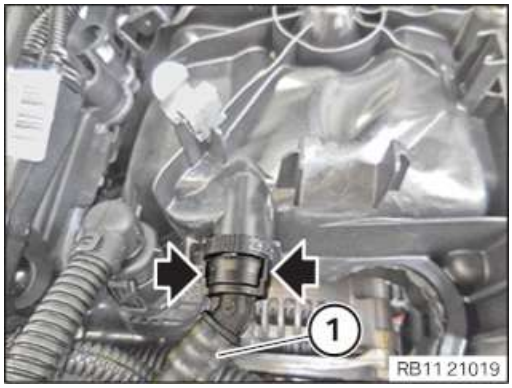
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

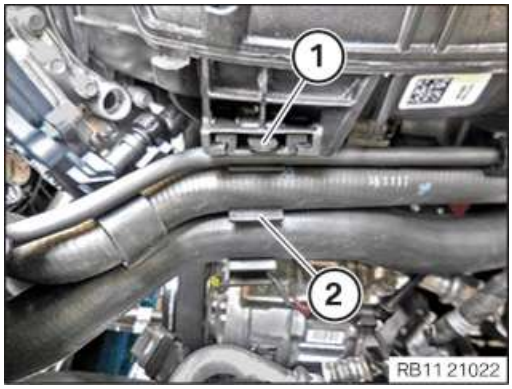
  The connector (1) must engage audibly.



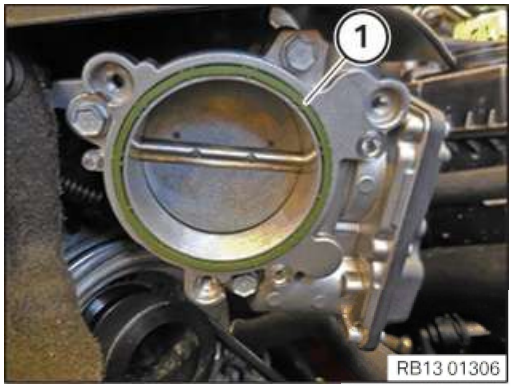
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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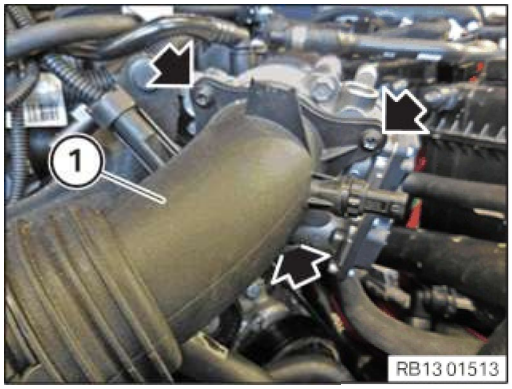


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

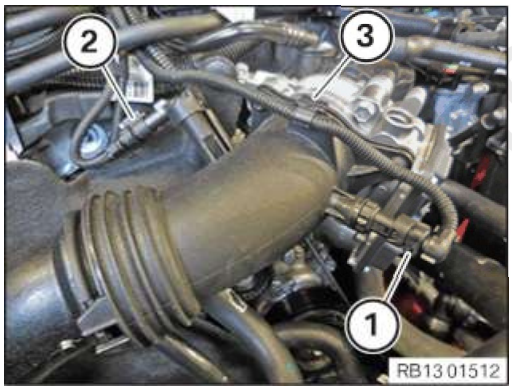
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

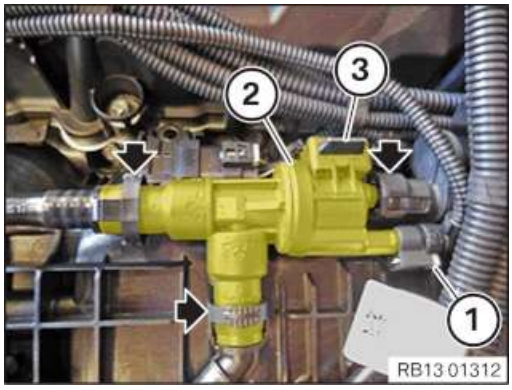
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

82 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

83 – Topping up the engine oil

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RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

TECHNICAL INFORMATION

- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

- Fill in engine oil at the oil filler neck.

Engine oil

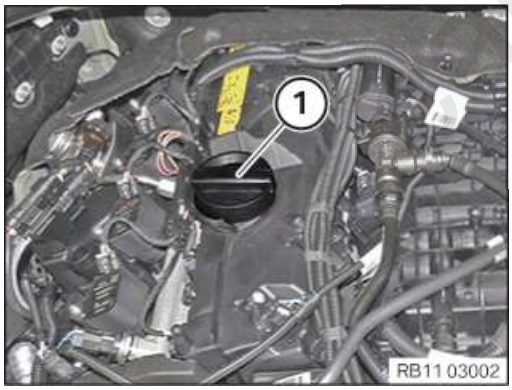
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

▸ **Installing the oil filler cap**

- Close oil filler cap (1).



84 – Remove the engine on an assembly stand

CAUTION

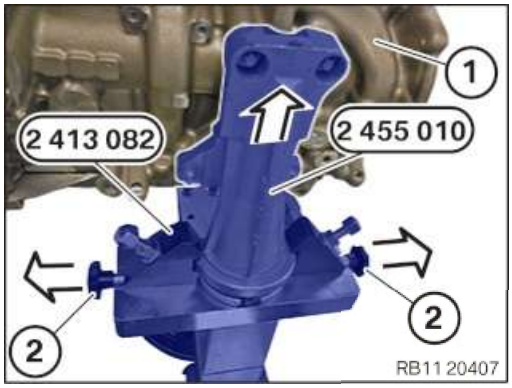
Heavy component.

Heavy components can lead to injury or damage.

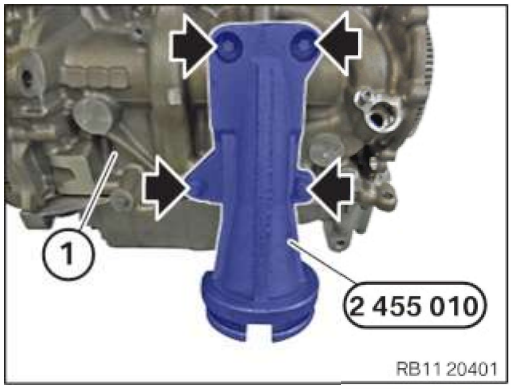
- Remove and install heavy components with the aid of another person/other persons.



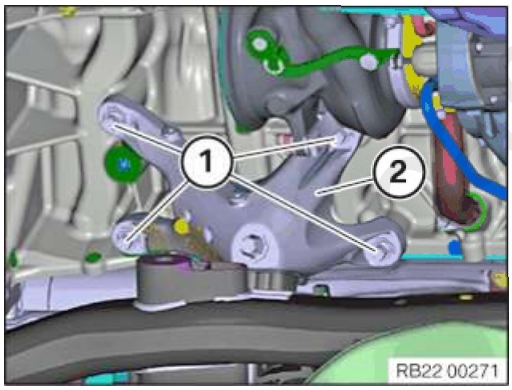
- Insert engine lifter with special tool and position engine (1).



- Unscrew the nuts on special tool .
- Detach the holder (2) in the direction of the arrow.
- Detach the engine (1) with special tool 2 455 010 out of the special tool in the direction of arrow.



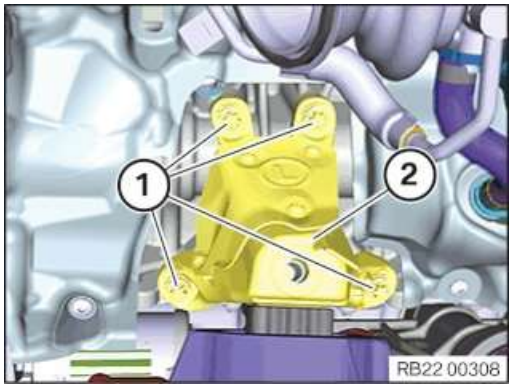
- Remove conventional screws (arrows).
- Feed out the special tool 2 455 010 on the engine (1) and remove.



- **Type: Rear-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm



- **Type: Four-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm

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- See additional information.

Additional Information

Overview of Tightening Torques

Special tool 2 455 010 to crankcase			Used in step 2
M10x30		Tightening torque	38 Nm

Special tool 11 8 930 to special tool 00 2 320			Used in step 2
M14x35		Tightening torque	160 Nm

Oil drain plug			Used in step 4
M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head			Used in step 176070
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 176070
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 26
M8		Tightening torque	21,5 Nm

Special tool 2 288 054 to crankshaft			Used in step 3740
		Tightening torque	20 Nm

Main bearing cap to crankcase			Used in step 40
M10x1.5	Renew screws.	1. Jointing torque	25 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

Gear to counterbalance shaft			Used in step 40
		1. Jointing torque	40 Nm
		2. Angle of rotation	70 °

Gear to crankcase			Used in step 40
			70 Nm

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Connecting rod bearing cap to connecting rod — Used in step 45

Renew screws.

Tighten screws crosswise.		Jointing torque	20 Nm
		1. Angle of rotation	70 °
		2. Angle of rotation	70 °

Oil deflector to crankcase — Used in step 46

M8 x 35		Renew screws.	15 Nm
			45 °

Camshaft sprocket to oil vacuum pump — Used in step 47

M8	Important - left-hand thread Renew screw.	1. Jointing torque	5 Nm
		2. Angle of rotation	90 °

Oil vacuum pump to crankcase — Used in step 48

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

Bearing journal to crankcase — Used in step 49

Bearing journal	Replace bearing journal.	Tightening torque	20 Nm

Rear timing case cover to crankcase — Used in step 50

M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °

Oil sump to crankcase — Used in step 51

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 51

M8 x 50		Tightening torque	19 Nm

Flywheel to crankshaft — Used in step 52

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

Vibration damper with belt pulley to crankshaft — Used in step 53

M10x65	Renew screws. Tighten screws crosswise.	1. Jointing torque	40 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

Battery positive lead to starter — Used in step 54

M8		Tightening torque	13,5 Nm

Cylinder head to crankcase — Used in step 59

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

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Cylinder head bolt to timing case cover — Used in step 59

M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head — Used in step 59

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head — Used in step 59

M6x16			8 Nm

Cable routing to cylinder head, rear — Used in step 59

M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head — Used in step 59

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 59

M6x16		Tightening torque	8 Nm

Manifold support for intake air to cylinder head — Used in step 59

M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head — Used in step 59

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 59

M6			8 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 59

M6x12		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 6667

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 69

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Oil return line to exhaust turbocharger/crankcase — Used in step 71

M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger — Used in step 7273

M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger — Used in step 72

M6		Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 73

M6 x 12		Tightening torque	8 Nm

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Cylinder head cover to cylinder head — Used in step 74

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 74

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 74

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 77

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 78

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 79

M14		Tightening torque	33 Nm

Spark plugs — Used in step 80

M12x1.25		Tightening torque	23 Nm

Intake plenum to cylinder head — Used in step 81

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 81

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 81

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 81

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 81

M6		Tightening torque	8 Nm

Engine support arm to engine — Used in step 84

M10		Tightening torque	38 Nm

Overview of Special Tools

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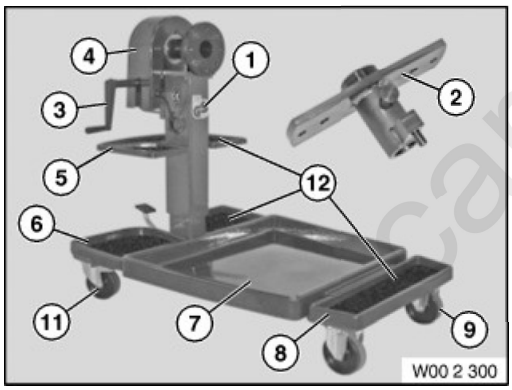
2 455 010 Engine support



Common Used in step 284

Usage	For accommodating engine on assembly stand. Engine: B3x, B4x, N47.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 495 187 (00 2 300) Assembly stand



Common Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

Consisting of

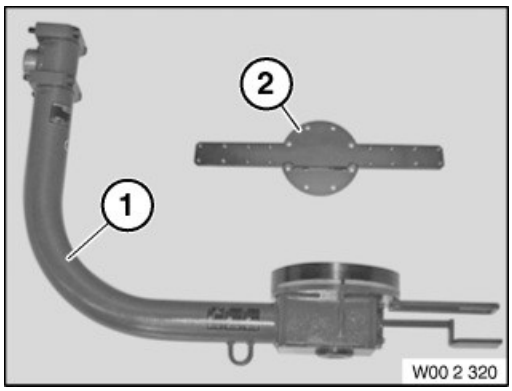
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	

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2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	
7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

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0 495 196 (00 2 320) Support arm



Common

Used in step 2

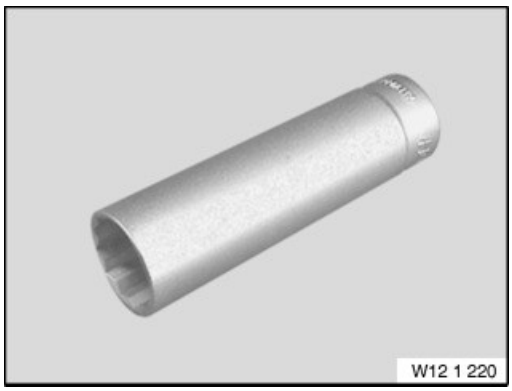
Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

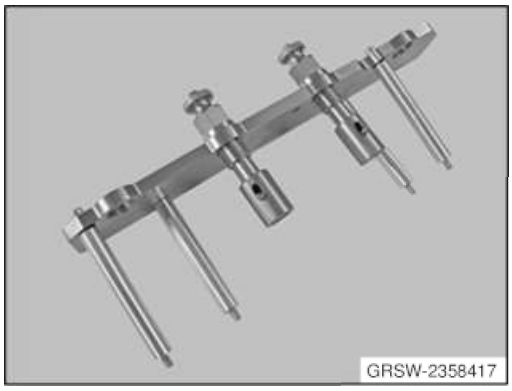
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0 495 560 (12 1 220) Socket



Common	Used in step 580
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

2 358 417 Device



Common	Used in step 8
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 8
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

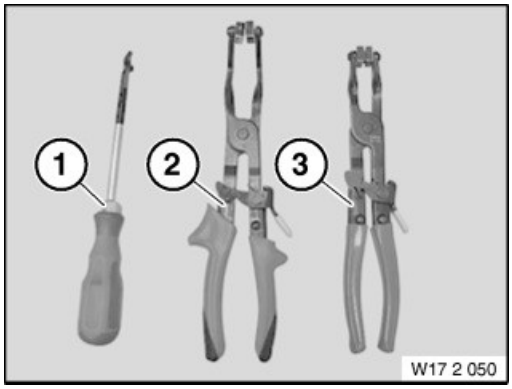
2 360 895 Pin wrench



Common	Used in step 975
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 794 (17 2 050) Pliers



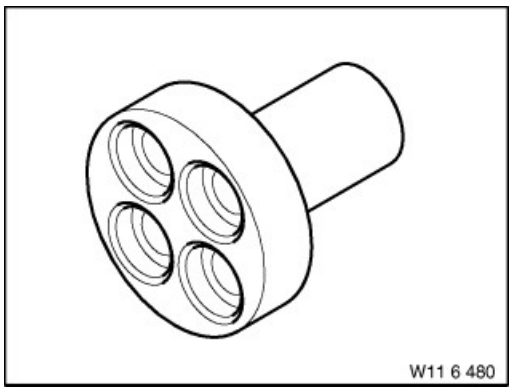
Common Used in step 1281

Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

0 493 380 (11 6 480) Connector



Common Used in step 1755687078

Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

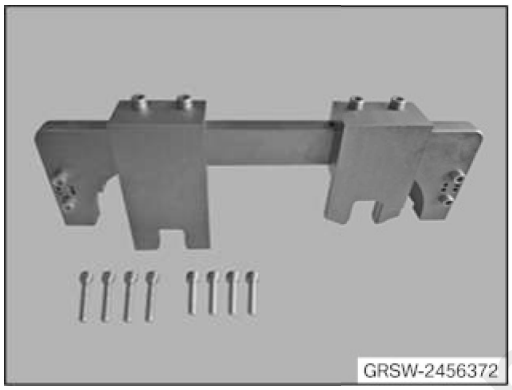
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2 288 380 Locating stud



Common	Used in step 17556870
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 1725606870
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 172570
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



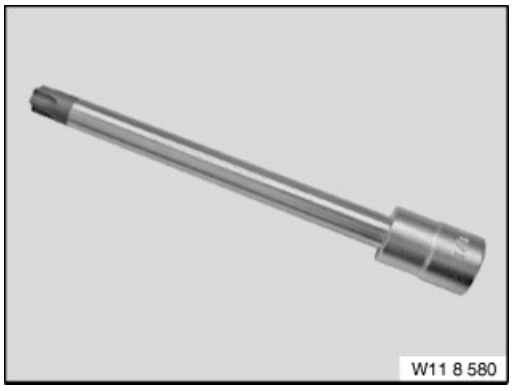
Common	Used in step 19206667
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 19206667
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

0 495 747 (11 8 580) Socket wrench



Common	Used in step 2659
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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2 220 718 Workshop crane



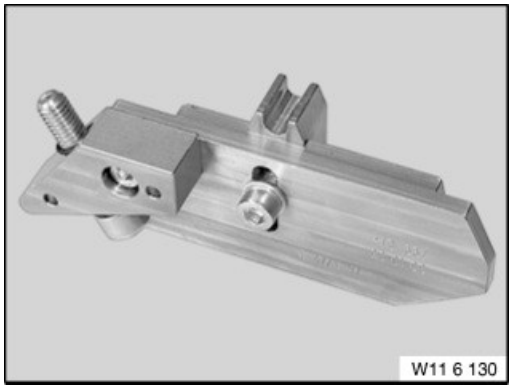
Common	Used in step 26
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

2 459 012 Holder



Common	Used in step 2659
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

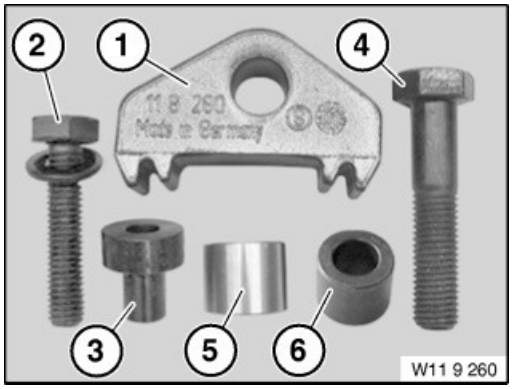
0 496 595 (11 6 130) Holder



Common	Used in step 2953
Usage	(counter support) For securing flywheel when releasing and tightening down screw connection of vibration absorber. Series: E90, E91, E92 with 4WD.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 05 09 (519)

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0 493 938 (11 9 260) Holder



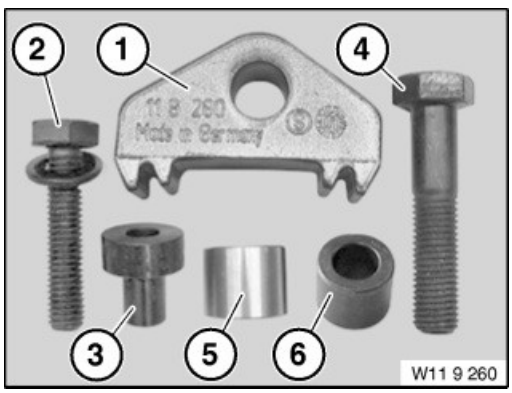
Common Used in step 3052

Usage	(Counter support with screw connection) For holding the flywheel when gearbox is removed
Included in the tool or work	
Storage location	A44
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 034 (11 9 261)		**Holder** (Individual counter support)	
2	0 494 035 (11 9 262)		**Screw** (Bolt (thread M10) with washer) For screwing counter support	
3	0 494 129 (11 9 263)		**Bush** (Bush for counter support) For counter support, for retaining flywheel when gearbox is removed Engine: N62, N73	
6	0 495 216 (11 9 266)		**Bush** For counter support, for retaining flywheel when gearbox is removed Engine: M57TU2	
4	0 494 130 (11 9 264)		**Screw** (Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed	
5	0 494 793 (11 9 265)		**Bush**	

0 494 130 (11 9 264) Screw

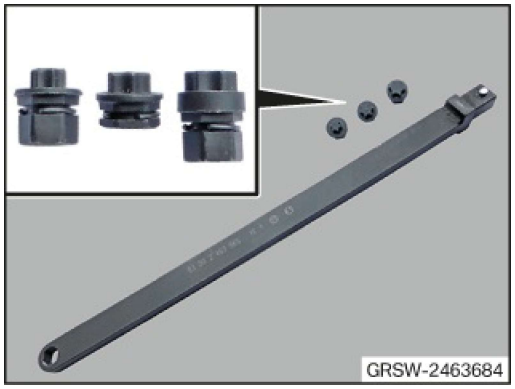


Common Used in step 3052

Usage	(Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed
Included in the tool or work	0 493 938
Storage location	A44
Replaced by	
In connection with	
SI-Number	

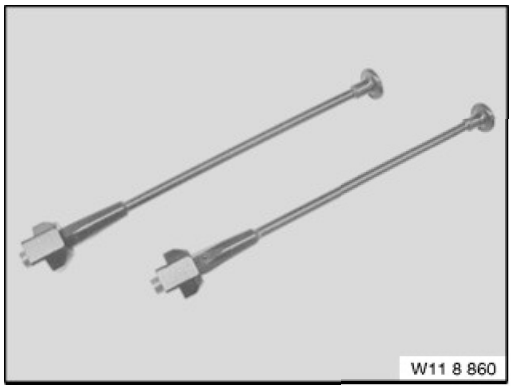
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2 463 965 Socket wrench



Common	Used in step 34
Usage	with T30, T40 and torx 45
Included in the tool or work	
Storage location	B6
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 496 144 (11 8 860) Assembly tool



Common	Used in step 3645
Usage	For installing piston with connecting rod in crankcase.
Included in the tool or work	
Storage location	A23
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

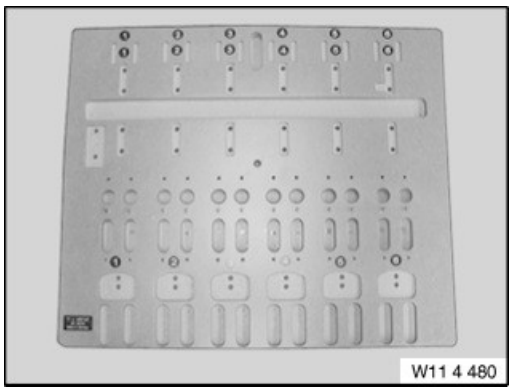
2 288 054 Gauge



Common	Used in step 3740
Usage	For positioning the counterbalance shafts during installation.
Included in the tool or work	
Storage location	C56
Replaced by	
In connection with	
SI-Number	01 06 14 (076)

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0 495 105 (11 4 480) oddments tray



Common

Used in step 37

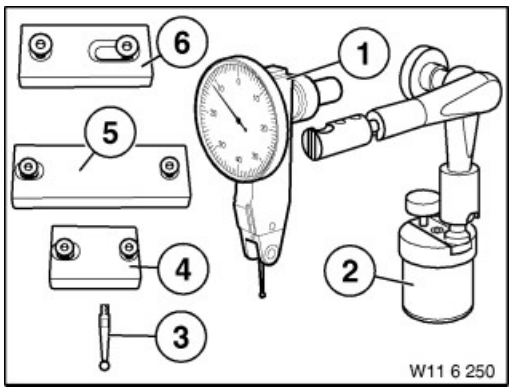
Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

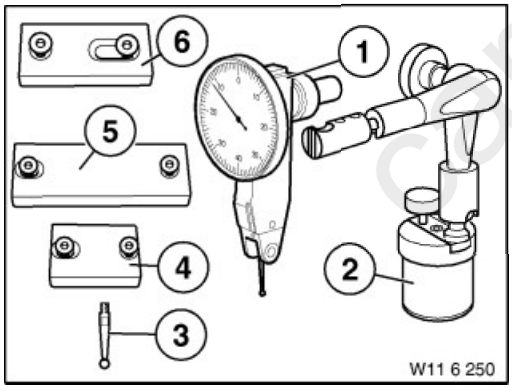
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0 493 144 (11 6 251) Dial gauge



Common	Used in step 4041
Usage	(Dial gauge) With 0.8 mm measuring range in each direction
Included in the tool or work	0 493 143
Storage location	
Replaced by	
In connection with	
SI-Number	

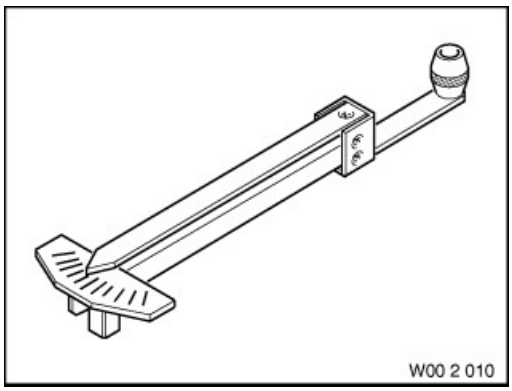
0 493 145 (11 6 252) Tripod



Common	Used in step 4041
Usage	(Small hydraulic tripod with magnetic base)
Included in the tool or work	0 493 143
Storage location	
Replaced by	
In connection with	
SI-Number	

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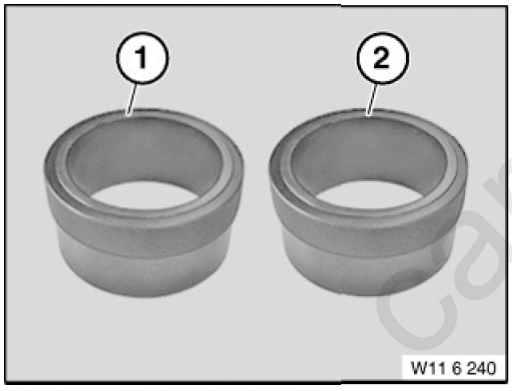
0 490 130 (00 2 010) Measurement aid



Common Used in step 42

Usage	(Coefficient of friction meter) For adjusting the steering box (measurement possible in both directions) and for checking and adjusting the bevel pinion and crown wheel bearing in all final drives
Included in the tool or work	
Storage location	X9
Replaced by	
In connection with	
SI-Number	

0 495 373 (11 6 240) Bush



Common Used in step 45

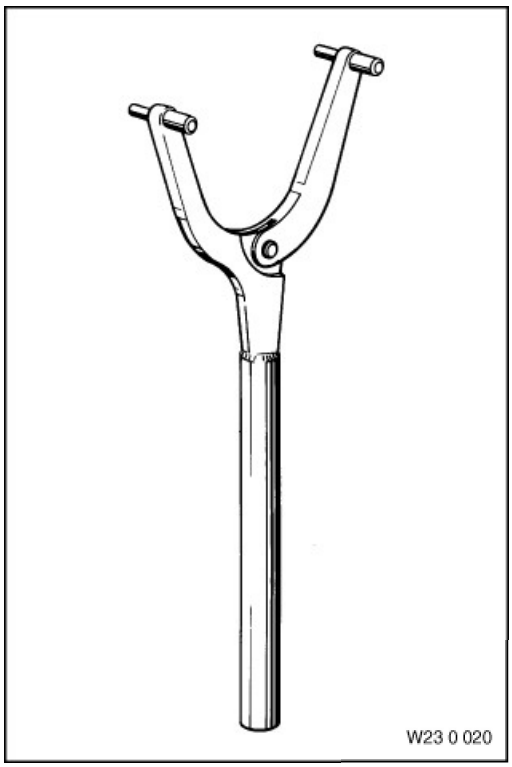
Usage	(Assembly bush set) For fitting pistons (diameter 82 mm) with connecting rod into the crankcase. Engine: N52B25
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 06 (244)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 527 (11 6 242)		**Bush** (assembly bush 82.25 mm)	
1	0 495 526 (11 6 241)		**Bush** (assembly bush 82.00 mm)	

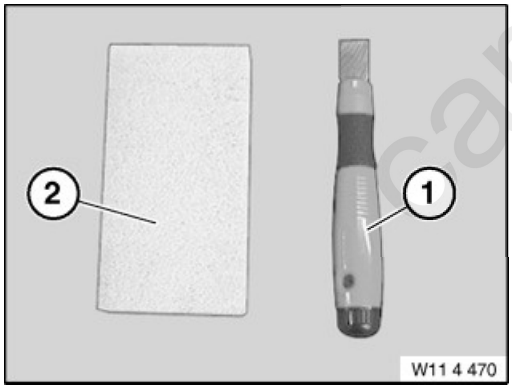
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0 491 440 (23 0 020) Holder



Common	Used in step 47
Usage	(counter support) For all three- and four-hole flanges when releasing and tightening down
Included in the tool or work	
Storage location	B4
Replaced by	
In connection with	
SI-Number	

0 495 102 (11 4 470) Tool



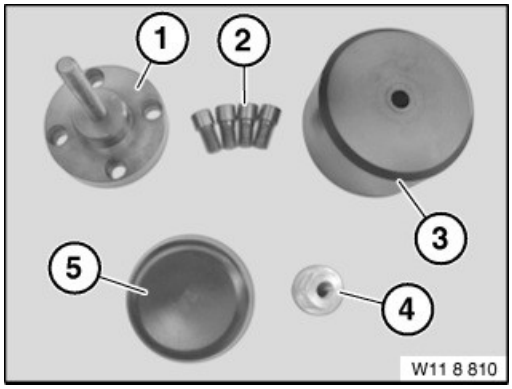
Common	Used in step 5051
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

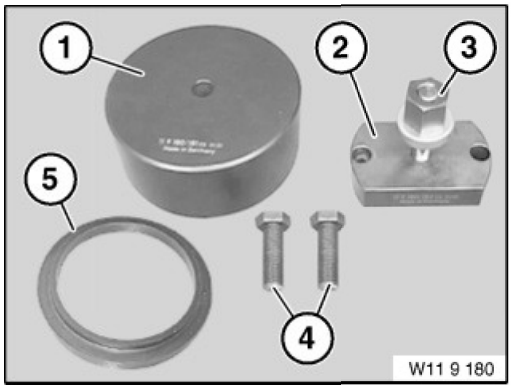
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0 496 137 (11 8 815) Holding sleeve



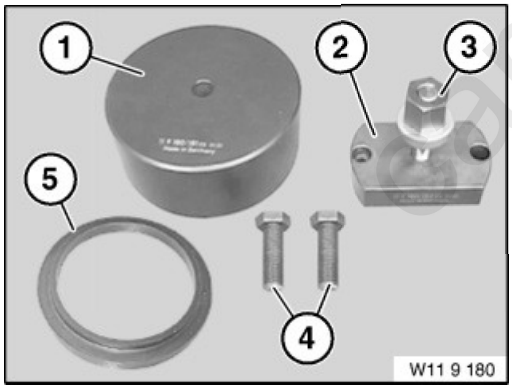
Common	Used in step 50
Usage	(Slip sleeve) Liquidation of existing inventory and then available only via complete tool set 11 8 810 = 83 30 0 496 132 - status 09.12.2011
Included in the tool or work	0 496 132
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 494 029 (11 9 182) Synchronising key



Common	Used in step 50
Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 494 031 (11 9 184) Screw



Common	Used in step 50
Usage	(screws (2 x))
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

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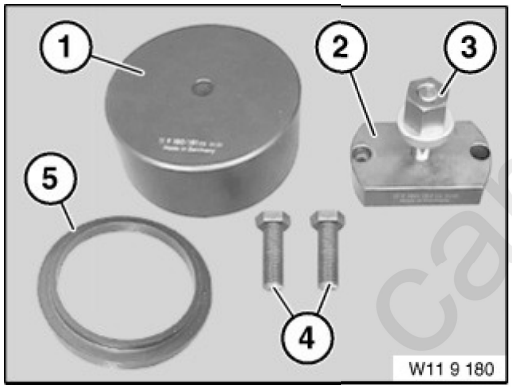
2 360 215 Adapter



Common Used in step 50

Usage	For installing the rear radial shaft seal. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B56
Replaced by	
In connection with	11 9 180 = 0493881
SI-Number	01 13 14 (098)

0 493 881 (11 9 180) Tool



Common Used in step 50

Usage	(pulling tool) For pulling radial shaft seal into engine block, rear
Included in the tool or work	
Storage location	C26
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 028 (11 9 181)		**Bush**	
2	0 494 029 (11 9 182)		**Synchronising key**	
3	0 494 030 (11 9 183)		**Nut**	
4	0 494 031 (11 9 184)		**Screw** (screws (2 x))	
5	0 496 660 (11 9 185)		**Ring** For installation shaft seal - rim offset 6.6 mm (N55).	

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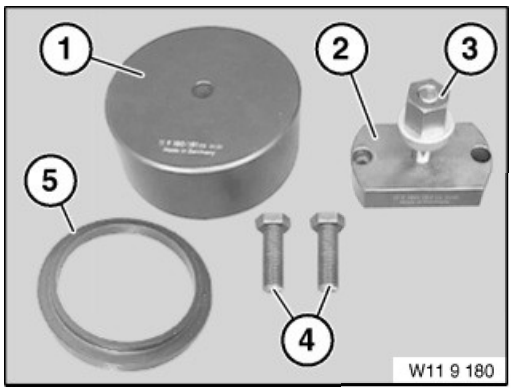
0 494 028 (11 9 181) Bush



Common Used in step 50

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

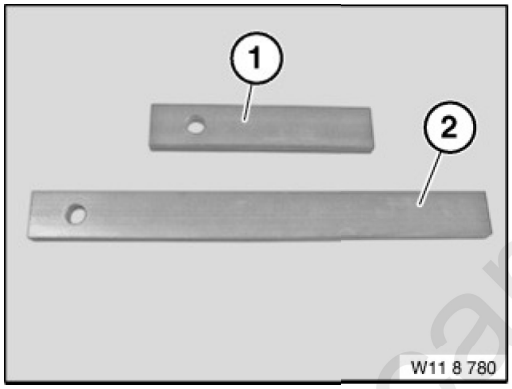
0 494 030 (11 9 183) Nut



Common Used in step 50

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 496 120 (11 8 780) Plate



Common Used in step 51

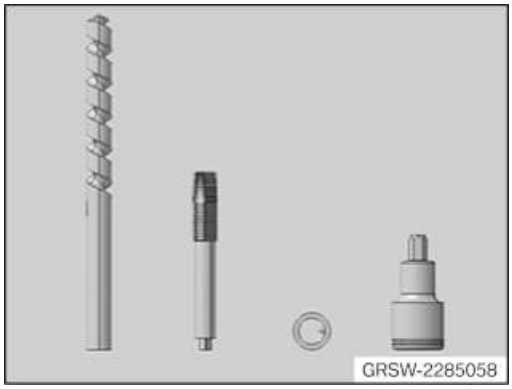
Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

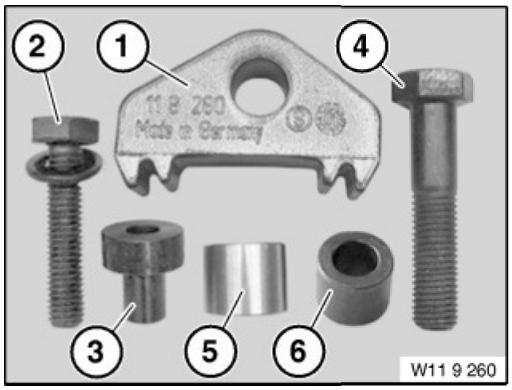
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2 285 058 Tool set



Common	Used in step 52
Usage	
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 14 (069)

0 494 034 (11 9 261) Holder



Common	Used in step 52
Usage	(Individual counter support)
Included in the tool or work	0 493 938
Storage location	
Replaced by	
In connection with	
SI-Number	

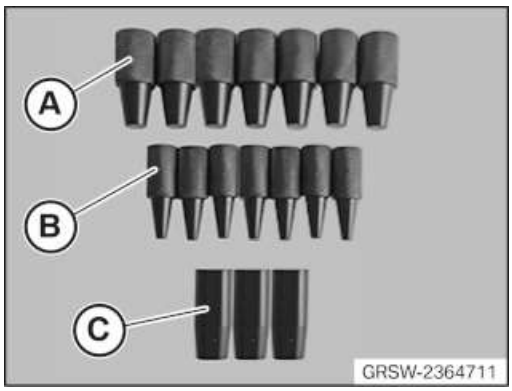
2 466 729 Fitting aid



Common	Used in step 53
Usage	For the installation of the vibration damper. Engine: B48, B58. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	
SI-Number	01 07 18 (545)

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2 364 711 Plug



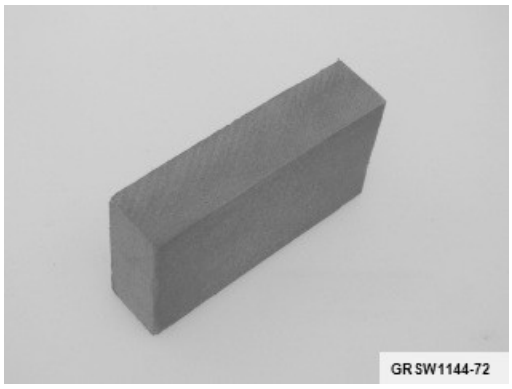
Common	Used in step 5657
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

0 495 103 (11 4 471) Scraper



Common	Used in step 57
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

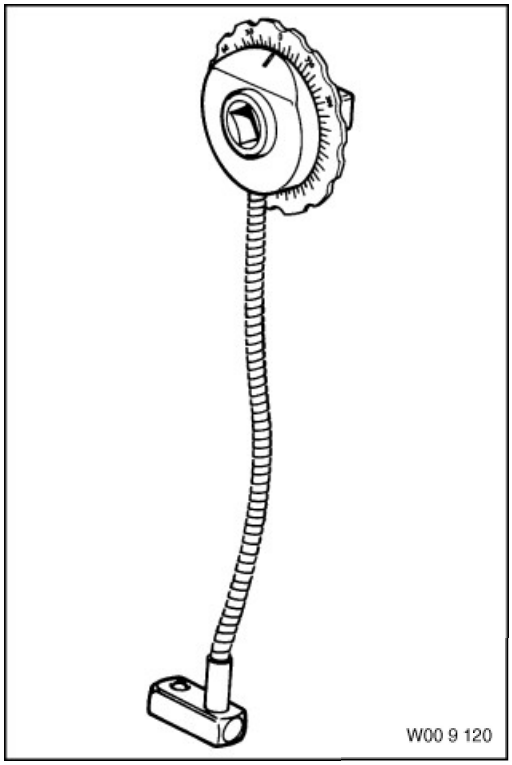
0 495 104 (11 4 472) Extractor



Common	Used in step 57
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

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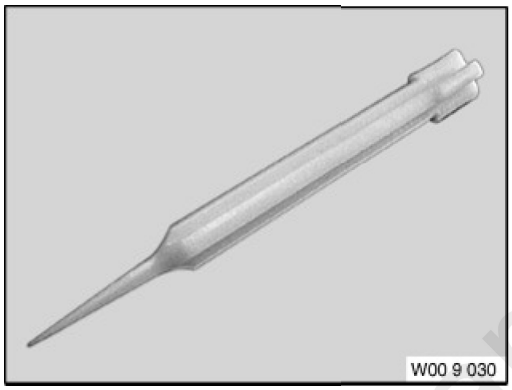
0 490 504 (00 9 120) Torque angle measuring dial



Common Used in step 59

Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common Used in step 597273

Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

2 455 654 Tensioning tool



Common Used in step 6568

Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 452 959 Pliers



Common	Used in step 76
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 76
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

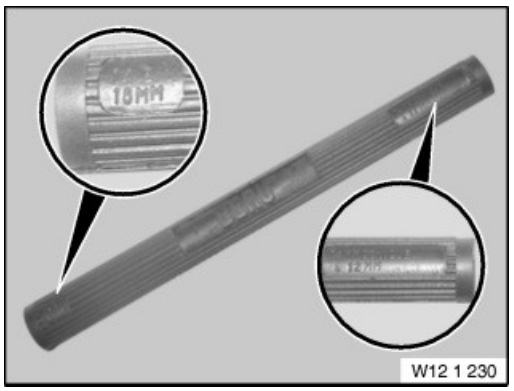
2 358 022 Gauge



Common	Used in step 77
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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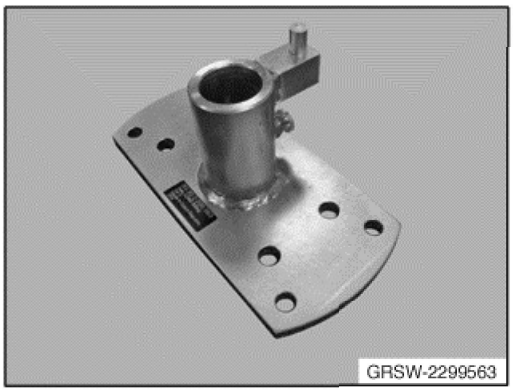
0 496 065 (12 1 230) Fitting aid



Common	Used in step 80
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

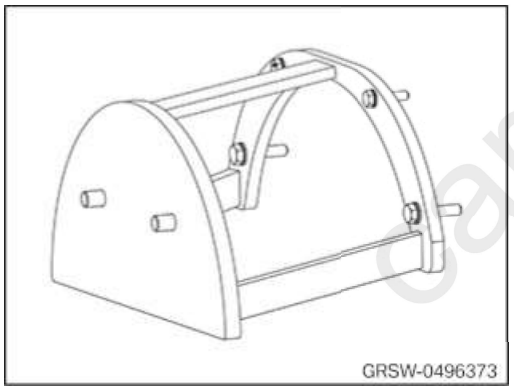
Replacement tools:

2 299 563 Adapter



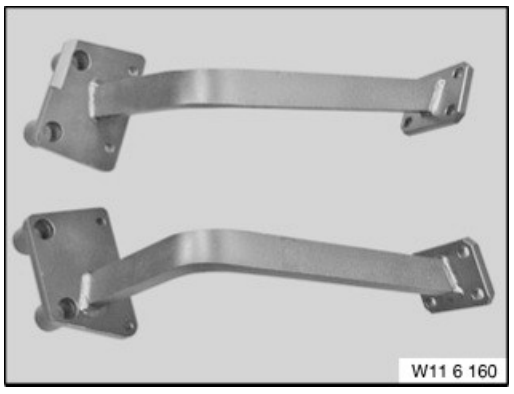
Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 373 (11 5 420) Plate



Common	Used in step 2
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 496 680 (11 6 160) Support



Common	Used in step 2
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

Overview Technical Data

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Axial play of crankshaft — Used in step 4041

min. 0,060 mm
max. 0,250 mm

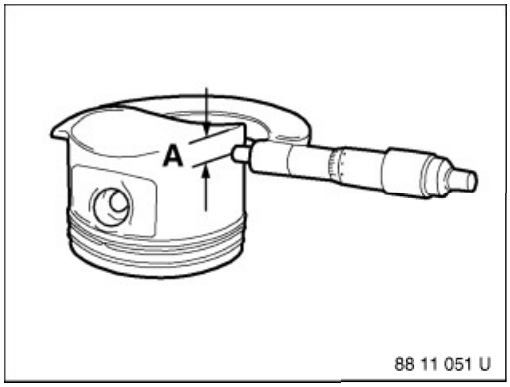
Maximum permitted torque of the crankshaft — Used in step 42

max. 2 Nm

Piston diameter — Used in step 43

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Cylinder bore B38/B46/B48/B58 — Used in step 44

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Height of the sealing bead — Used in step 50

2,0 mm ... 2,5 mm

Engine oil — Used in step 83

Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Engine oil B48B20O1/B46B20O1 — Used in step 83

Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Screw-in depth of thread cutter — Used in step 52

Screw-in depth	18 mm

Links

Functional descriptions	Used in step
Petrol particulate filter	83

General repair instructions	Used in step

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11 00 ... Overview of consumables (Electronic Parts Catalogue)	5051

Repair instructions	Used in step
11 00 050 Removing and installing engine	185
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31 10 001 Completely removing and installing front axle with engine and transmission	185
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11 00 050 Removing and installing engine	185
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11 00 050 Removing and installing/replacing engine (N63)	185
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11 00 050 Removing and installing engine	185
11 00 050 Removing and installing engine	185
11 00 050 Remove and install engine	185
11 00 050 Remove and install engine (Automatic)	185
11 00 050 Remove and install engine (Automatic)	185
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11 00 050 Remove and install engine	185
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11 00 050 Remove and install engine	185
11 00 050 Remove and install engine	185
11 00 050 Removing and installing the engine with a double-clutch transmission (DKG)	185
11 00 050 Remove and install engine	185
13 53 ... Clean the cylinder head around the injectors due to grit / dust	8
61 13 ... Unlocking and disconnecting different plug connections	81074
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61 35 ... Notes on ESD protection (Electro Static Discharge)	911

Operating materials	**Used in step**
3.0 Technically appropriate engine oils for BMW Group engines	83

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11 22 000 Removing and installing/replacing the flywheel

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Removing the clean air pipe with the resonator

WARNING

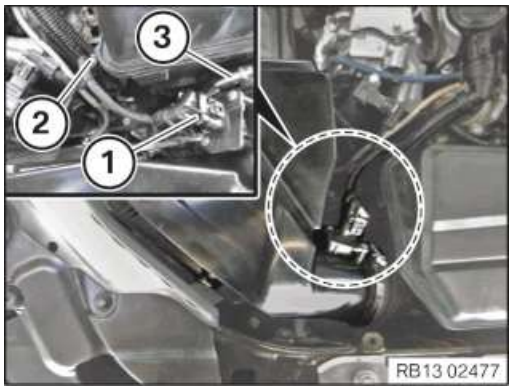
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

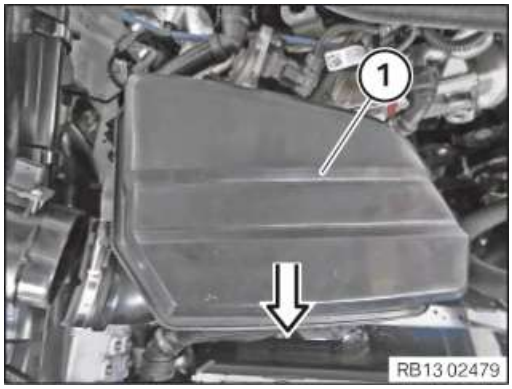


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

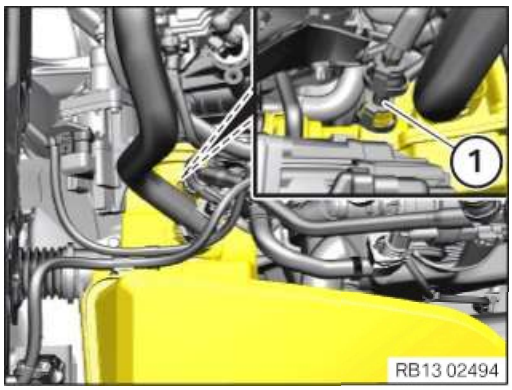


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

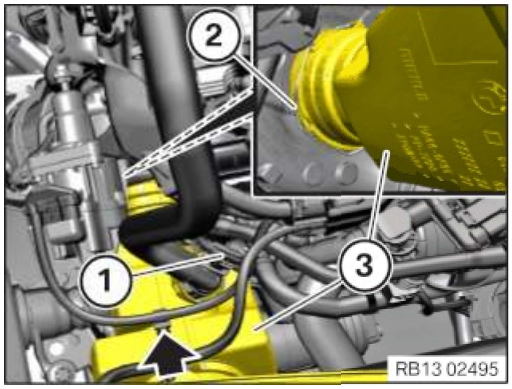
bmwdiagn.com



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

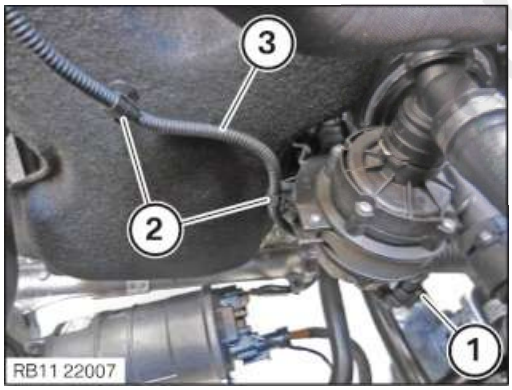


- Unlock and disconnect the tank ventilation line (1).

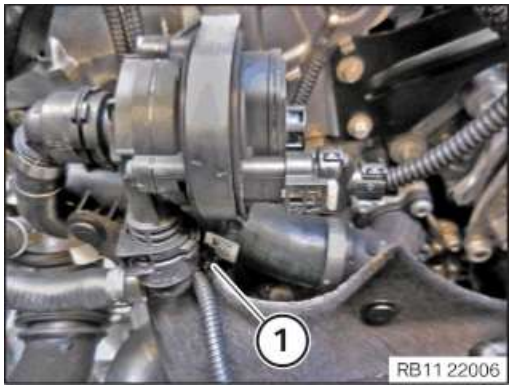


- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

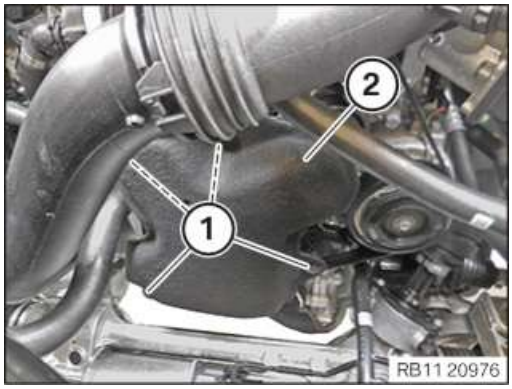
4 – Removing the acoustic cover for the engine at the front



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

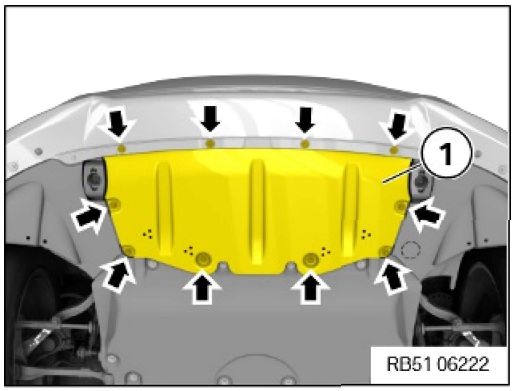


- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

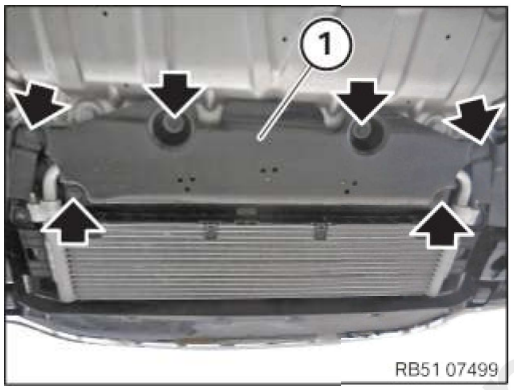
5 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

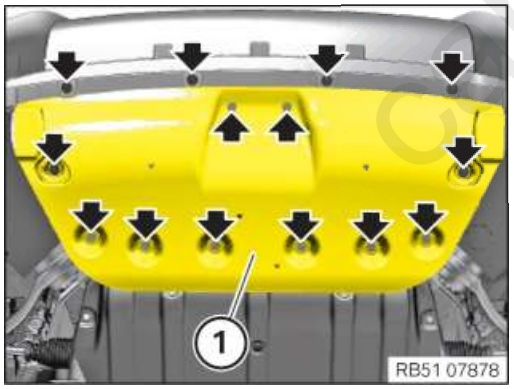
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

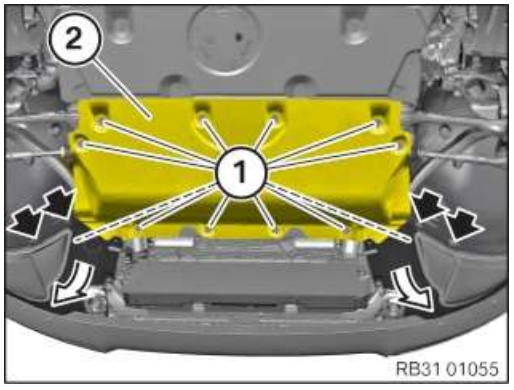


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

6 – Remove the underbody protection of the steering gear



- **Version 1:**

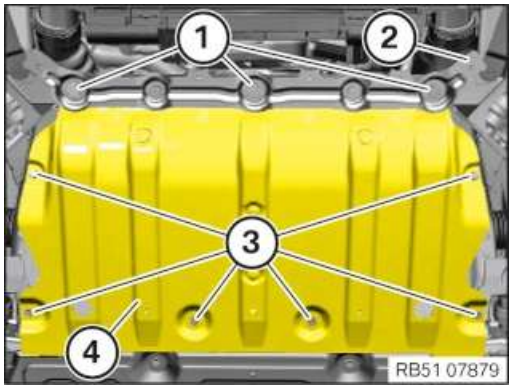
  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).

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- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

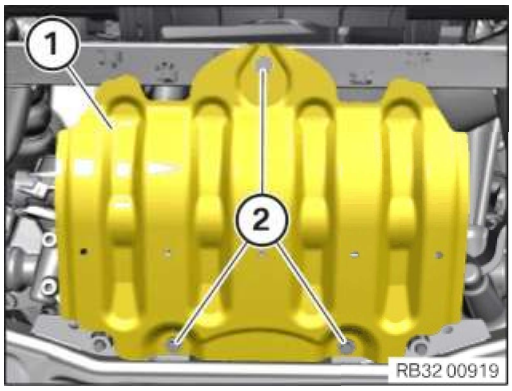
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

7 – If installed: Removing the steering start protection

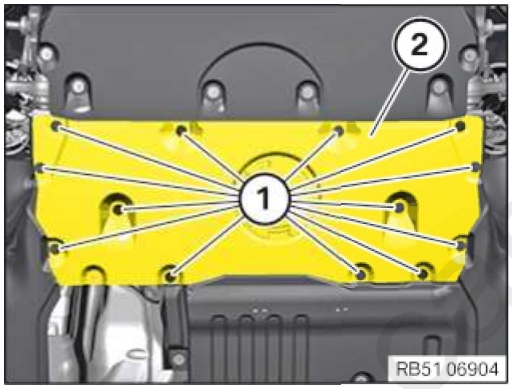
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

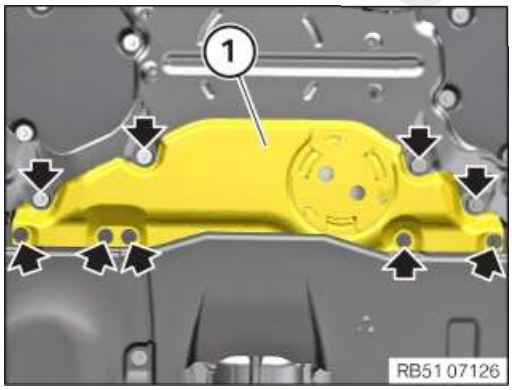
8 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



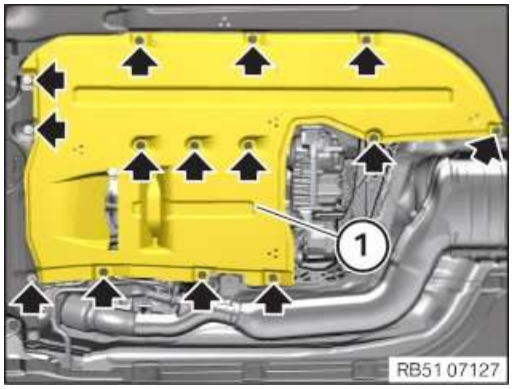
- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

9 – Remove rear underbody protection

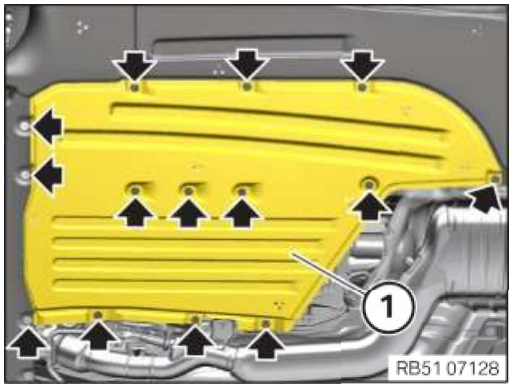
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- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

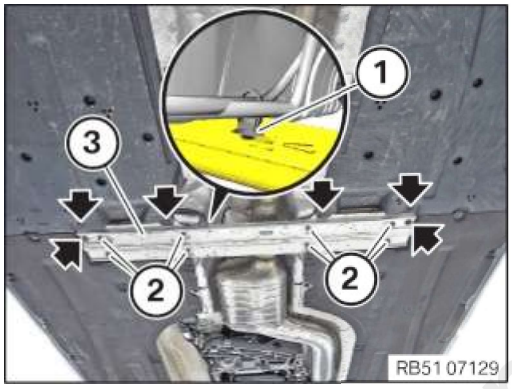


- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

10 – Remove the connecting support from the tunnel



- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

11 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

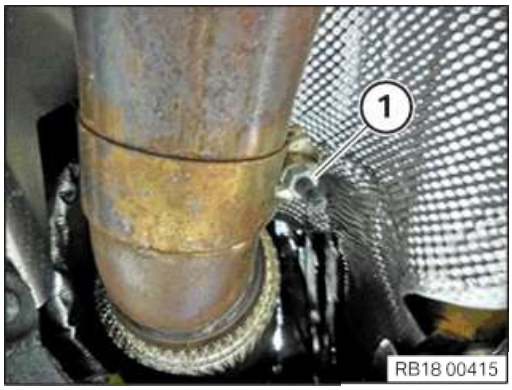
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CAUTION

Heavy component.

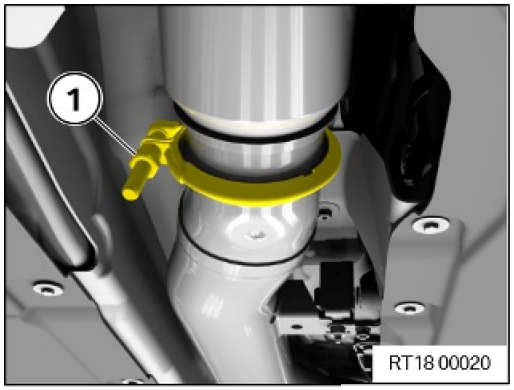
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



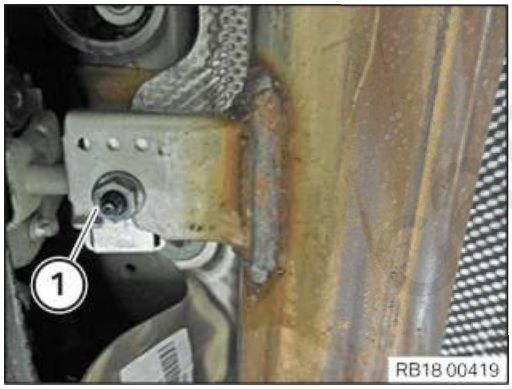
- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).

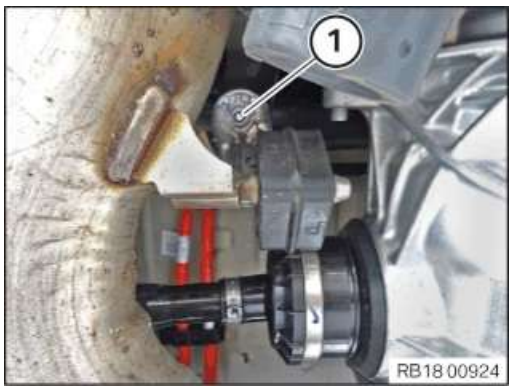


- **Equipment specification 2 (V-clips)**

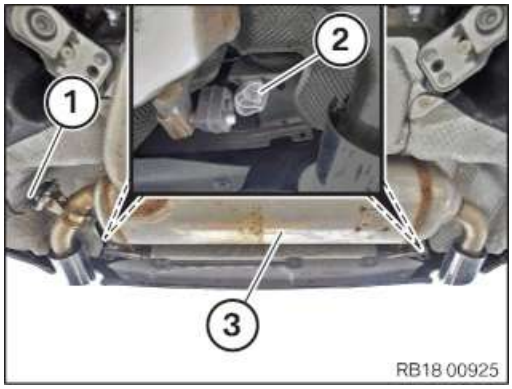
  Unfasten clamp (1).



- Loosen nut (1).



- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

12 – Removing starter motor

Prerequisite

Battery earth leads are disconnected.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

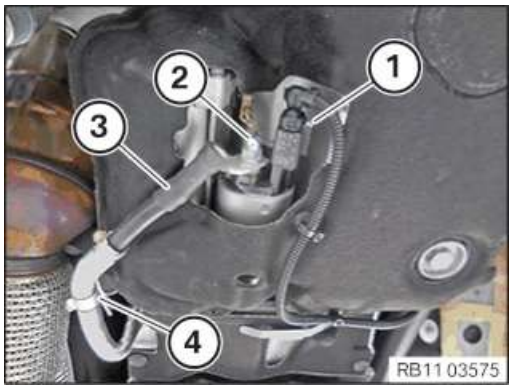
Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

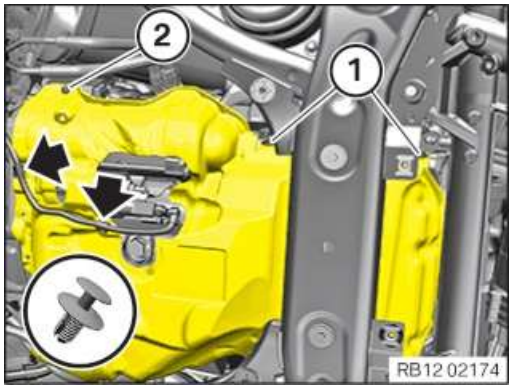
TECHNICAL INFORMATION

Make sure that the acoustic cover is **not** damaged while removing the starter motor.
A damaged lower acoustic cover can only be renewed when the front axle is lowered.

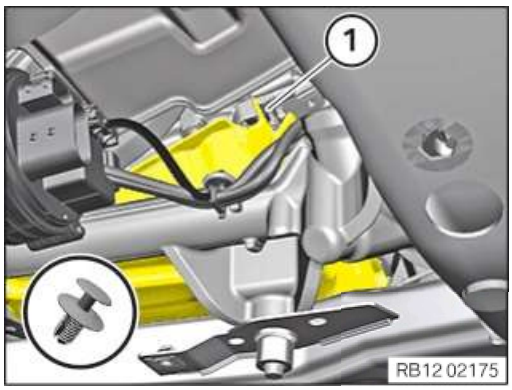


- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Release positive battery cable (3) from holder (4).

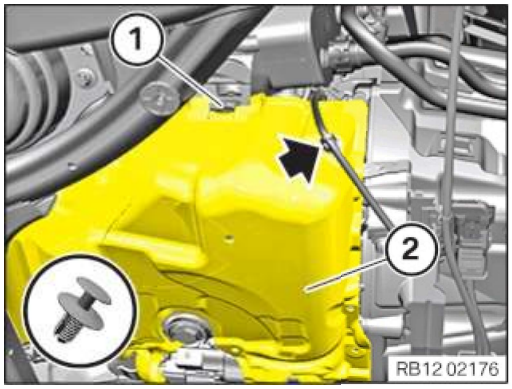
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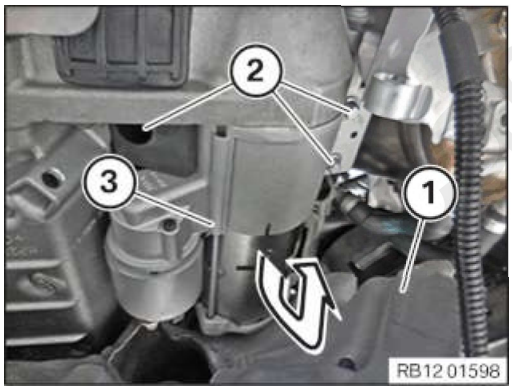
- Loosen the expanding rivet (1).
- Undo fir tree clip (2).
- Release the clamps (arrows).



- Loosen expanding rivet (1).
- Lower the acoustic cover of the oil sump.

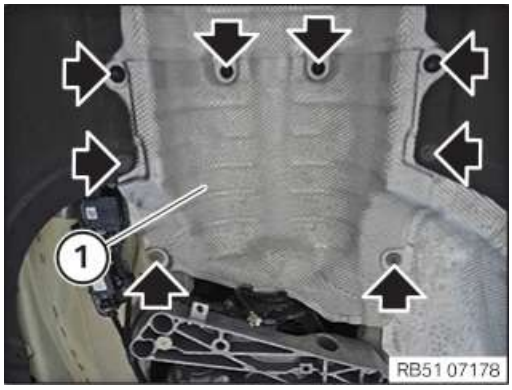


- Loosen expanding rivet (1).
- Loosen the clamp (arrow).
- Lower acoustic cover (2).



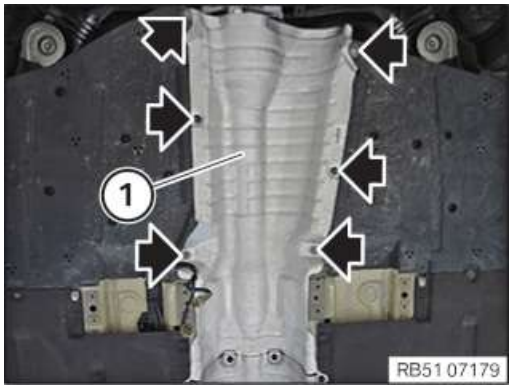
- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Loosen screws (2).
- Carefully guide out the starter motor (3) in direction of arrow and remove.

13 – Remove heat shields



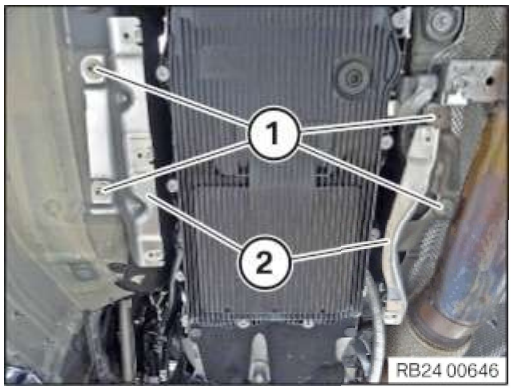
- Loosen bolts and nuts (arrows).
- Remove heat shield (1).

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- Loosen bolts and nuts (arrows).
- Remove heat shield (1).

14 – Remove the retaining plates



- Loosen nuts (1).
- Feed out retaining plates (2) and remove.

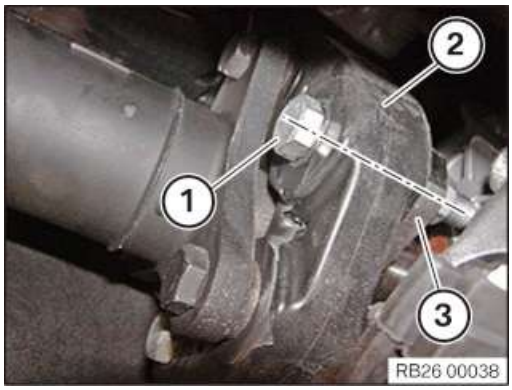
15 – Partially release propeller shaft

RISK OF DAMAGE

Damage to propeller shaft during removal.

Non-observance of the removal guidelines for the propeller shaft on the rear axle differential may cause severe damage.

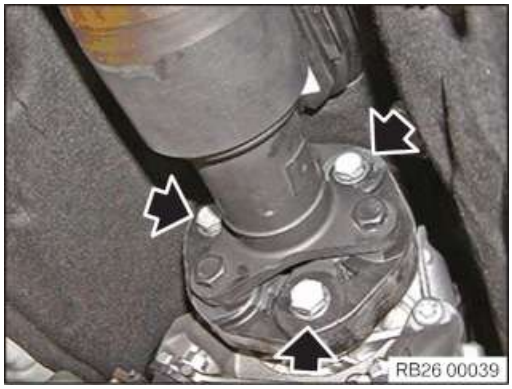
- Do not disassemble the three-hole flange, flexible disc and propeller shaft. The three-hole flange to the rear axle differential is balanced with the flexible disc and propeller shaft.
- Loosen the recessed nut against the direction of travel in clockwise direction. The propeller shaft must be loosened on the recessed nut only and exclusively in the direction of rotation otherwise the anti-twist lock of the bi-hexagonal flange nut is damaged.
- In the event of a damaged anti-twist lock on the bi-hexagonal flange nut: Replace the rear axle differential.



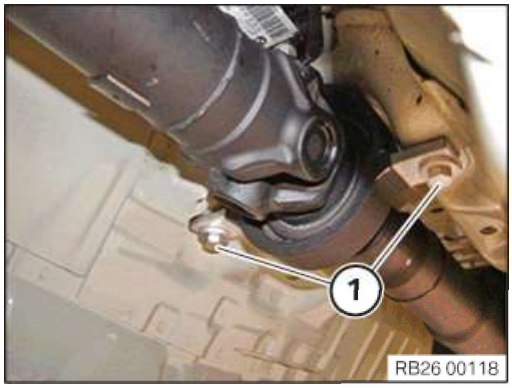
- Mark the installation position of the screw connection (1) of the flexible disc (2) and the three-hole flange (3).

  The mark makes it possible for the propeller shaft to be installed again in the same position. This should prevent a humming noise from the drive train during driving.

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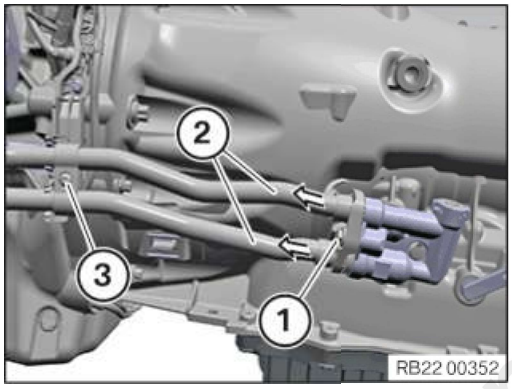
- Remove screws (arrows).



- Unscrew the bolts (1) on the centre mount and hold down the propeller shaft.

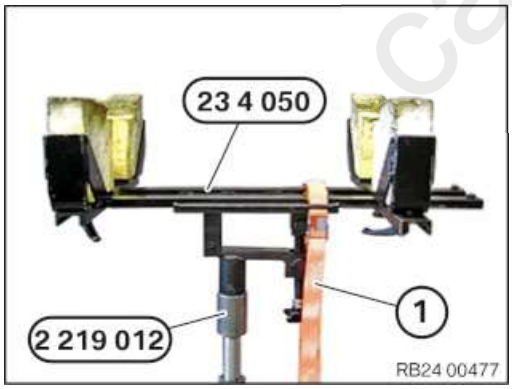
  Major deflection angles of the propeller shaft may damage the propeller shaft and/or the joints.
- Tie up propeller shaft to underbody.

16 – Disconnect hydraulic lines on the transmission

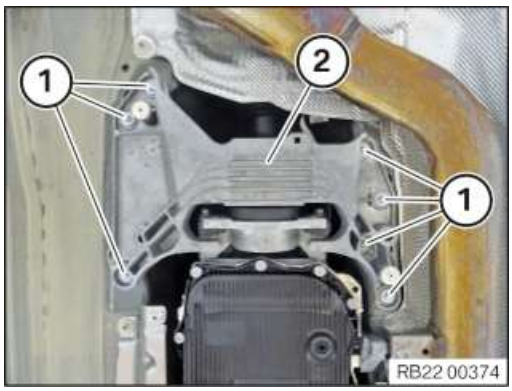


- Loosen screw (1).
- Loosen screw (3).
- Disconnect hydraulic lines (2) to transmission oil cooler.

17 – Detach transmission cross member



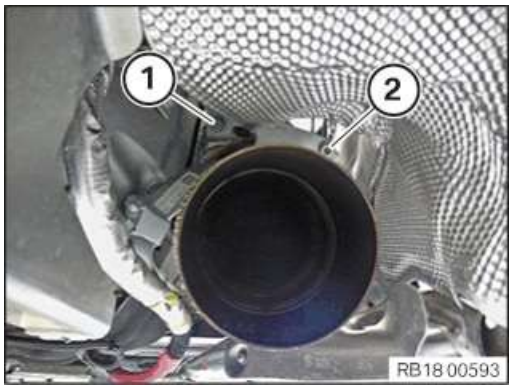
- Support the transmission using special tools 0 495 498 (23 4 050) and 2 219 012.
- Secure the transmission with the tensioning strap (1).



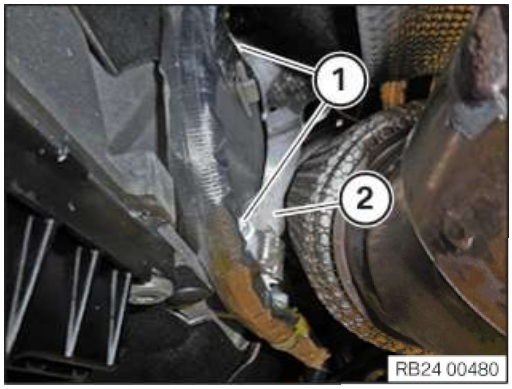
- Loosen screws (1).
- Release transmission cross member (2).

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18 – Remove exhaust system holder



- Loosen screw (1).
- Loosen nut (2).



- Loosen screws (1).
- Remove the exhaust bracket (2).

19 – Remove automatic transmission (GA8HP51Z)

CAUTION

Materials harmful to health.

Contact with fluids harmful to health!

- Note and follow safety information on containers.
- Conduct all work in appropriate personal protective equipment only.

RISK OF DAMAGE

Damage to the engine block.

Damaged and corroded bolts will lead to major damage in the engine block and the transmission.

- It is imperative that protruding threads of the transmission bolts are checked for corrosion and damage prior to removal.
- It is imperative that all rust is removed from corroded threads and that they are cleaned prior to removal.
- Renew rusted and damaged bolts.

RISK OF DAMAGE

Damage of components in the engine compartment.

When removing the transmission, tilting of the engine may damage components in the engine compartment.

- Before removing the transmission: Support engine.
- Secure the engine against tilt movements.
- Follow the specifications of the repair instructions.

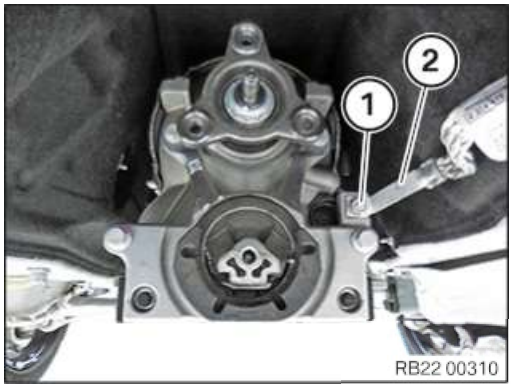
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RISK OF DAMAGE

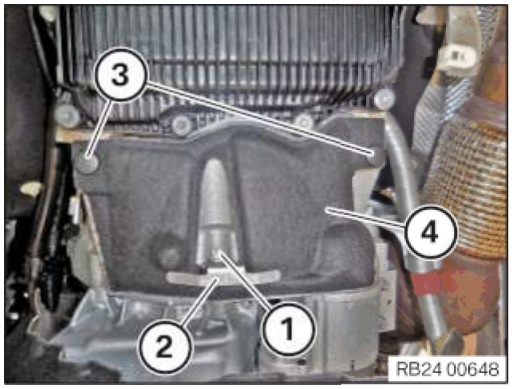
Damage to the transmission.

Damage to the transmission through unapproved transmission oil.

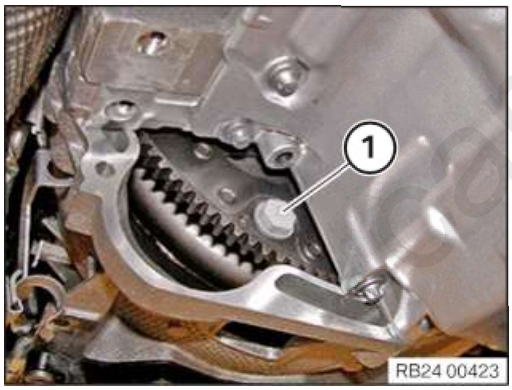
- Use only the approved transmission oil.
- After completion of repair work, check transmission oil level.



- Unscrew the bolt (1) and disconnect the ground strap (2).



- Loosen the screw (1) and remove the holder (2).
- Pull the expanding rivet (3) off.
- Remove the acoustic cover (4).



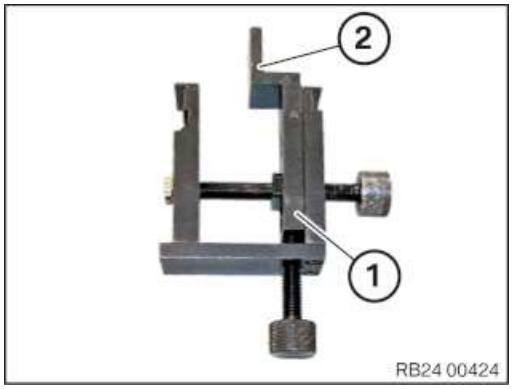
TECHNICAL INFORMATION

Only G05 and G07

In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

- Turn the engine on the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of rotation until the bolt (1) becomes visible in the recess.
- Undo all 6 screws (1) on the torque converter.

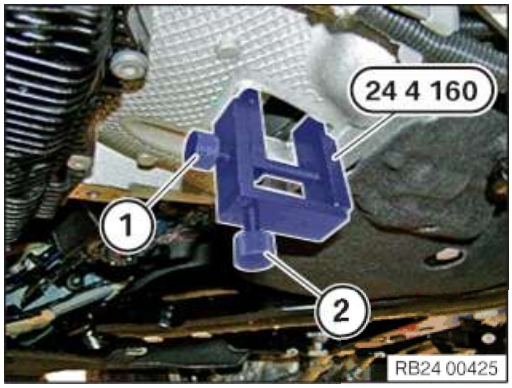


- Prepare special tool 0 494 478 (24 4 161) (1) with the shaped element 0 496 061 (24 4 166) (2) as shown.

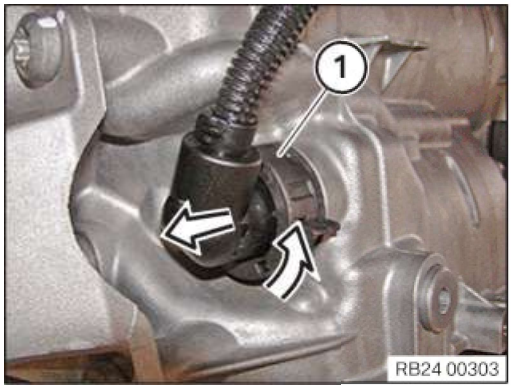
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- Remove the sealing cap (1).



- Insert special tool 0 494 451 (24 4 160) into the recess of the transmission housing and apply slight tension using the screw (1).
- Screw the bolt (2) in to the stop.
- Tighten down screw (1).

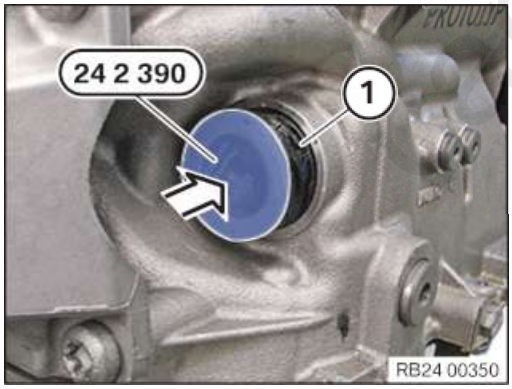


TECHNICAL INFORMATION

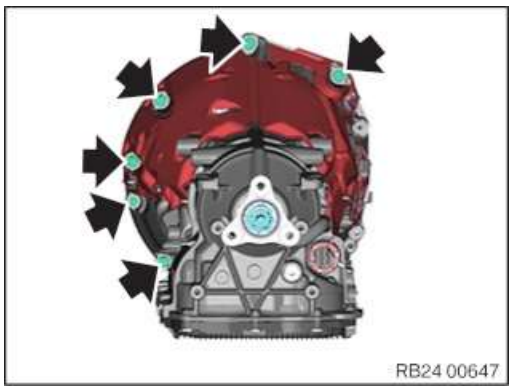
Notes on mechatronics are a fundamental requirement for these repair instructions and must be complied with at all times.

For additional information see: 24 34 ... Notes on mechatronics (GA8HP50Z/GA8HP51Z/GA8HP75Z/GA8HP76Z/GA8HP95Z)

- Unlock connector (1) by turning and pull off.
- Do not touch pins.
- Loosen all cable clips.

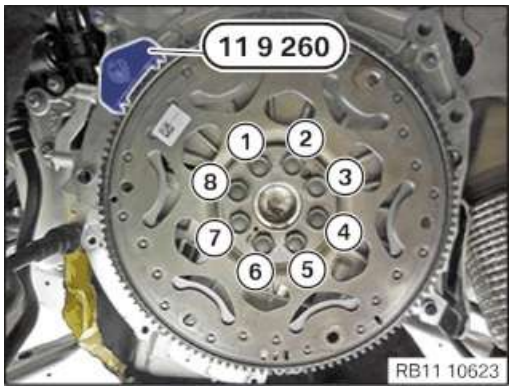


- Insert the special tool 0 494 213 (24 2 390) in the sealing sleeve (1) in direction of arrow.



- Support engine.
- Release remaining screws.
- Remove transmission.

20 – Removing flywheel



- Fasten the flywheel with the special tool 0 493 938 (11 9 260) and tighten with the special tool 0 494 130 (11 9 264).
- Loosen screws (1-8).

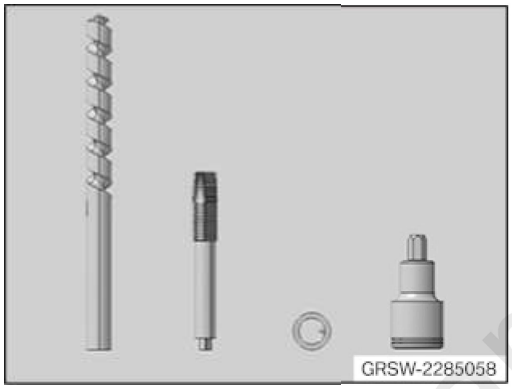
21 – Installing the flywheel



TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).



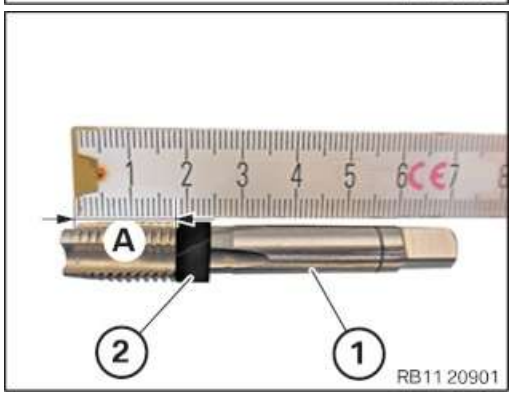
- Use the set of special tools 2 285 058.

Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool



- Assemble tool set.

Number	Description
1	Tool holder
2	Thread cutter M12X1,5

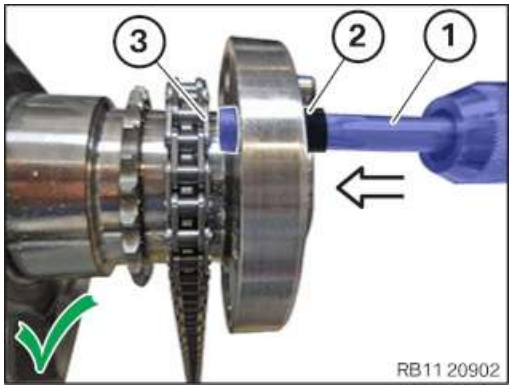


- Mark the screw-in depth (A) on thread cutter (1) from the set of special tools 2 285 058 with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

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NOTICE

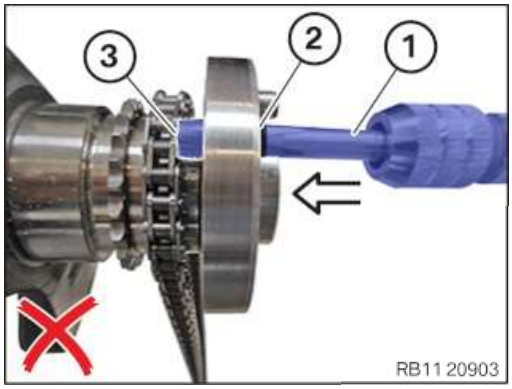
To provide a better overview: Shown with engine removed.

- Screw in the thread cutter (1) from the set of special tools 2 285 058 in direction of arrow up to the screw-in depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).

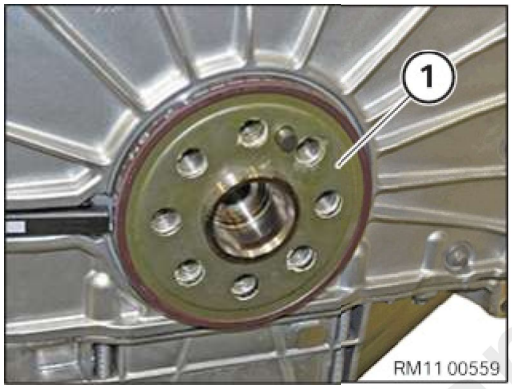


TECHNICAL INFORMATION

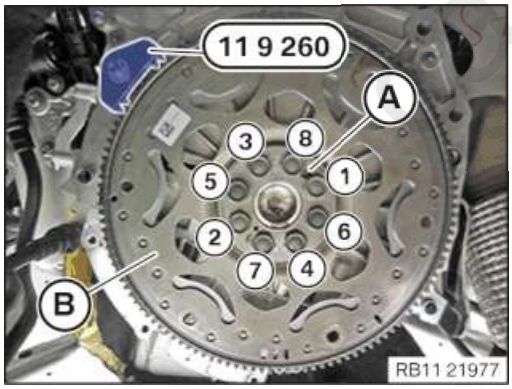
- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

- Make sure that the screw-in depth (2) of the screw tap (1) is not exceeded.

  The thread cutter (1) may not rest on the timing chain (3).



- Make sure the magnet wheel (1) is installed correctly.



- Renew screws (1) to (8).

  Parts: Bolts
- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool 0 494 034 (11 9 261) and screw the special tool 0 494 130 (11 9 264) tightly.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten flywheel bolts in sequence (1) to (8).

Flywheel to crankshaft

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

- Remove special tool 0 493 938 (11 9 260).

POSTPROCESSES

22 – Install automatic transmission (GA8HP51Z)

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RISK OF DAMAGE

Damage to the transmission.

Damage to the transmission through unapproved transmission oil.

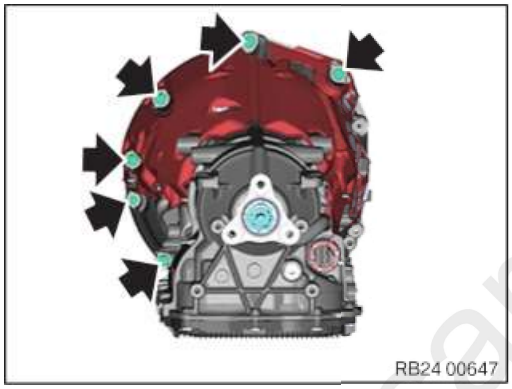
- Use only the approved transmission oil.
- After completion of repair work, check transmission oil level.

TECHNICAL INFORMATION

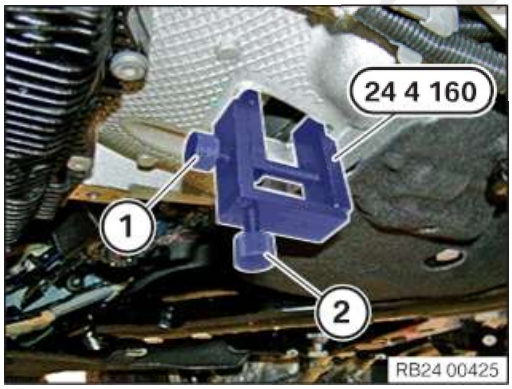
After completion of the work, program the control unit for the electronic transmission control (EGS).



- Check the fitting sleeves (1) for correct fit and damage and renew as needed.



- Transmission flange-mount.
- Rotate the torque converter until the bore hole of the torque converter is flush with bore hole in drive plate.
- Fit the transmission bolts (arrows) and apply lightly.



- Release screw (1) and screw (2).
- Remove special tool 0 494 451 (24 4 160).

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- Install the sealing cap (1).



TECHNICAL INFORMATION

Only G05 and G07

In vehicles with active anti-roll bar (ARS) the fan cowl must be removed in order to spin the engine.

For additional information see: 17 11 035 Removing and installing/replacing the fan cowl including electric fan

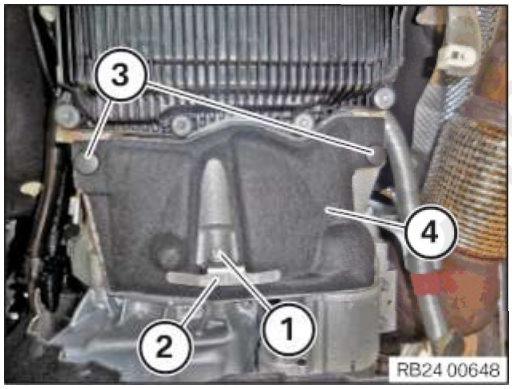
- Renew screws.

  Parts: Bolts

- Crank the engine on the vibration damper in the direction of rotation using special tool 0 493 380 (11 6 480) to tighten all six screws (1).
- Tighten all 6 screws (1) of the torque converter using special tool 0 491 667 (24 1 110) .

Torque converter to flywheel

M10	Renew screws.	Tightening torque	56 Nm



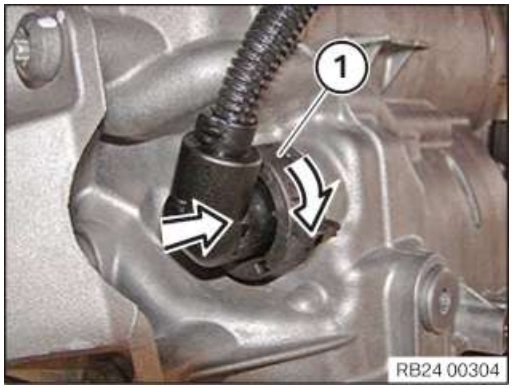
- Install acoustic cover (4).
- Install expanding rivet (3).
- Install the holder (2) and tighten the screw (1).

Transmission to engine

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm



- Remove the special tool 0 494 213 (24 2 390) from the sealing sleeve in direction of arrow.

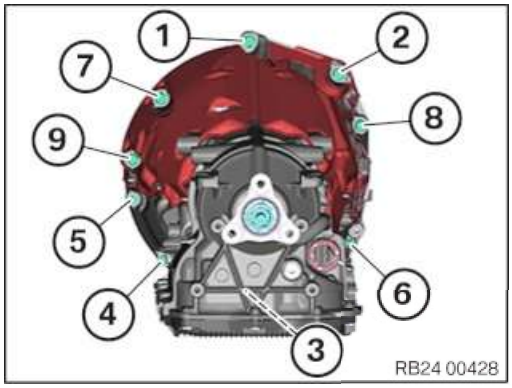


TECHNICAL INFORMATION

Notes on mechatronics are a fundamental requirement for these repair instructions and must be complied with at all times.

For additional information see: 24 34 ... Notes on mechatronics (GA8HP50Z/GA8HP51Z/GA8HP75Z/GA8HP76Z/GA8HP95Z)

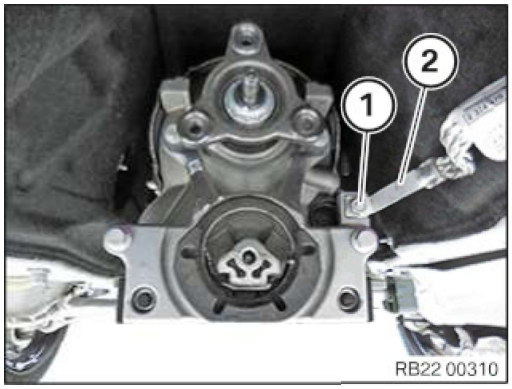
- Slide the connector (1) on and turn it to lock.



- Tighten the transmission bolts in sequence (1) to (9).

Transmission to engine

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm

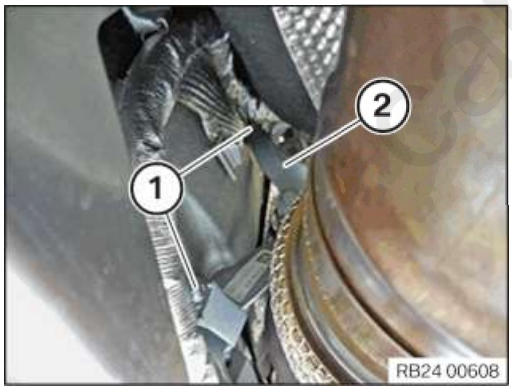


- Install the ground strap (2).
- Tighten down screw (1).

Ground strap to transmission or body

M8		Tightening torque	19 Nm

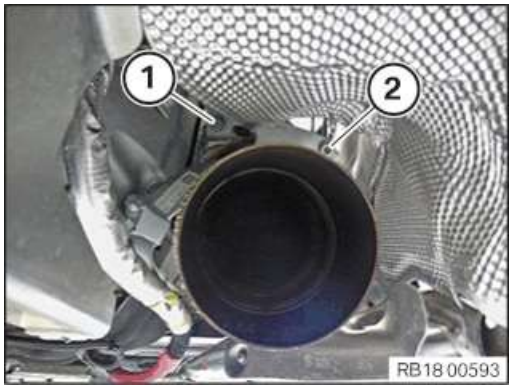
23 – Install the exhaust bracket



- Install the exhaust bracket (2).
- Tighten the screws (1).

Transmission to engine

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm



- Tighten down screw (1).

Catalytic converter to holder

M8	Renew screw.	Tightening torque	19 Nm

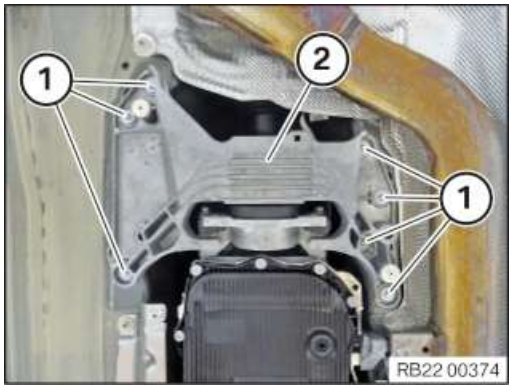
- Tighten nut (1).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm

24 – Install transmission cross member.

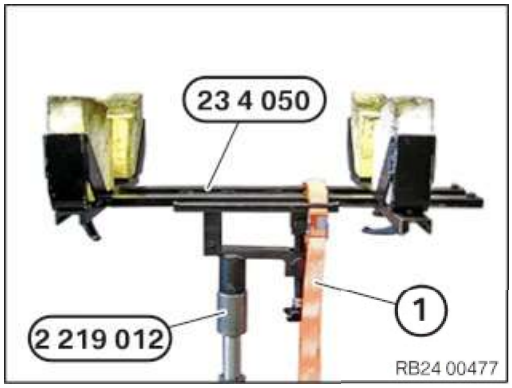
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- Install the transmission cross member (2).
- Tighten the screws (1).

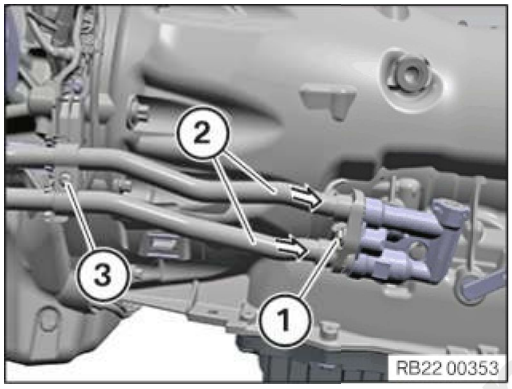
Transmission cross member to body

M8	Renew screws.	Tightening torque	19 Nm



- Loosen the tensioning strap (1) from the transmission.
- Remove the special tools 0 495 498 (23 4 050) and 2 219 012 from the transmission.

25 – Fix hydraulic lines



- Renew sealing rings.

  Parts: Sealing ring
- Install hydraulic lines (2) on transmission.
- Position and tighten the screw (1).

Transmission oil line to transmission

M6x25	Renew the sealing ring.	Tightening torque	8 Nm

- Position and tighten the screw (3).

Transmission oil line on holder

M6		Tightening torque	8 Nm

26 – Partially installing the propeller shaft



- Check centring (1) for damage; renew if necessary.

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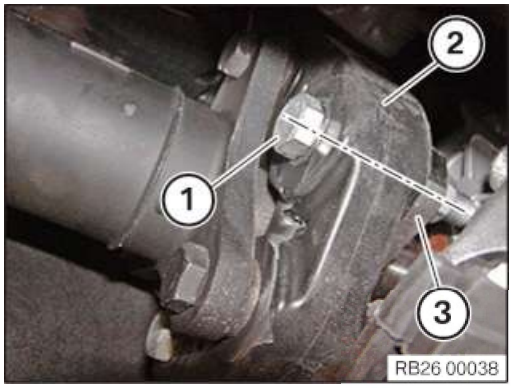


- Apply a thin coat of grease to the soft centring (1), if necessary.

  Do not grease the hard centring (2).

Expendable materials

Lubricating grease Olistamoly 2 LN 584 LO	100 g, Tube	83 19 0 447 919

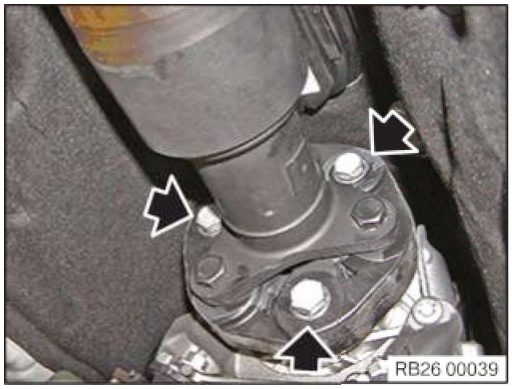


- Renew screws and the self-locking nuts.

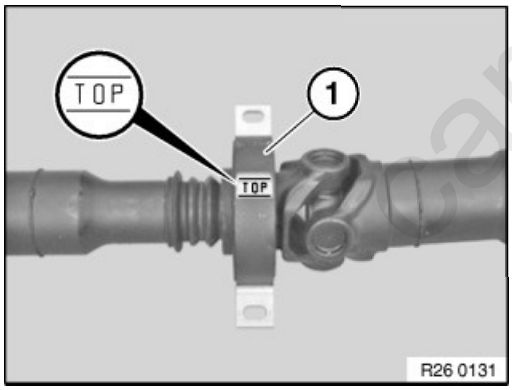
  Parts: Screws, self-locking nuts

- Assemble the screw connections (1) of the flexible disc (2) and the three-hole flange (3) according to the self-affixed identification.

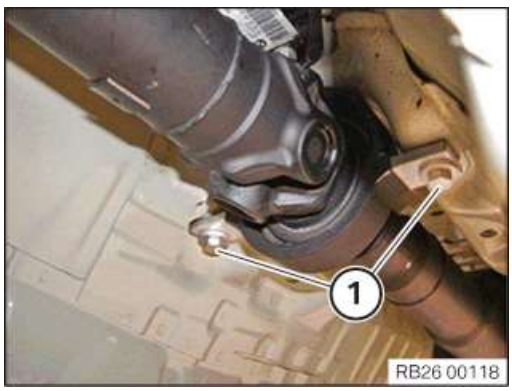
  This should prevent a humming noise from the drive train during driving.



- Hand-tighten the screws and nuts (arrows), but do not tighten fully.



- **Centre mount with TOP marking:**
- The centre mount (1) must be installed with the TOP marking at the top in the gearbox tunnel.



- Position centre mount.
- Hand-tighten the bolts (1), but do not tighten fully.

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- Renew screws.

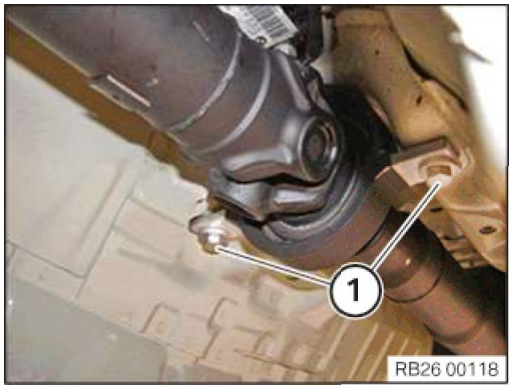
  Parts: Bolts

- Provide counter support for the bolts of the flexible disc on the nut and tighten with the bolts.

Front flexible disc to propeller shaft

M12	Renew screws. Comply with jointing torque and angle of rotation. Tightening via screw.	Jointing torque Angle of rotation	55 Nm 90 °

- Secure the special tool 0 490 504 (00 9 120) with the special tool on the vehicle underbody and continue to screw it in according to the angle of rotation.

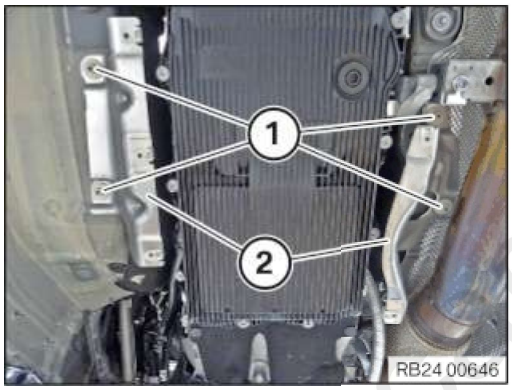


- Tighten the screws (1).

Centre mount to body

M8		Tightening torque	19 Nm

27 – Install the retaining plates

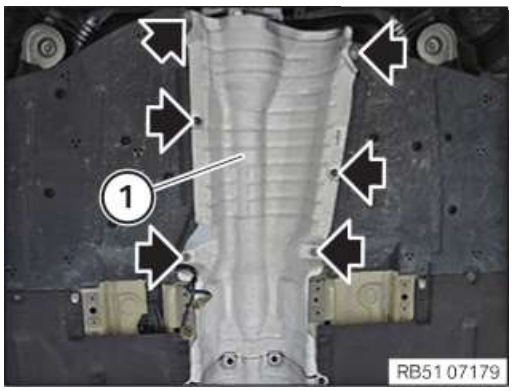


- Feed in retaining plate (2) and install.
- Tighten nuts (1).

Retaining plates for vehicle underbody cover

Sheet metal nut	Replace nuts.	Tightening torque	3 Nm

28 – Install the heat shields

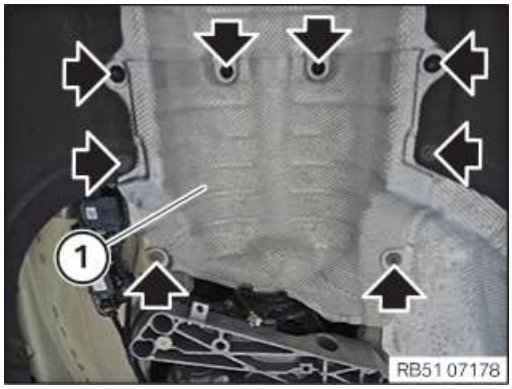


- Install heat shield (1).
- Tighten the nuts and bolts (arrows).

Heat shield to vehicle underbody

Screws and nuts		Tightening torque	3 Nm

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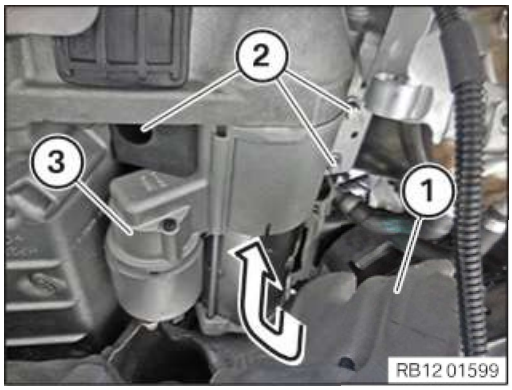


- Install heat shield (1).
- Tighten the nuts and bolts (arrows).

Heat shield to vehicle underbody

Screws and nuts		Tightening torque	3 Nm

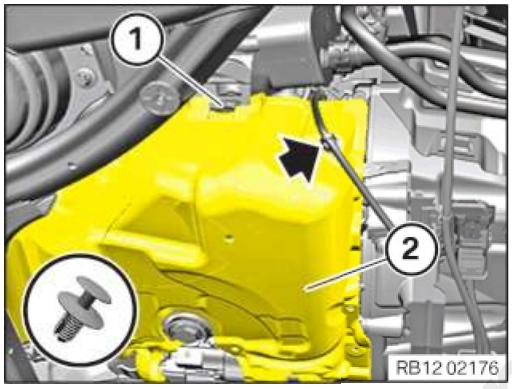
29 – Installing starter motor



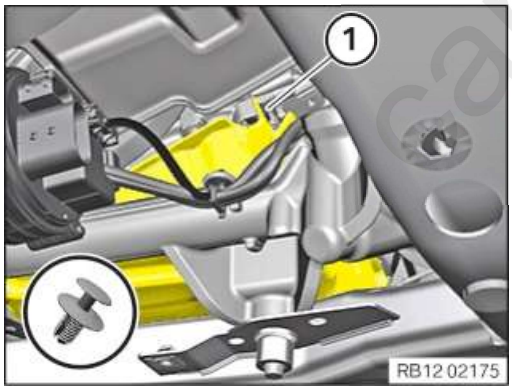
- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Feed in and install the starter motor (3) in the direction of the arrow.
- Tighten the screws (2).

Starter motor to engine

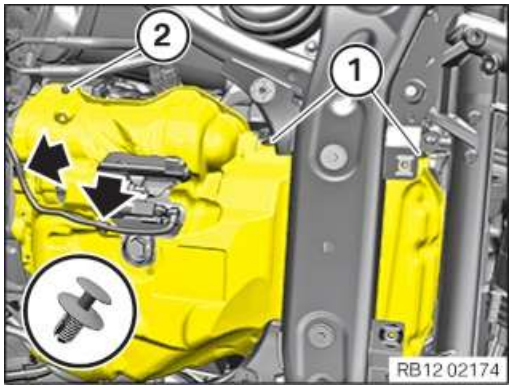
M8X60		Tightening torque	19 Nm



- Position the acoustic cover (2).
- Fasten expanding rivet (1).
- Secure clamp (arrow).

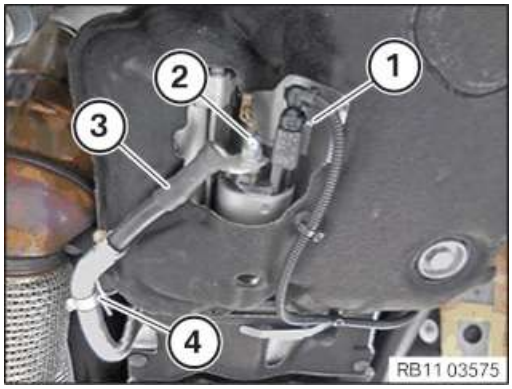


- Fasten expanding rivet (1).

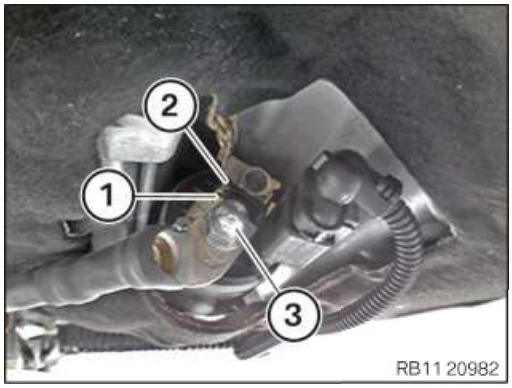


- Secure fir tree clip (2).
- Secure expanding rivet (1).
- Secure the clamps (arrows).

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- Secure the positive battery cable (3) in the holder (4) and position it at the starter motor.
- Tighten the nut (2) hand-tight.
- Connect the connector (1) and audibly lock it.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

30 – Installing the complete exhaust system

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

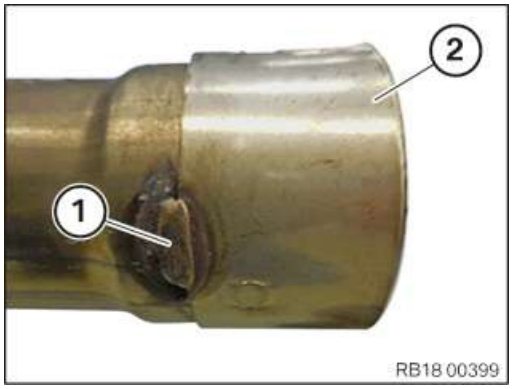
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

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CAUTION

Swarf resulting from sawing or grinding components.

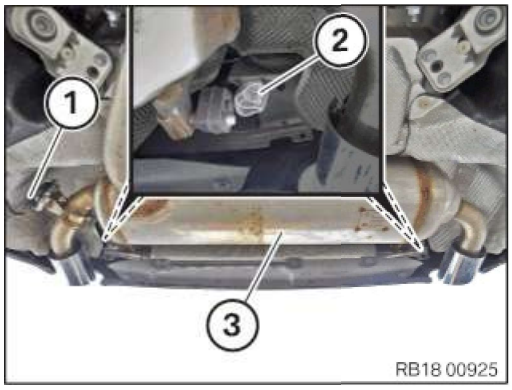
Danger of injury!

- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp



- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

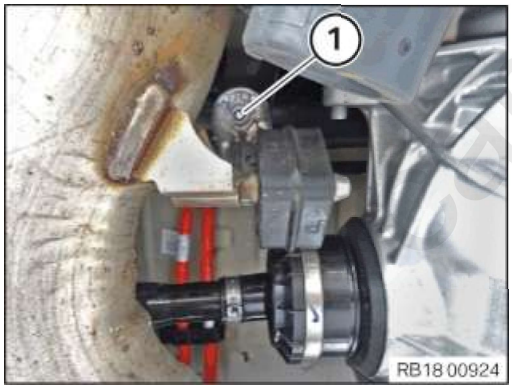
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm



- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

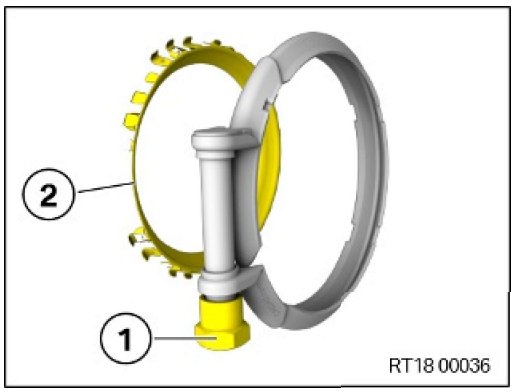
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

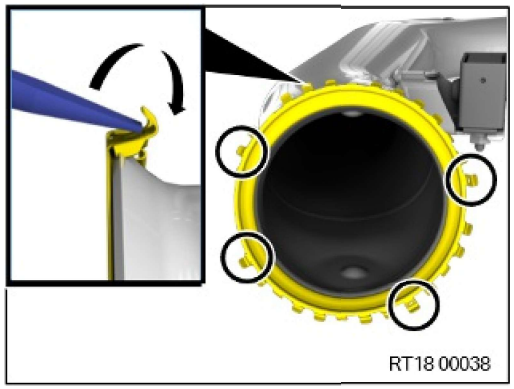


- **Equipment specification 2 (V-clips)**

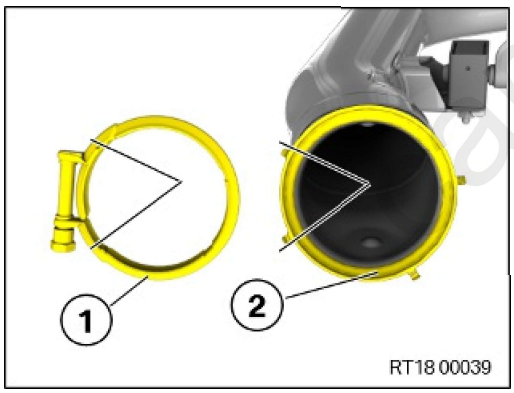
  Renew V-band clamp.

  Parts: V-band clamp

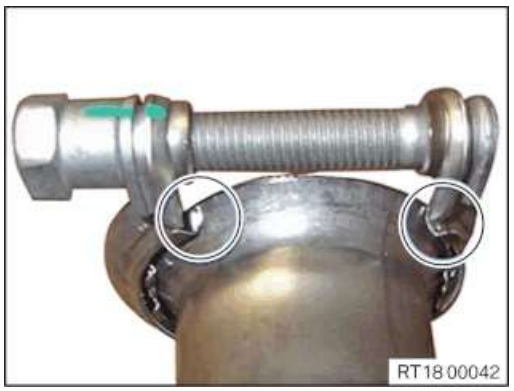
  Unscrew the nut (1) and remove the sealing ring (2).



- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.

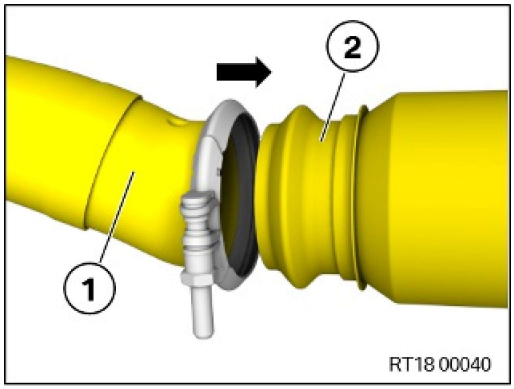


- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).

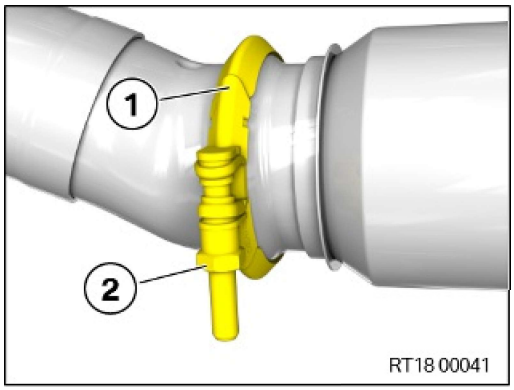


- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.

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- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).

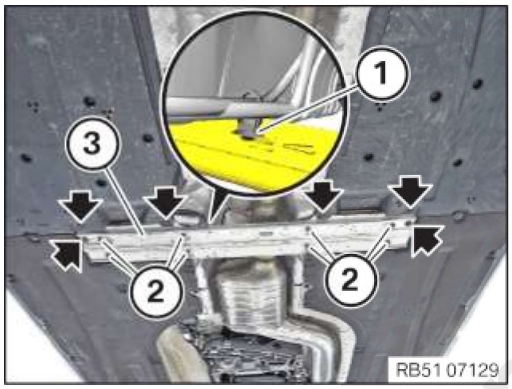


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

31 – Install the connecting supports on the tunnel



- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

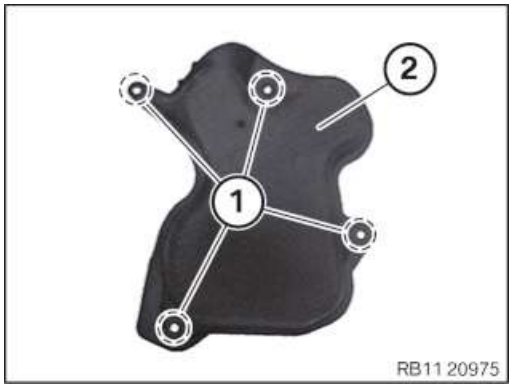
- Tighten screws (arrows).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

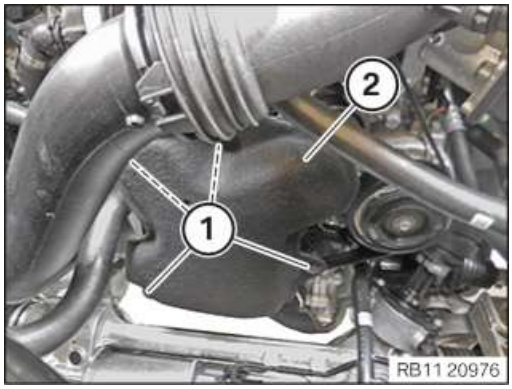
32 – Install the acoustic cover for the engine at the front



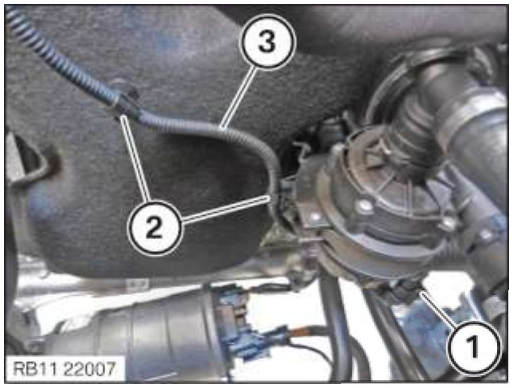
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

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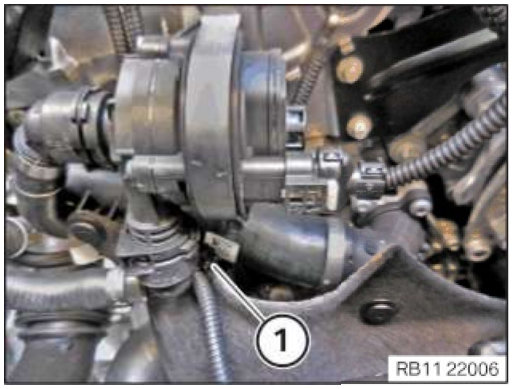


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

33 – Installing the clean air pipe with resonator



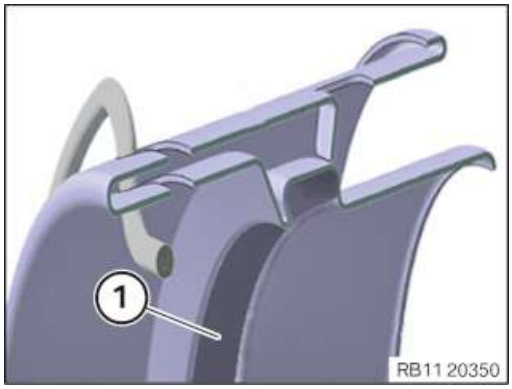
- Check the seal (1) for damages, replace if necessary.

▶ **Replace damaged gasket**

TECHNICAL INFORMATION

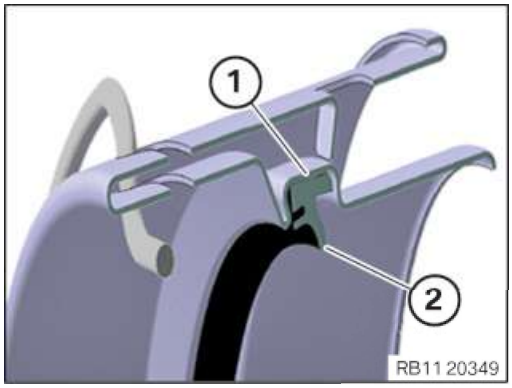
Do not use pointed or sharp-edged tools for the installation and/or removal.

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- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



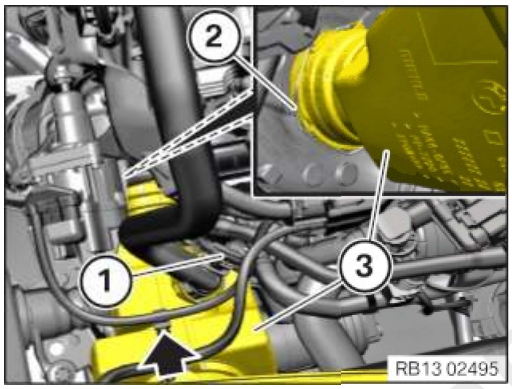
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

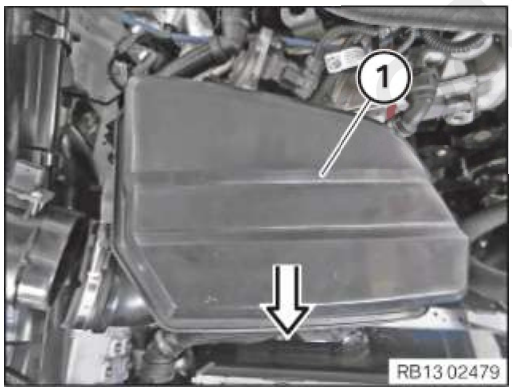
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



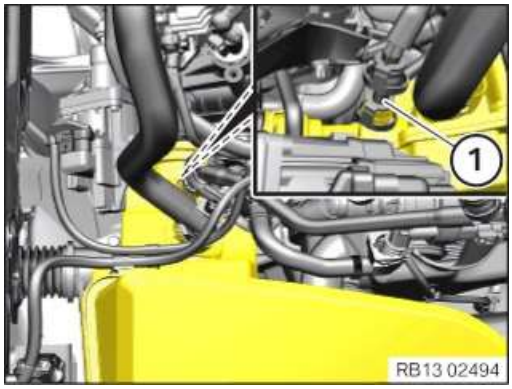
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Secure clamp (arrow).

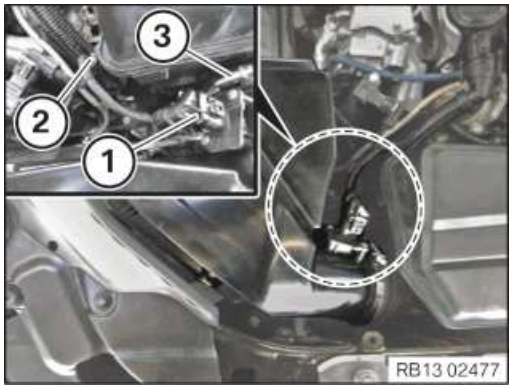


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).

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- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

34 – Disconnecting all battery earth leads



- See additional information.

35 – Checking/topping up oil level in automatic transmission

Prerequisite

Vehicle in horizontal position.

The vehicle is secured against rolling away.

CAUTION

Materials harmful to health.

Contact with fluids harmful to health!

- Note and follow safety information on containers.
- Conduct all work in appropriate personal protective equipment only.

TECHNICAL INFORMATION

To set the correct oil level, it is mandatory that the service function "Transmission control unit: Oil-level adjustment" is carried out with the diagnosis system.

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TECHNICAL INFORMATION

Performing oil-level adjustment:

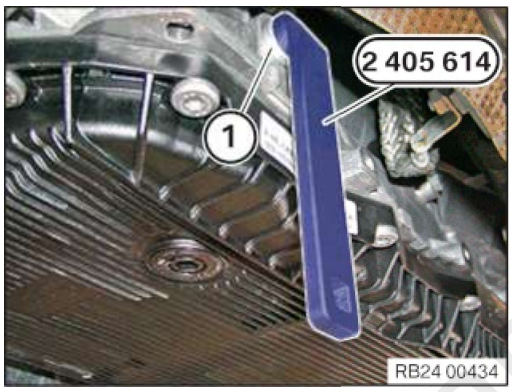
Certain fault memory entries may require an oil-level adjustment in the automatic transmission and after repairs have been completed (e.g. exchange of mechatronics, exchange of the converter, exchange of the transmission, servicing of automatic transmission oil).

TECHNICAL INFORMATION

The automatic transmission fluid specified by BMW must be used for the automatic transmission.

For additional information see: SBS-ANL-SBS1996-240596143_A14 (automatic transmission fluid for ZF transmissions, etc.)

- Connect diagnosis system.
- Observe preconditions for the oil-level adjustment with the diagnosis system:
  - Precondition for beginning: Transmission oil temperature 30°C to 40°C.
  - Precondition for ending: Transmission oil temperature 40°C to 50°C.
- Call up service function (drive).
- Carry out oil-level adjustment in accordance with instructions.



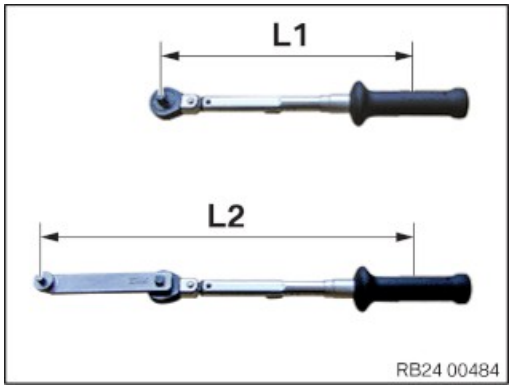
- **Top up the automatic transmission fluid:**
- Loosen the oil filler plug (1) using the special tool 2 405 614.
- Top up automatic transmission fluid according to the instructions in the diagnosis system.

GA8HP51Z transmission capacity

	min. 9,28 l
Transmission oil:	Automatic transmission fluid ATF 3+

GA8HP76Z transmission capacity

	min. 9,35 l
Transmission oil:	Automatic transmission fluid ATF 3+



TECHNICAL INFORMATION

The setpoint torque deviates from the torque to be set when using special tool 2 405 614.

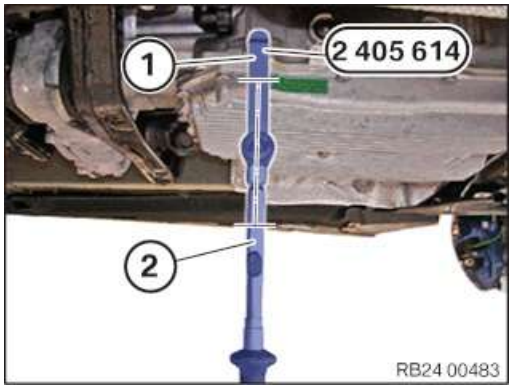
- **Converting the setpoint torque into the torque to be set:**

  (setpoint torque x L1) : L2 =torque to be set.

  L1 = Length from the centre of the handle to the reversible ratchet head

  L2 = Length from the centre of the handle to the engaging of the special tool in the bolt.

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- Renew the oil filler plug (1) and the sealing ring.

  Parts: Oil filler plug, sealing ring
- Make sure that the special tool 2 405 614 and the torque wrench (2) align while tightening the oil filler plug (1).
- Tighten the oil filler plug (1) with the special tool 2 405 614 and the torque wrench (2).

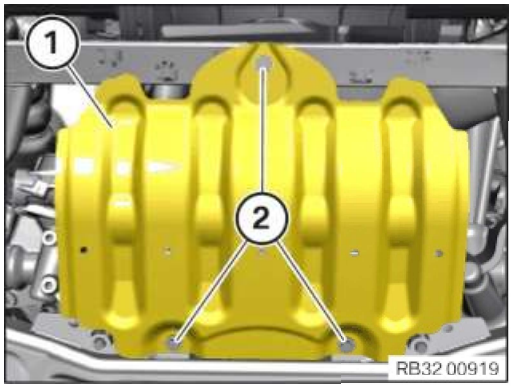
Oil filler plug

M18x1.5		Tightening torque	35 Nm

36 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

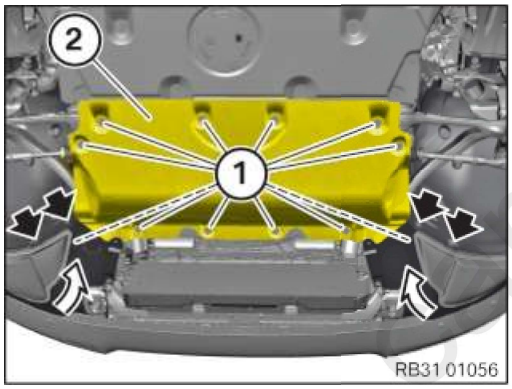


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

37 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

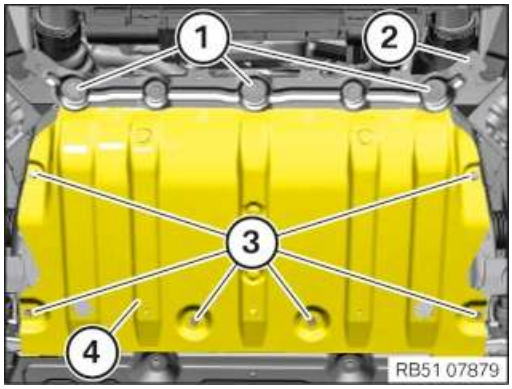
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

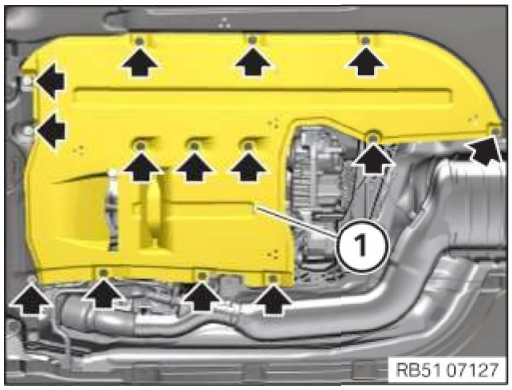
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

38 – Installing underbody protection at rear



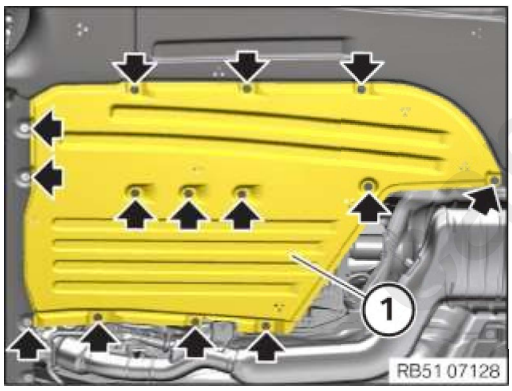
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

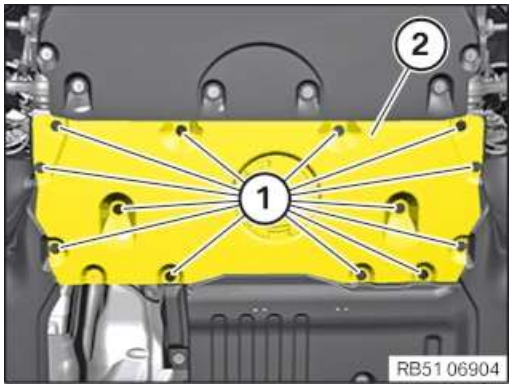
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

39 – Installing the centre underbody protection



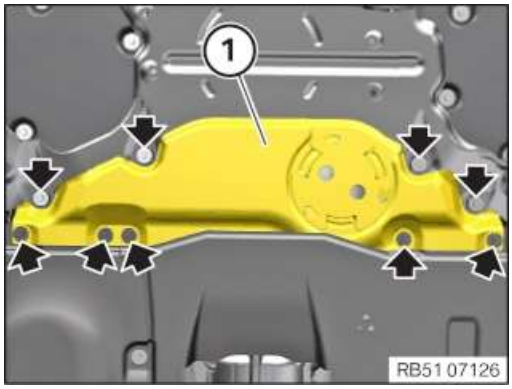
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

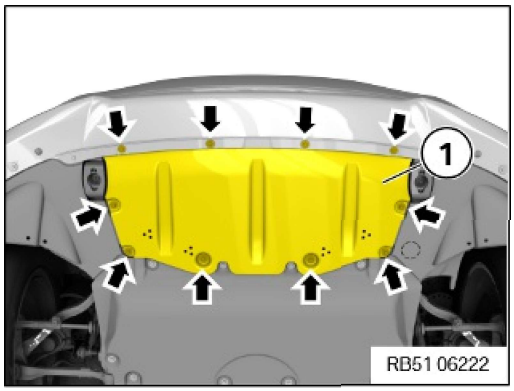
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

40 – Installing the front underbody protection



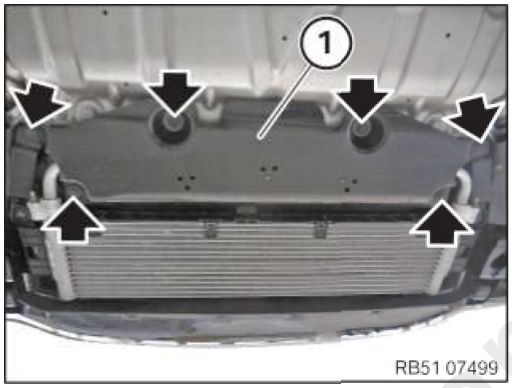
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



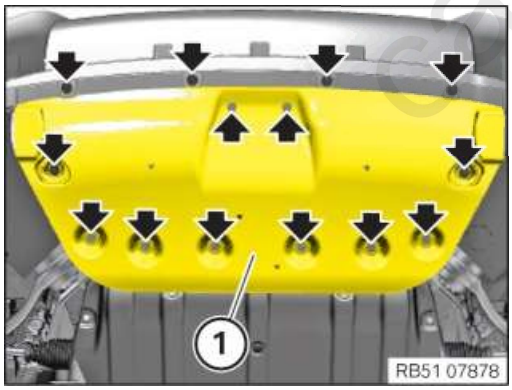
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Flywheel to crankshaft Used in step 21

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

Torque converter to flywheel — Used in step 22

M10	Renew screws.	Tightening torque	56 Nm

Transmission to engine — Used in step 2223

M8		Tightening torque	19 Nm
M12		Tightening torque	66 Nm

Ground strap to transmission or body — Used in step 22

M8		Tightening torque	19 Nm

Catalytic converter to holder — Used in step 23

M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder — Used in step 23

M8	Renew nut.	Tightening torque	19 Nm

Transmission cross member to body — Used in step 24

M8	Renew screws.	Tightening torque	19 Nm

Transmission oil line to transmission — Used in step 25

M6x25	Renew the sealing ring.	Tightening torque	8 Nm

Transmission oil line on holder — Used in step 25

M6		Tightening torque	8 Nm

Front flexible disc to propeller shaft — Used in step 26

M12	Renew screws. Comply with jointing torque and angle of rotation. Tightening via screw.	Jointing torque Angle of rotation	55 Nm 90 °

Centre mount to body — Used in step 26

M8		Tightening torque	19 Nm

Retaining plates for vehicle underbody cover — Used in step 27

Sheet metal nut	Replace nuts.	Tightening torque	3 Nm

Heat shield to vehicle underbody — Used in step 28

Screws and nuts		Tightening torque	3 Nm

Starter motor to engine — Used in step 29

M8X60		Tightening torque	19 Nm

Battery positive lead to starter — Used in step 29

M8		Tightening torque	13,5 Nm

Rear silencer to body / bumper support — Used in step 30

M8	Replace nuts.	Tightening torque	19 Nm

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Exhaust system to rear axle carrier — Used in step 30

Nut M8	Renew nut.	Tightening torque	19 Nm

Front silencer / petrol particulate filter on transmission bracket — Used in step 30

M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter — Used in step 30

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter — Used in step 30

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

Connecting support to tunnel — Used in step 31

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Clean air pipe to upper section of intake filter housing — Used in step 33

Clamp		Tightening torque	3 Nm

Oil filler plug — Used in step 35

M18x1.5		Tightening torque	35 Nm

Bumper buffer device steering on front axle support — Used in step 36

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 37

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 37

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 37

M10		Tightening torque	56 Nm

Underbody protection — Used in step 3839

Hexagon screw		Tightening torque	3 Nm

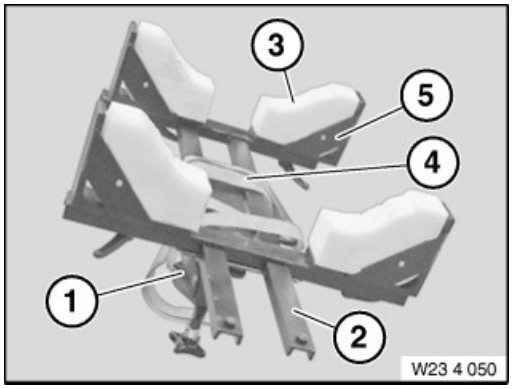
Underbody protection front — Used in step 40

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

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0 495 498 (23 4 050) Support



Common Used in step 1724

Usage	(universal gearbox holder) Support for removing and installing manual gearboxes and automatic transmissions for BMW & RR.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 06 (256)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
3	0 495 549 (23 4 053)		**Insert** (Foam material insert (1 set = 4 pieces)) deleted, can be ordered only via tool set	
1	0 495 547 (23 4 051)		**Joint** Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	
2	0 495 548 (23 4 052)		**Frame** (Basic frame) Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	
4	0 495 550 (23 4 054)		**Belt** (Tensioning strap) Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	
5	0 496 018 (23 4 055)		**Support** (Fixture for foam insert) Available only as a complete tool set 23 4 050 (83 30 0 495 498) - as of 16.07.12.	

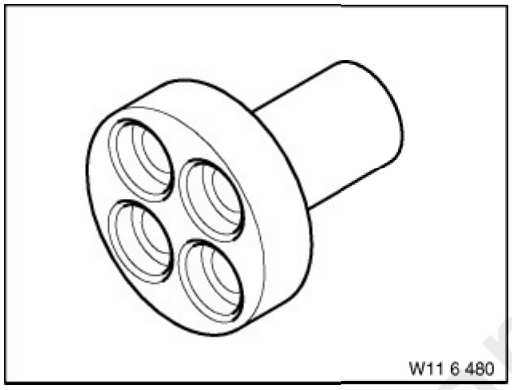
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2 219 012 Hydraulic lifter



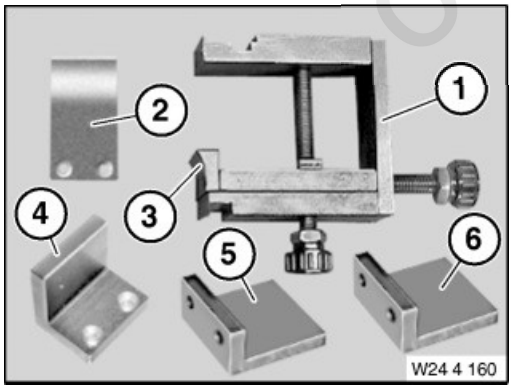
Common	Used in step 1724
Usage	For raising and lowering various vehicle components.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 90 (207)

0 493 380 (11 6 480) Connector



Common	Used in step 1922
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

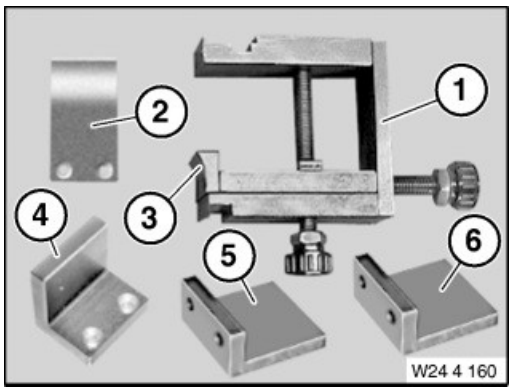
0 494 478 (24 4 161) Basic body



Common	Used in step 19
Usage	
Included in the tool or work	0 494 451
Storage location	C46
Replaced by	
In connection with	
SI-Number	

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0 496 061 (24 4 166) Shaped element



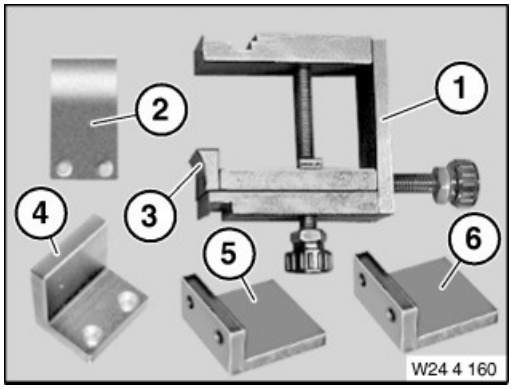
Common Used in step 19

Usage	Transmission: GA6L45R (GM6) in E83 / N52K Deletion, only available via tool set
Included in the tool or work	0 494 451
Storage location	C46
Replaced by	
In connection with	
SI-Number	01 02 07 (334)

0 494 451 (24 4 160) Holder

Used in step 1922

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Common

Usage	For securing converter during removal and installation of transmission
Included in the tool or work	
Storage location	B45
Replaced by	
In connection with	
SI-Number	01 11 02 (908)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 494 479 (24 4 162)		**Shaped element** For converter version N73 discontinued, available as part of set of special tools only	
5	0 494 965 (24 4 165)		**Shaped element** Transmission: GA6 HP19 in E87, E90 Discontinued, available as part of set of special tools only	
3	0 494 477 (24 4 163)		**Shaped element** For converter version M57TU discontinued, available as part of set of special tools only	
1	0 494 478 (24 4 161)		**Basic body**	
4	0 494 622 (24 4 164)		**Shaped element** For converter version M54 discontinued, available as part of set of special tools only	
6	0 496 061 (24 4 166)		**Shaped element** Transmission: GA6L45R (GM6) in E83 / N52K Discontinued, available as part of set of special tools only	

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0 494 213 (24 2 390) Cap



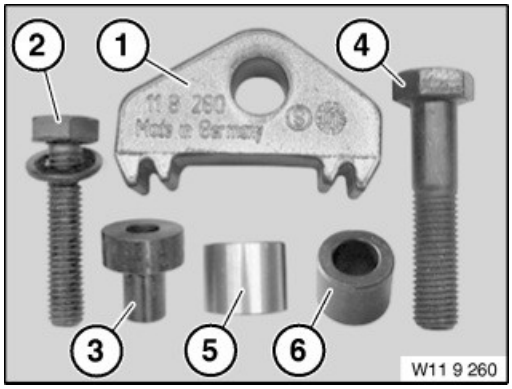
Common Used in step 1922

Usage	(protective cap) For sealing off the guide sleeve of the transmission connector
Included in the tool or work	
Storage location	C49
Replaced by	
In connection with	
SI-Number	01 14 01 (766)

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0 493 938 (11 9 260) Holder

Used in step 2021



Common

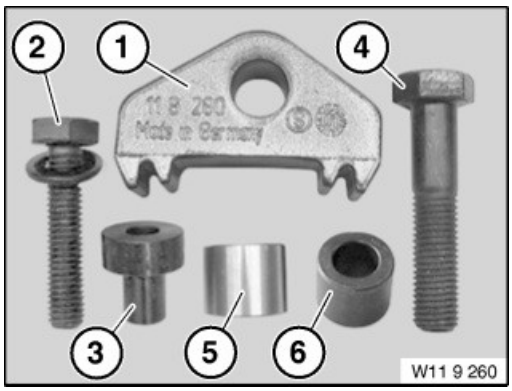
Usage	(Counter support with screw connection) For holding the flywheel when gearbox is removed
Included in the tool or work	
Storage location	A44
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 034 (11 9 261)		**Holder** (Individual counter support)	
2	0 494 035 (11 9 262)		**Screw** (Bolt (thread M10) with washer) For screwing counter support	
3	0 494 129 (11 9 263)		**Bush** (Bush for counter support) For counter support, for retaining flywheel when gearbox is removed Engine: N62, N73	
6	0 495 216 (11 9 266)		**Bush** For counter support, for retaining flywheel when gearbox is removed Engine: M57TU2	
4	0 494 130 (11 9 264)		**Screw** (Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed	
5	0 494 793 (11 9 265)		**Bush**	

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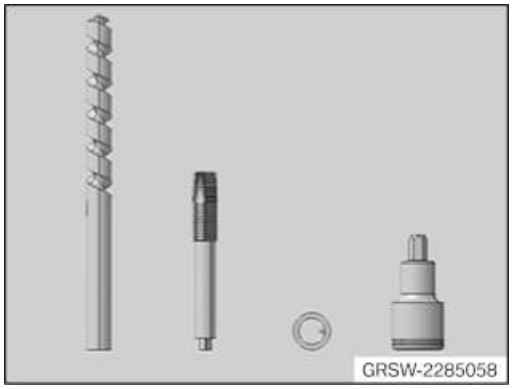
0 494 130 (11 9 264) Screw



Common Used in step 2021

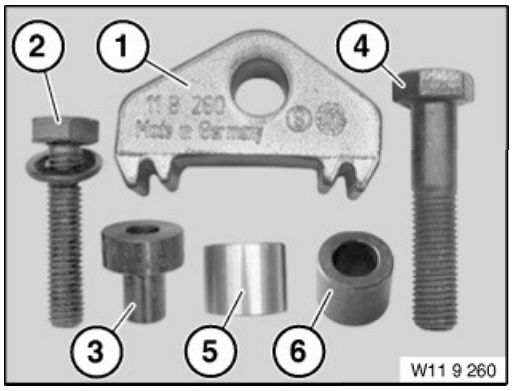
Usage	(Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed
Included in the tool or work	0 493 938
Storage location	A44
Replaced by	
In connection with	
SI-Number	

2 285 058 Tool set



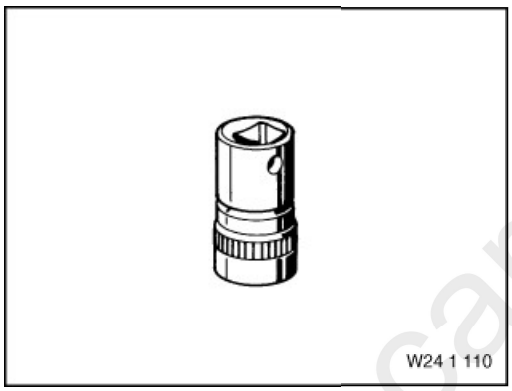
Common	Used in step 21
Usage	
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 14 (069)

0 494 034 (11 9 261) Holder



Common	Used in step 21
Usage	(Individual counter support)
Included in the tool or work	0 493 938
Storage location	
Replaced by	
In connection with	
SI-Number	

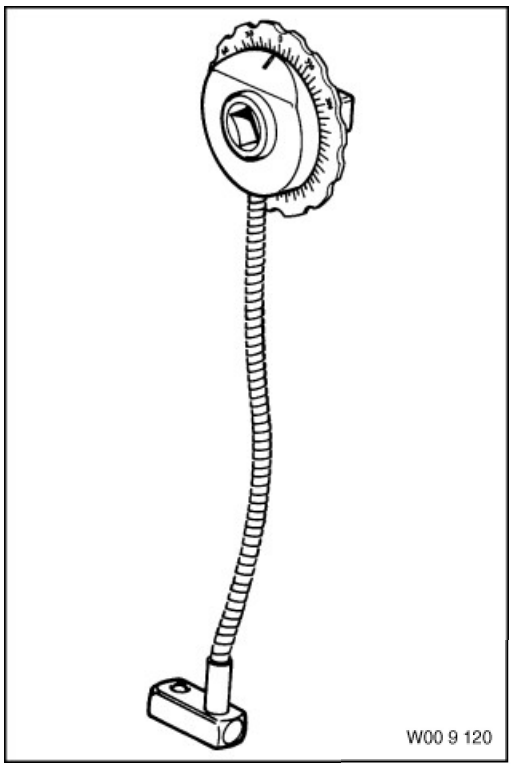
0 491 667 (24 1 110) Socket wrench insert



Common	Used in step 22
Usage	Loosening and fastening the converter fastener
Included in the tool or work	
Storage location	A14
Replaced by	
In connection with	
SI-Number	01 04 86 (566)

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0 490 504 (00 9 120) Torque angle measuring dial



Common Used in step 26

Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

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2 405 614 Socket wrench



Common	Used in step 35
Usage	For opening and closing the oil filler plug. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969). Replaced by 2455997
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 33 15 (305)

Overview Technical Data

GA8HP51Z transmission capacity — Used in step 35

	min. 9,28 l

Transmission oil: Automatic transmission fluid ATF 3+

GA8HP76Z transmission capacity — Used in step 35

	min. 9,35 l

Transmission oil: Automatic transmission fluid ATF 3+

Screw-in depth of thread cutter — Used in step 21

Screw-in depth	18 mm

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	134
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	134
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
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61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
61 20 900 Disconnecting and connecting battery earth lead	134
17 11 035 Removing and installing/replacing fan cowl with electric fan	19

Operating materials	**Used in step**
14.0 Automatic transmission fluid for ZF-transmission GA8HP45Z / GA8HP50Z / GA8HP70Z / GA8HP90Z / GA8P70H / GA8P75H / GA8HP75Z	35

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11 23 010 Removing and installing/replacing vibration damper

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Removing the clean air pipe with the resonator

WARNING

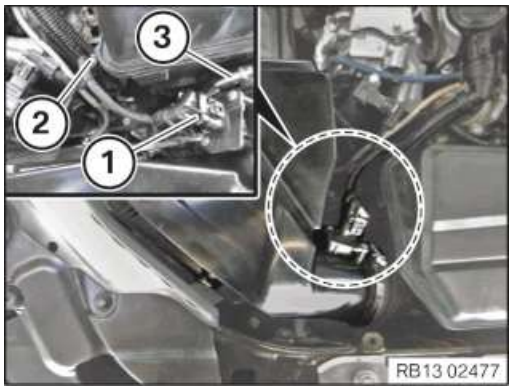
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

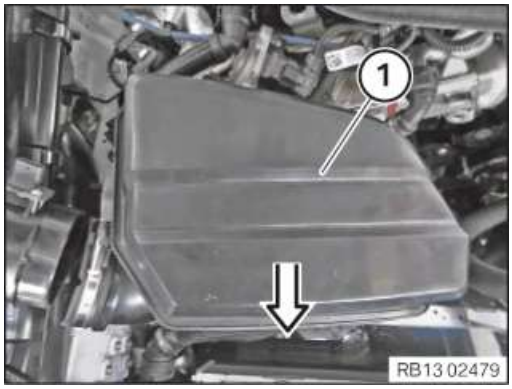


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

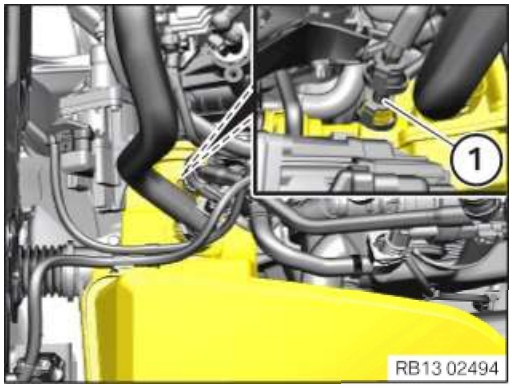


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

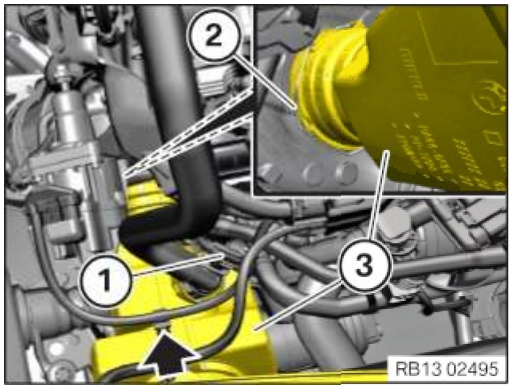
bmwdiagn.com



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

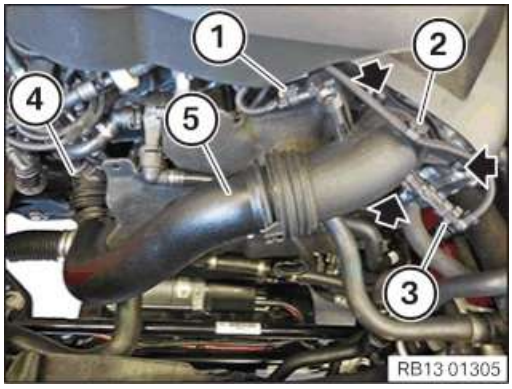
4 – Remove charge air line

WARNING

Hot surfaces.

Risk of burning!

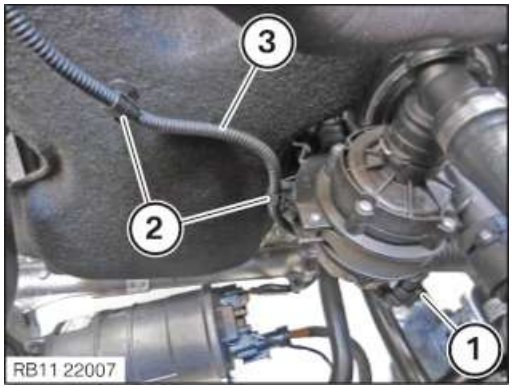
- Perform all work only on components that have cooled down.



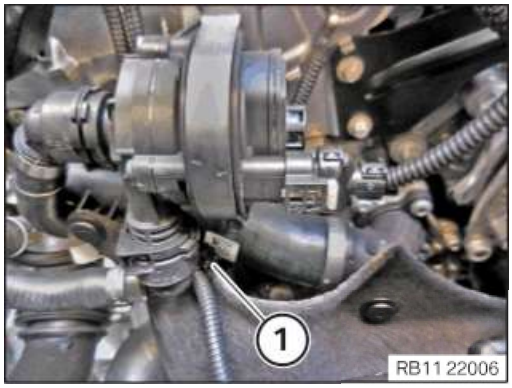
- Unlock and loosen the connector (1) on the charging pressure sensor.
- Unlock and loosen clamp (2).
- Unlock and disconnect the connector (3) from the charge-air temperature sensor.
- Remove screws (arrows).
- Unlock and loosen the clamp (4) on the exhaust turbocharger.
- Guide out and remove charge air line (5).

5 – Removing the acoustic cover for the engine at the front

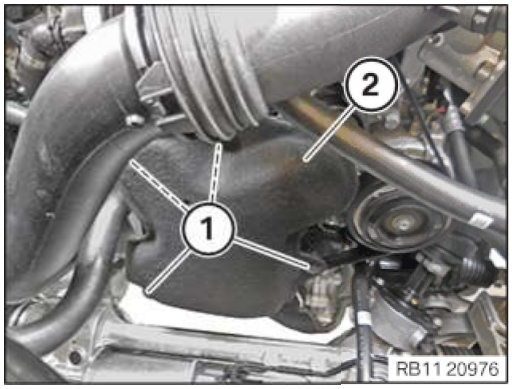
cardiagn.com



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

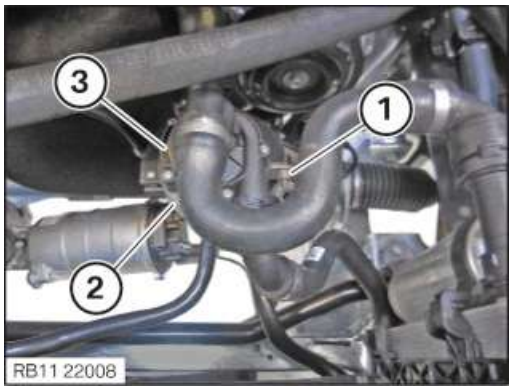
6 – Releasing the electrical auxiliary coolant pump for the charge air cooler or the air conditioning condenser

RISK OF DAMAGE

Non-visible damage to the coolant pump.

Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.



- Loosen nut (1).
- Thread out holder (2) and set aside.
- Guide out the electrical auxiliary coolant pump (3) and set it aside.

7 – Removing the drive belt for alternator

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CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

Component with preload.

Danger of injury!

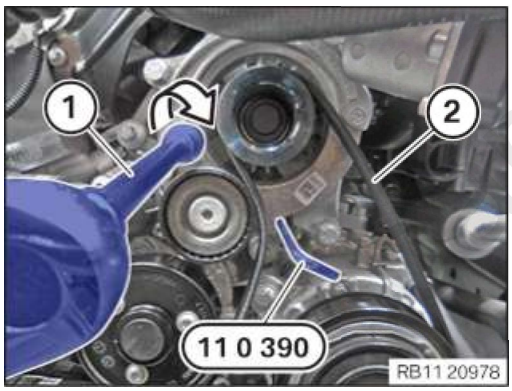
- Reduce preload as far as possible before disassembly. Relieve component.

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

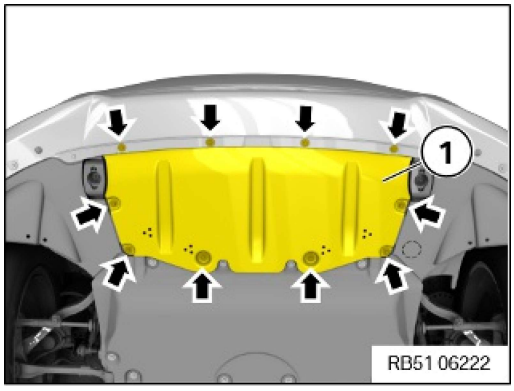
TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.



- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Secure the belt tensioner with the special tool 0 496 268 (11 0 390).
- Guide out the drive belt for the alternator (2) and remove it.

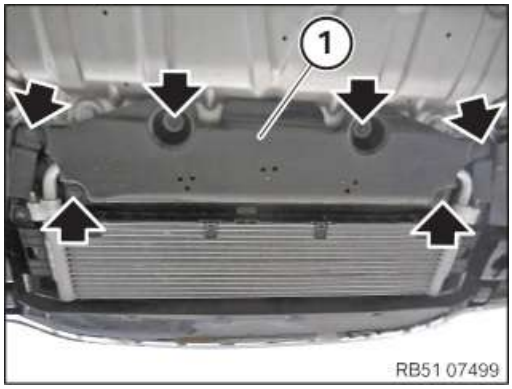
8 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

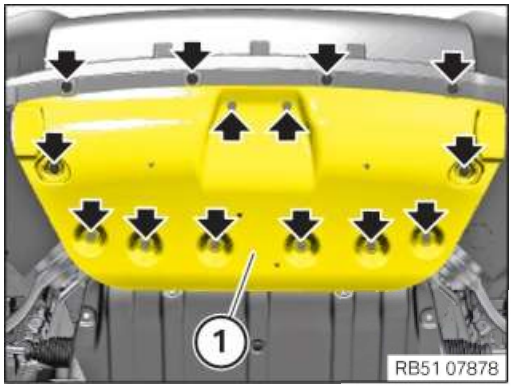
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

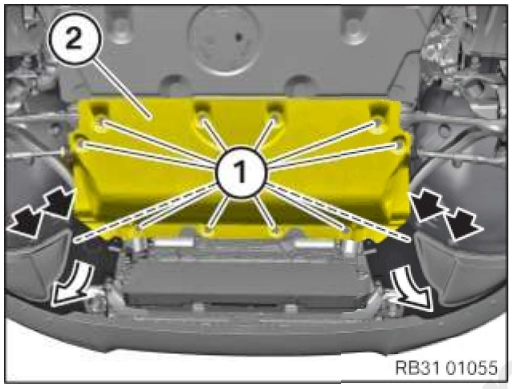


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

9 – Remove the underbody protection of the steering gear



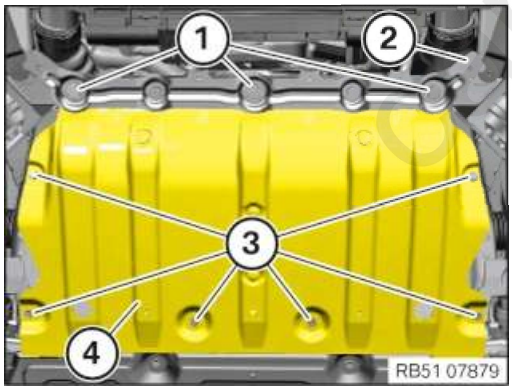
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

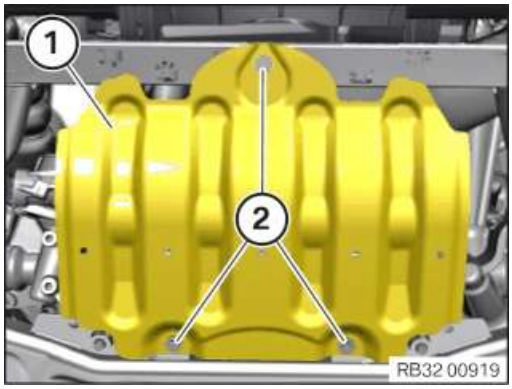
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

10 – If installed: Removing the steering start protection

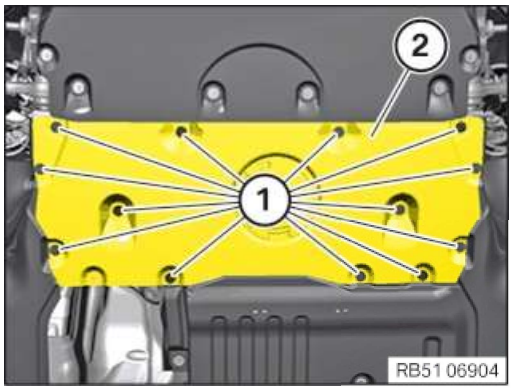
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

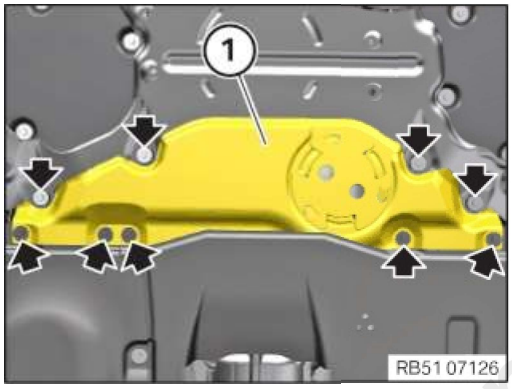
11 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

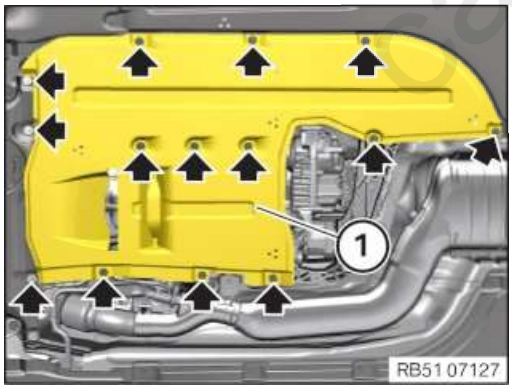


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

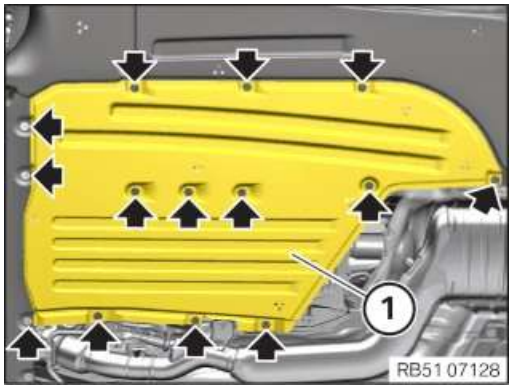
12 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

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13 – Removing starter motor

Prerequisite

Battery earth leads are disconnected.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

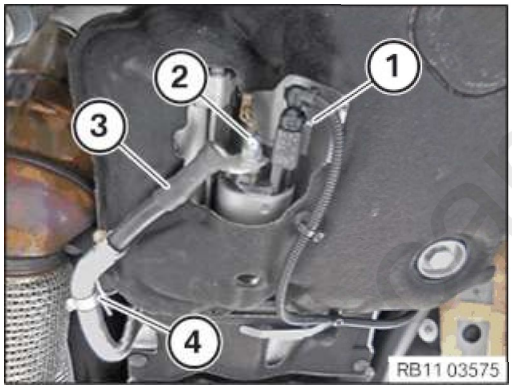
Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

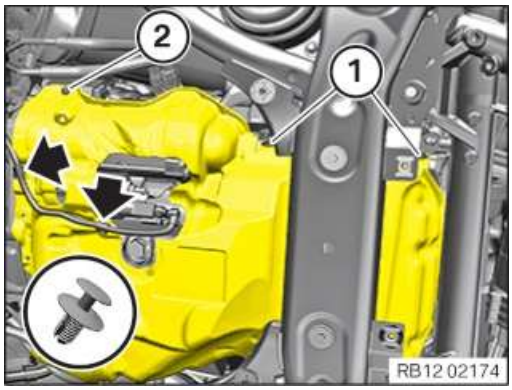
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

TECHNICAL INFORMATION

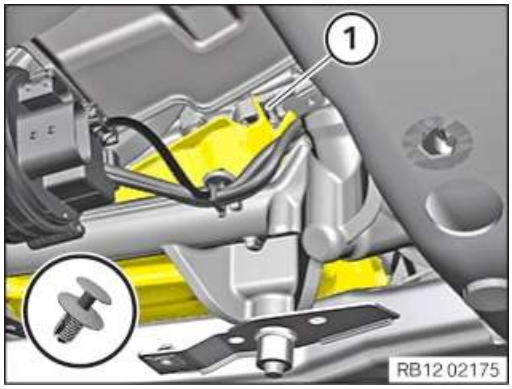
Make sure that the acoustic cover is **not** damaged while removing the starter motor.
A damaged lower acoustic cover can only be renewed when the front axle is lowered.



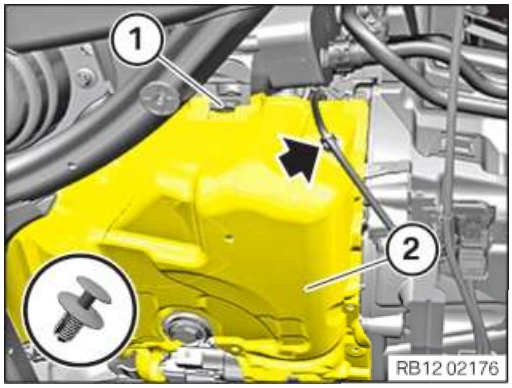
- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Release positive battery cable (3) from holder (4).



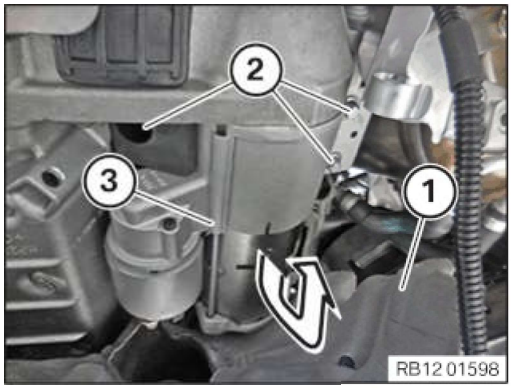
- Loosen the expanding rivet (1).
- Undo fir tree clip (2).
- Release the clamps (arrows).



- Loosen expanding rivet (1).
- Lower the acoustic cover of the oil sump.



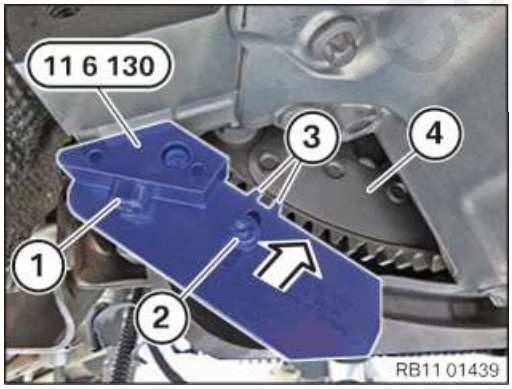
- Loosen expanding rivet (1).
- Loosen the clamp (arrow).
- Lower acoustic cover (2).



- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Loosen screws (2).
- Carefully guide out the starter motor (3) in direction of arrow and remove.

MAIN WORK

14 – Removing the vibration damper



- Position the special tool 0 496 595 (11 6 130) and secure it on the timing case cover using the bolt (1).

  The special tool 0 496 595 (11 6 130) must lie flat on the transmission housing.
- If necessary, turn the engine in the direction of rotation until the teeth (3) engage completely in the gearing of the flywheel (4).
- Slide the counter support with the bolt (2) up until the teeth (3) engage completely in the gearing of the flywheel.
- Tighten down screw (2).

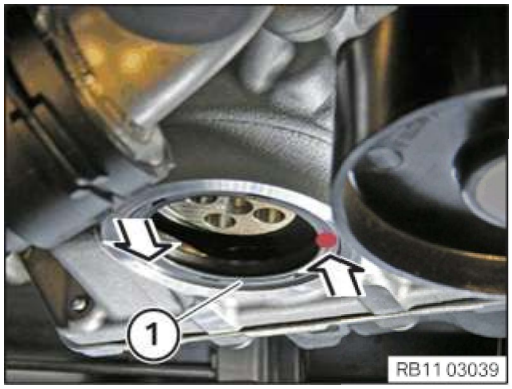
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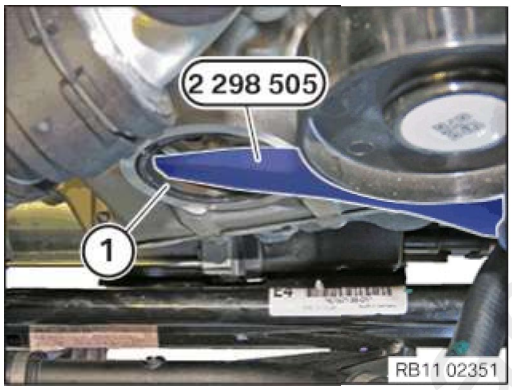
- Unscrew the bolts (arrows) on the vibration damper (1).
- Feed out and remove the vibration damper (1).

15 – Renewing the front crankshaft seal

▸ **Removing the front crankshaft seal**

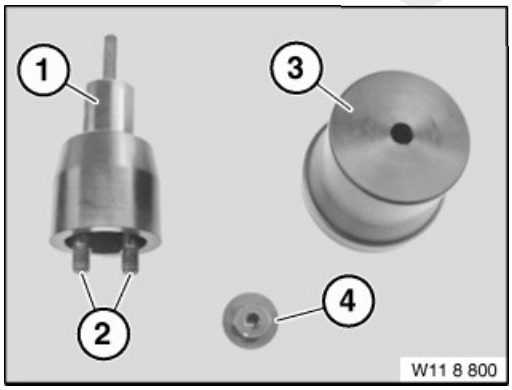


- Drive in the crankshaft seal (1) in the marked area with a punch to approx. 1 cm deep.



- Lever out the crankshaft seal (1) with the special tool 2 298 505.
- Make sure that the sealing surface on the crankcase is **not** scratched.

▸ **Installing the front crankshaft seal**

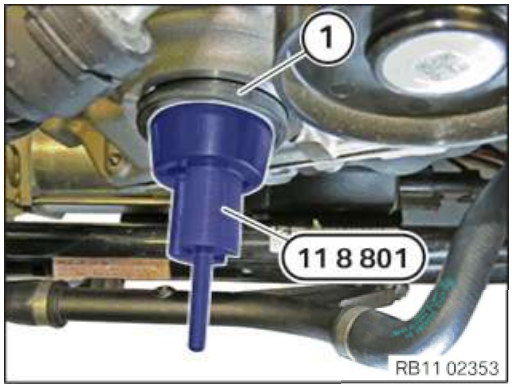


- Prepare special tool 0 496 130 (11 8 803).

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- Clean the special tool 0 496 128 (11 8 801) from the set of special tools 0 496 127 (11 8 800) and coat it with fresh engine oil.
- Secure special tool 0 496 128 (11 8 801) using special tool 0 496 129 (11 8 802) from the set of special tools 0 496 127 (11 8 800) to the crankshaft.



RISK OF DAMAGE

Radial shaft seal damage.

Touching the sealing lip (inner) and applying oil to the radial shaft seal will lead to its destruction.

- Do not touch the sealing lip (inner) of the radial shaft seal.
- Do not apply oil to the radial shaft seal.
- Install the radial shaft seal dry.

- Carefully slide crankshaft sealing ring (1) straight **in a rotational movement** onto special tool 0 496 128 (11 8 801) from the set of special tools 0 496 127 (11 8 800) until the crankshaft sealing ring (1) rests against the crankcase.



- Mount special tool 0 496 130 (11 8 803) on special tool 0 496 128 (11 8 801) from the set of special tools0 496 127 (11 8 800) in the direction of the arrow.



- Screw in special tool (sleeve) 0 496 130 (11 8 803) using special tool 0 496 131 (11 8 804) from the set of special tools 0 496 127 (11 8 800) and a suitable tool until the sleeve rests flush against crankcase (1).

carmanualsdiagram.com



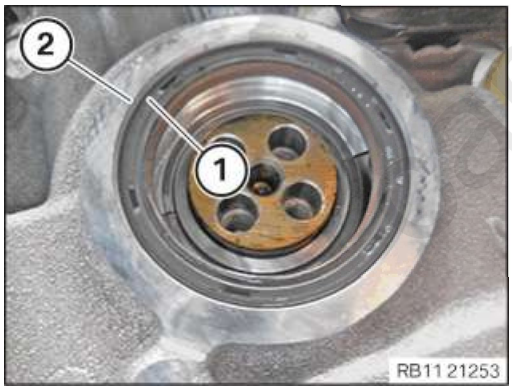
- Release and remove special tool 0 496 131 (11 8 804).



- Guide out and remove special tool 0 496 130 (11 8 803) in the direction of the arrow from special tool 0 496 128 (11 8 801) from the set of special tools 0 496 127 (11 8 800).



- Release special tool 0 496 129 (11 8 802).
- Guide out and remove special tool 0 496 128 (11 8 801) I 0 496 129 (11 8 802) on the crankshaft.



- Ensure that crankshaft sealing ring (1) is fitted correctly on crankcase (2).

16 – Installing the vibration damper

RISK OF DAMAGE

Radial shaft seal damage.

When installing the vibration damper, the rotary shaft seal can be damaged.

- The special tool must be used to install the vibration damper.

TECHNICAL INFORMATION

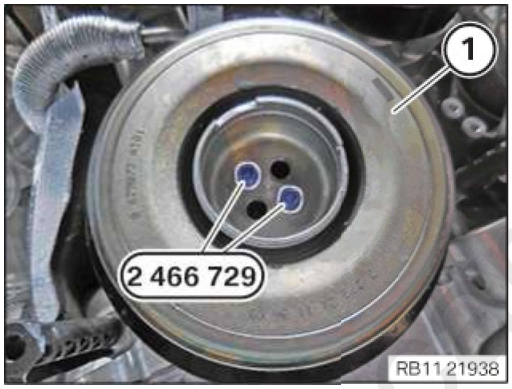
When removing and installing or replacing the vibration damper, the rotary shaft seal must be replaced.



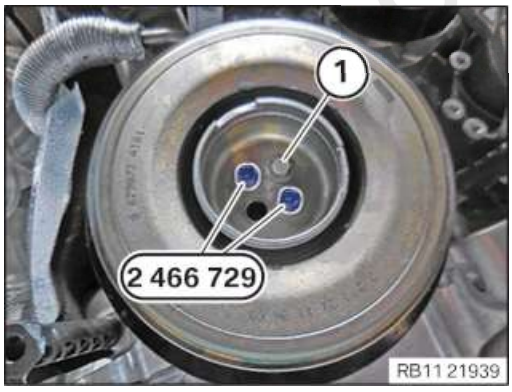
- Clean the sealing surface (1) from oil and contamination.



- Screw special tool 2 466 729 into the crankshaft by hand.



- Insert vibration damper (1) into the special tool 2 466 729 and install.



- Renew the bolts (arrows).

  Parts: Bolts
- Hand-tighten the bolt (1).
- Guide the special tool 2 466 729 out and remove.

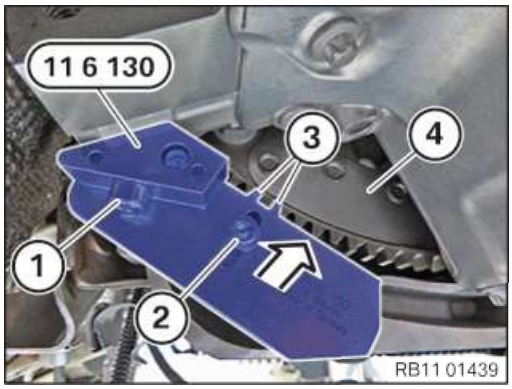
.com



- Position vibration damper (1).
- Tighten the bolts (arrows) on the vibration damper (1).

Vibration damper with belt pulley to crankshaft

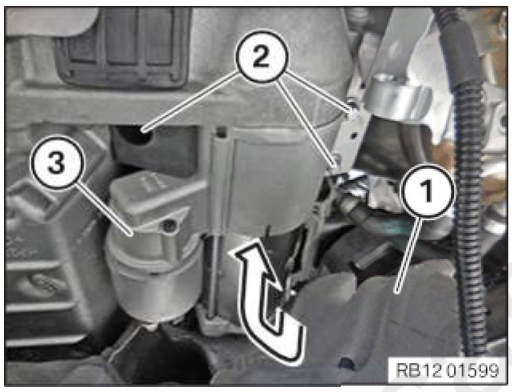
M10x65	Renew screws. Tighten screws crosswise.	1. Jointing torque 2. Angle of rotation	40 Nm 60 °
		3. Angle of rotation	60 °



- Loosen screw (2).
- Slide the counter support with the bolt (2) down until the teeth (3) are no longer engaged in the gearing of the flywheel (4).
- Release the screw (1) and feed out and remove special tool 0 496 595 (11 6 130).

POSTPROCESSES

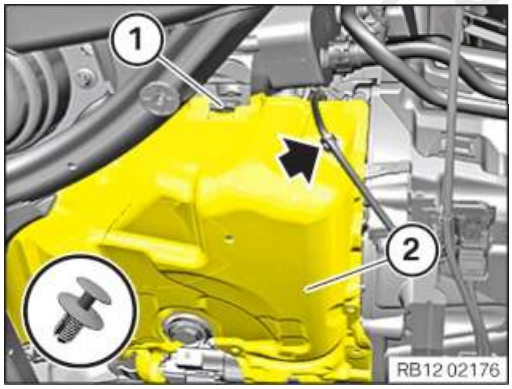
17 – Installing starter motor



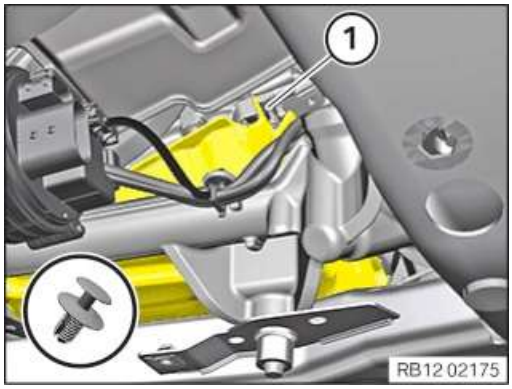
- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Feed in and install the starter motor (3) in the direction of the arrow.
- Tighten the screws (2).

Starter motor to engine

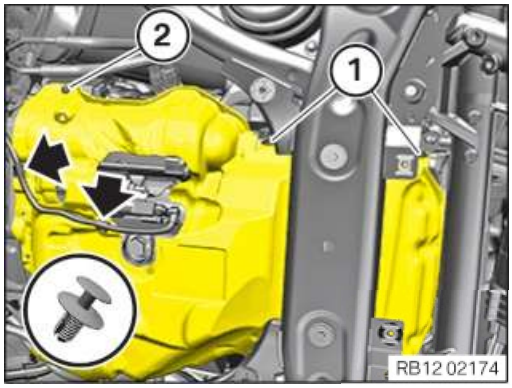
M8X60		Tightening torque	19 Nm



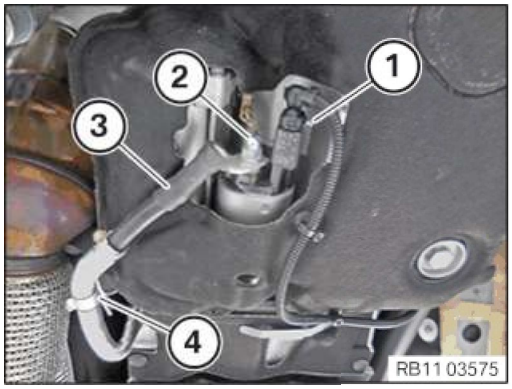
- Position the acoustic cover (2).
- Fasten expanding rivet (1).
- Secure clamp (arrow).



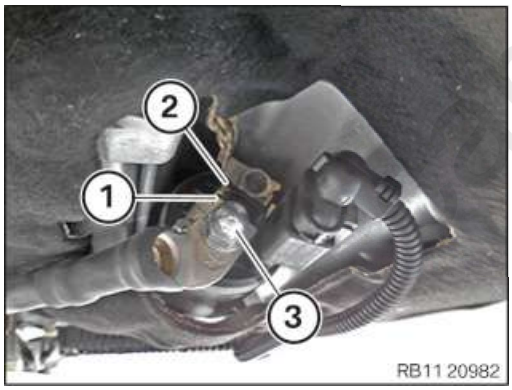
- Fasten expanding rivet (1).



- Secure fir tree clip (2).
- Secure expanding rivet (1).
- Secure the clamps (arrows).



- Secure the positive battery cable (3) in the holder (4) and position it at the starter motor.
- Tighten the nut (2) hand-tight.
- Connect the connector (1) and audibly lock it.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

18 – Installing the drive belt for alternator

Overview of drive belt for alternator



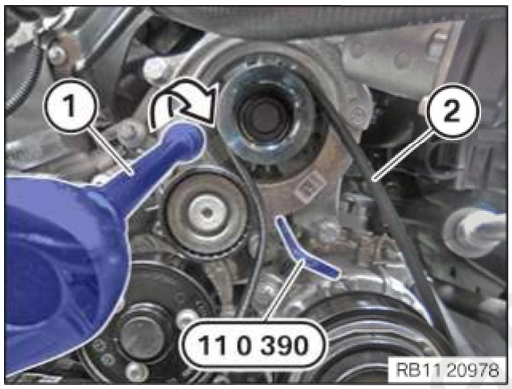
1. Drive belt for alternator

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

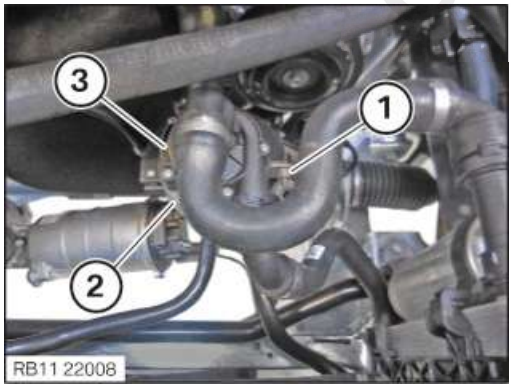
TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.



- Position the drive belt for alternator (2) on the ancillary components.
- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Feed the special tool 0 496 268 (11 0 390) out of the belt tensioner and remove it.

19 – Mounting the electrical auxiliary coolant pump for the charge air cooler/air conditioning condenser



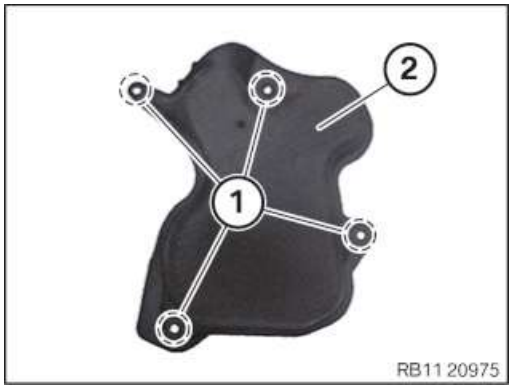
- Feed in and position the electrical auxiliary coolant pump (3).
- Insert and install the holder (2).
- Tighten nut (1).

Electric coolant pump to holder

M6		Tightening torque	8 Nm

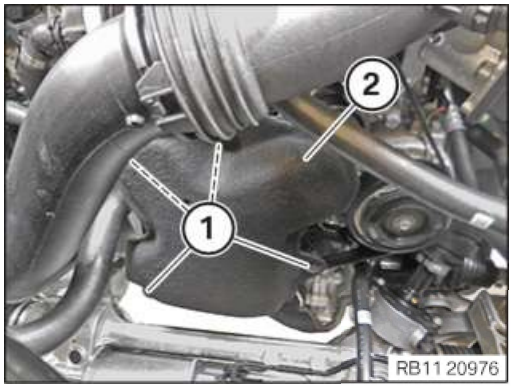
20 – Install the acoustic cover for the engine at the front

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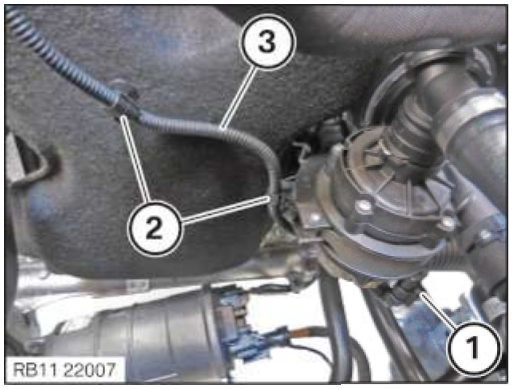


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

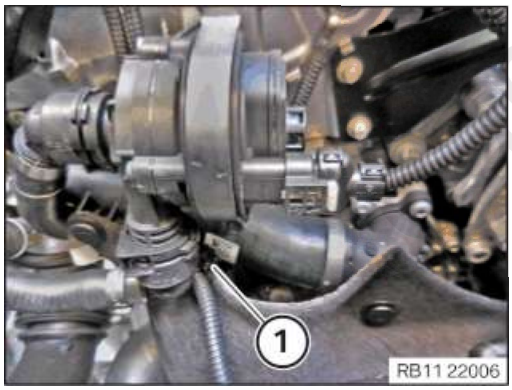


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



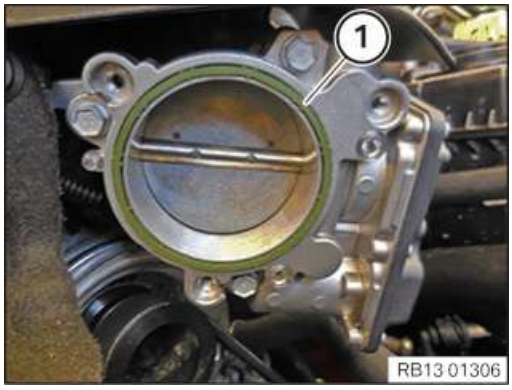
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

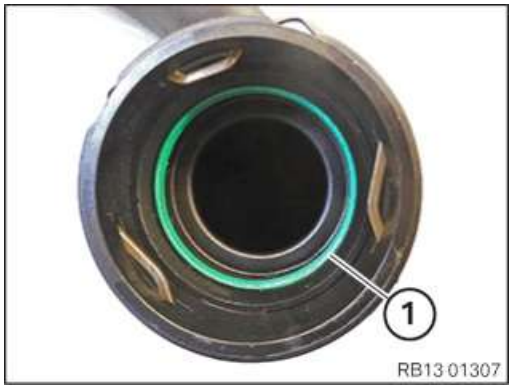
21 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring

rdiagn.com

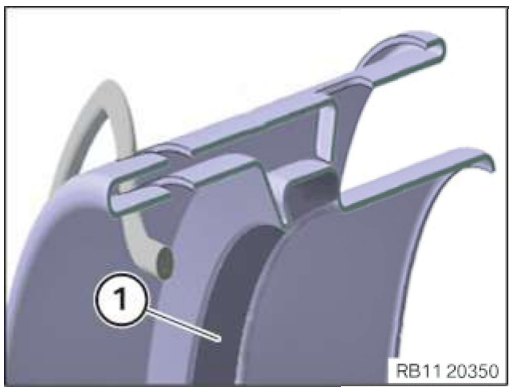


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▶ **Replace damaged gasket**

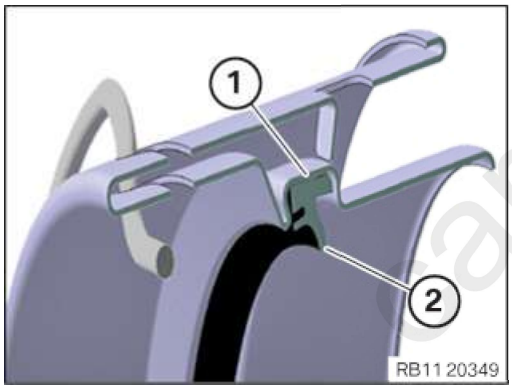
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



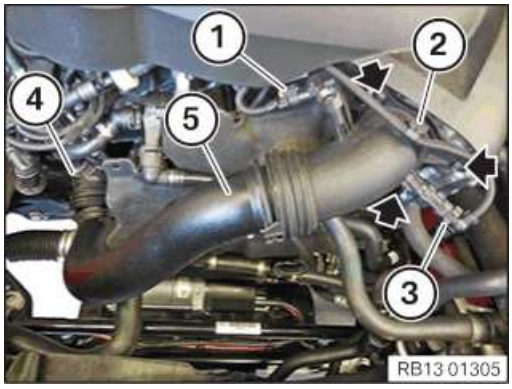
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

Charge air line to throttle body

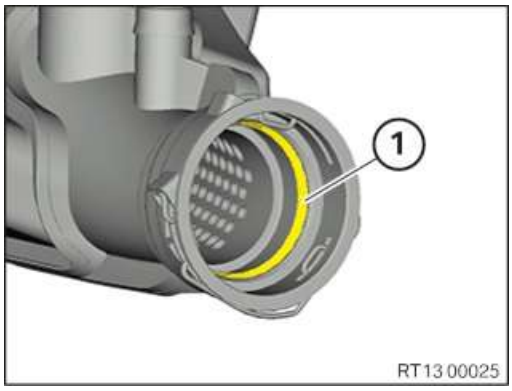
M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

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22 – Installing the clean air pipe with resonator

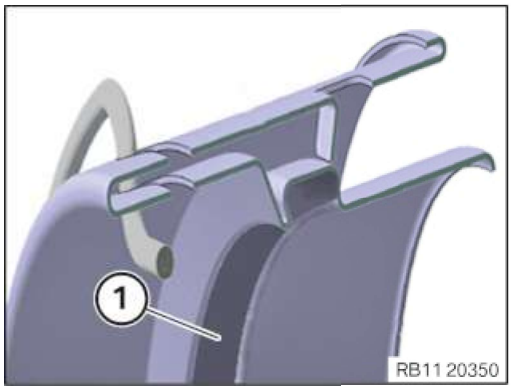


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

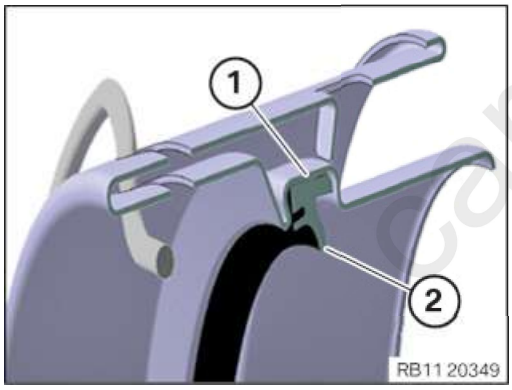
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



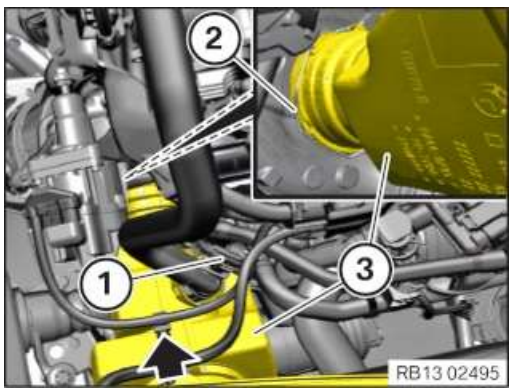
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).

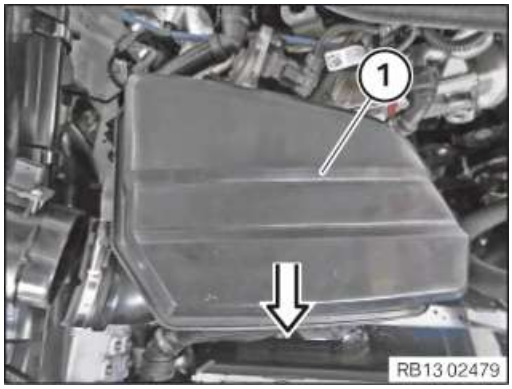


- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

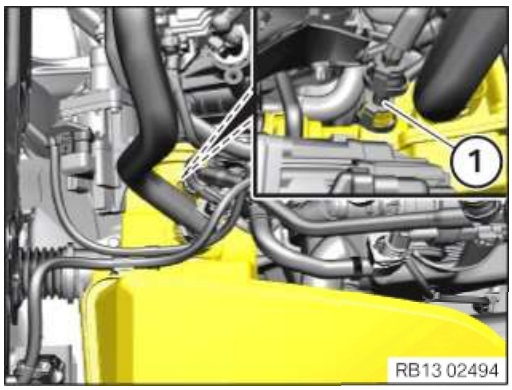
  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Secure clamp (arrow).

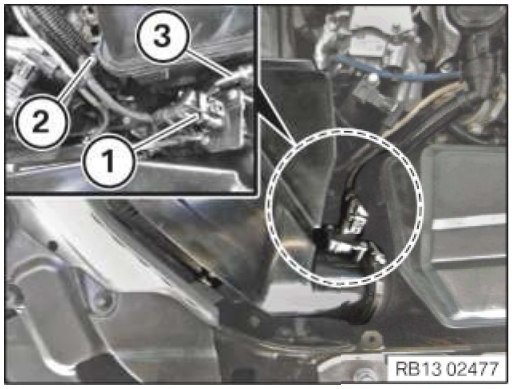
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- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

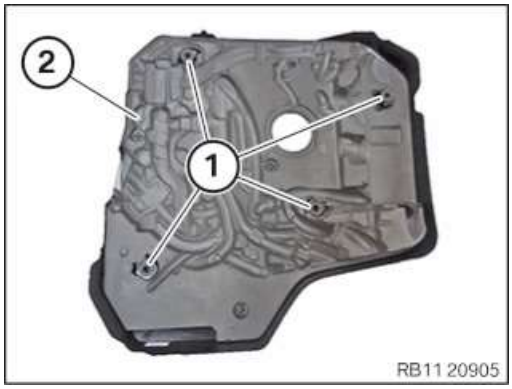
23 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

24 – Disconnecting all battery earth leads

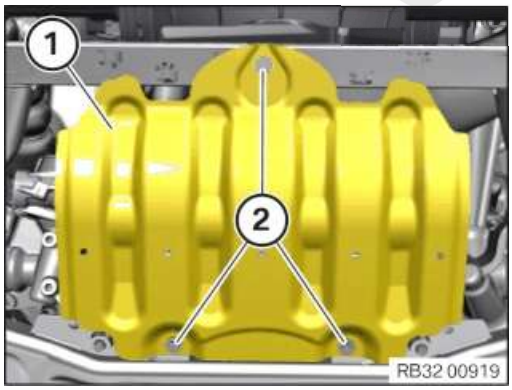


- See additional information.

25 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



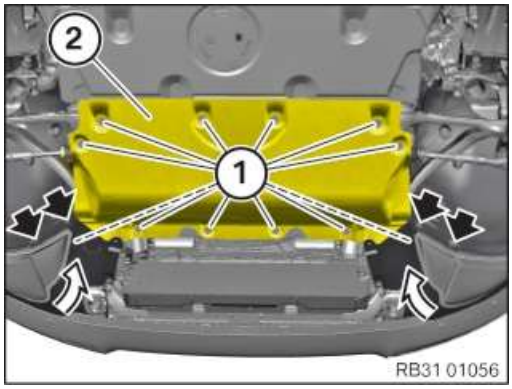
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

26 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

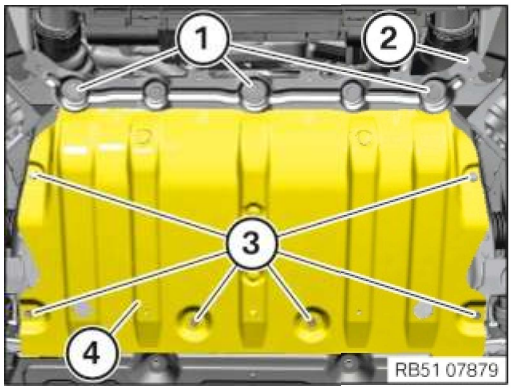
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

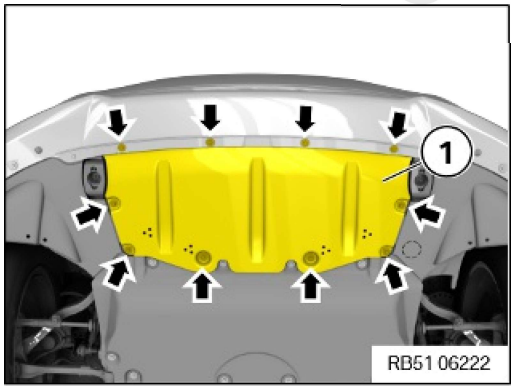
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

27 – Installing the front underbody protection



- **Version 1:**

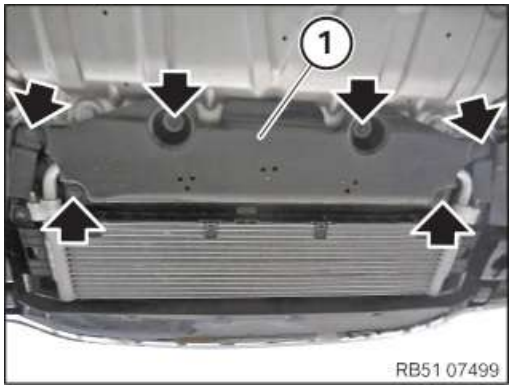
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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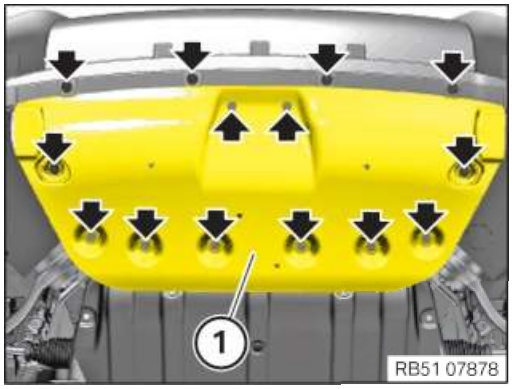
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

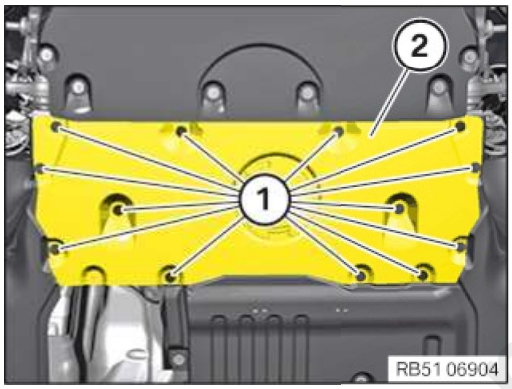
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

28 – Installing the centre underbody protection



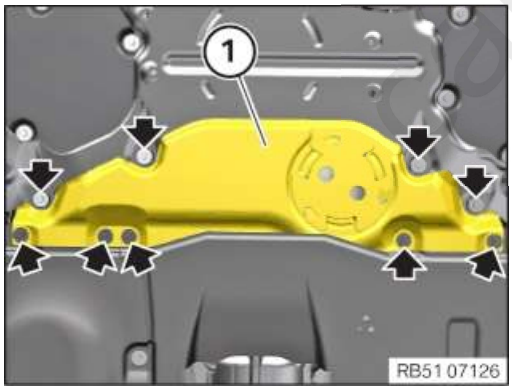
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

  Guide in and install the centre of underbody protection (1).

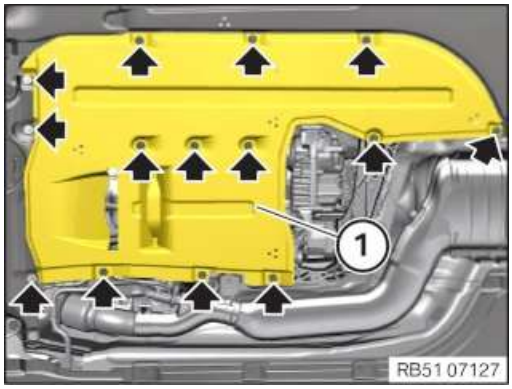
  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

29 – Installing underbody protection at rear

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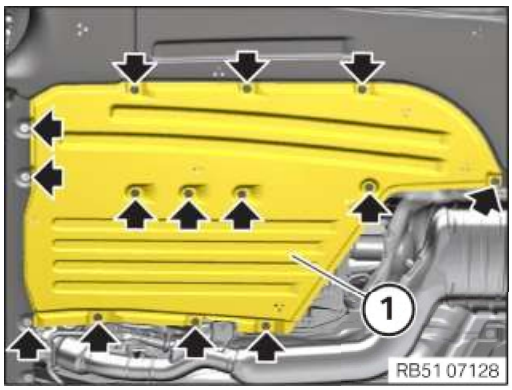
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

Additional Information

Overview of Tightening Torques

Vibration damper with belt pulley to crankshaft — Used in step 16

M10x65	Renew screws. Tighten screws crosswise.	1. Jointing torque	40 Nm
		2. Angle of rotation	60 °
		3. Angle of rotation	60 °

Starter motor to engine — Used in step 17

M8X60		Tightening torque	19 Nm

Battery positive lead to starter — Used in step 17

M8		Tightening torque	13,5 Nm

Electric coolant pump to holder — Used in step 19

M6		Tightening torque	8 Nm

Charge air line to throttle body — Used in step 21

M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 22

Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 25

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 26

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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Wheel arch cover (screws) Used in step 26

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support Used in step 26

M10		Tightening torque	56 Nm

Underbody protection front Used in step 27

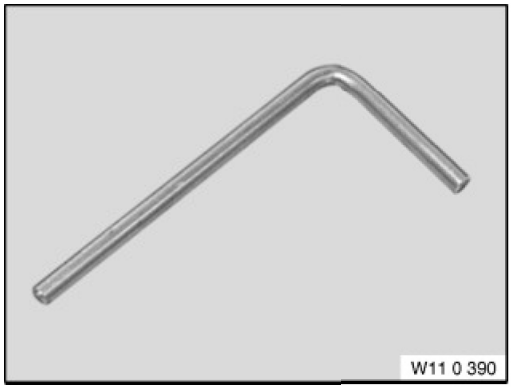
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Underbody protection Used in step 2829

Hexagon screw		Tightening torque	3 Nm

Overview of Special Tools

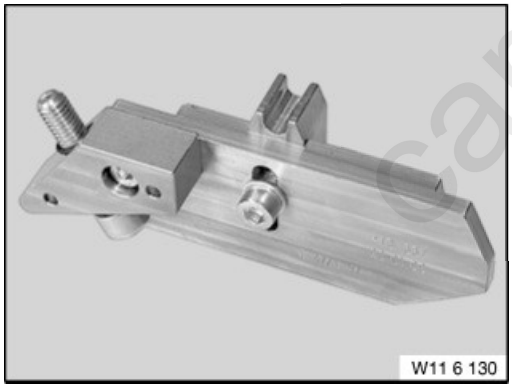
0 496 268 (11 0 390) Pin



Common Used in step 718

Usage	(roll pin) For securing new tensioning pulley (poly-V belt)
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 15 07 (390)

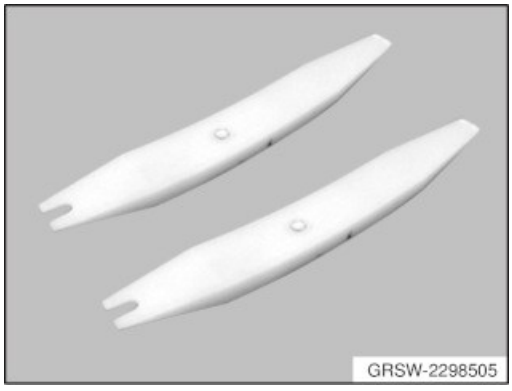
0 496 595 (11 6 130) Holder



Common Used in step 1416

Usage	(counter support) For securing flywheel when releasing and tightening down screw connection of vibration absorber. Series: E90, E91, E92 with 4WD.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 05 09 (519)

2 298 505 Wedge

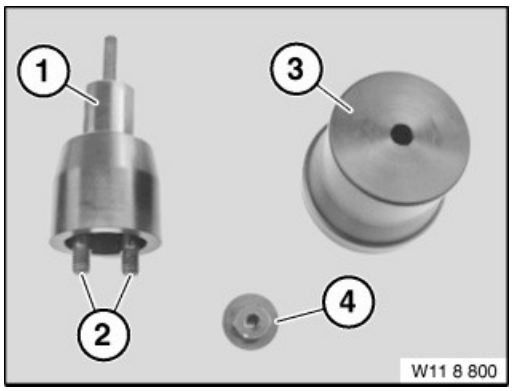


Common Used in step 15

Usage	Set (delivery of 2 pieces)
Included in the tool or work	
Storage location	C34
Replaced by	
In connection with	
SI-Number	01 03 12 (792)

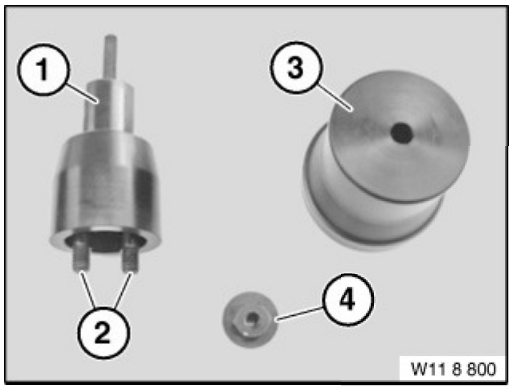
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0 496 130 (11 8 803) Holding sleeve



Common	Used in step 15
Usage	(Thrust piece) sale of existing inventory and then available as part of complete tool set 11 8 800 = 83 30 0 496 127 only - as of 30.11.2011
Included in the tool or work	0 496 127
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 496 128 (11 8 801) Basic body

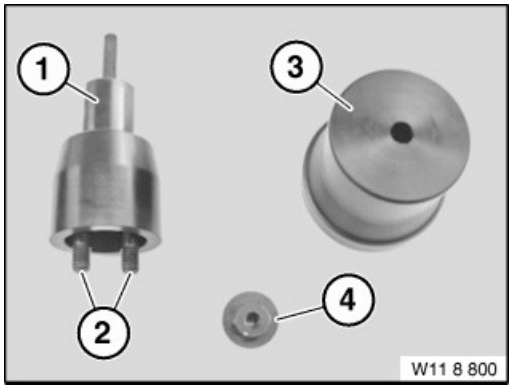


Common	Used in step 15
Usage	Available only as a complete tool set 11 8 800 = 83 30 0 496 127 - as of 30.11.2011
Included in the tool or work	0 496 127
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 496 127 (11 8 800) Device

Used in step 15

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Common

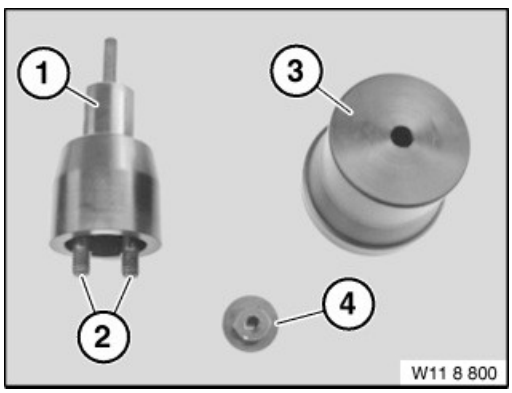
Usage	(Pulling device) For installing front radial shaft seal.
Included in the tool or work	
Storage location	B23
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
3	0 496 130 (11 8 803)		**Holding sleeve** (Thrust piece) sale of existing inventory and then available as part of complete tool set 11 8 800 = 83 30 0 496 127 only - as of 30.11.2011	
1	0 496 128 (11 8 801)		**Basic body** Available only as a complete tool set 11 8 800 = 83 30 0 496 127 - as of 30.11.2011	
2	0 496 129 (11 8 802)		**Screw** (Set of screws) Can only be ordered as part of complete tool 11 9 660 = 0495955	
4	0 496 131 (11 8 804)		**Nut** (Nut with collar) available as part of set of tools 11 8 800 = 83 30 0 496 127 only - as of 30.11.2011	

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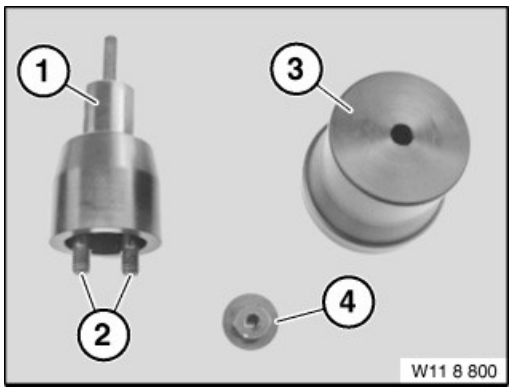
0 496 129 (11 8 802) Screw



Common Used in step 15

Usage	(Set of screws) Can only be ordered as part of complete tool 11 9 660 = 0495955
Included in the tool or work	0 496 127
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 496 131 (11 8 804) Nut



Common	Used in step 15
Usage	(Nut with collar) available as part of set of tools 11 8 800 = 83 30 0 496 127 only - as of 30.11.2011
Included in the tool or work	0 496 127
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

2 466 729 Fitting aid



Common	Used in step 16
Usage	For the installation of the vibration damper. Engine: B48, B58. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	
SI-Number	01 07 18 (545)

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	124
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	124
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
61 20 900 Disconnecting and connecting battery earth lead	124
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61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
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61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads) 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 20 900 Disconnecting and connecting battery earth lead 124
61 35 ... Notes on ESD protection (Electro Static Discharge) 6

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This documentation refers to special tools that were not yet available when going to press.

11 24 571 Replace all conrod bearing shells.

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Removing engine



- See additional information.

2 – Mount engine on assembly stand

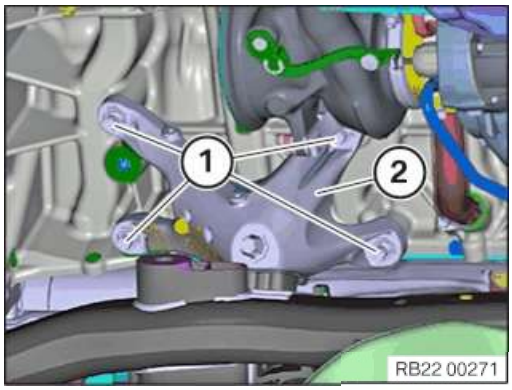
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CAUTION

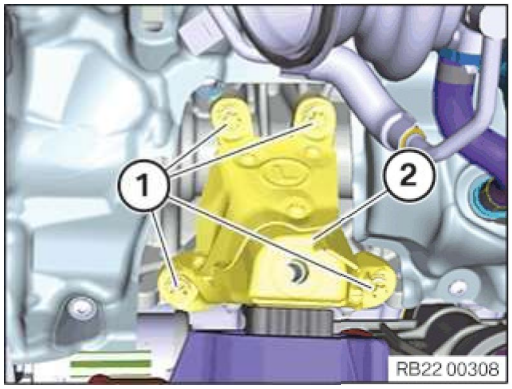
Heavy component.

Heavy components can lead to injury or damage.

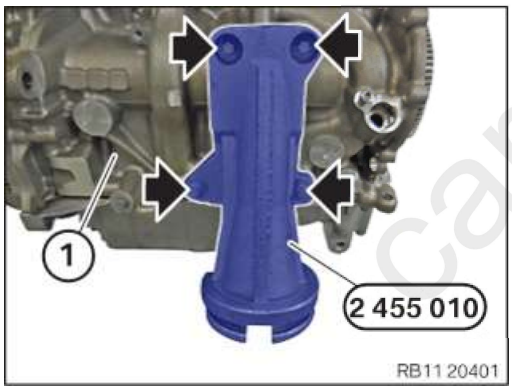
- Remove and install heavy components with the aid of another person/other persons.



- **Type: Rear-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



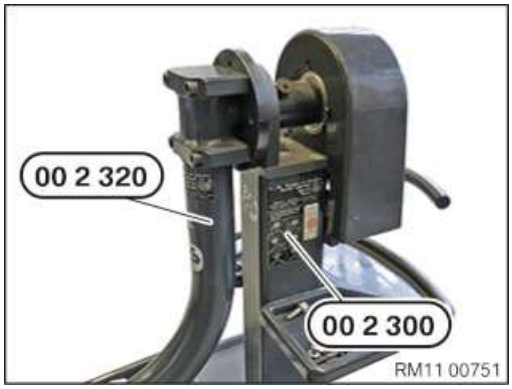
- **Type: Four-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



- Position the special tool 2 455 010 on the engine (1).
- Position the standard bolts **M10x30**.
- Tighten the standard bolts (arrows).

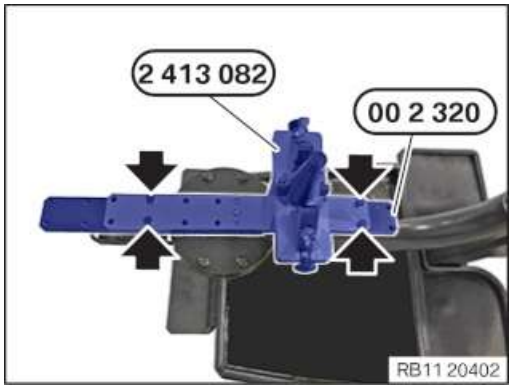
Special tool 2 455 010 to crankcase

M10x30		Tightening torque	38 Nm



- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).

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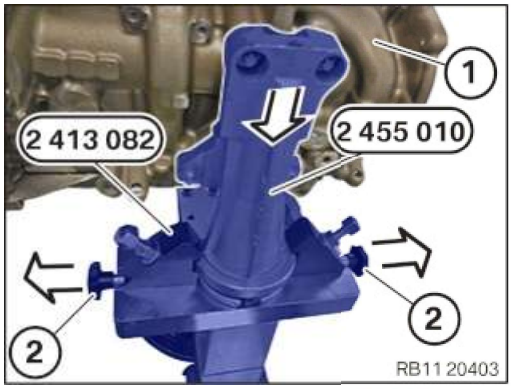
- Screw the special tool to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

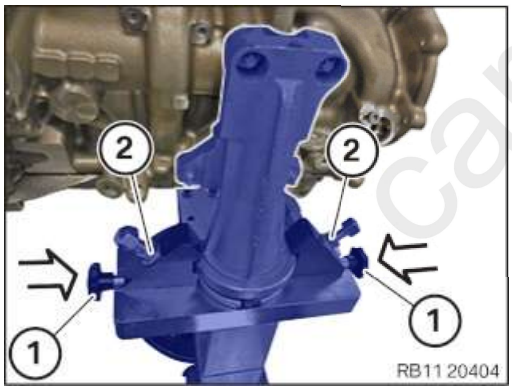
M14x35		Tightening torque	160 Nm



- Position the engine lifter with the special tool and the engine on the special tool 0 495 187 (00 2 300).



- Detach the holder (2) in the direction of the arrow.
- Position the engine (1) with the special tool 2 455 010 in the direction of the arrow on the special tool .



- Lock the holder (1) in direction of arrow.
- Tighten nuts (2).

3 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

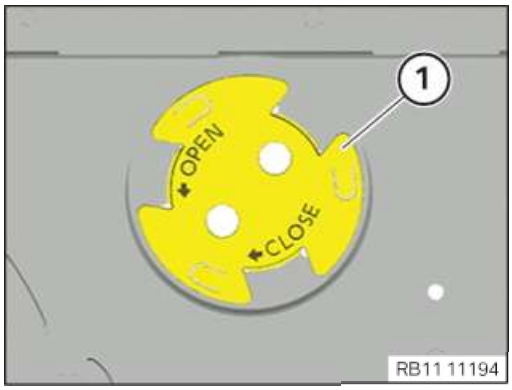
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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).



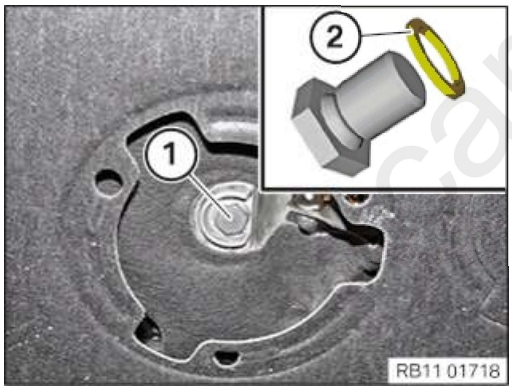
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

4 – Tightening the oil drain plug

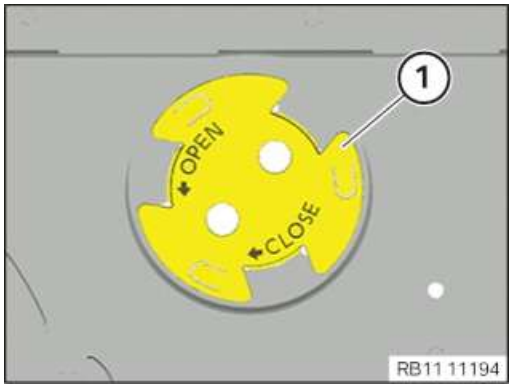


- Renew sealing ring (2).

  Parts: Sealing ring
- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

M12x16	Renew the sealing ring.	Tightening torque	25 Nm



- Install service cap (1).

5 – Removing all spark plugs

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

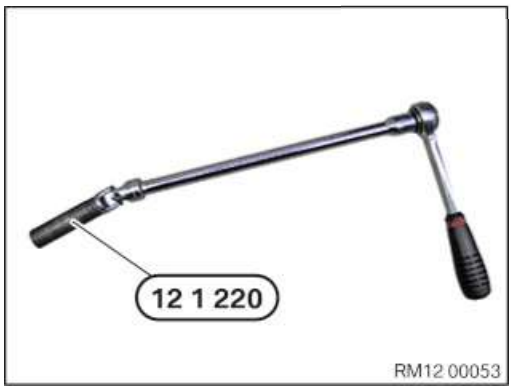
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

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- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

6 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

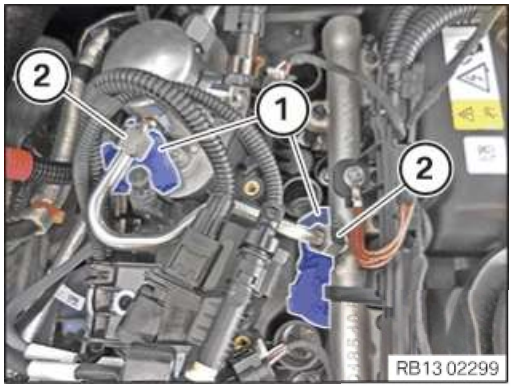
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

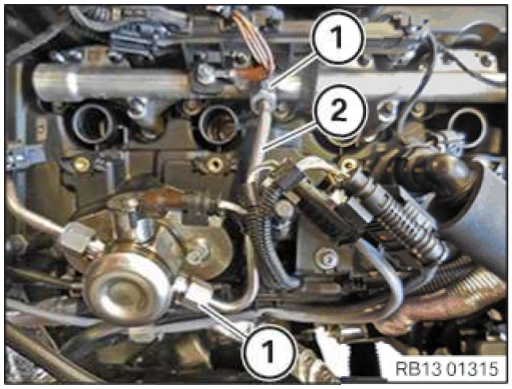
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- Have the special tool ready.



- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

7 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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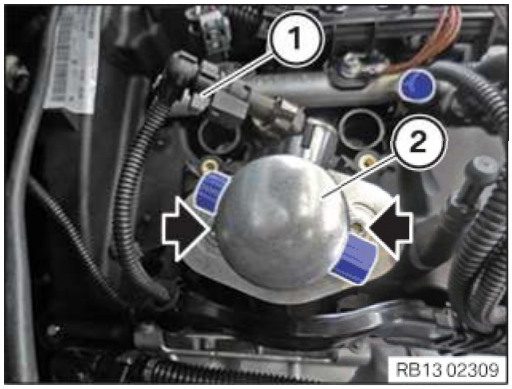
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

8 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

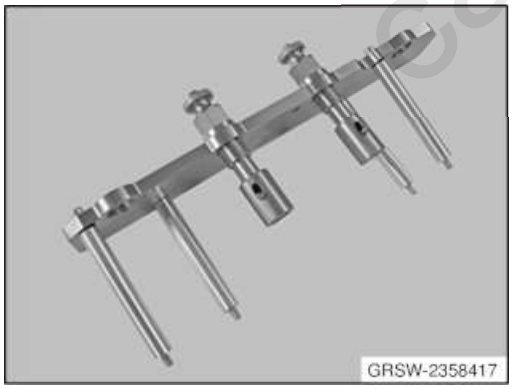
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Prepare special tool .

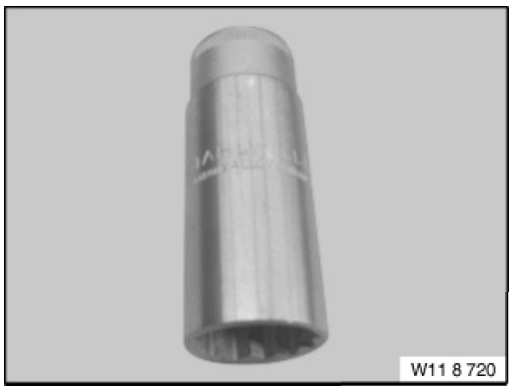


- Prepare special tool 2 358 417.

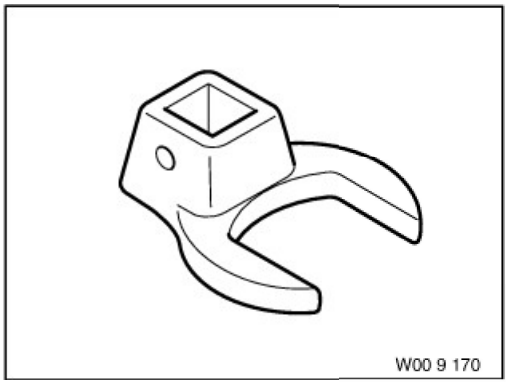
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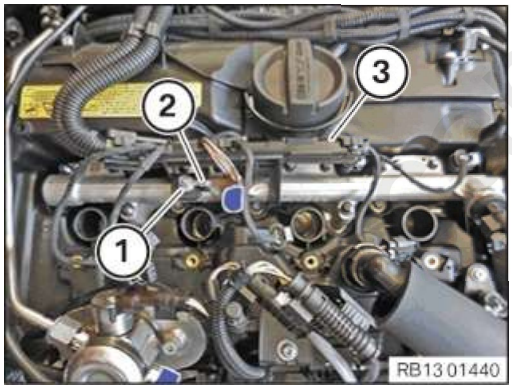
- Prepare special tool .



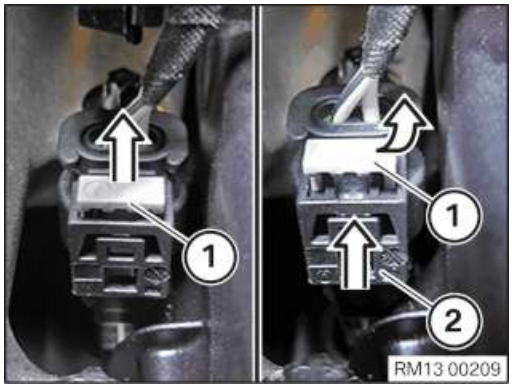
- Prepare special tool 0 496 106 (11 8 720).



- Prepare special tool .

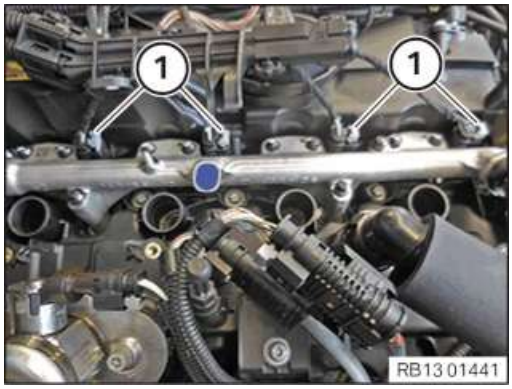


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.



- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.

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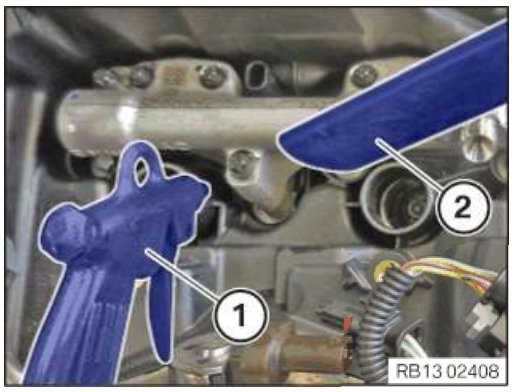
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

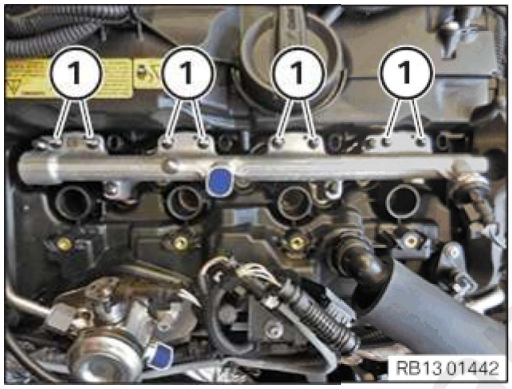


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

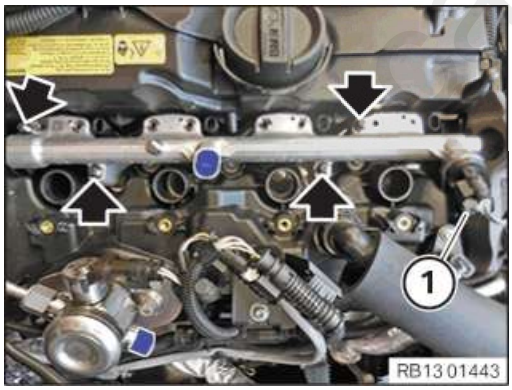
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

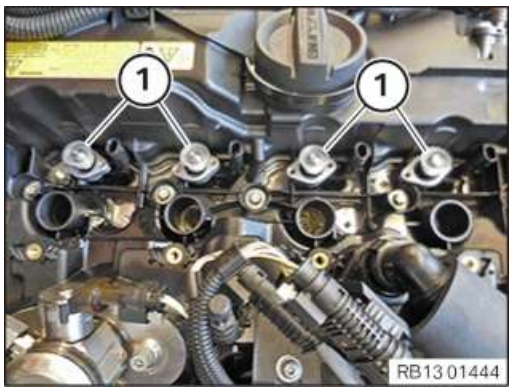


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

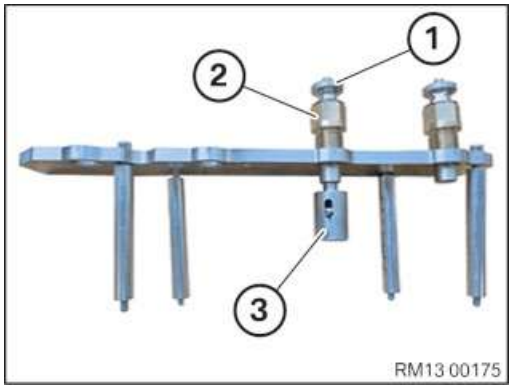
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

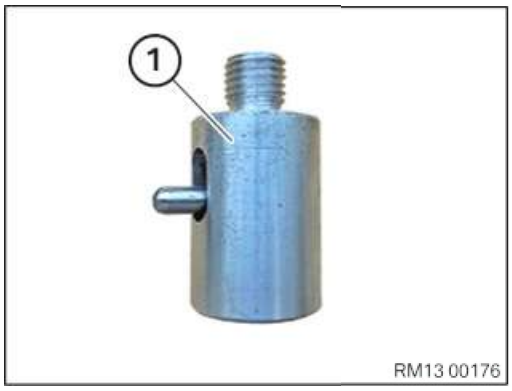
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

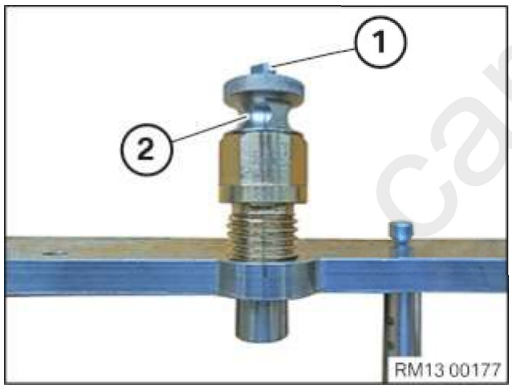
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

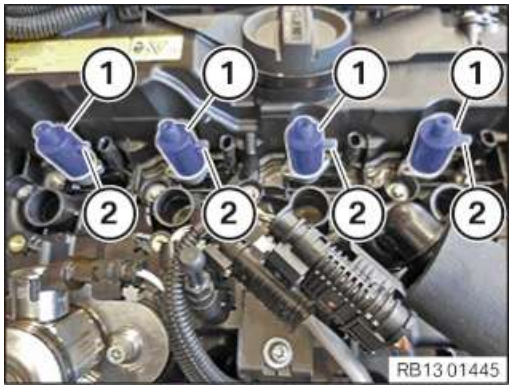
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



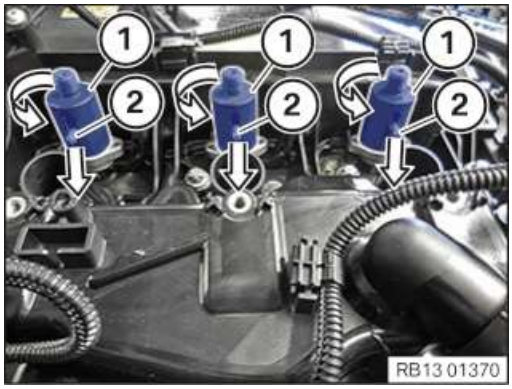
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



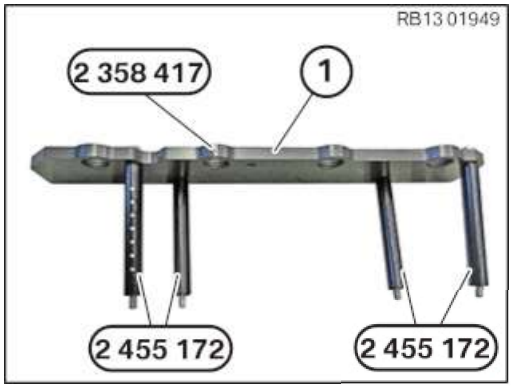
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

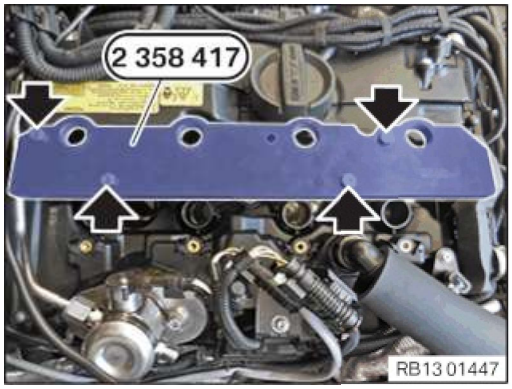
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



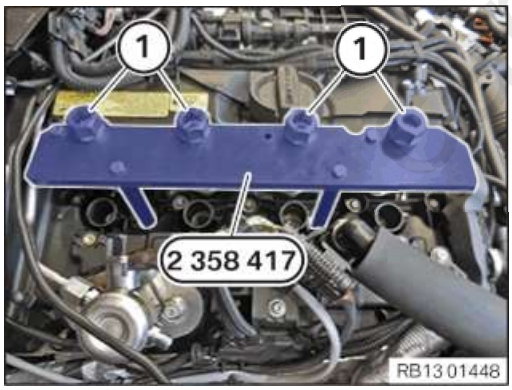
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

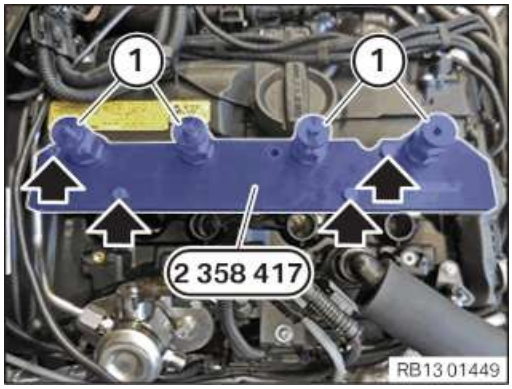
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

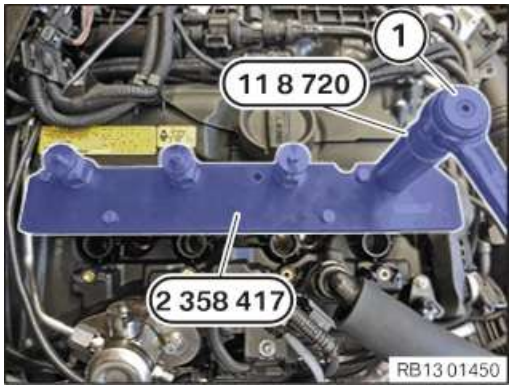
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

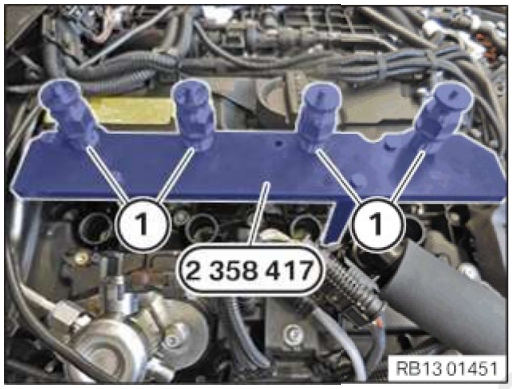


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

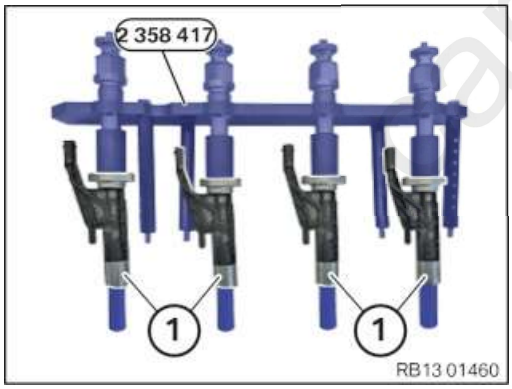
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

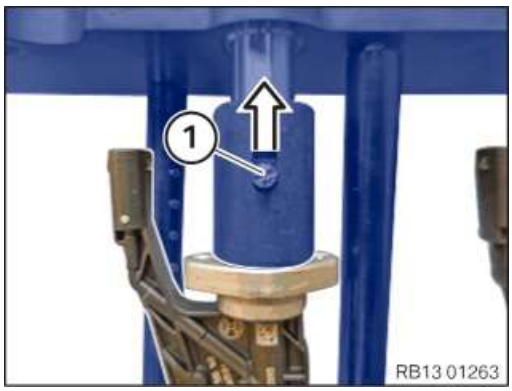


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

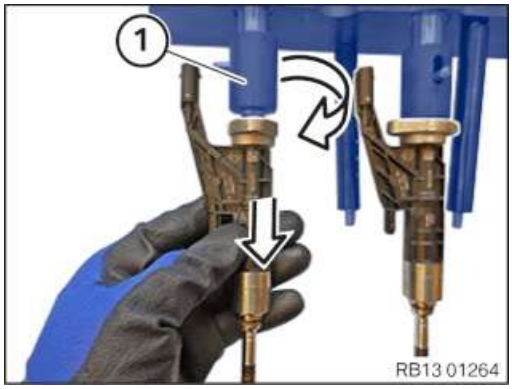


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

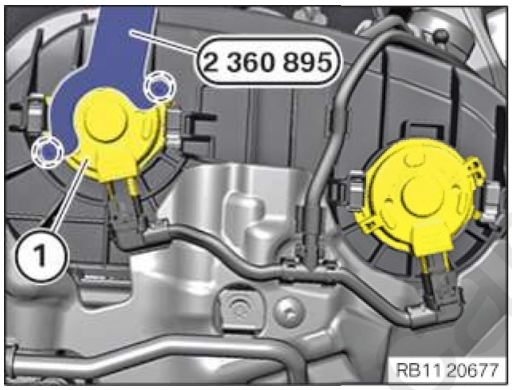
9 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

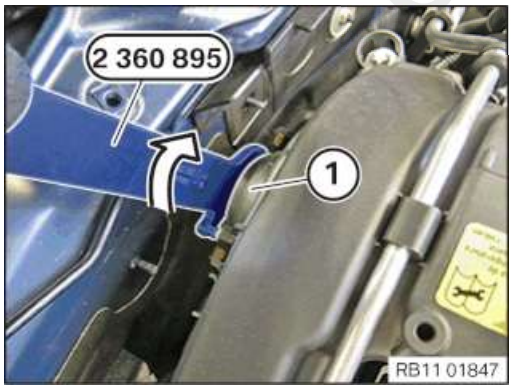
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



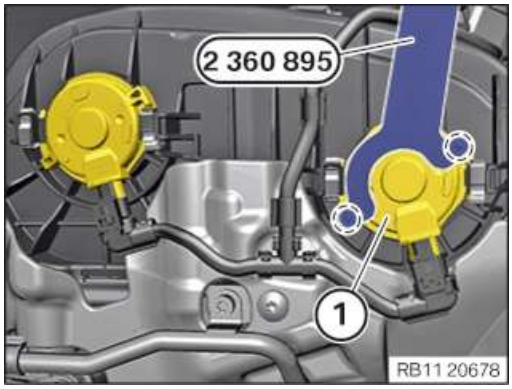
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



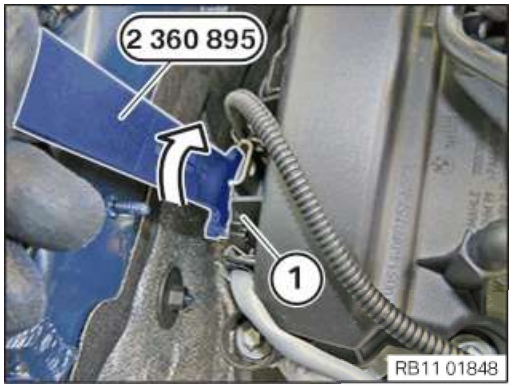
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



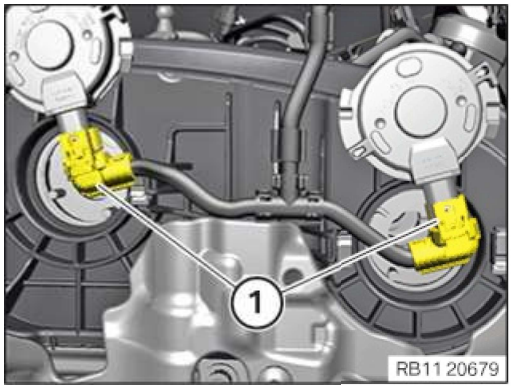
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

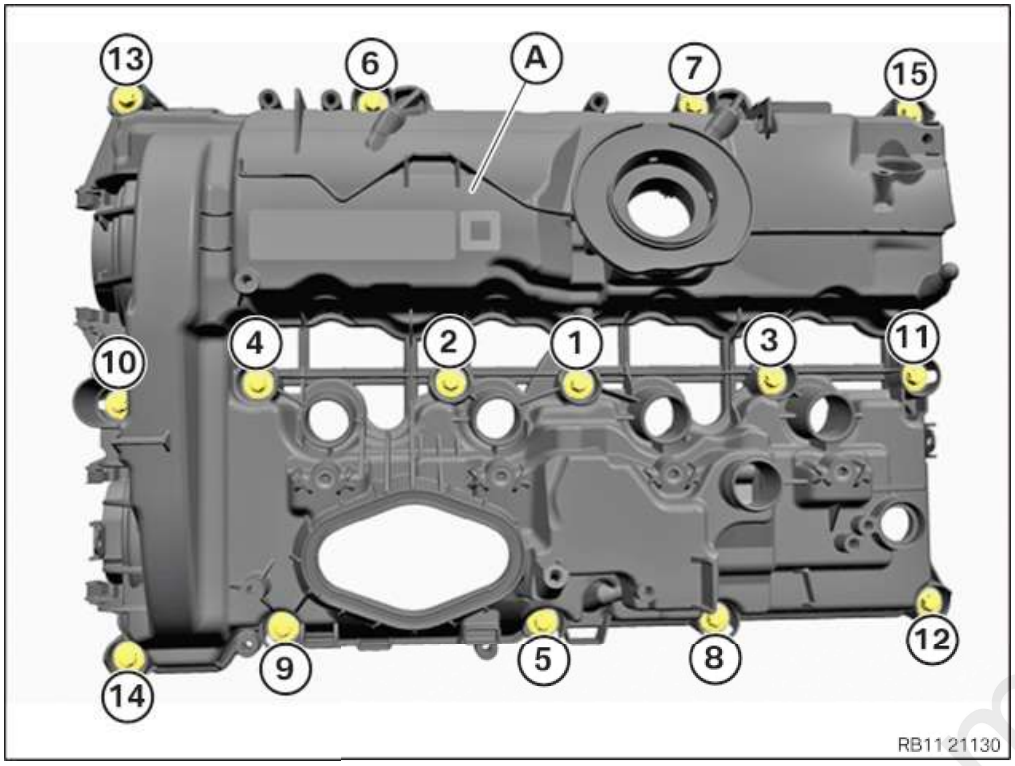
The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

10 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

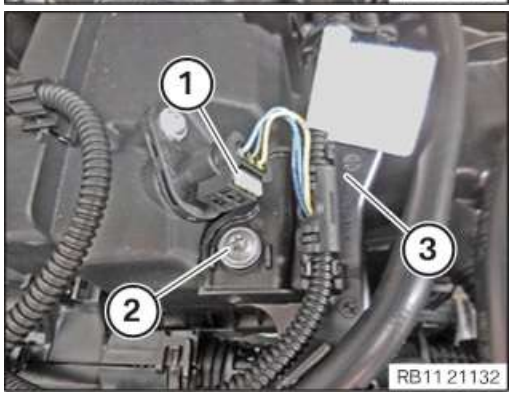
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

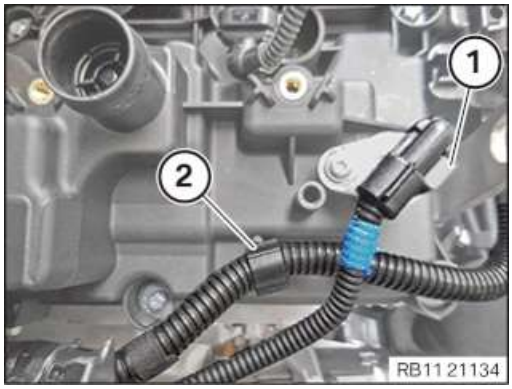
- Do not pull on the wires when disconnecting connectors and plug connections.



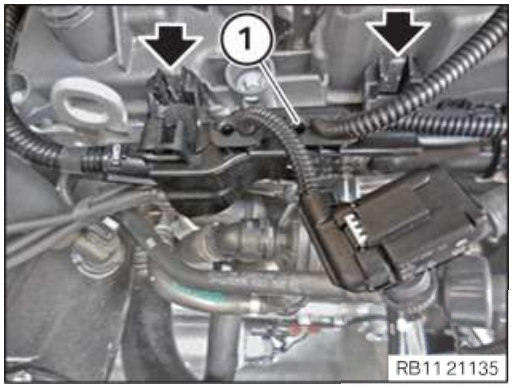
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



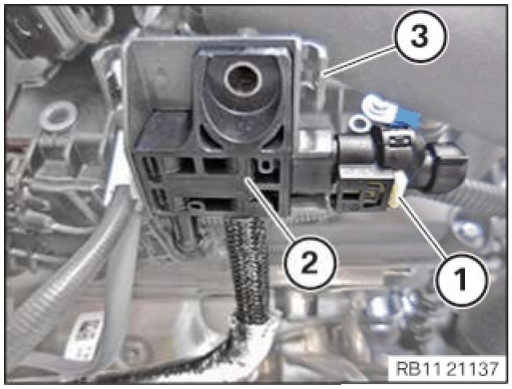
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



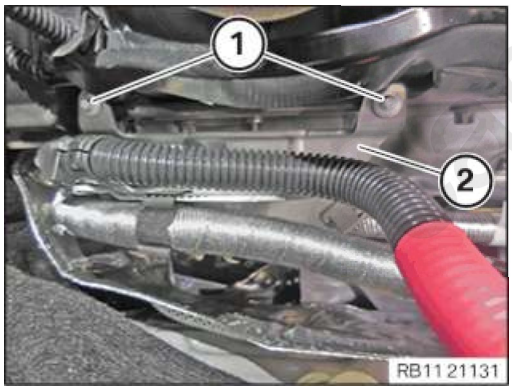
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



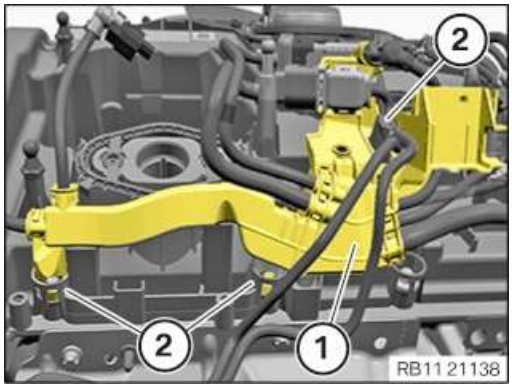
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.

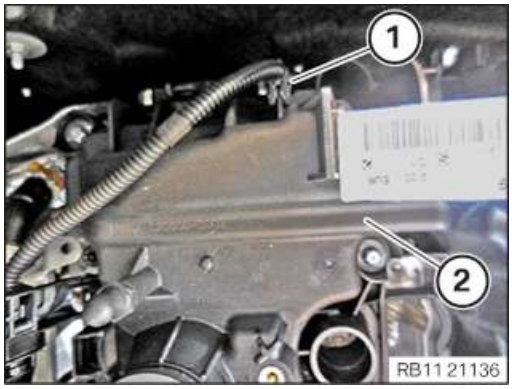


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

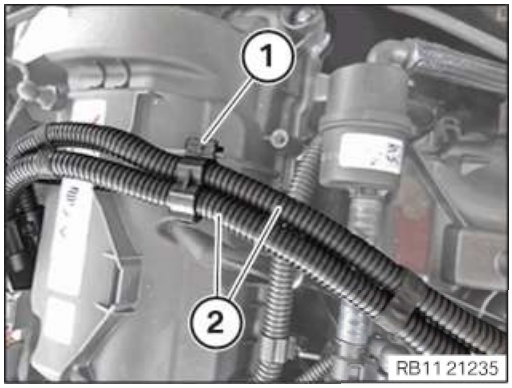


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

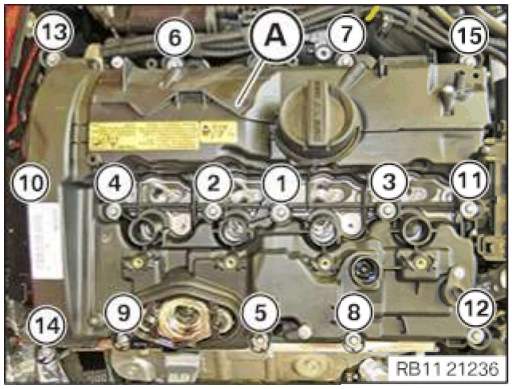
ardiagn.com



- Loosen clamp (1).



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

11 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

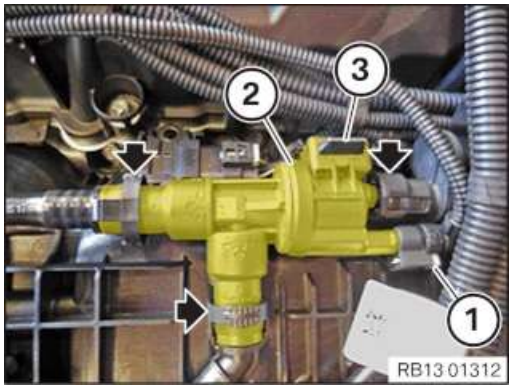
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

12 – Removing the intake plenum

RISK OF DAMAGE

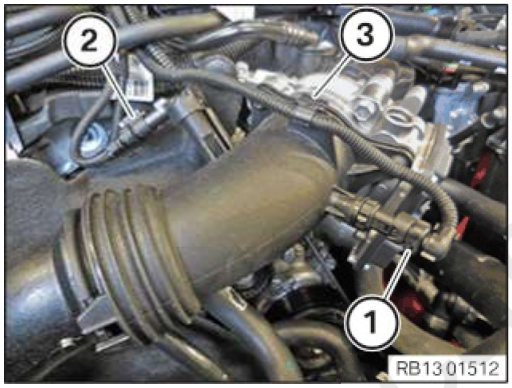
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

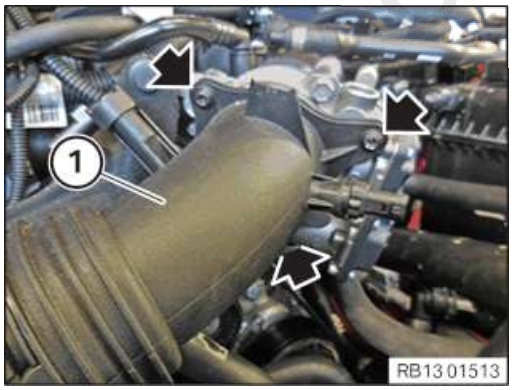
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

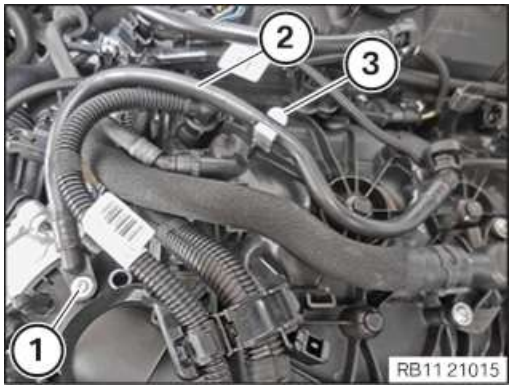
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



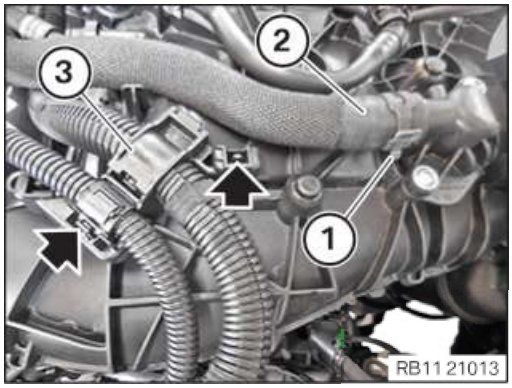
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



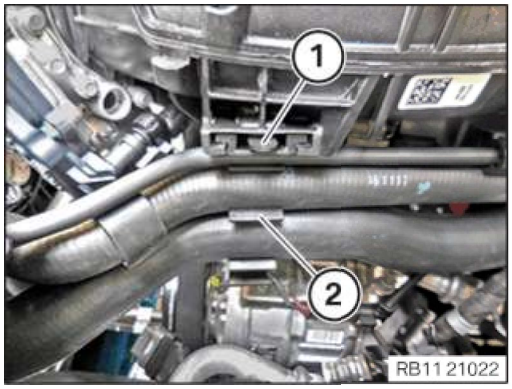
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



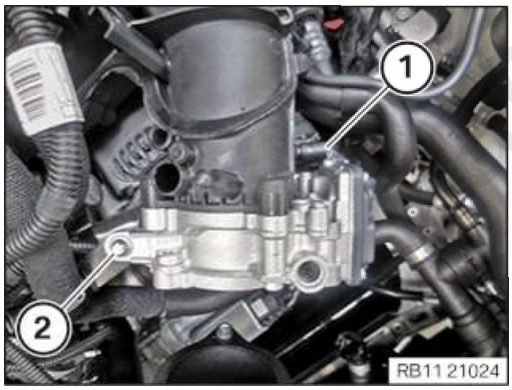
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



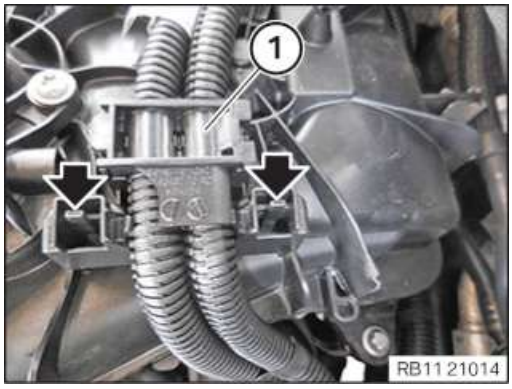
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

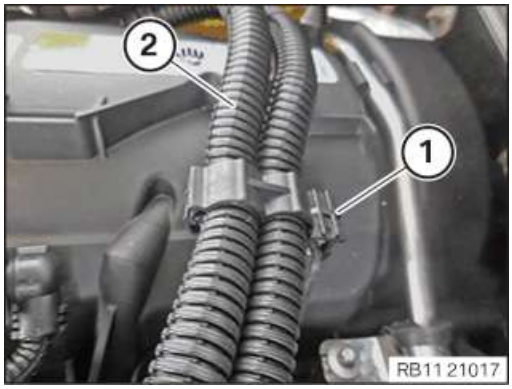


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

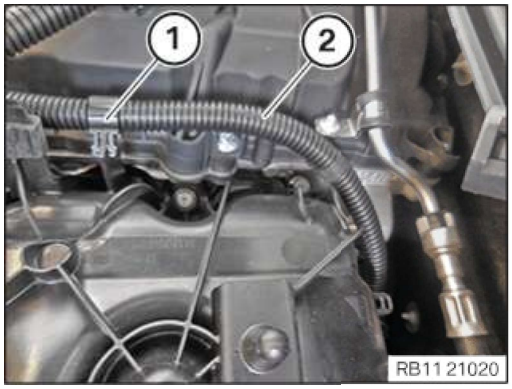
mdiagn.com



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



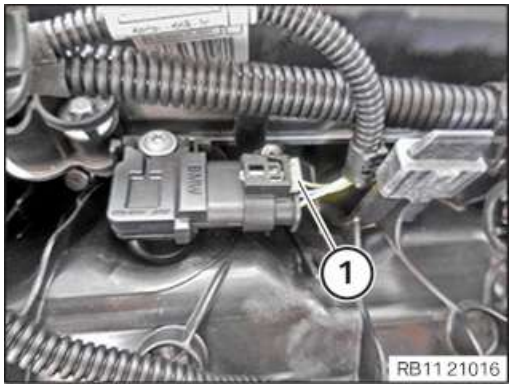
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

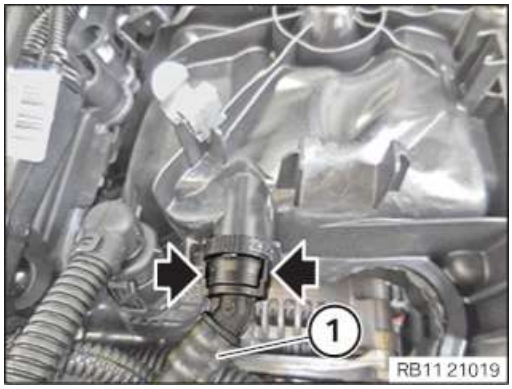


- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

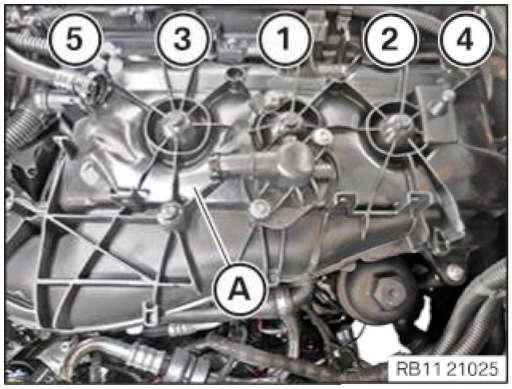
rdiagn.com



- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

13 – Remove the heat shield on the cylinder head

WARNING

Hot surfaces.

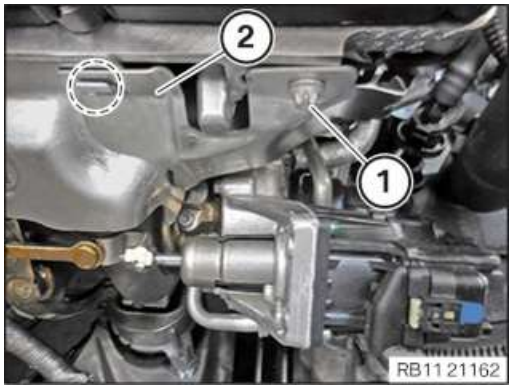
Risk of burning!

- Perform all work only on components that have cooled down.

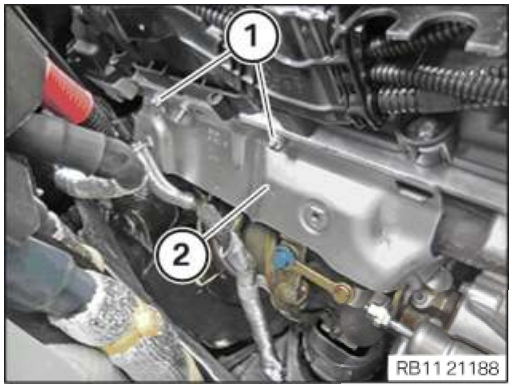


- Loosen screw (1).

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- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

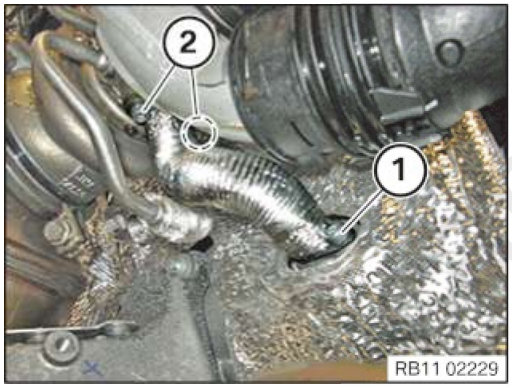


- Loosen screws (1).
- Feed out and remove the heat shield (2).

14 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

15 – Remove the coolant return line for the exhaust turbocharger

WARNING

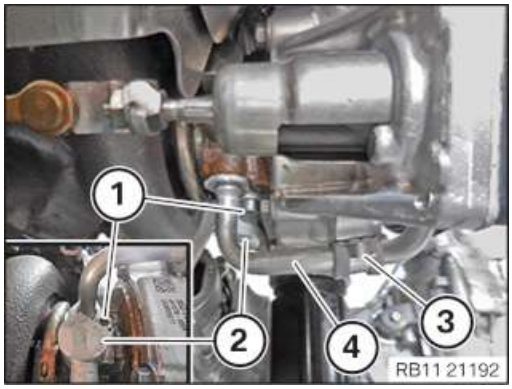
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

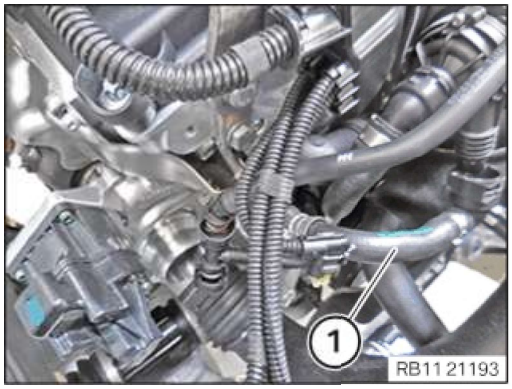
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

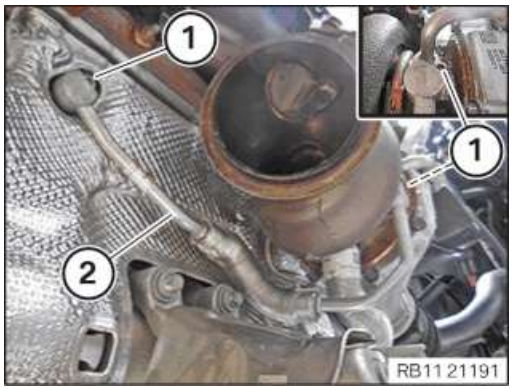


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

16 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

17 – Block the engine with the special tool in TDC firing position

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- Thread the sealing cap (1) out and remove.



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

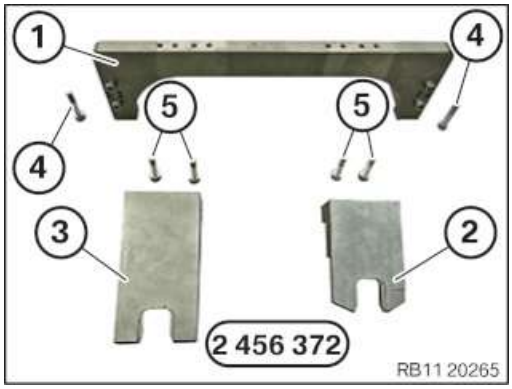


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

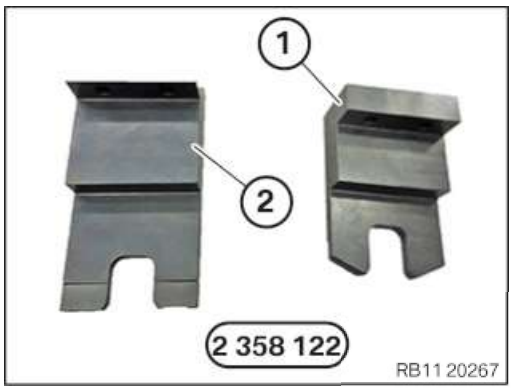
  The engine is in the TDC firing position of cylinder 1.

erdiagn.com



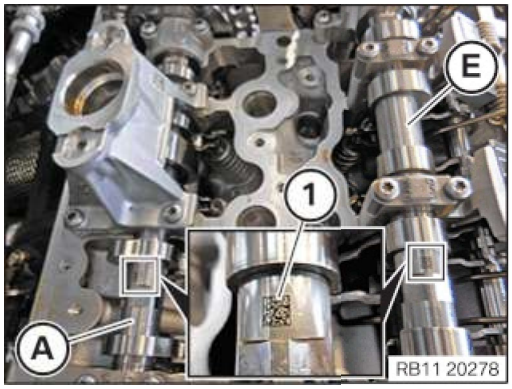
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

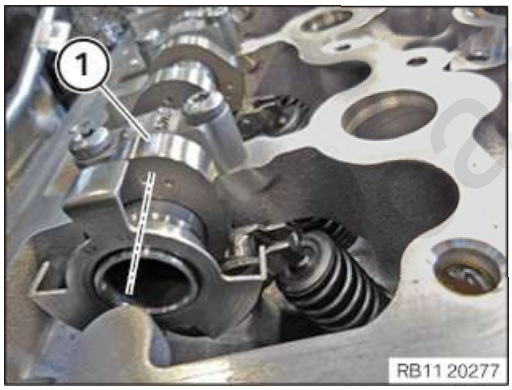


- Overview of the test gauges from the set of special tools 2 358 122:

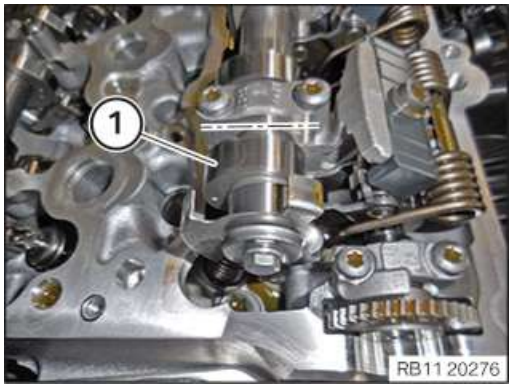
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

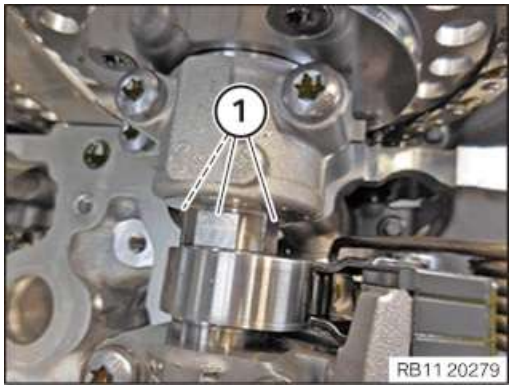


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

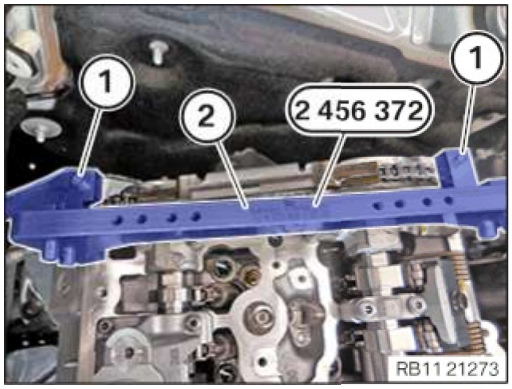
ardiagn.com



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



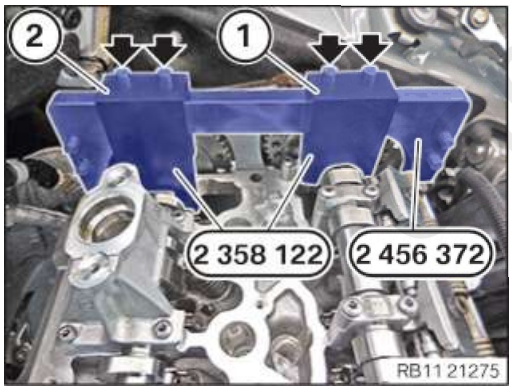
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

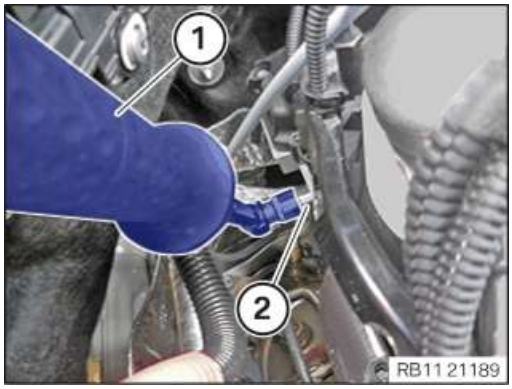
M6		Tightening torque	8 Nm

18 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

diagn.com



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

19 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

The figure shows the rear side of the engine.

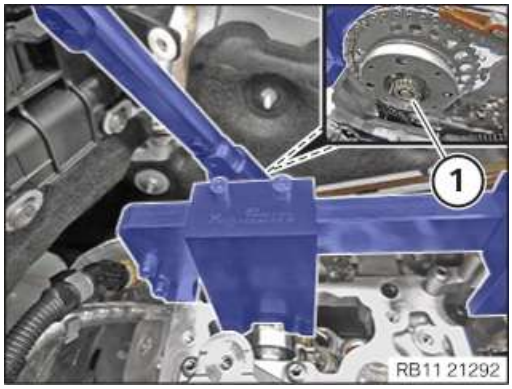
- Release the VANOS central valve (1) of the intake adjuster.

20 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

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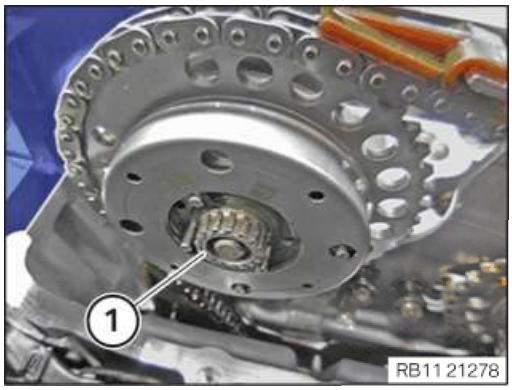


NOTICE

The figure shows the rear side of the engine.

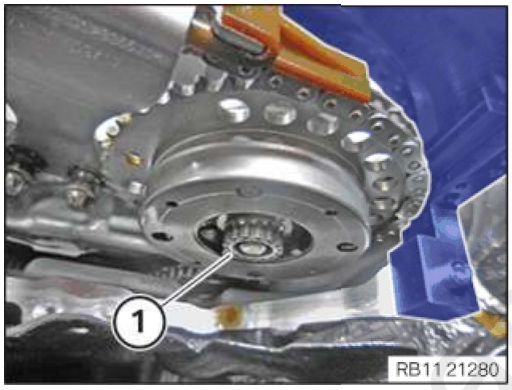
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

21 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

22 – Remove the VANOS central valve of the exhaust camshaft adjuster



- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

23 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.



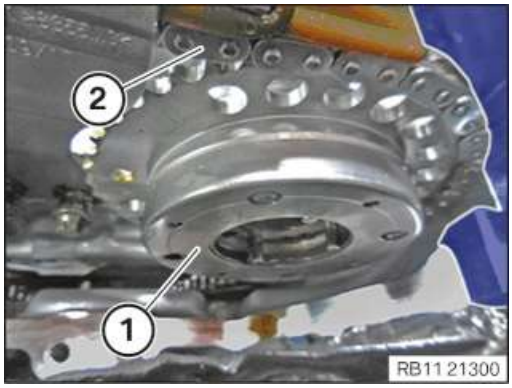
- Guide out the intake adjuster (1) from the timing chain (2) and remove.

24 – Remove exhaust camshaft adjuster

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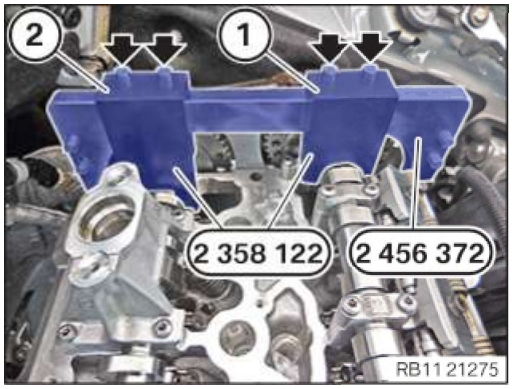
NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

25 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

26 – Remove cylinder head.

CAUTION

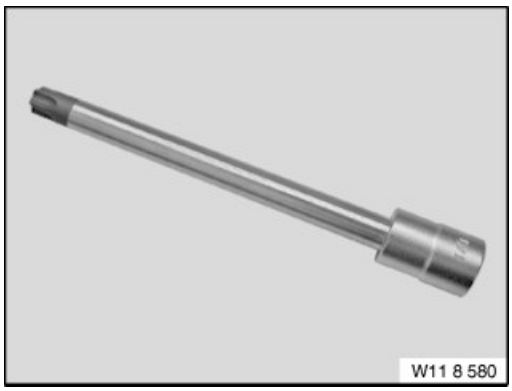
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

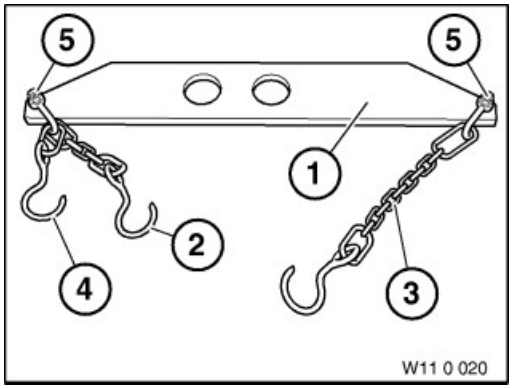
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Prepare special tool 0 495 747 (11 8 580).

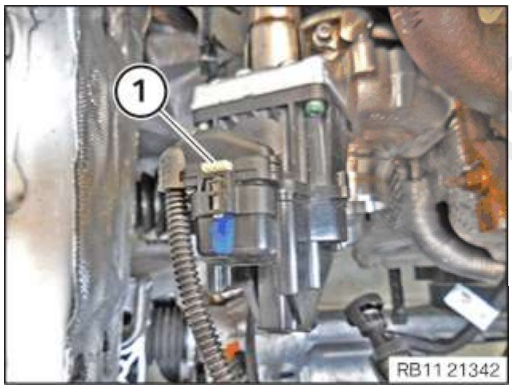
cardiagn.com



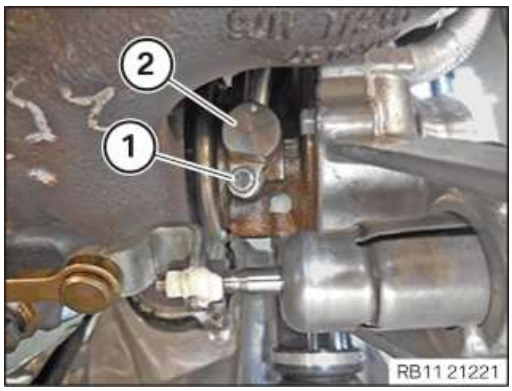
- Prepare special tool .



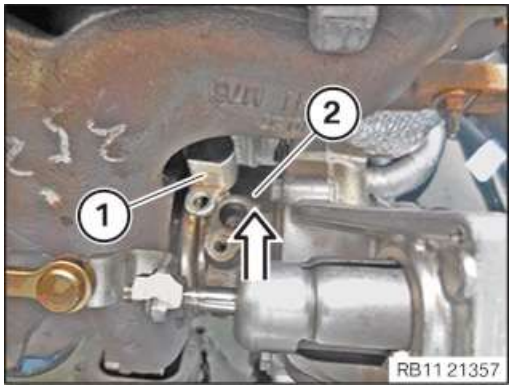
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.



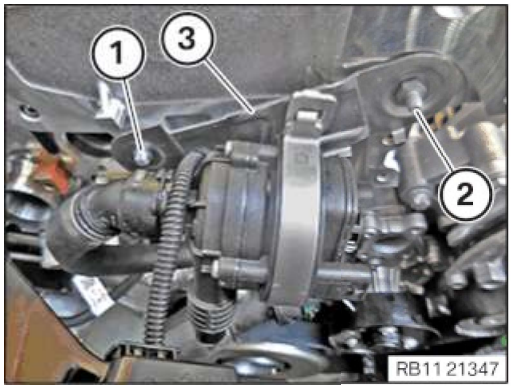
- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.



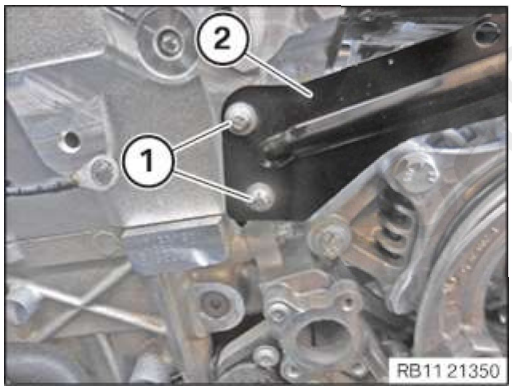
- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.

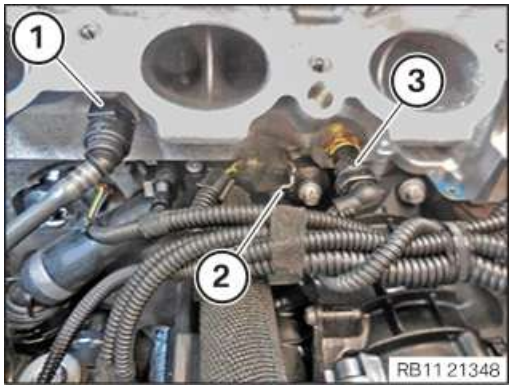


- Loosen screws (1).
- Thread out holder (2) and set aside.

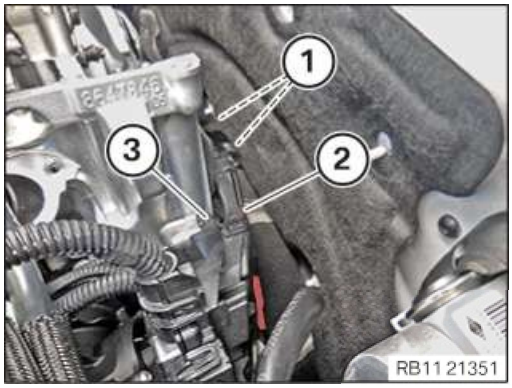


- Unlock plug connection (1) and disconnect.

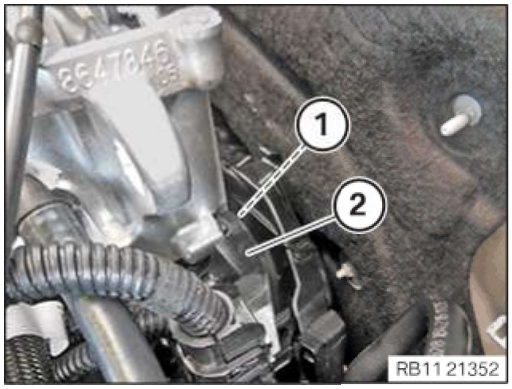
rdiagn.com



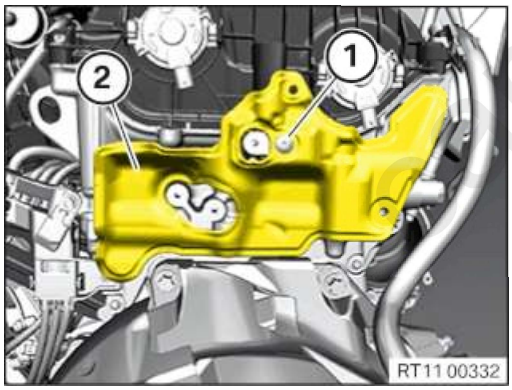
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



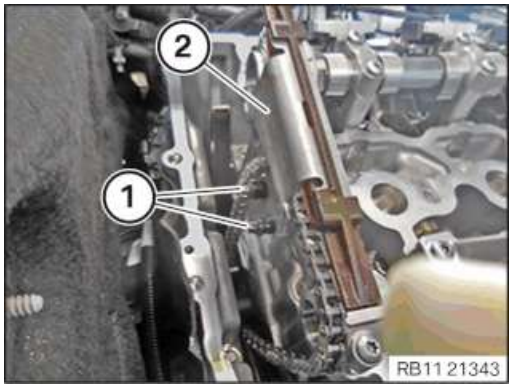
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



NOTICE

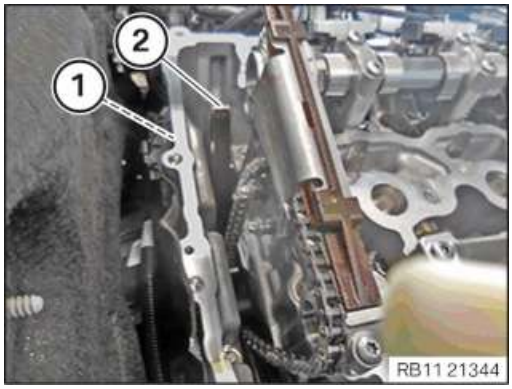
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

carsdiagn.com



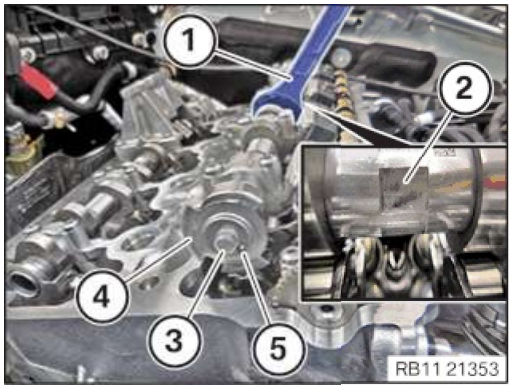
- Release the bearing journal (1) from the guide rail (2).



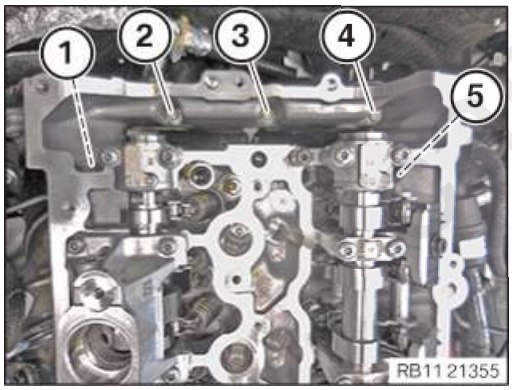
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm



- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.

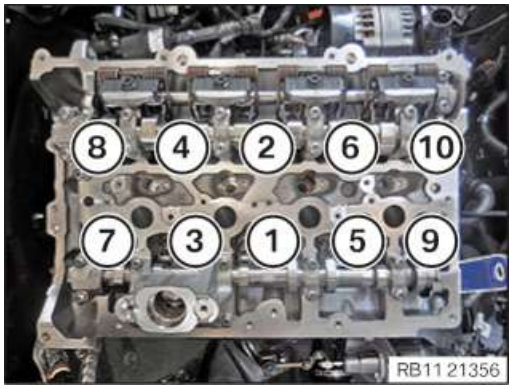


- Loosen the cylinder head bolts in the sequence from (5) to (1).

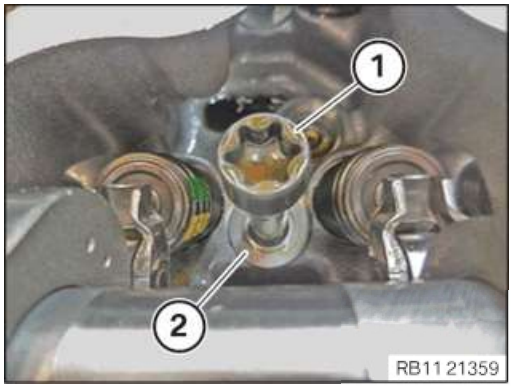


- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

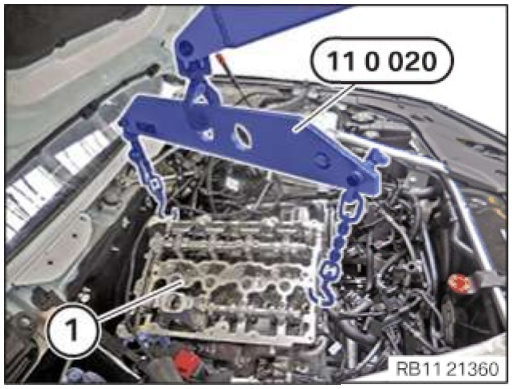
tdiagn.com



- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to the guide rails.

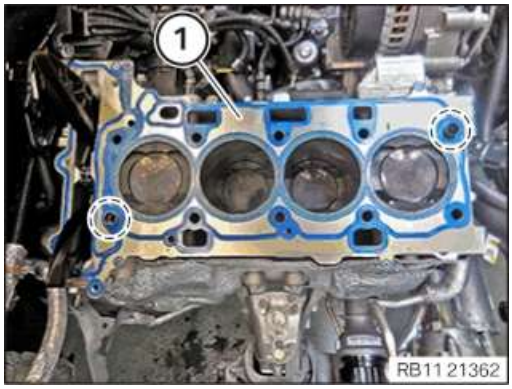
Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Attach special tool to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an **auxiliary person**, the workshop crane and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

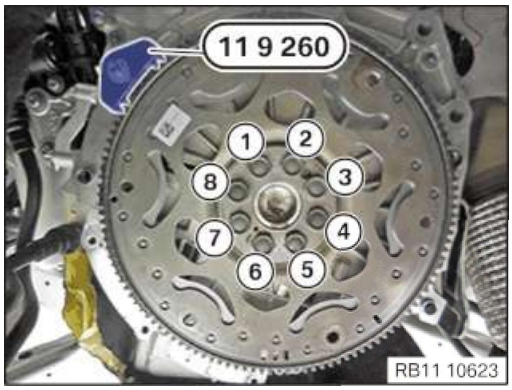
27 – Removing the cylinder head gasket

carmagn.com



- Guide out and remove cylinder head gasket (1) in the **marked** area.

28 – Removing flywheel

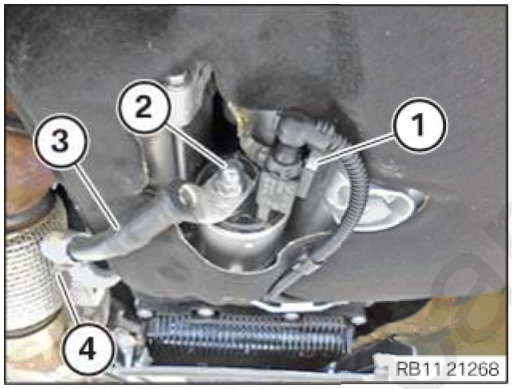


- Fasten the flywheel with the special tool 0 493 938 (11 9 260) and tighten with the special tool 0 494 130 (11 9 264).
- Loosen screws (1-8).

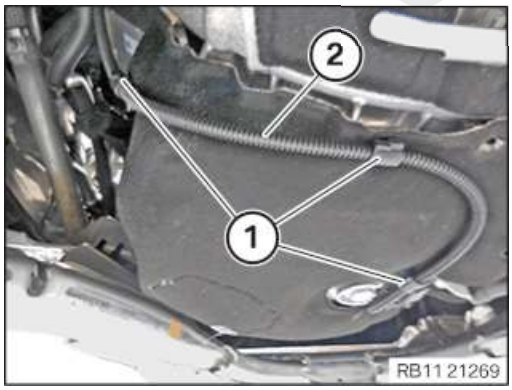
29 – Removing the acoustic cover of the oil sump

Prerequisite

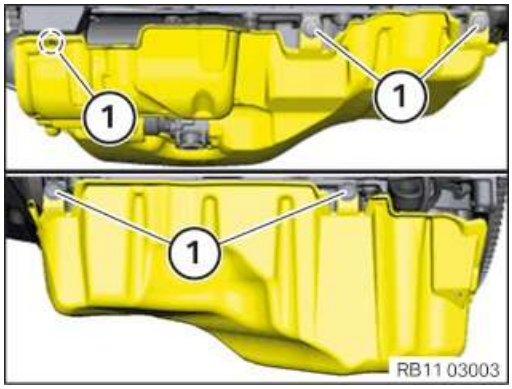
Disconnect all negative battery cables.



- Unlock and loosen connector (1).
- Loosen nut (2).
- Guide the positive battery cable (3) out of the clamp (4) and lay to one side.



- Unlock and loosen the clamps (1).
- Guide out the wiring harness section of automatic transmission (2) and set it aside.



- Detach all expanding rivets (1).



- Guide out acoustic cover (1) downwards to the rear and remove it.

30 – Remove oil sump

RISK OF DAMAGE

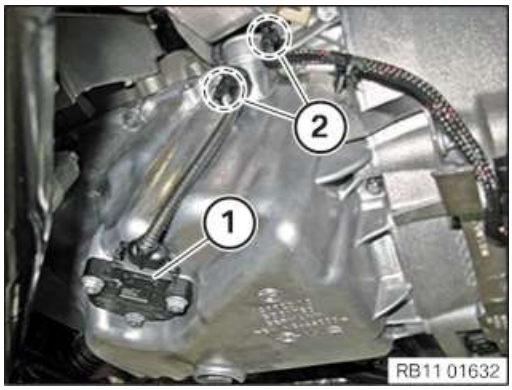
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

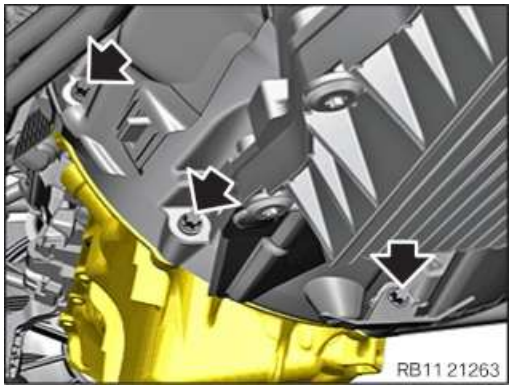
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

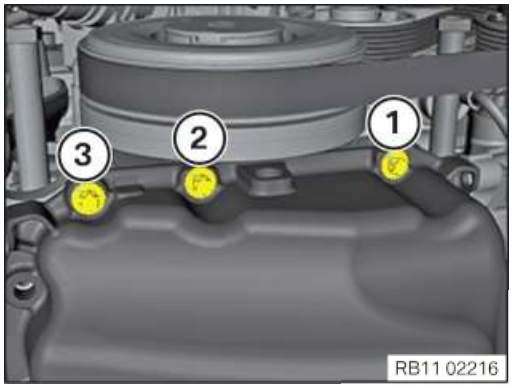


- Unlock and loosen connector (1).
- Release the cable from the clips (2) of the oil sump.

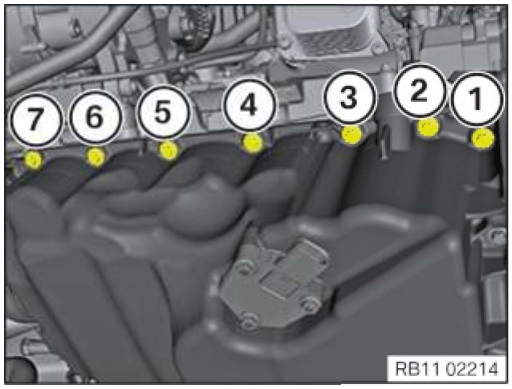
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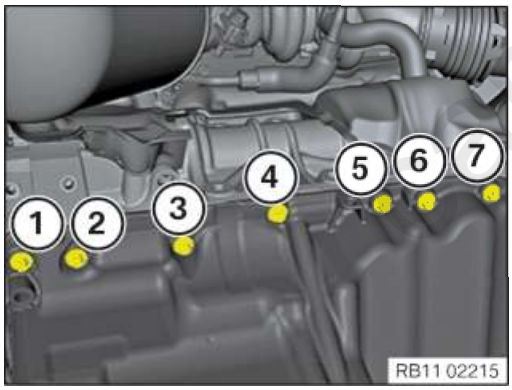
- Unscrew the transmission bolts (arrows).



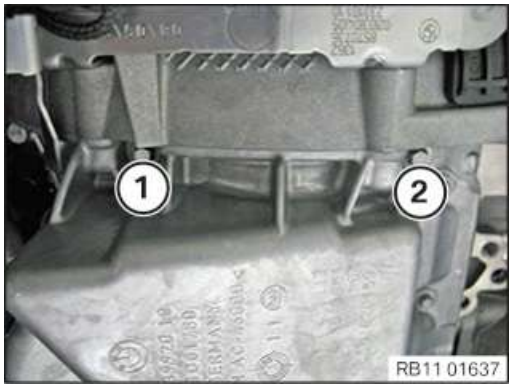
- Loosen screws (1), (2) and (3).



- Loosen screws (1) to (7).



- Loosen screws (1) to (7).



- Loosen screws (1) and (2).

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TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump in the **marked** areas using suitable tools (1).



- Guide out the oil sump (1) downwards to the rear and remove.

31 – Remove the oil vacuum pump

RISK OF DAMAGE

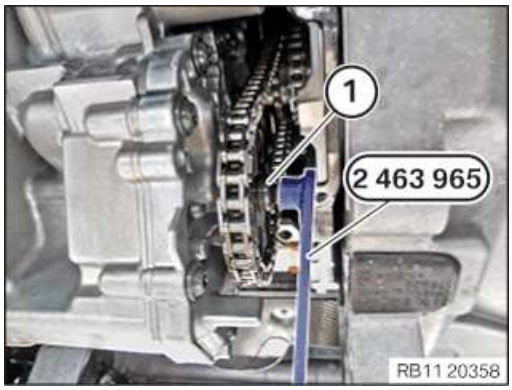
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

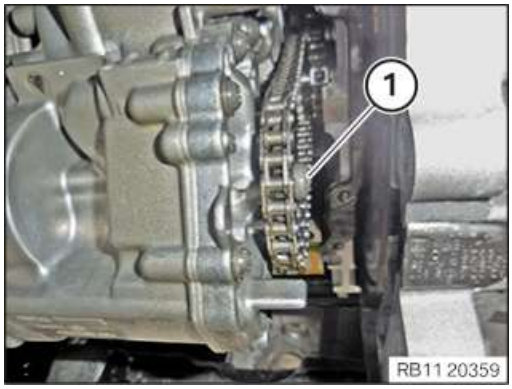
TECHNICAL INFORMATION

The thread is a left-hand thread.

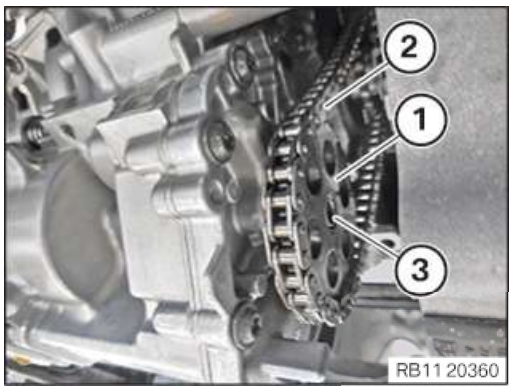


- Release bolt (1) with the special tool 2 463 965.

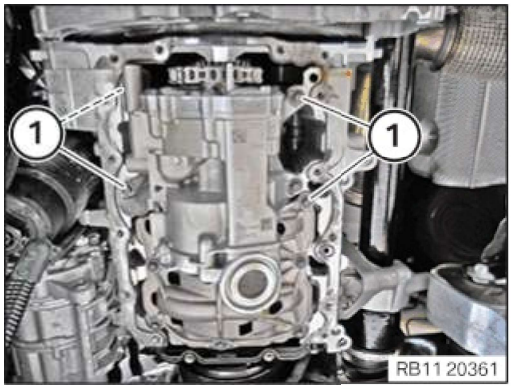
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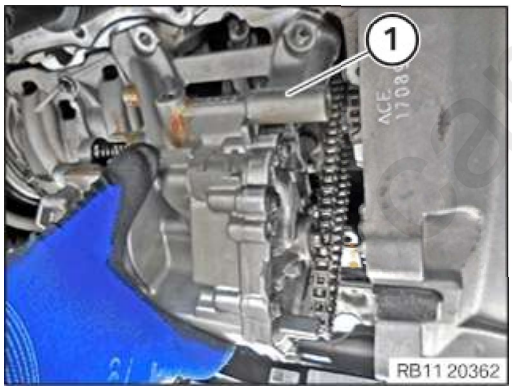
- Thread out the bolt (1) and remove it.



- Detach the camshaft sprocket (1) from the oil vacuum pump (3).
- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.

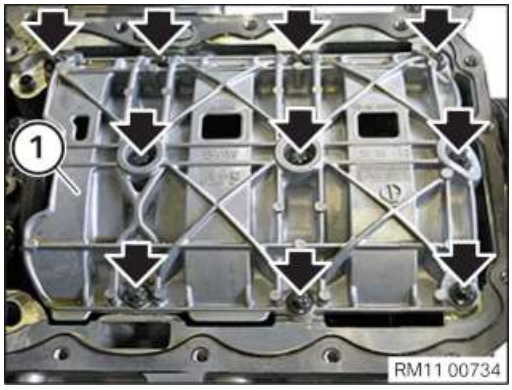


- Loosen screws (1).



- Feed out the oil vacuum pump (1) and remove it.

32 – Removing the oil deflector



- Release all bolts (arrows).
- Remove the oil deflector (1).

33 – Removing all pistons with connecting rod

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NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Removing the piston with connecting rod**

TECHNICAL INFORMATION

Piston, gudgeon pin, connecting rod and connecting rod bearing shells are matched to each other and balanced.

Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

TECHNICAL INFORMATION

The connecting rods of the engine are balanced and are matched to each other.

A single connecting rod is not permitted to be replaced. Always replace all connecting rods.

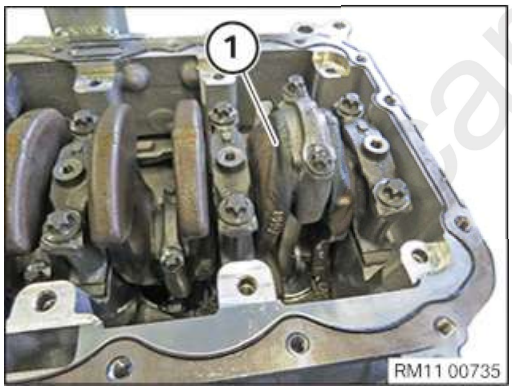
▷ **Detach the lower connecting rod bearing**

RISK OF DAMAGE

Damage on the cylinder wall and oil spray nozzles.

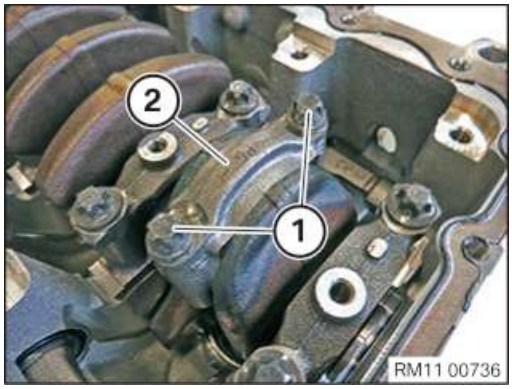
Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.



- Turn the crankshaft until the connecting rod bearing journal (1) reaches a vertical position.

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RISK OF DAMAGE

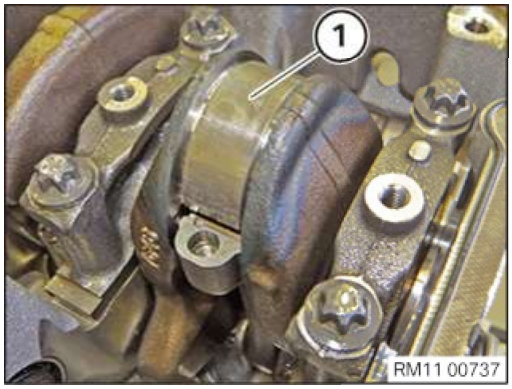
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Unscrew the connecting rod bolts (1).
- Remove the connecting rod bearing cap (2) and put to one side in the correct order.

  Make sure that the connecting rod bearing cap (2) can be re-installed in the correct position.



RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

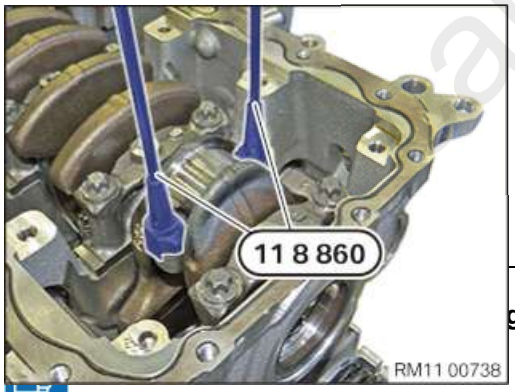
Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Remove the connecting rod bearing (1).

  Make sure that the connecting rod bearing (1) can be re-installed in the correct position.

◁



- Screw special tool 0 496 144 (11 8 860) in at large connecting rod eye.

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g shells



- Press piston (1) with connecting rod up and out of crankcase.

Engine damage caused by incorrectly nstalled bearing shells and bearing supports.

ctly installing bearing shells and bearing supports.

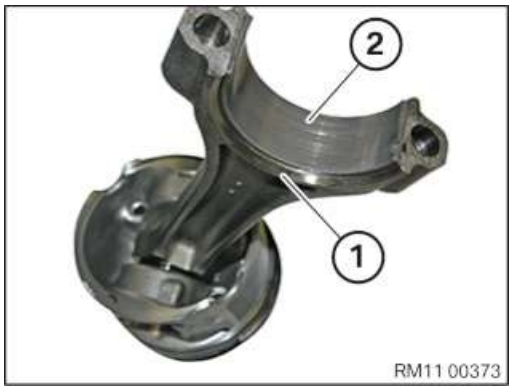
- Always install all bearing shells and bearing supports in the same position from which they were removed.

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TECHNICAL INFORMATION

Piston, gudgeon pin, connecting rod and connecting rod bearing shells are matched to each other and balanced.

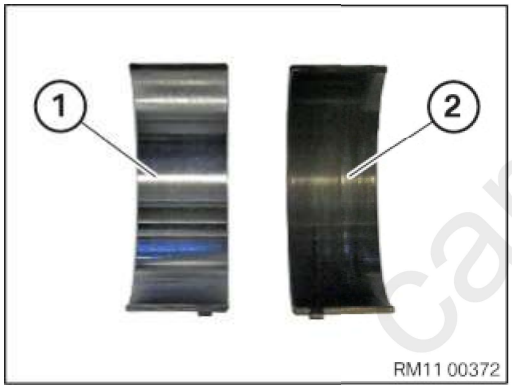
Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.



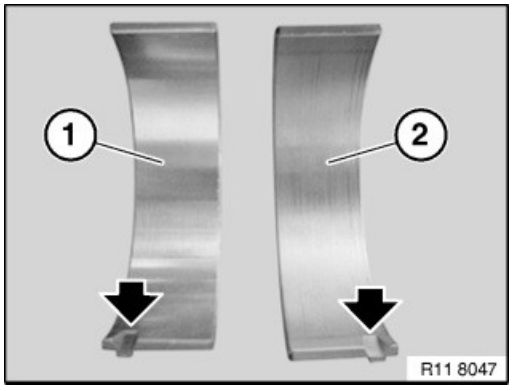
- Thread out and remove connecting rod bearing shell (2) from the connecting rod (1).



- Thread out and remove connecting rod bearing shell (2) from the connecting rod bearing cap (1).



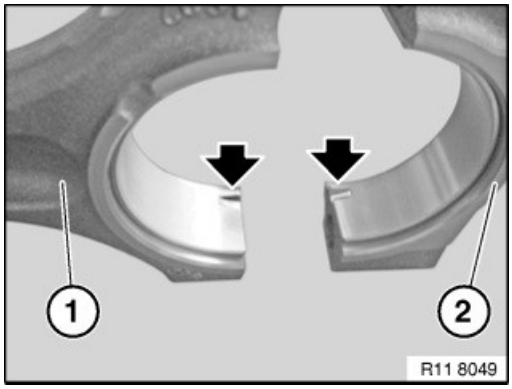
- Ensure that the connecting rod bearing shell (1) and connecting rod bearing shell (2) are different



- To avoid incorrect assembly: Pay attention to marks (arrows).

  The connecting rod bearing shell (1) and the connecting rod bearing shell (2) are equipped **with a fuse each to act** against incorrect assembly.

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- To avoid incorrect assembly: Pay attention to marks (arrows).

  The connecting rod bearing cap (2) and the connecting rod (1) are equipped with **a fuse each to act** against incorrect assembly.



- Insert the dark connecting rod bearing shell (2) into the connecting rod (1).

  Parts: Connecting rod bearing shell

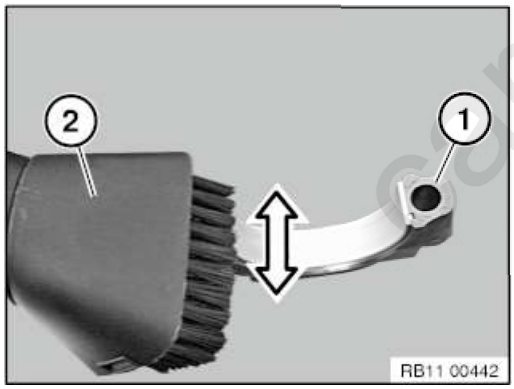
- Oil the connecting rod bearing shell (2).



- Insert the connecting rod bearing shell (2) into the connecting rod bearing cap (1).

  Parts: Connecting rod bearing shell

- Oil the connecting rod bearing shell (2).



- Vacuum the crack surfaces (1) with a conventional vacuum cleaner (2).

  Do not blow off the crack surfaces (1) **using** compressed air.

POSTPROCESSES

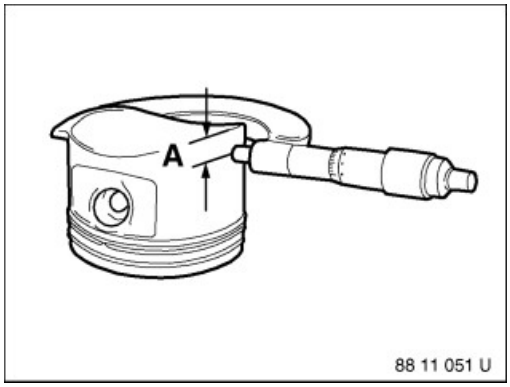
35 – Measuring piston

NOTICE

The description is for one component only. The procedure is identical for all further components.

Check

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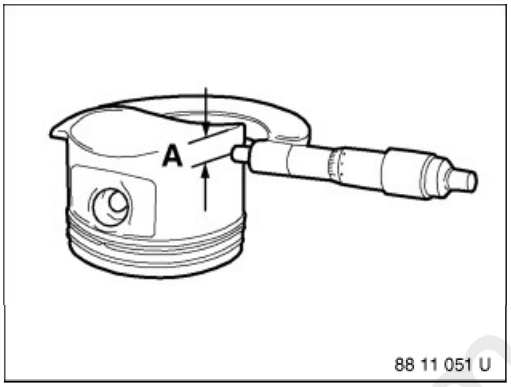


- Position measuring bolt in area (A) and measure piston installation clearance transversely to gudgeon pin.

Piston diameter

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Result

» Piston does not correspond to the specifications.

Measure

- Renew the piston.

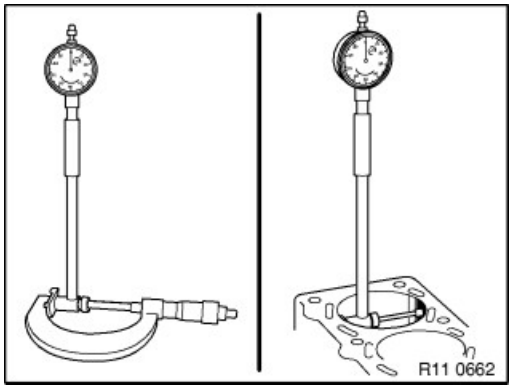
36 – Measuring a cylinder

Prerequisite

Cylinder barrel is cleaned.

Check

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- Carry out a measurement at all cylinders.
- Adjusting measuring screw to nominal dimension of cylinder bore.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

- Insert internal measuring device into measuring screw and set to zero.
- With the internal measuring device, measure the cylinder at the following points and check the deviations from the nominal dimension.
  - Lower third of the cylinder bore in direction of travel,
  - Lower third of the cylinder bore transversely to direction of travel,
  - Middle third of the cylinder bore in direction of travel,
  - Middle third of the cylinder bore transversely to direction of travel,
  - Upper third of the cylinder bore in direction of travel,
  - Upper third of the cylinder bore transversely to direction of travel.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Result

» Cylinder does not correspond to the specifications.

Measure

- Renew the crankcase.

37 – Installing all pistons with connecting rod

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Installing piston with connecting rod**

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RISK OF DAMAGE

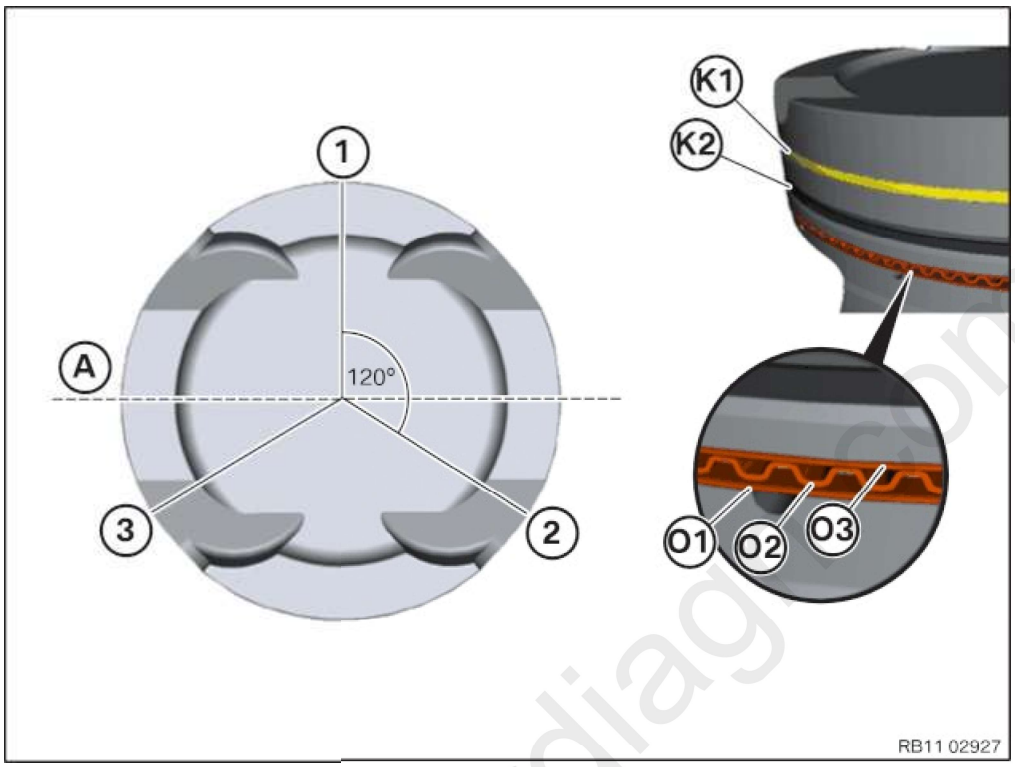
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

▷ **Aligning piston rings**

Aligning piston rings



1 12 o'clock position

2 4 o'clock position

3 8 o'clock position

A Axis of gudgeon pin

K1 Upper piston ring

K2 Middle piston ring

O1 Lower oil scraper ring

O2 Spring

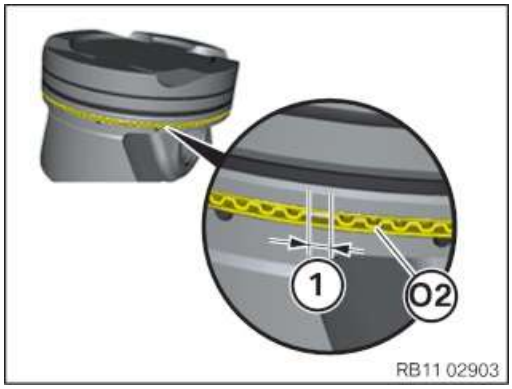
O3 Upper oil scraper ring

- Align the contact points of all piston rings rotated by 120° each.

  Do not position contact points over axis of gudgeon pin (A).

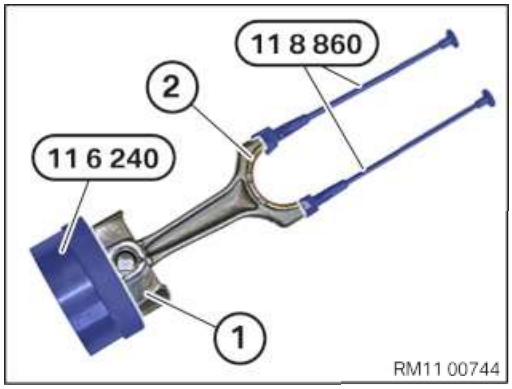
Piston ring	Align at the following position
Lower oil scraper ring (O3)	Align at the 12 o'clock position (1)
Spring (O2)	Align at the 4 o'clock position (2)
Upper oil scraper ring (O1)	Align at the 8 o'clock position (3)
Middle piston ring (K2)	Align at the 12 o'clock position (1)
Upper piston ring (K1)	Align at the 4 o'clock position (2)

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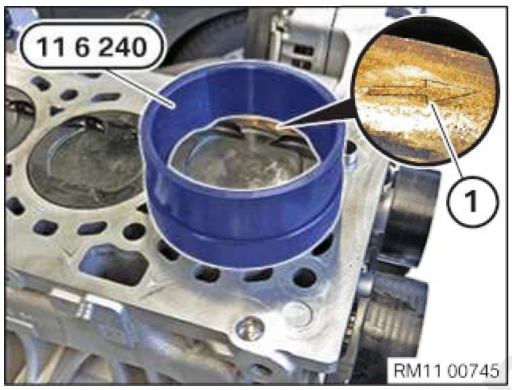


- Make sure that contact point (1) does not overlap spring (O2).

◁



- Coat the pistons (1) and piston rings lightly with oil.
- Insert the pistons (1) with the piston rings into the bush 0 495 373 (11 6 240).
- Screw special tool 0 496 144 (11 8 860) on at large connecting rod eye (2).



- Align the piston so that the arrow (1) points to cylinder 1.
- Insert the piston with the connecting rod into the special tool 0 495 373 (11 6 240) and guide it into the cylinder.

RISK OF DAMAGE

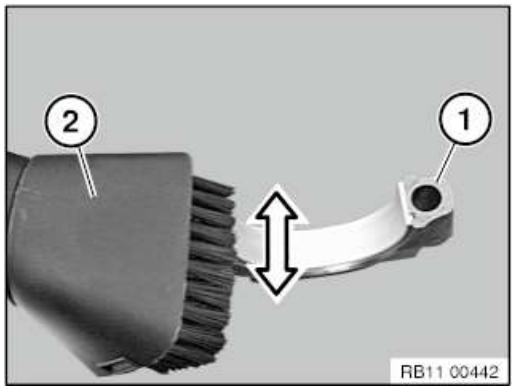
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

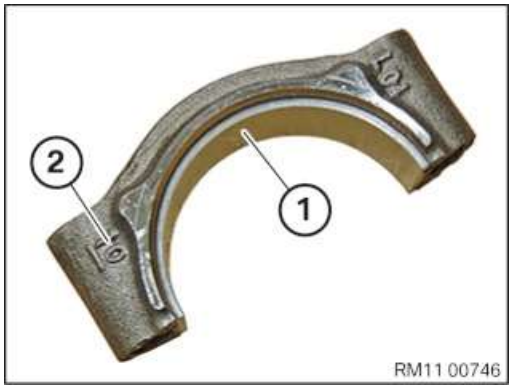
- Push in piston by hand with only little force. Do not use striking tools.

▷ **Install the lower connecting rod bearing**

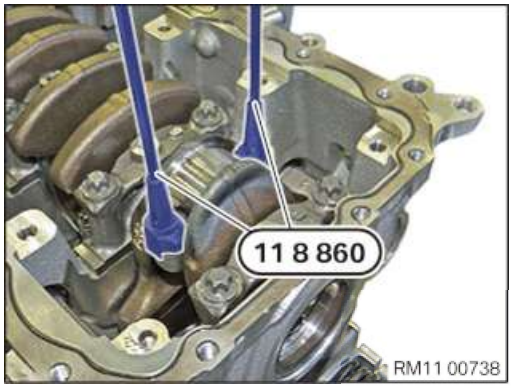


- Vacuum the connecting rod bearing shell and cracked surface (1) with a vacuum cleaner (2).

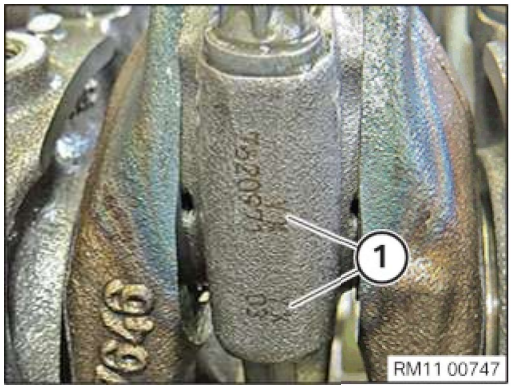
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- Insert the connecting rod bearing shell (1) into the connecting rod bearing cap (2).
- Apply a light coat of oil to the connecting rod bearing shell (1).



- If necessary, screw the assembly tool 0 496 144 (11 8 860) into the large connecting rod eye.
- Pull the connecting rod up to the connecting rod bearing journal.



RISK OF DAMAGE

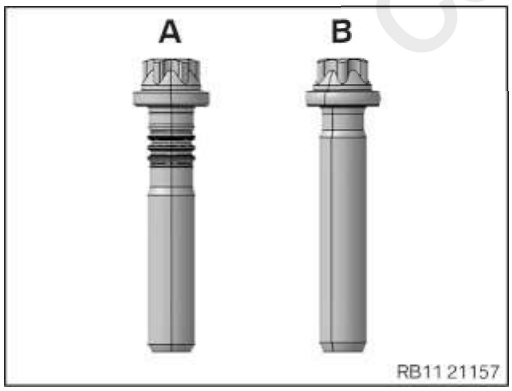
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

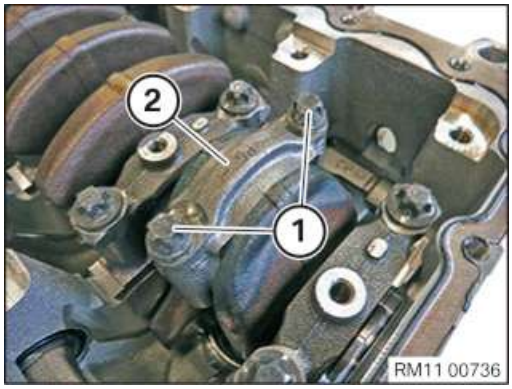
- Attach the connecting rod bearing caps to the connecting rod until the designations (1) match.

  Make sure that the connecting rod bearing (2) is attached to the same connecting rod that it was detached from.



- A mixed installation of connecting rod bolts (A) and (B) on a connecting rod bearing cap is **not** permitted.

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TECHNICAL INFORMATION

When installing new connecting rod bolts, ensure that two identical connecting rod bolts are used on one connecting rod bearing cap.

A mixed installation of different connecting rod bolts on one connecting rod bearing cap is not permitted.

- Renew screws (1).
- Tighten the screws.

  Make sure that the connecting rod bearing cap (2) rests completely on the connecting rod.

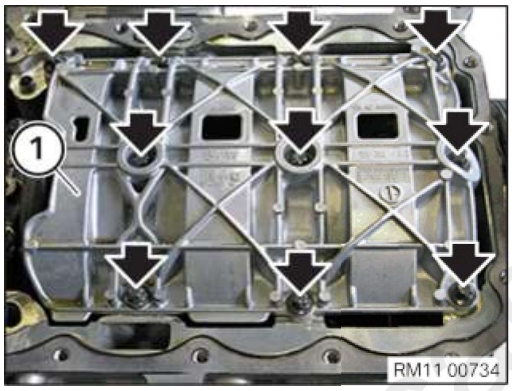
Connecting rod bearing cap to connecting rod

Renew screws.

Tighten screws crosswise.	Jointing torque	20 Nm
	1. Angle of rotation	70 °
	2. Angle of rotation	70 °

◁

38 – Installing the oil deflector



- Install the oil deflector (1).
- Renew screws.

  Parts: Bolts
- Tighten all bolts cross-wise.

Oil deflector to crankcase

M8 x 35		Renew screws.	15 Nm
			45 °

39 – Oil vacuum pump preparation

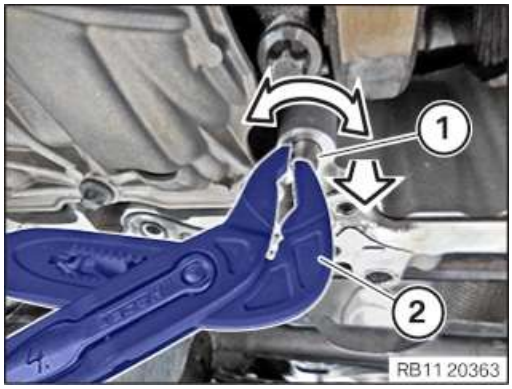
RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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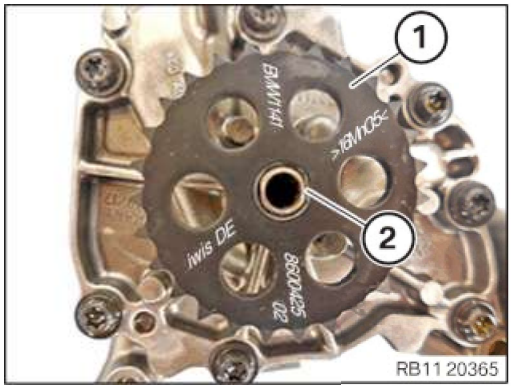


- Remove the centring sleeves (1) in direction of arrow using conventional tools (2).
- Renew the centring sleeves (1).

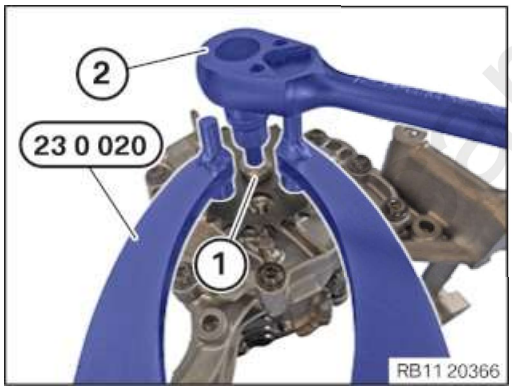
  Parts: Centring sleeves



- Insert and install new centring sleeves (1) on the oil vacuum pump (2).



- Insert and install the camshaft sprocket (1) on the oil vacuum pump (2).
- Make sure the **labelling** on the camshaft sprocket points to the **front**.



TECHNICAL INFORMATION

The thread is a left-hand thread.

- Insert and install the new screw (1).
- Hold camshaft sprocket with special tool 0 491 440 (23 0 020) and tighten screw (1) with conventional tools (2).

Note: Carry out work with a second person assisting.

Camshaft sprocket to oil vacuum pump

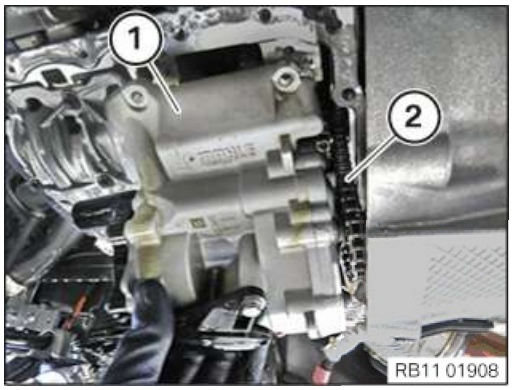
M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °



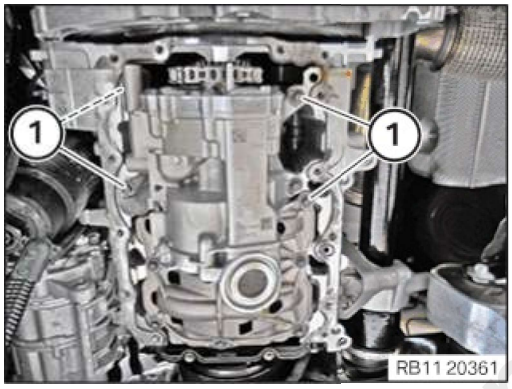
- Make sure the sealing ring (1) is installed correctly.

  The sealing ring (1) must not be damaged or missing.

40 – Install the oil vacuum pump



- Feed the oil vacuum pump (1) into the drive chain (2) and position it.



- Tighten the new bolts (1).

Oil vacuum pump to crankcase

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

41 – Refitting sump



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the rough seal remains on the sealing surface (1) of the crankcase with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



- Have the special tool ready.



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

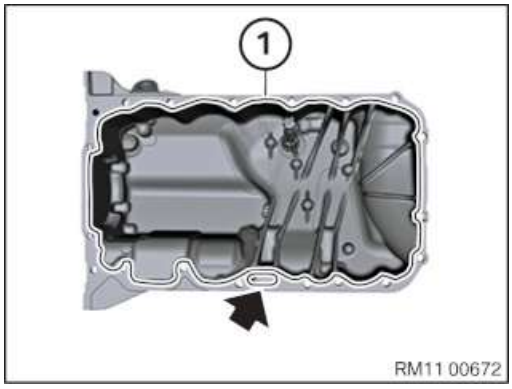
- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)



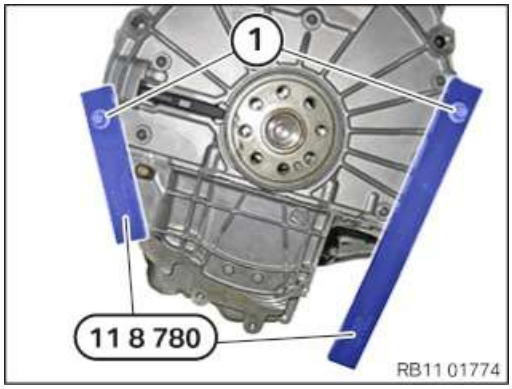
TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound along the line (1) with a thickness of 2 mm to 2.5 mm.

  Apply the sealing compound along the inner edge.
- Completely encircle the oil return orifice (arrow) with the sealing compound.

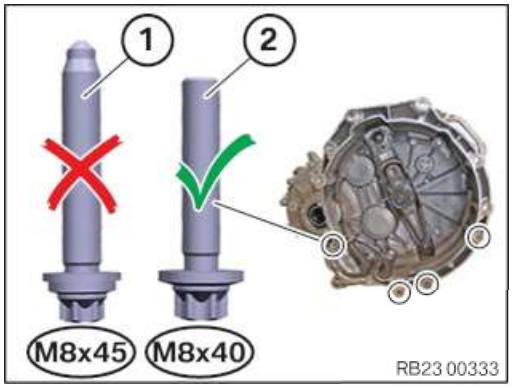
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TECHNICAL INFORMATION

The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with engine block.
- If necessary, renew fitting sleeves.



RISK OF DAMAGE

Component damage caused by incorrect screw length.

The use of screws with the incorrect screw length can damage the component.

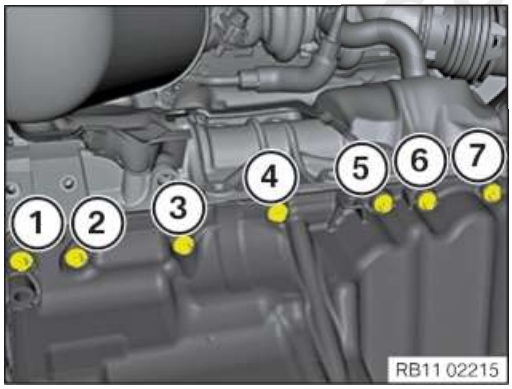
- Check for correct screw length.
- Re-install screws that correspond to the original screw length.

- Ensure that the **correct** screw (2) (M8x40) is used for mounting the oil sump on the transmission.

  The screw (1) (mounting bolt of the starter motor) may **never** be used for mounting the oil sump.



- Install oil sump (1) to top front.
- **Hand-tighten** all oil sump screws but do not tighten completely.

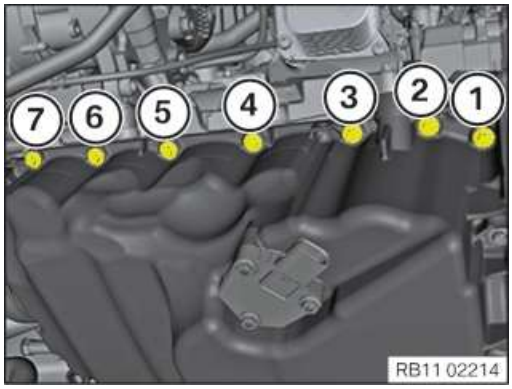


- Tighten the screws (1) to (7).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

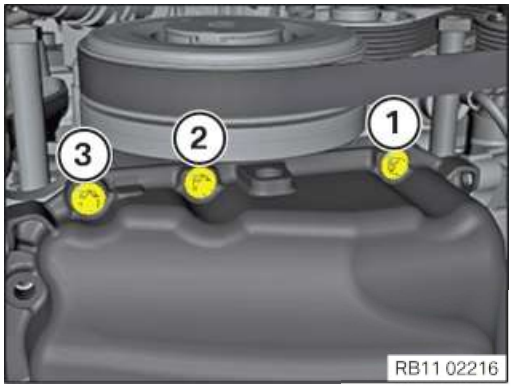
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- Tighten the screws (1) to (7).

Oil sump to crankcase

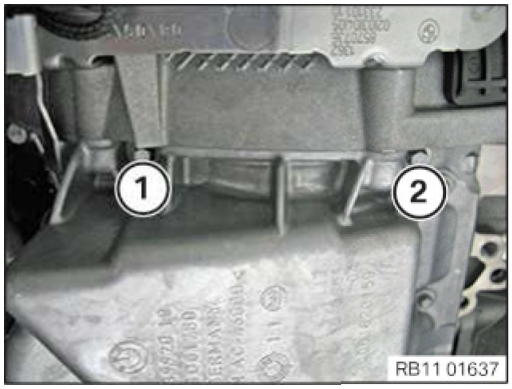
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1), (2) and (3).

Oil sump to crankcase

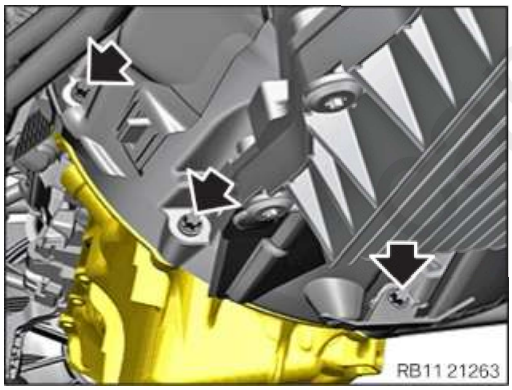
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten down screws (1) and (2).

Oil sump to crankcase

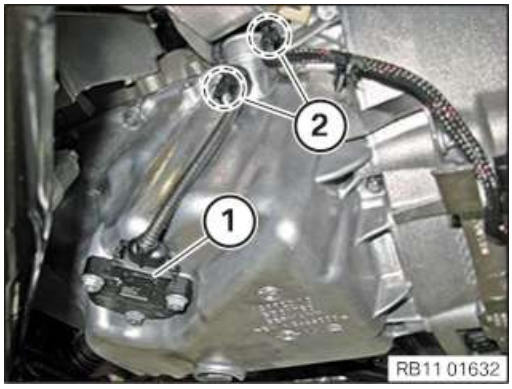
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm



- Fasten cable on the clips (2) from the oil sump.
- Connect and lock the connector (1).
- Make sure the connector 1 engages audibly.

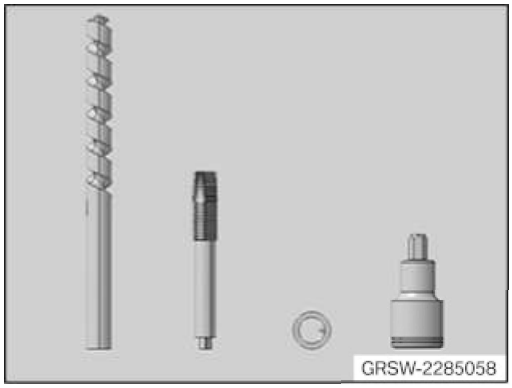
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TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).



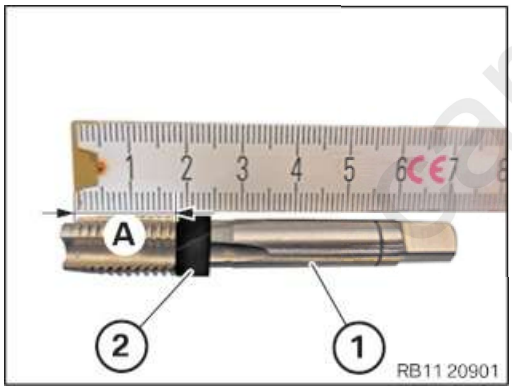
- Use the set of special tools 2 285 058.

Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool



- Assemble tool set.

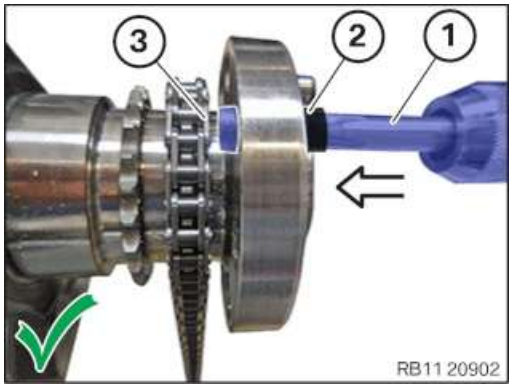
Number	Description
1	Tool holder
2	Thread cutter M12X1,5



- Mark the screw-in depth (A) on thread cutter (1) from the set of special tools 2 285 058 with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm



NOTICE

To provide a better overview: Shown with engine removed.

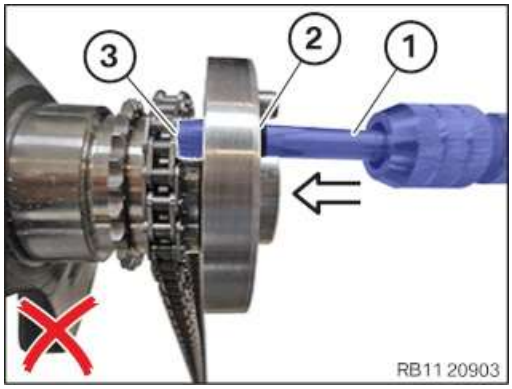
- Screw in the thread cutter (1) from the set of special tools 2 285 058 in direction of arrow up to the screw-in depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).

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TECHNICAL INFORMATION

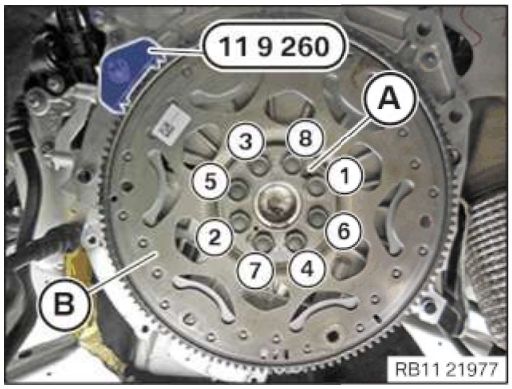
- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

- Make sure that the screw-in depth (2) of the screw tap (1) is not exceeded.

  The thread cutter (1) may not rest on the timing chain (3).



- Make sure the magnet wheel (1) is installed correctly.



- Renew screws (1) to (8).

  Parts: Bolts
- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool 0 494 034 (11 9 261) and screw the special tool 0 494 130 (11 9 264) tightly.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten flywheel bolts in sequence (1) to (8).

Flywheel to crankshaft

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

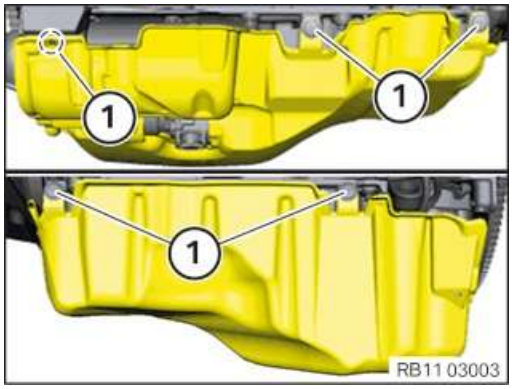
- Remove special tool 0 493 938 (11 9 260).

43 – Installing the acoustic cover for the oil sump

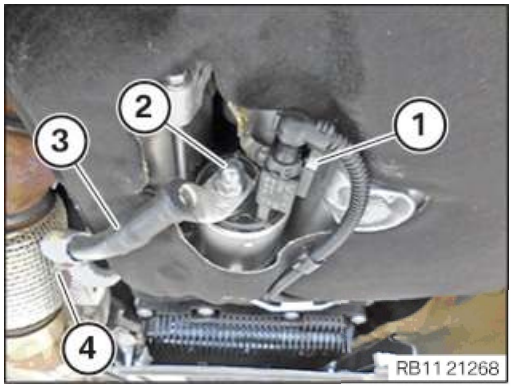


- Install acoustic cover (1) to the top front.

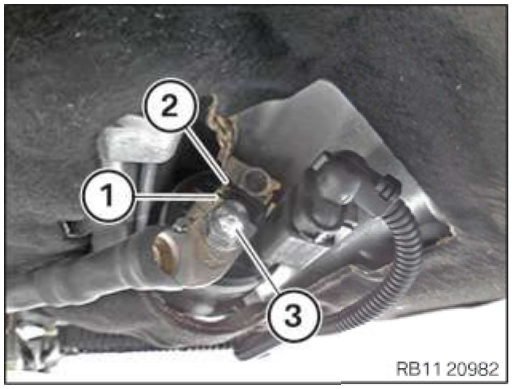
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- Secure all expanding rivets (1).



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.
- Insert and install the positive battery cable (3).
- Secure positive battery cable (3) at the clamp (4).
- Tighten the nut (2) hand-tight.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

44 – Block the crankshaft in he TDC firing position of cylinder 1



RISK OF DAMAGE

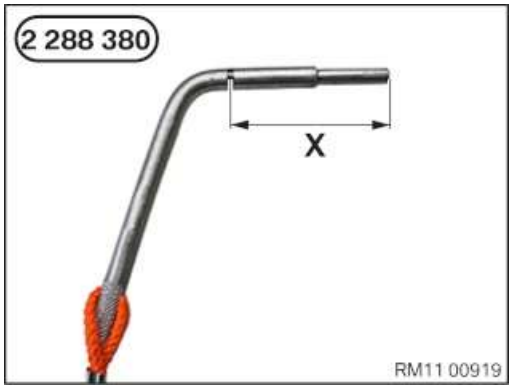
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

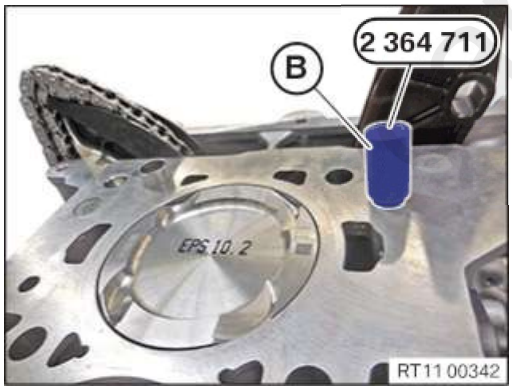


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

45 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

46 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

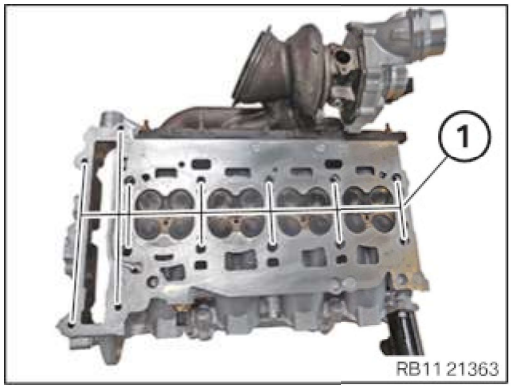
- Do not use any metal-cutting tools.



- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.

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CAUTION

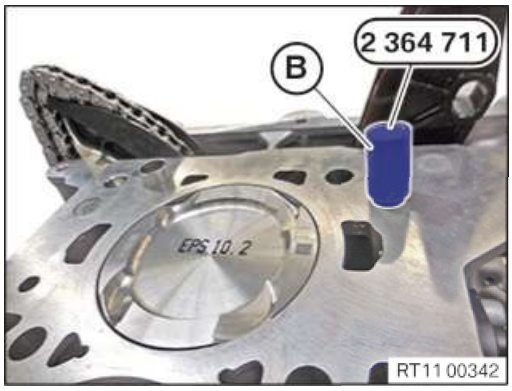
Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

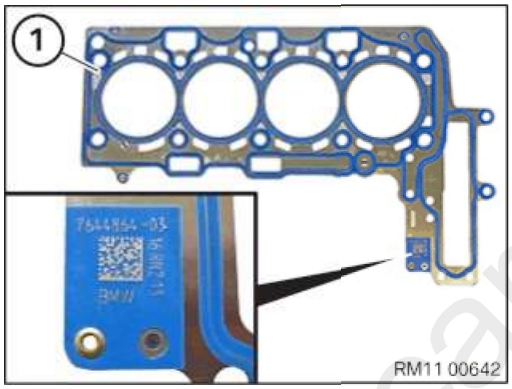
- Wear safety goggles.

- Clean all the threaded holes in the **marked** area of the crankcase with compressed air.



- Remove special tool (B) contained in the set of special tools 2 364 711.

47 – Renewing the cylinder head gasket



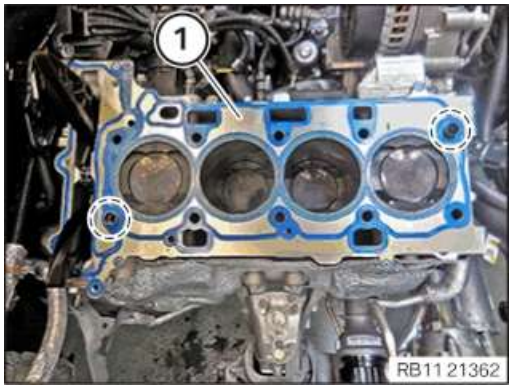
- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional thicker gasket 0.3 mm is available for service personnel.



- Check fitting sleeves (1) in the **marked** area for damage and, if necessary, renew them.

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- Guide cylinder head gasket (1) into the **marked** area and install it.

48 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

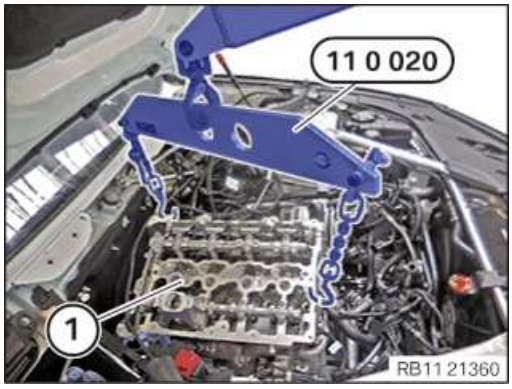
- Dry threaded holes (e.g. using compressed air).

TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



RISK OF DAMAGE

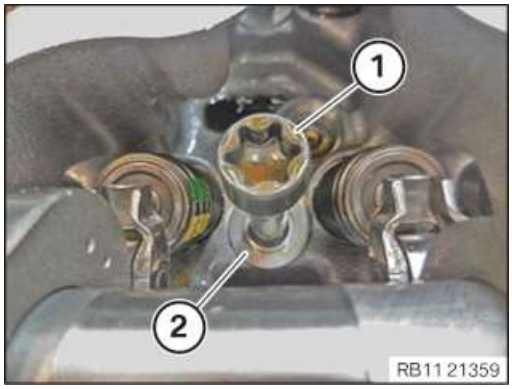
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

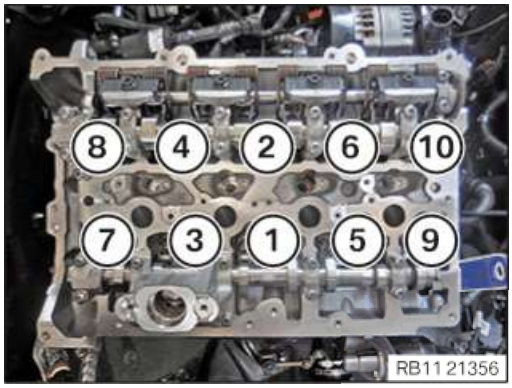
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- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of engine block.
- Guide in and install cylinder head bolts (1).



TECHNICAL INFORMATION

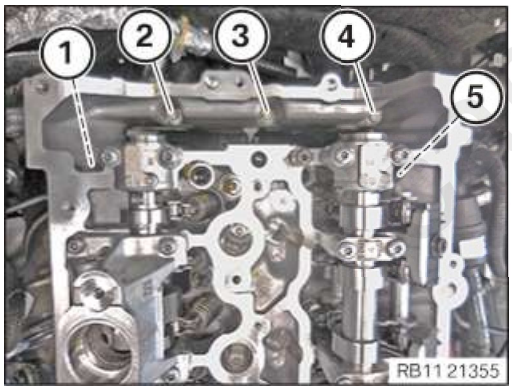
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °



- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

Cylinder head bolt to timing case cover

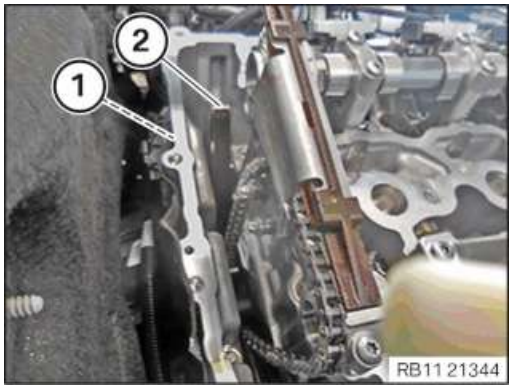
M8x40	Renew screws.	Tightening torque	19 Nm



- Renew bearing journal (1).

  Parts: Bearing journal

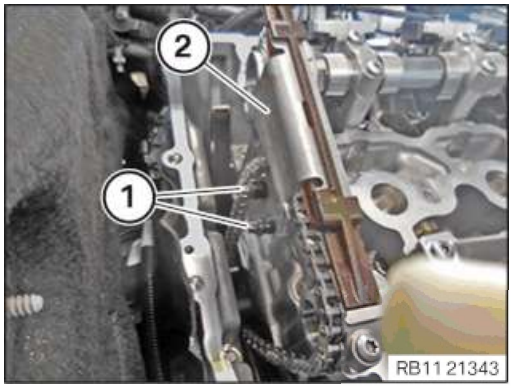
tdiagn.com



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

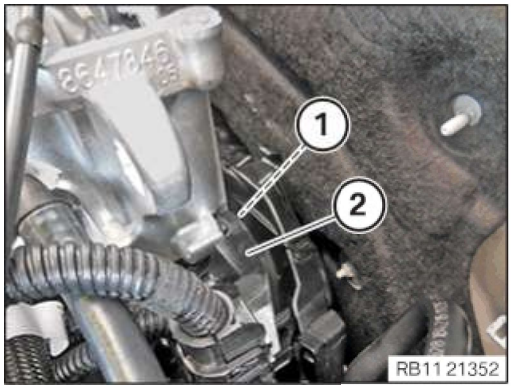
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

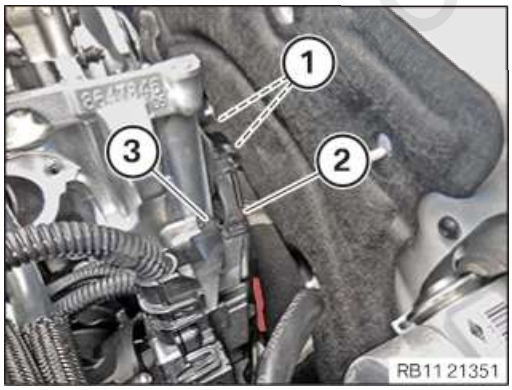
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

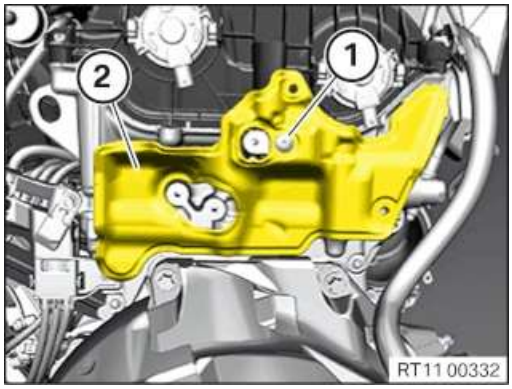
- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm

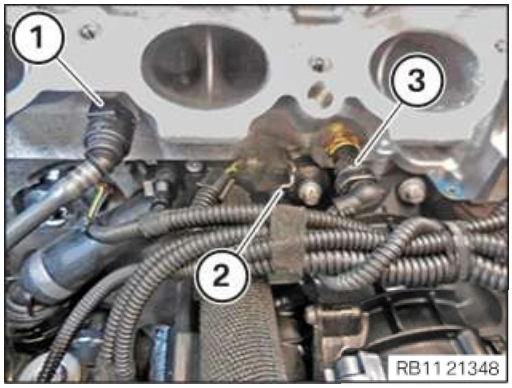
cardiagn.com



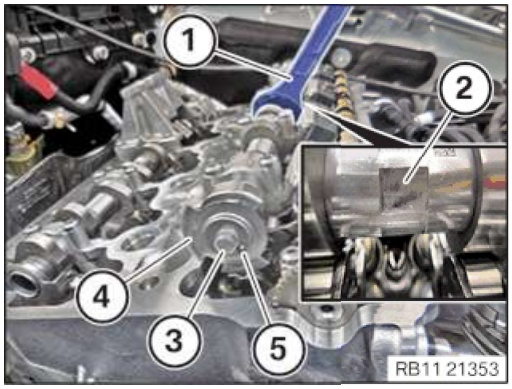
- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



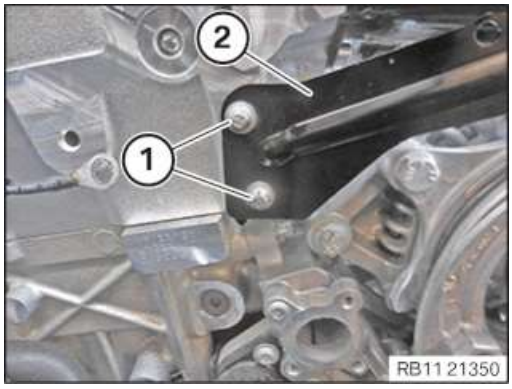
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

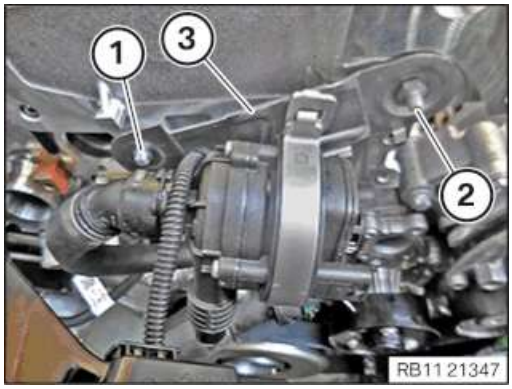


- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm

rdiagn.com



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

Holder for electrical auxiliary coolant pump on cylinder head

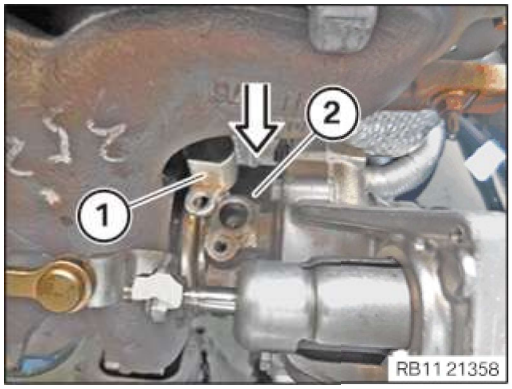
M6		Tightening torque	7 Nm



- Thread in ground cable (2) and install.
- Tighten nut (1).

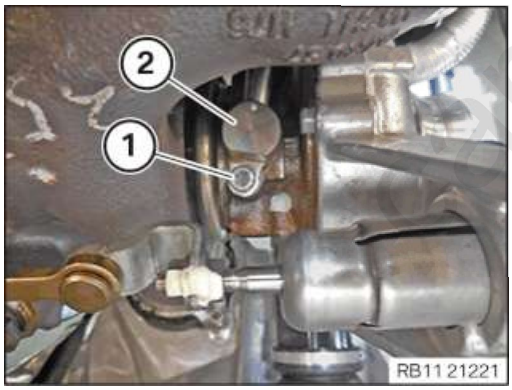
Standard screw connection M6

M6		8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

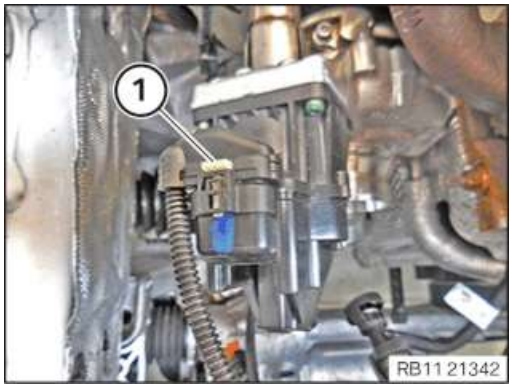
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm



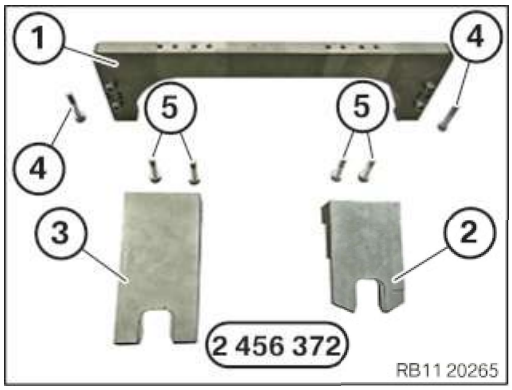
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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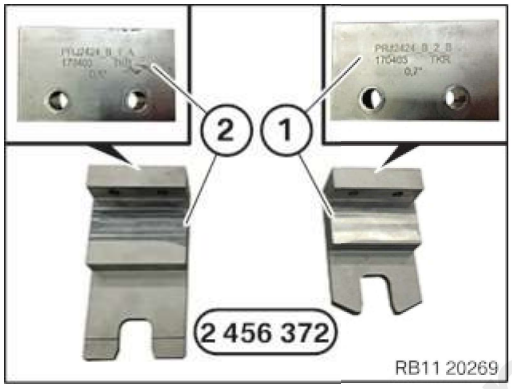
- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

49 – Adjust the camshafts with the special tool

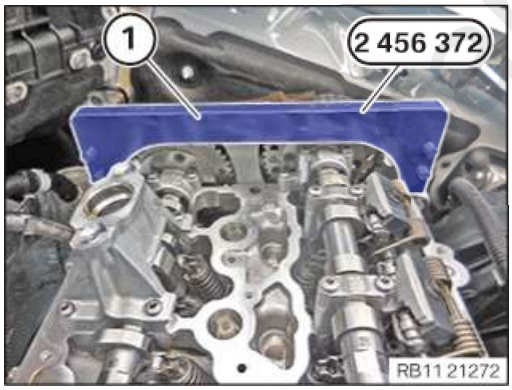


- Overview of the set of special tools 2 456 372:

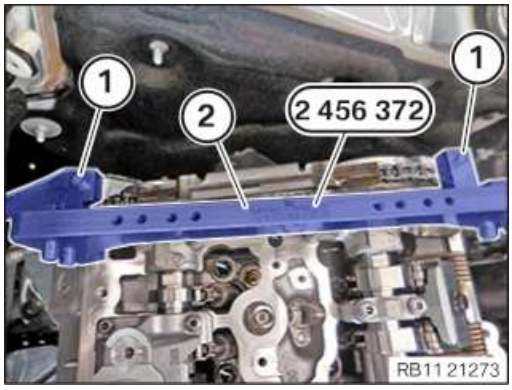
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



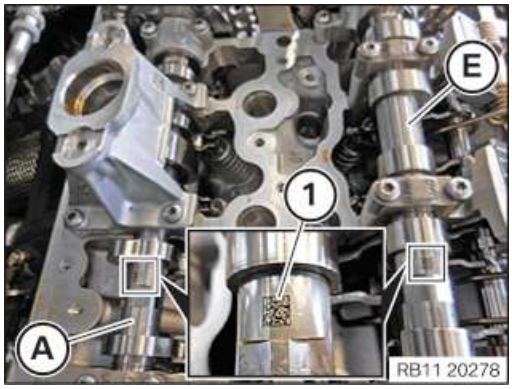
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



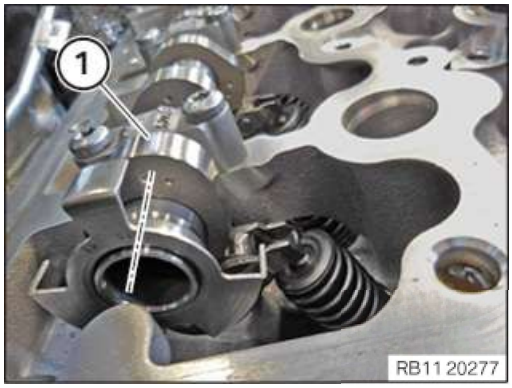
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

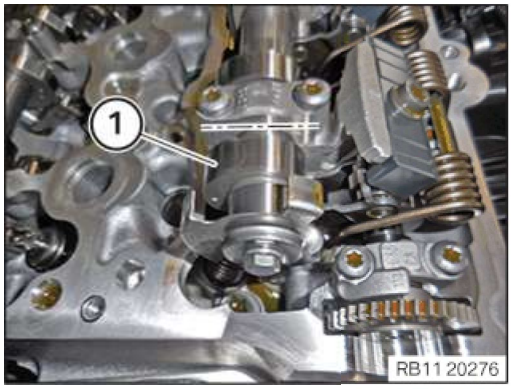
M6		Tightening torque	8 Nm



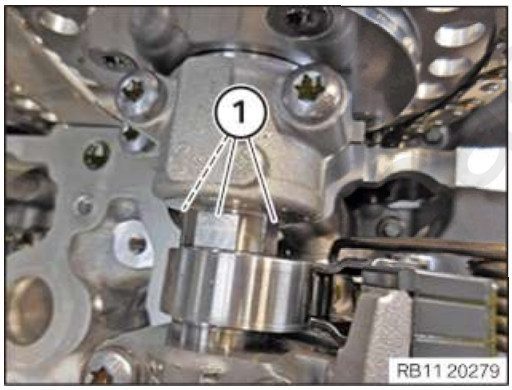
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



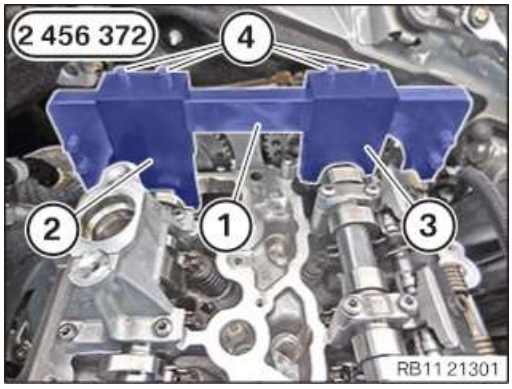
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

50 – Install exhaust camshaft adjuster

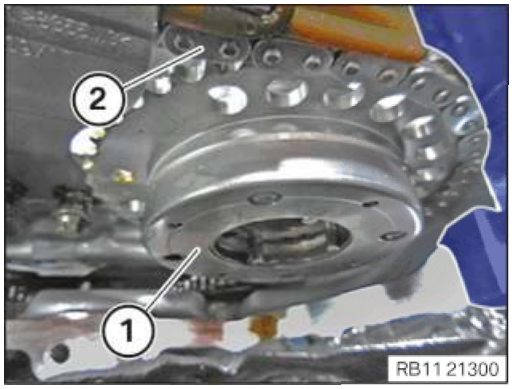
arodiagn.com

NOTICE

The figure shows the rear side of the engine.



- Keep exhaust camshaft adjuster (1) marked EX ready.



- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

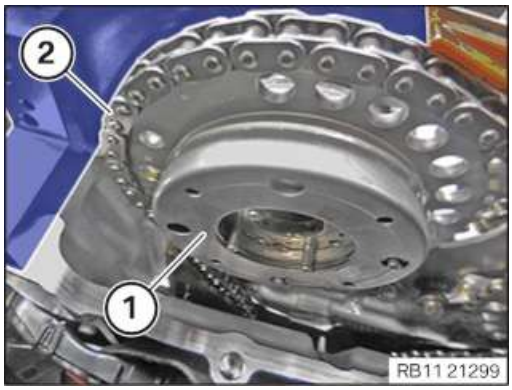
51 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.



- Keep intake adjuster (1) marked IN ready.

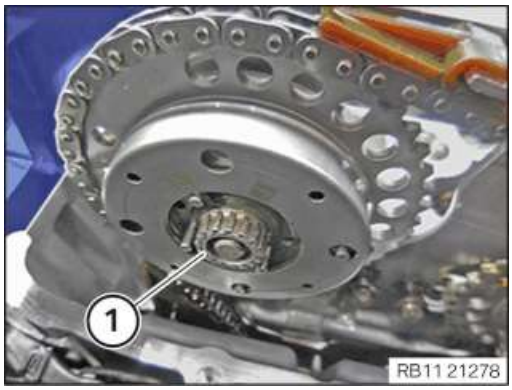


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

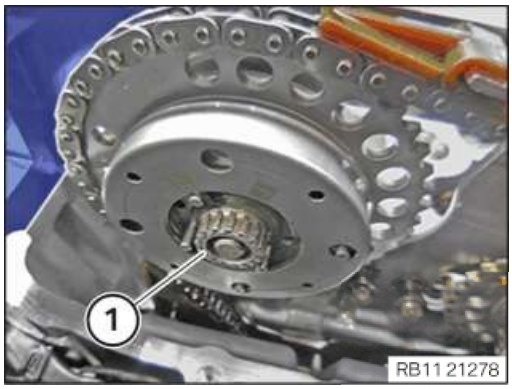
52 – Install the VANOS central valve of the intake adjuster

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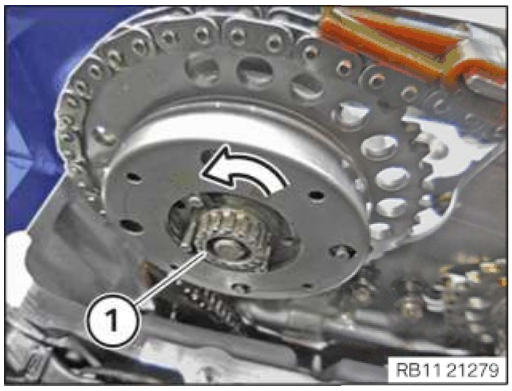
– Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.

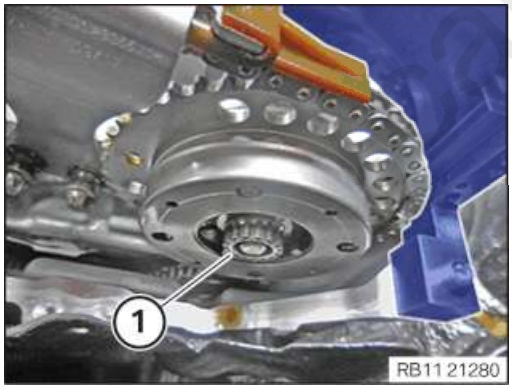


- Hand-tighten the VANOS central valve (1) of the intake adjuster.

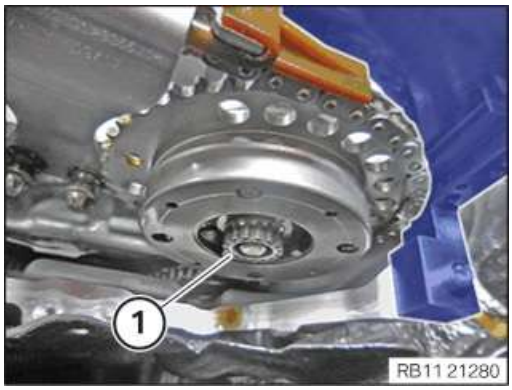


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

53 – Installing the VANOS central valve of the exhaust camshaft adjuster

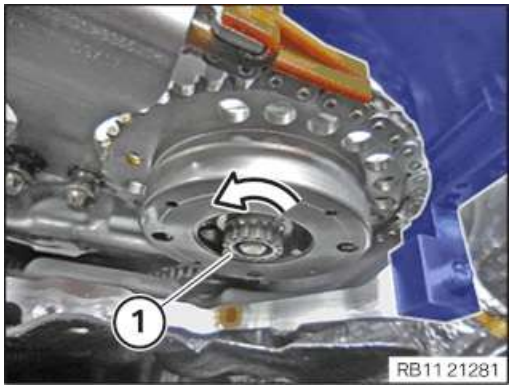


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



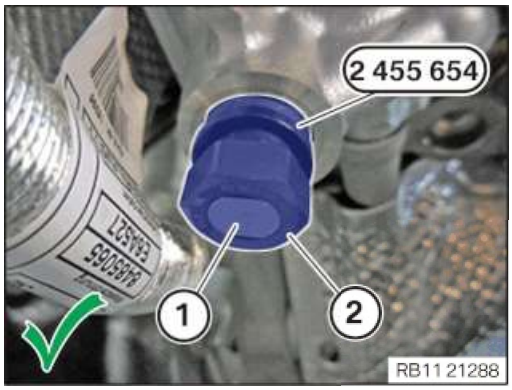
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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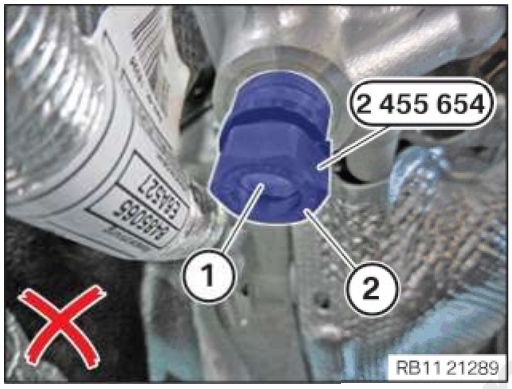
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

54 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

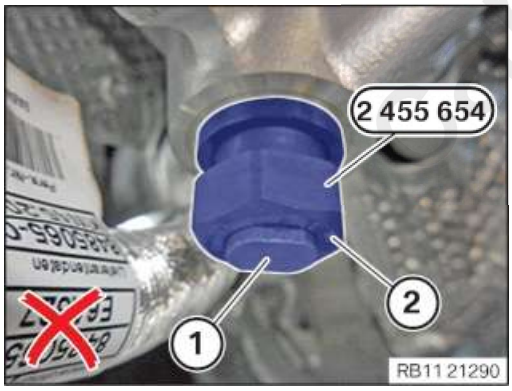
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

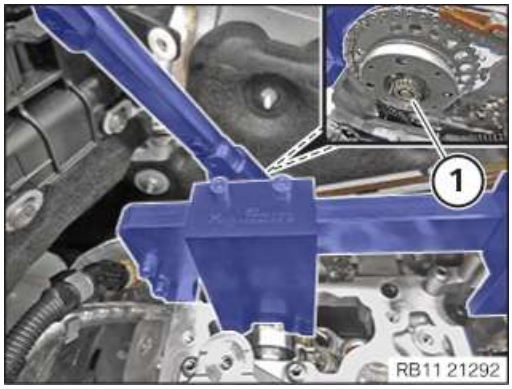
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

55 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

56 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

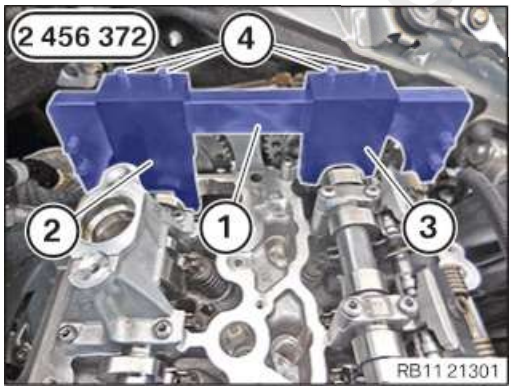


- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

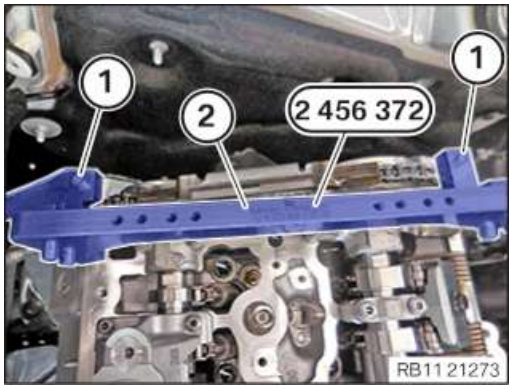
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

57 – Disassembling all special tools

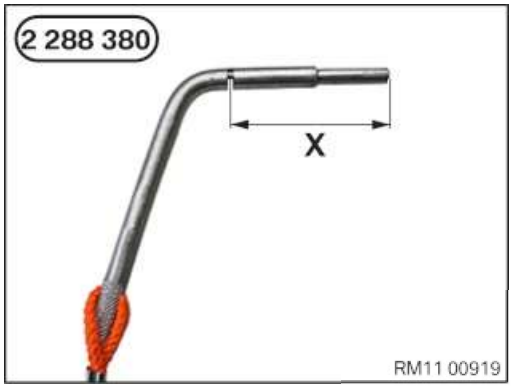


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

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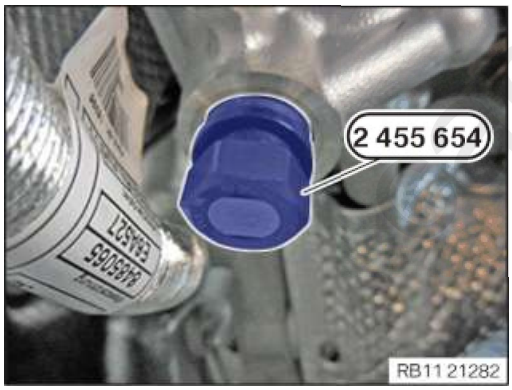
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

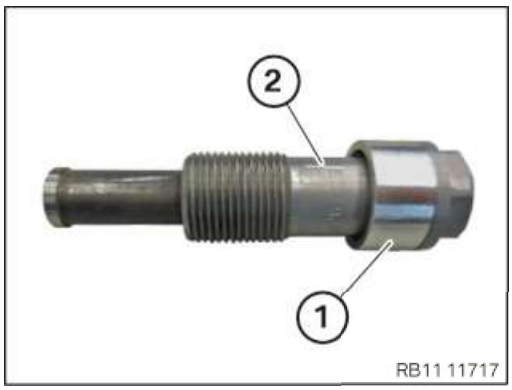
58 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

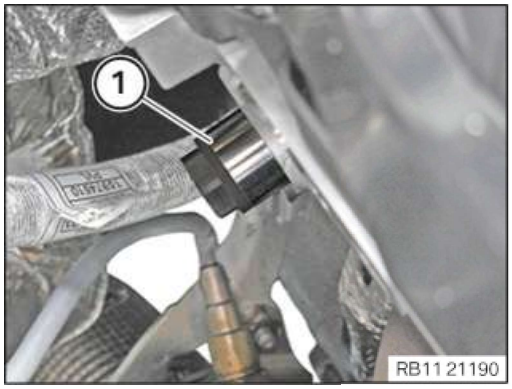


- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

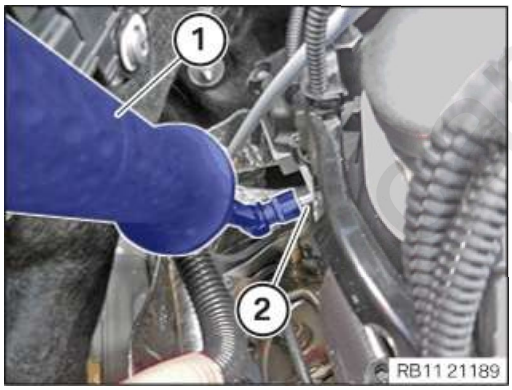


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

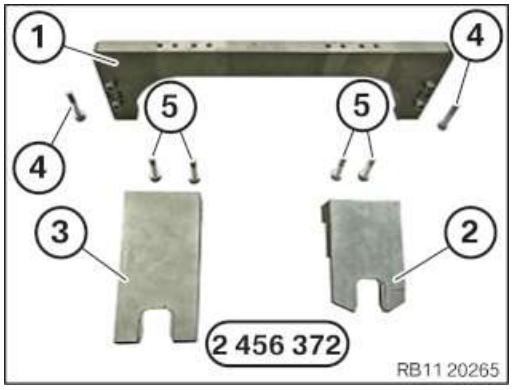


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

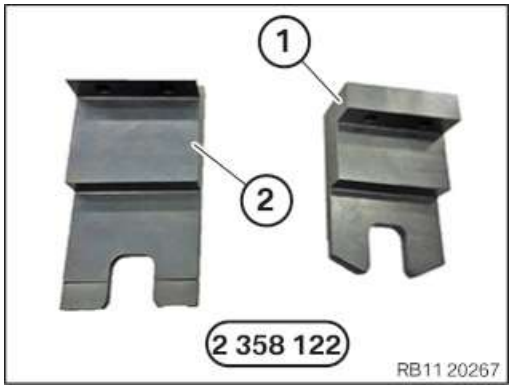
59 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

cardiagn.com



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



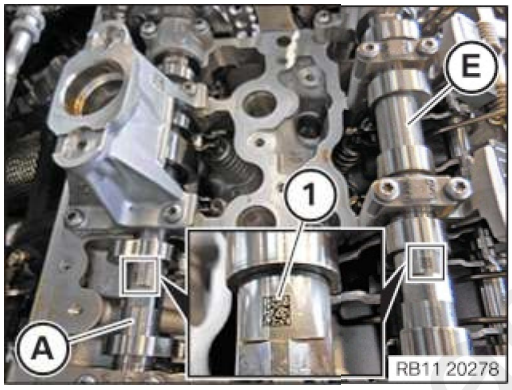
RISK OF DAMAGE

Damage to the engine.

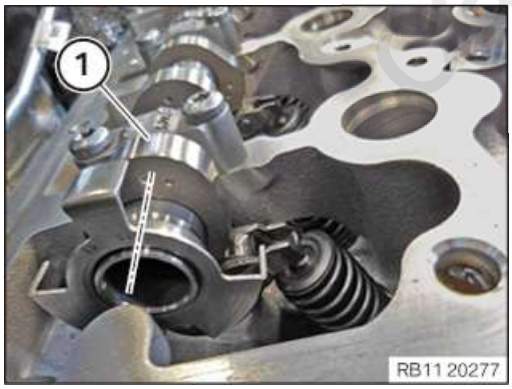
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

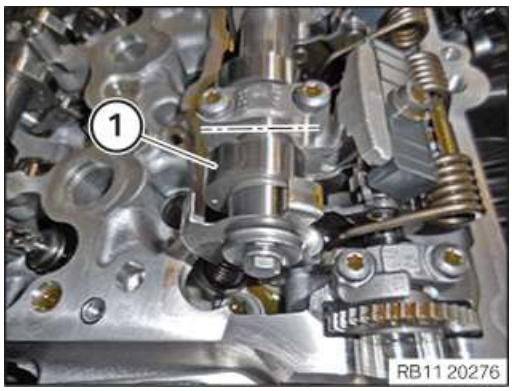
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.

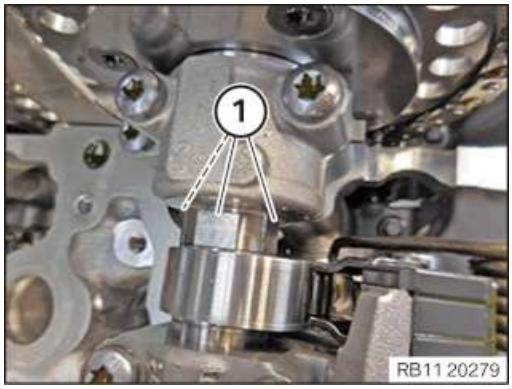


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

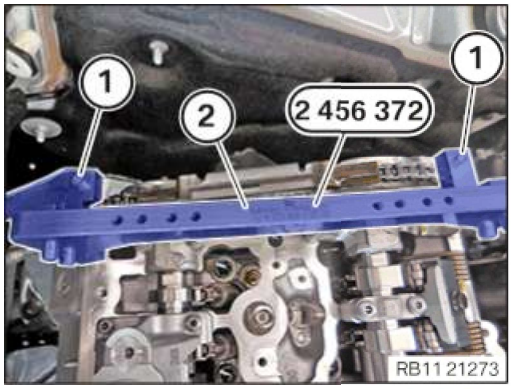
carfdiag.com



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



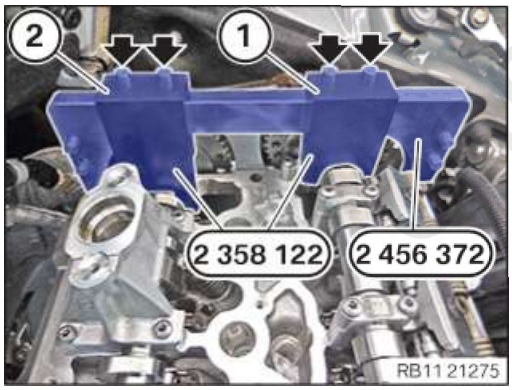
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

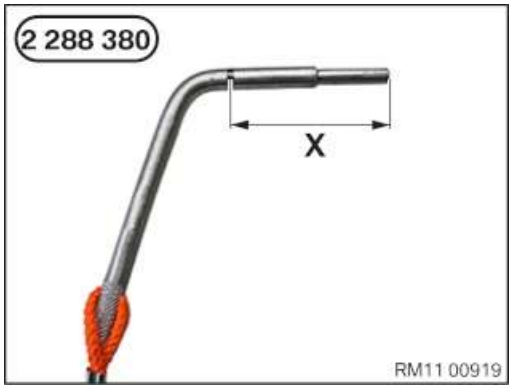
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

rdiagn.com



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

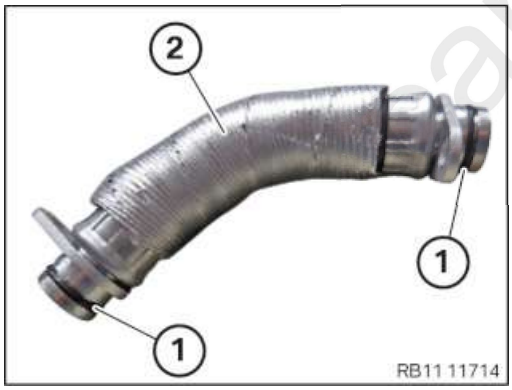


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

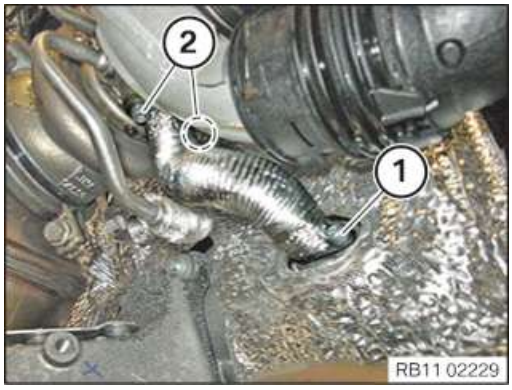
  The engine **is in the** TDC firing position of cylinder 1.

60 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

Oil return line to exhaust turbocharger/crankcase

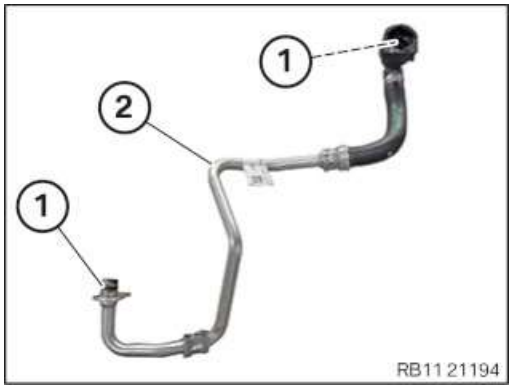
M6x14		Tightening torque	8 Nm

61 – Install the coolant return line for the exhaust turbocharger

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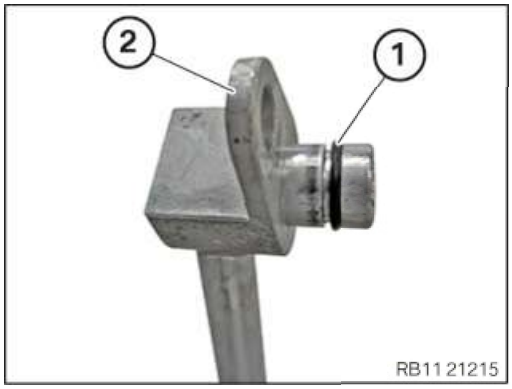
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



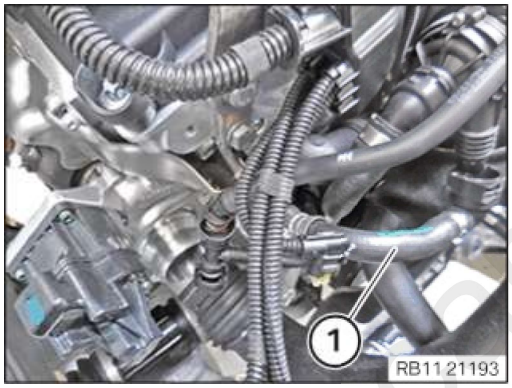
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-ring

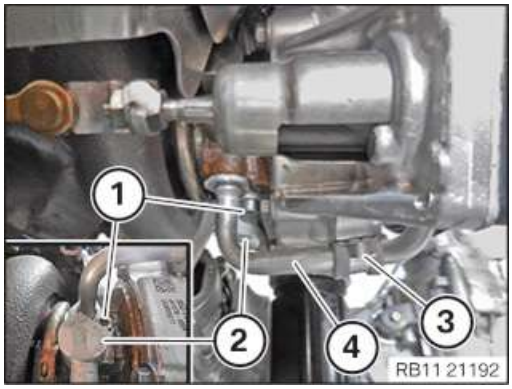


- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.

.com



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

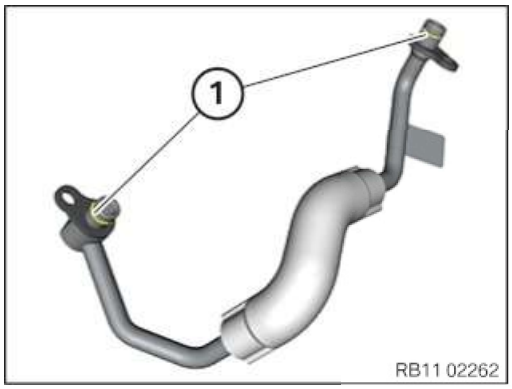
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

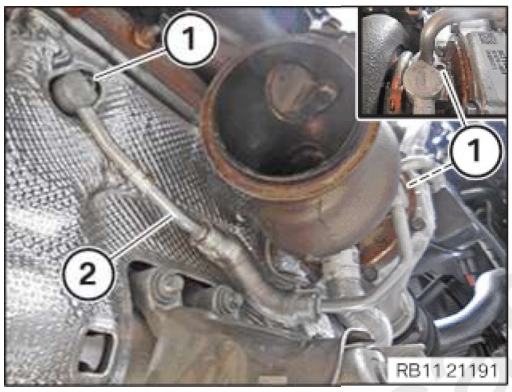
M6		Tightening torque	8 Nm

62 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

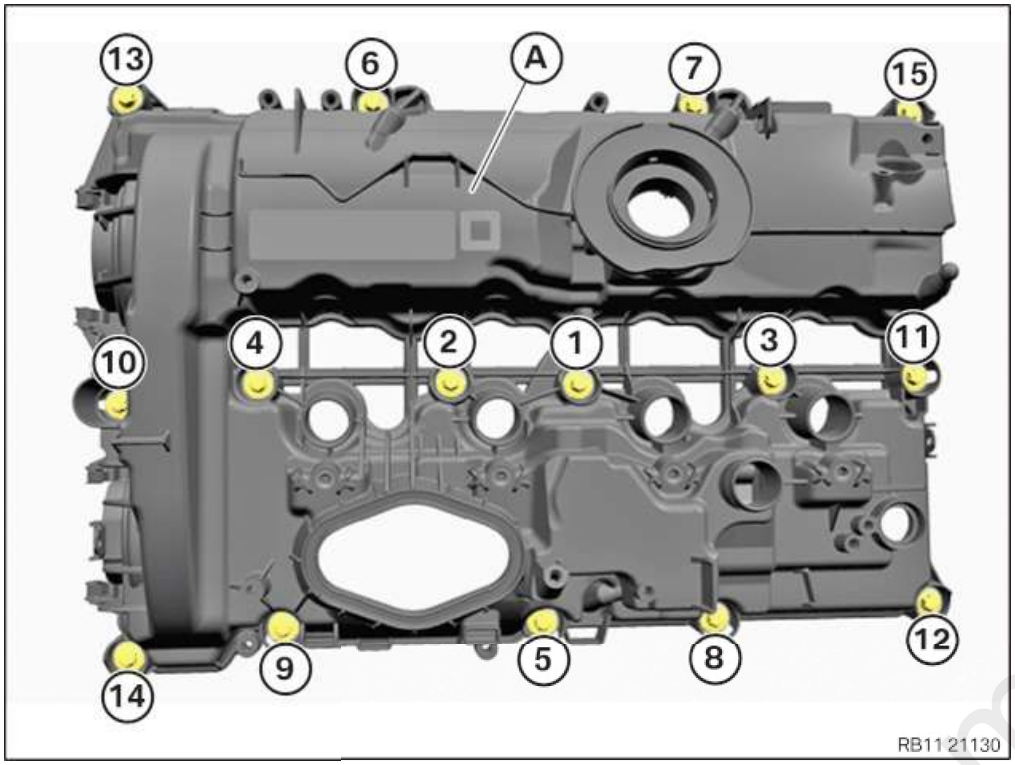
Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

63 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

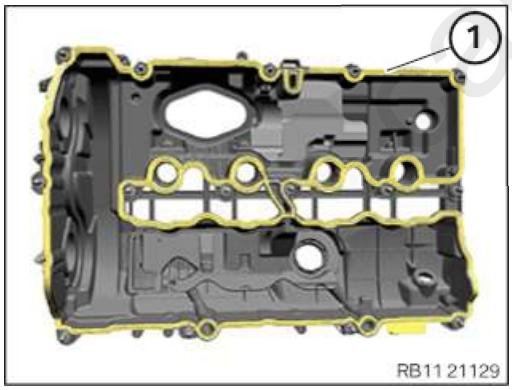
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

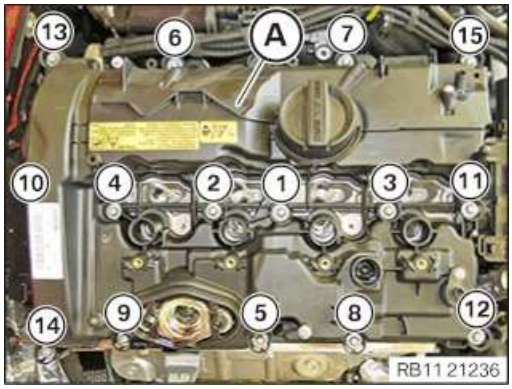
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).

erdiagn.com



TECHNICAL INFORMATION

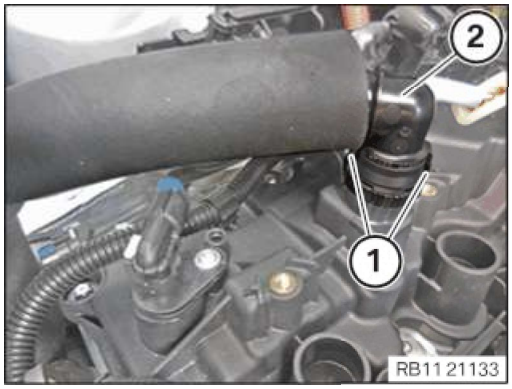
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

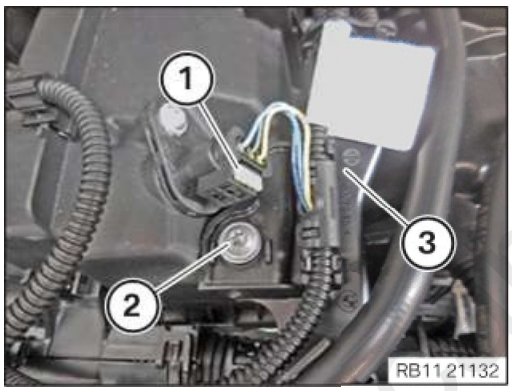
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

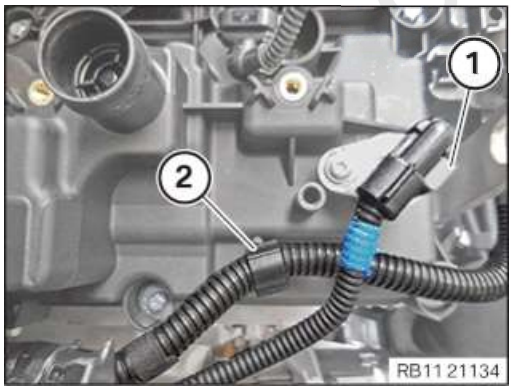


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

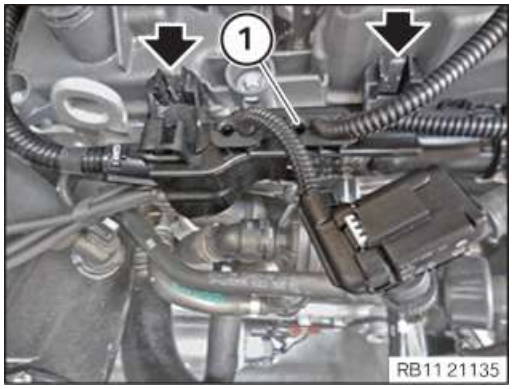
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

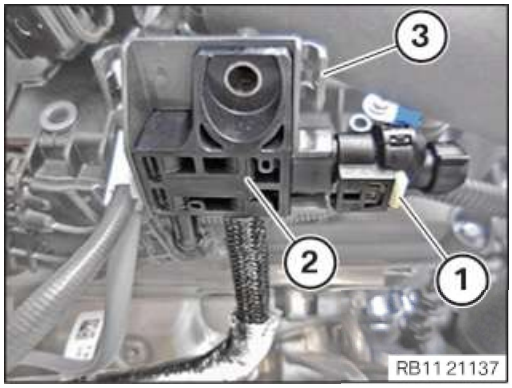


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

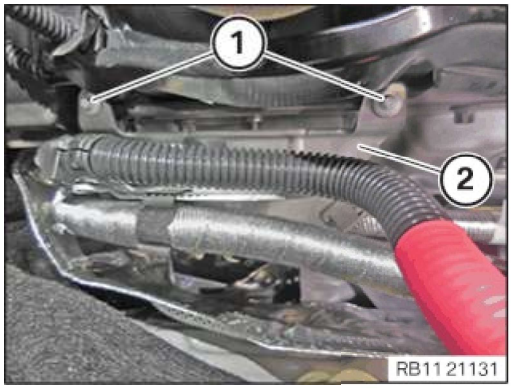
mdiagn.com



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

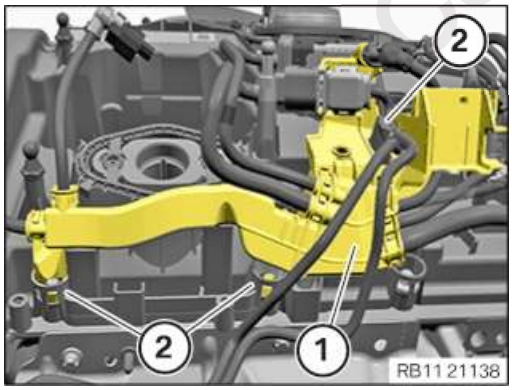
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

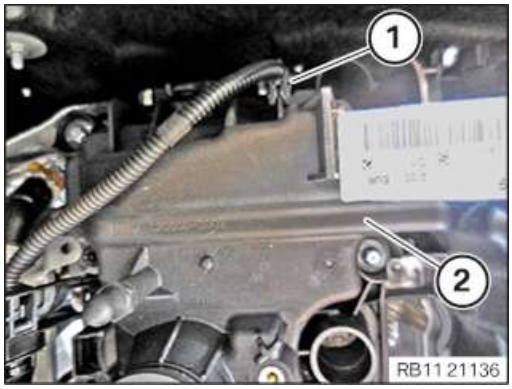
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

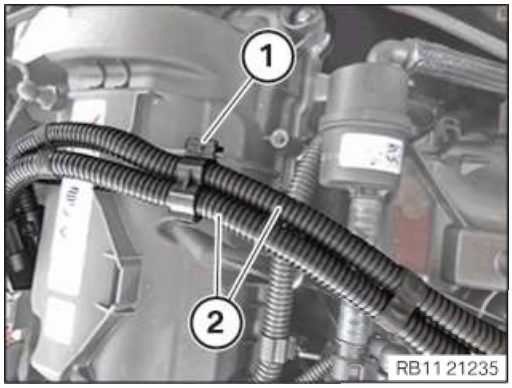


- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

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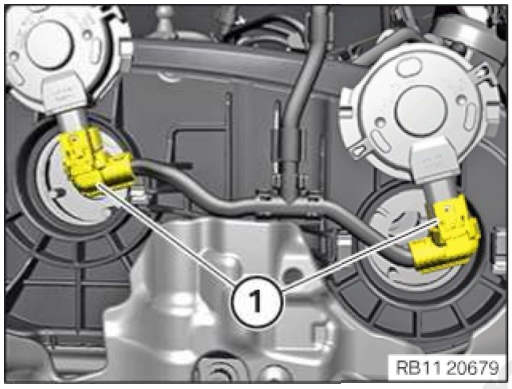


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

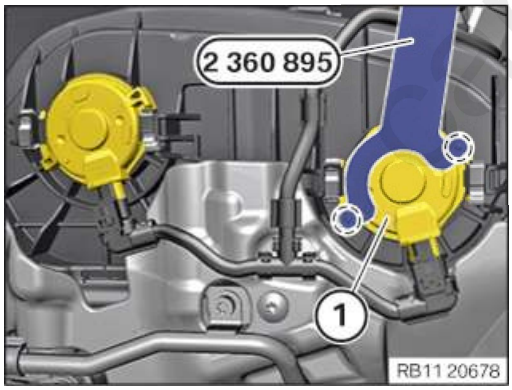
64 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

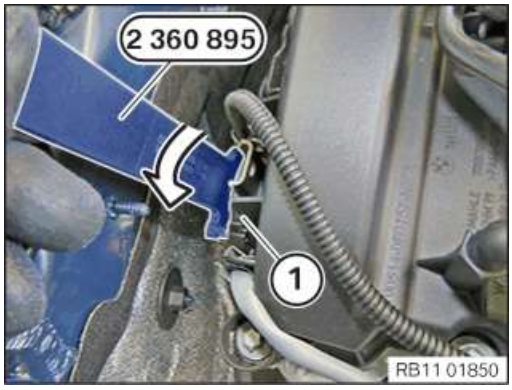
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



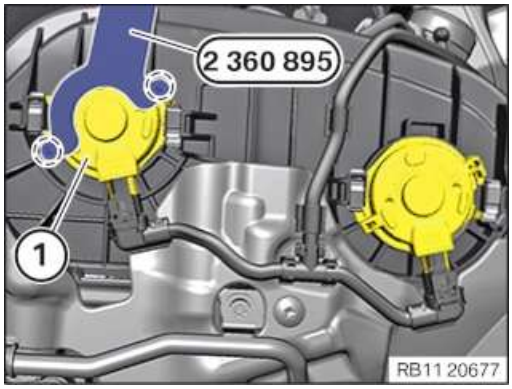
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



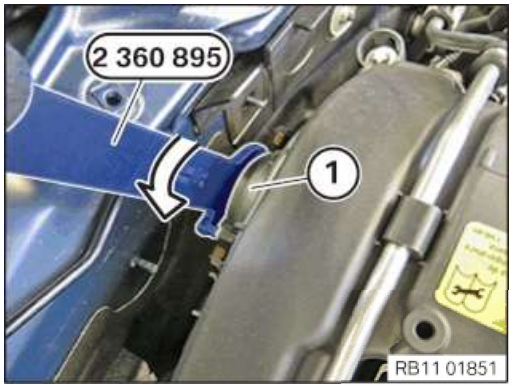
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

65 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

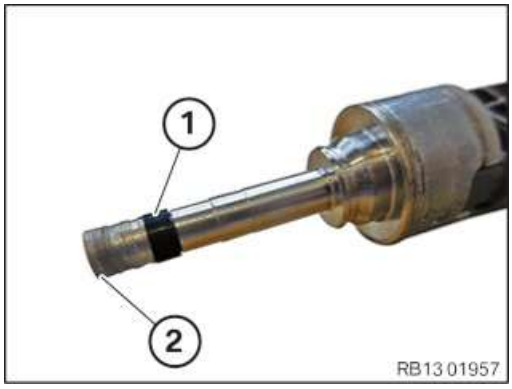
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.

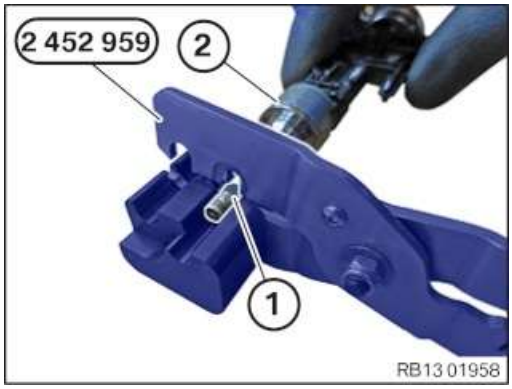


- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).

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- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

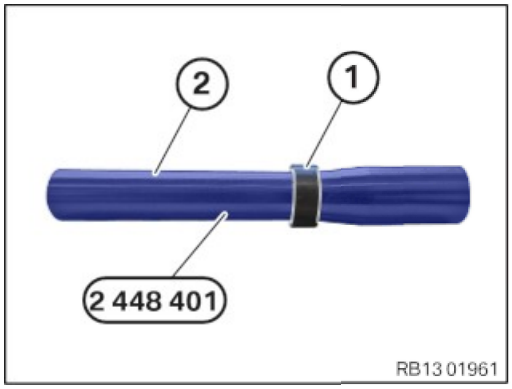


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

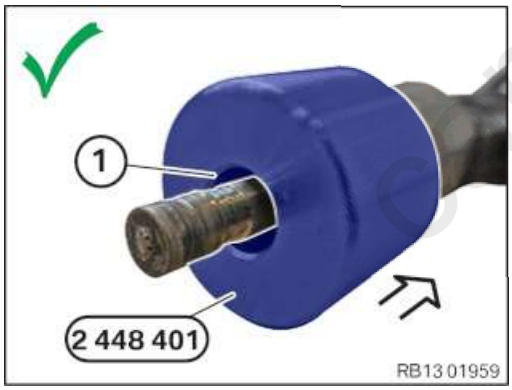
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

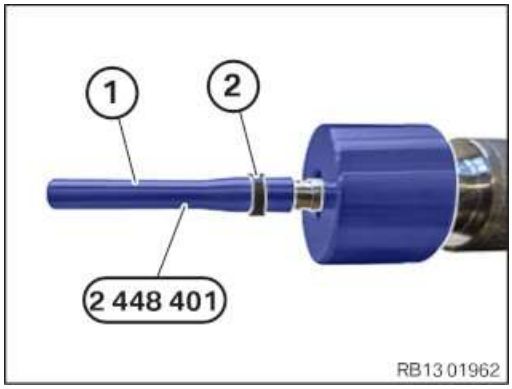
  The larger diameter of the assembly sleeve (1) must point to the injector tip.



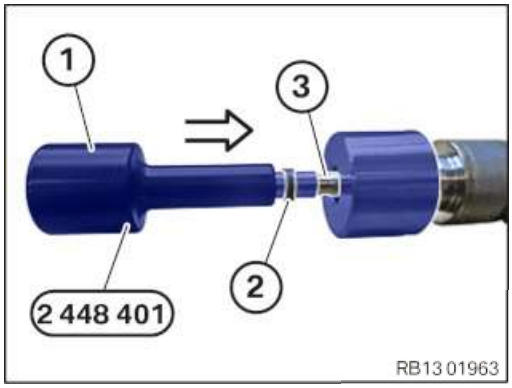
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

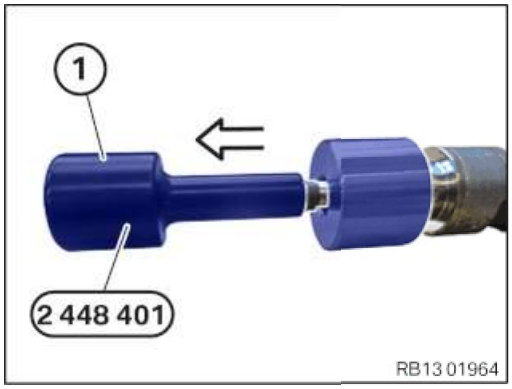
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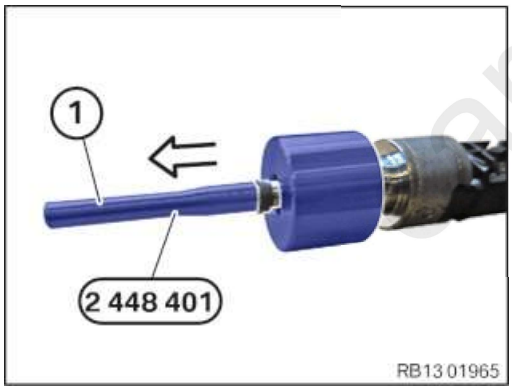
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



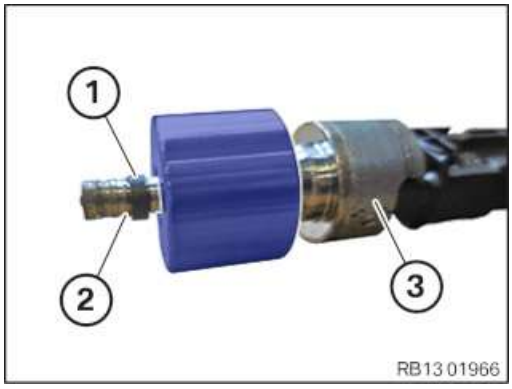
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

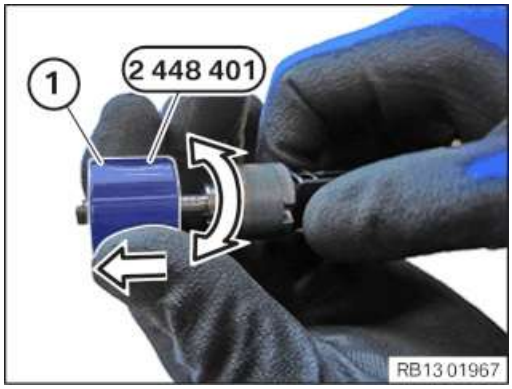


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



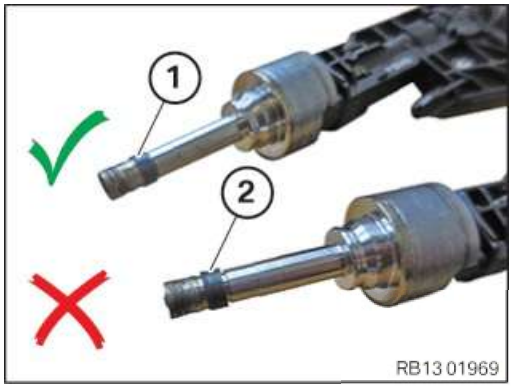
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

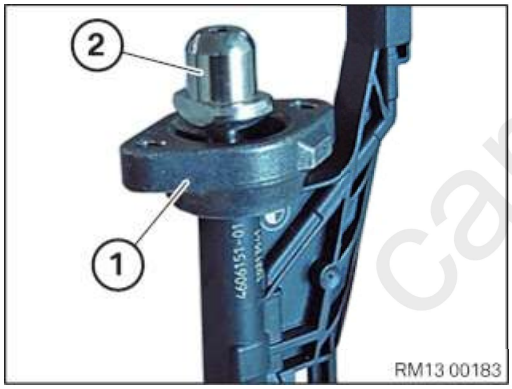


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

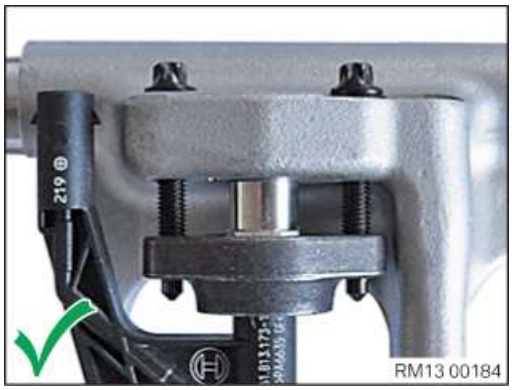
66 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



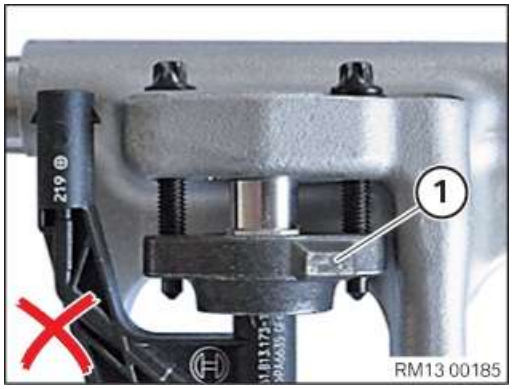
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

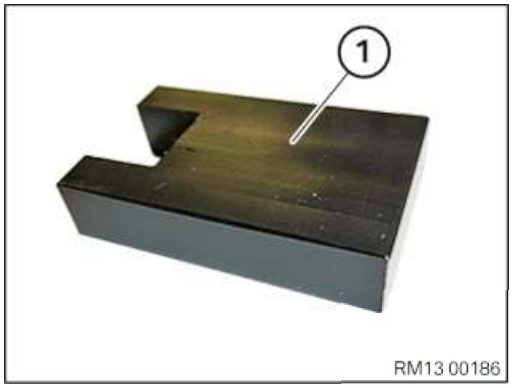
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



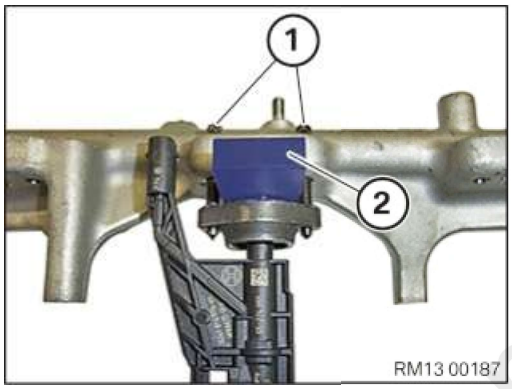
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



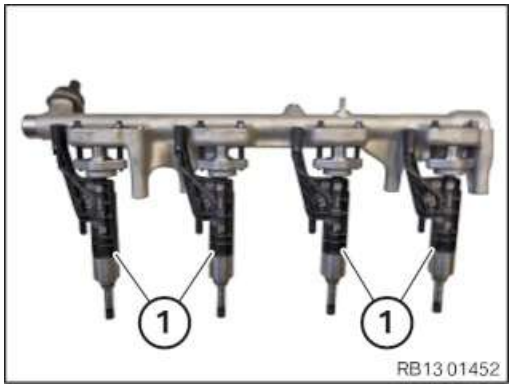
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

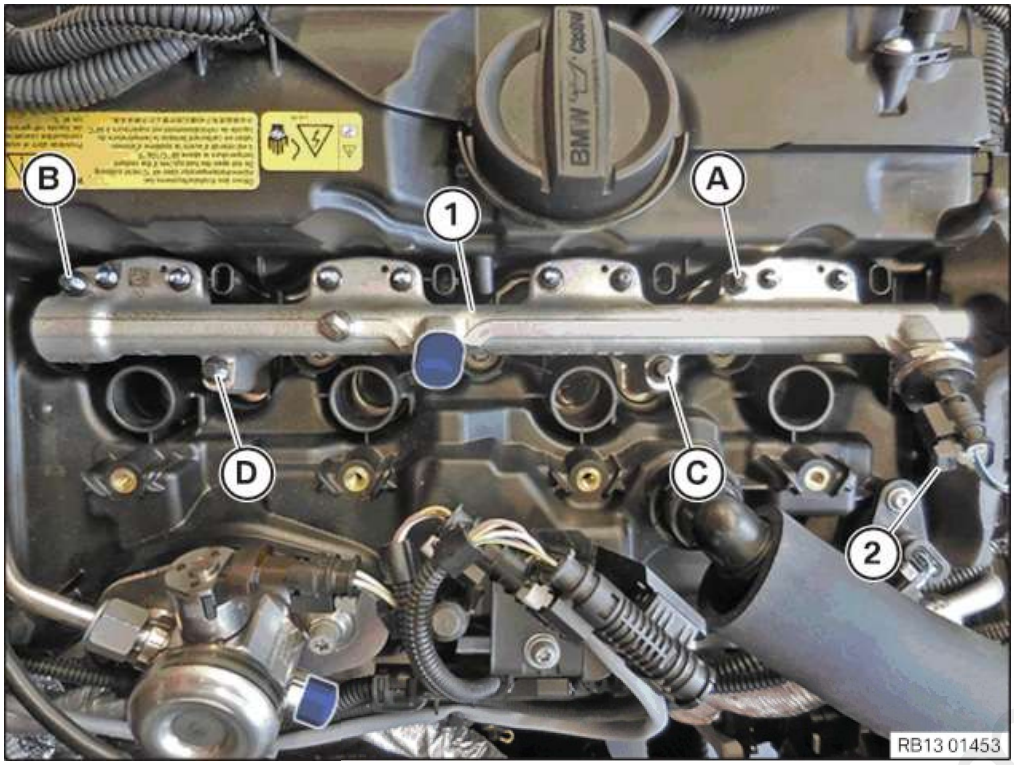


- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

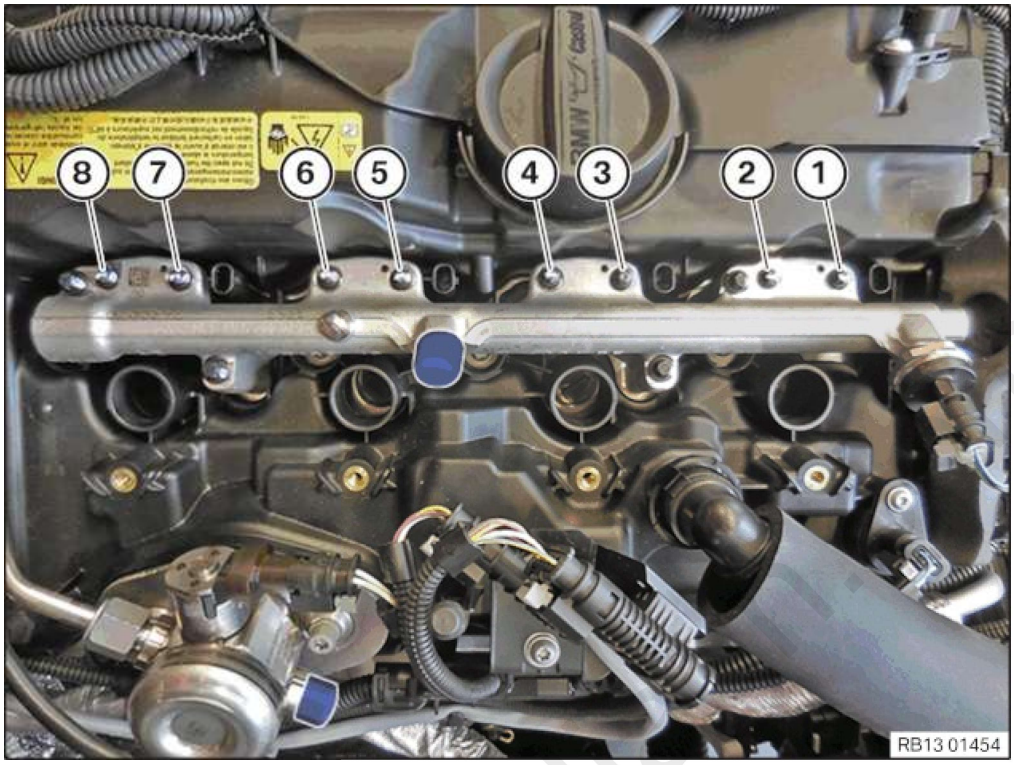
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.

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- Make sure that the rail (1) rests flat against the cylinder head.



- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

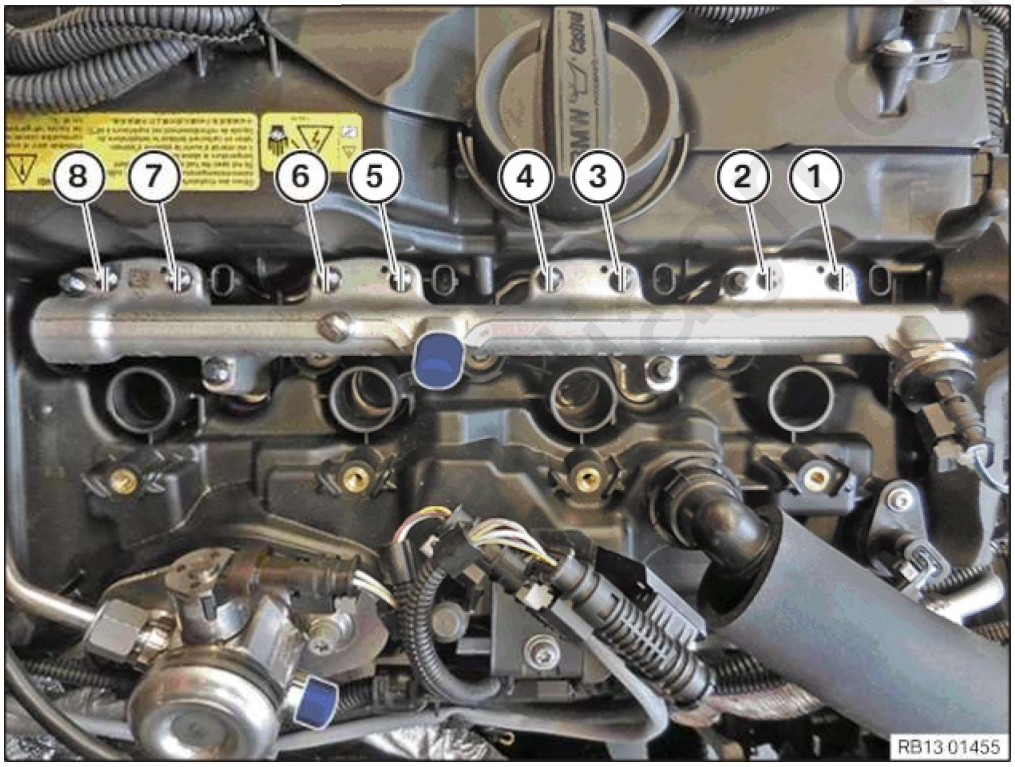
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

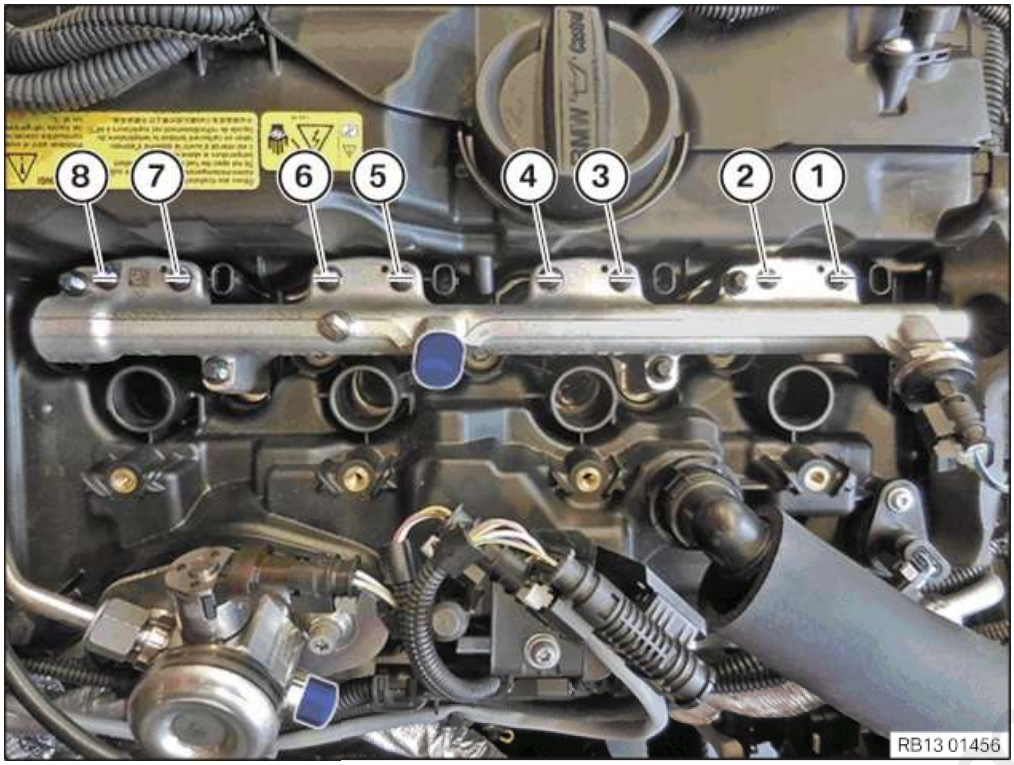
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.

- **Fuel injector 3:**
- Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
- **Fuel injector 4:**
- Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

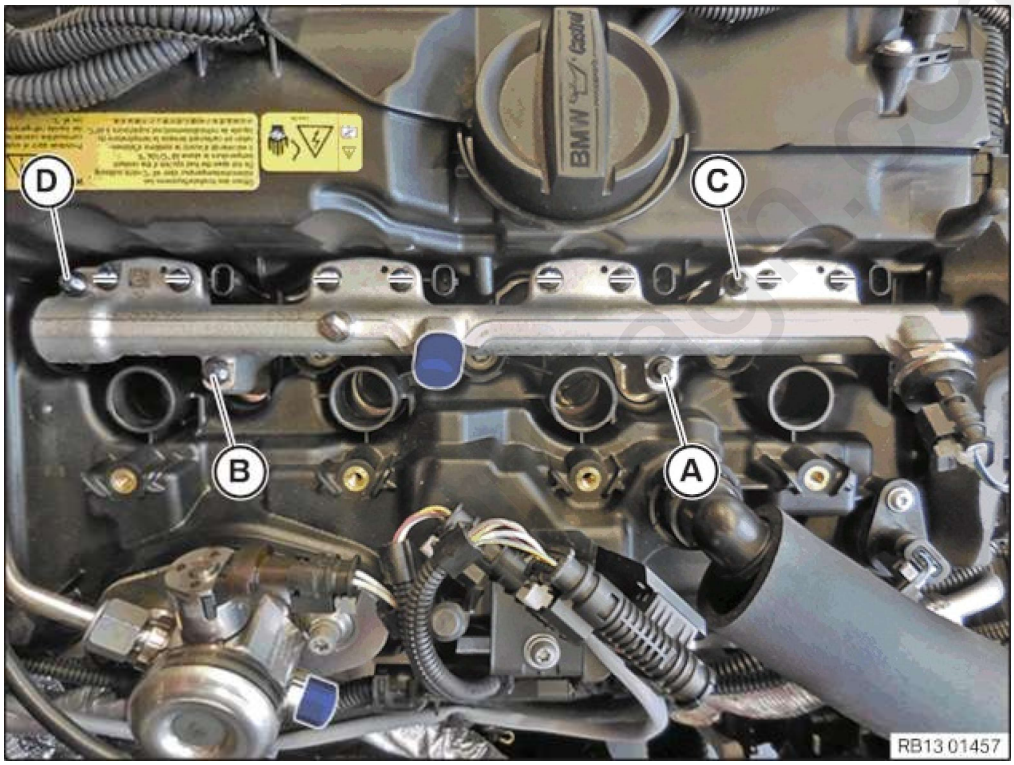


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

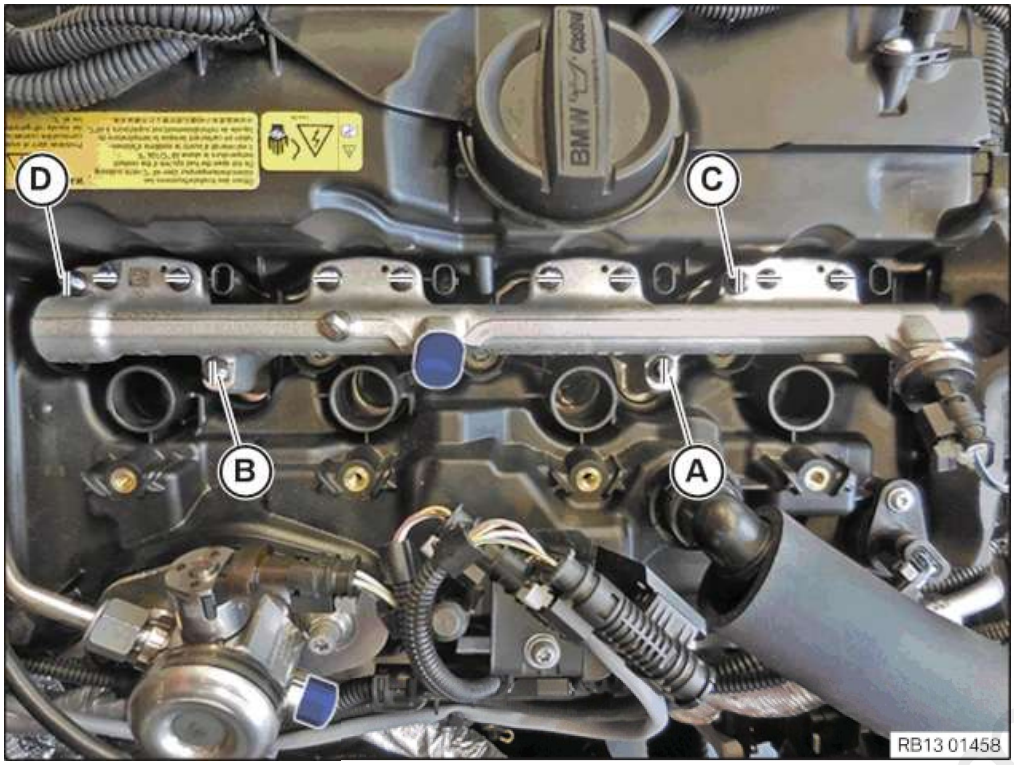
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

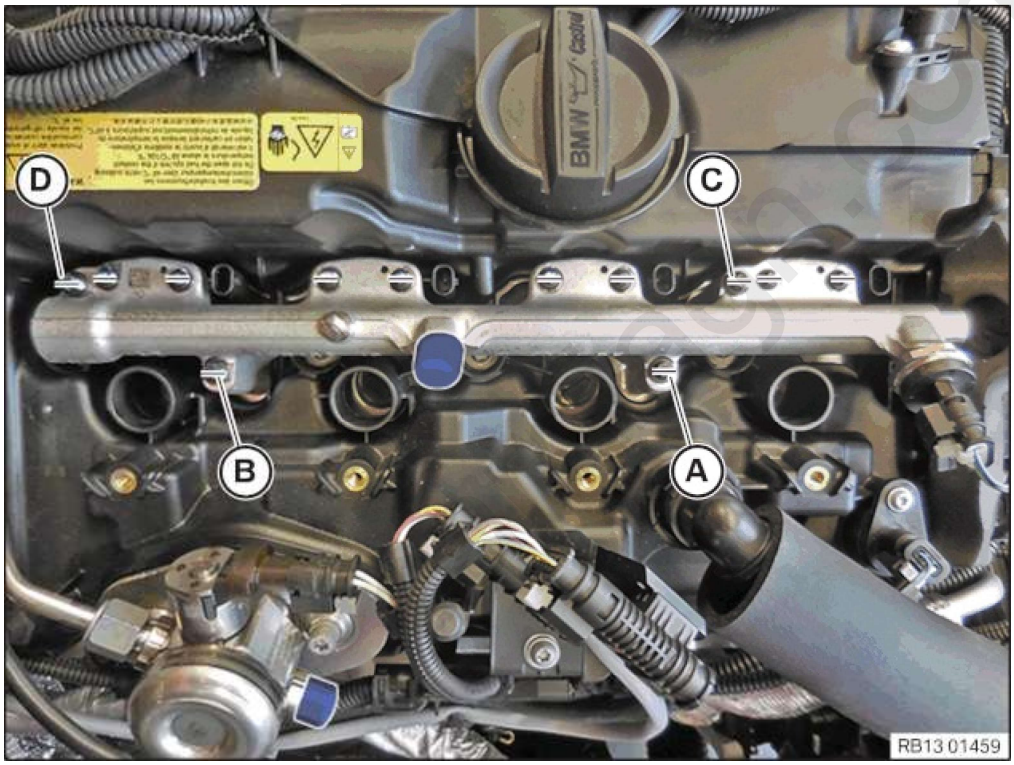
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

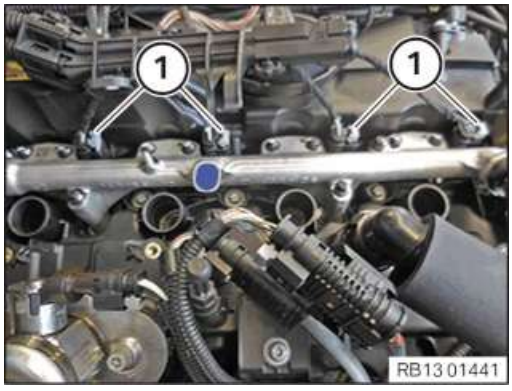


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



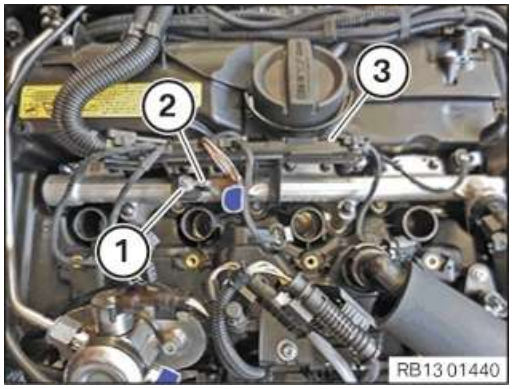
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

67 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

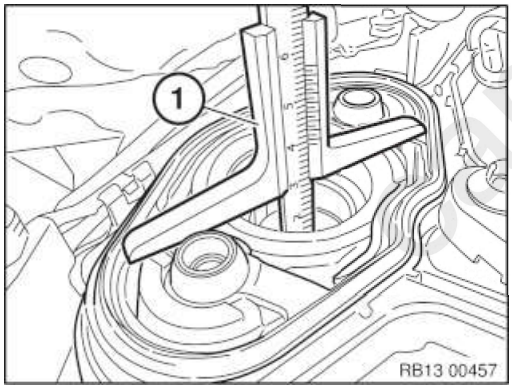
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

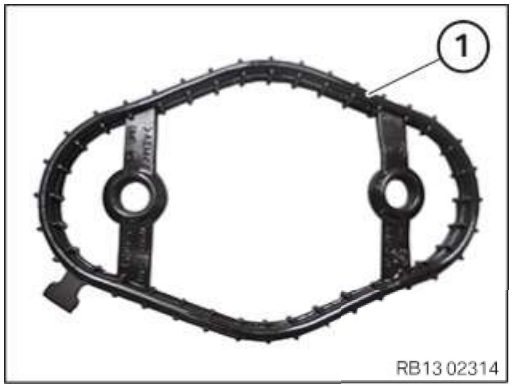
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



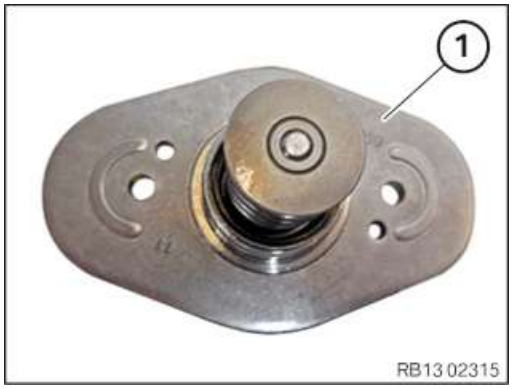
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

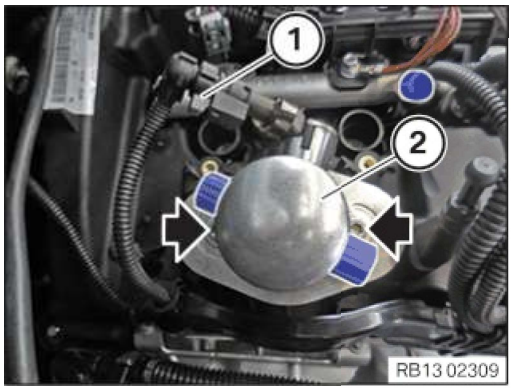
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

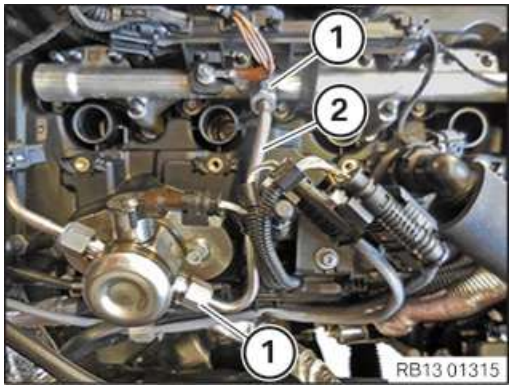
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

68 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

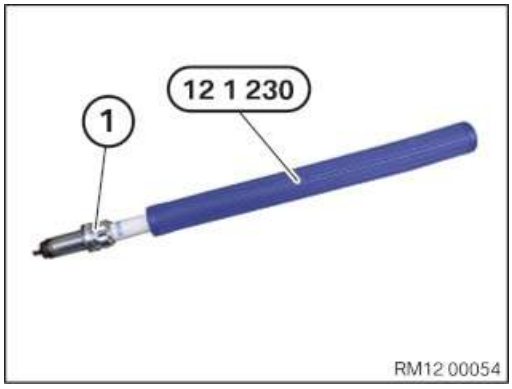
High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

69 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

M12x1.25		Tightening torque	23 Nm

70 – Installing the intake plenum

RISK OF DAMAGE

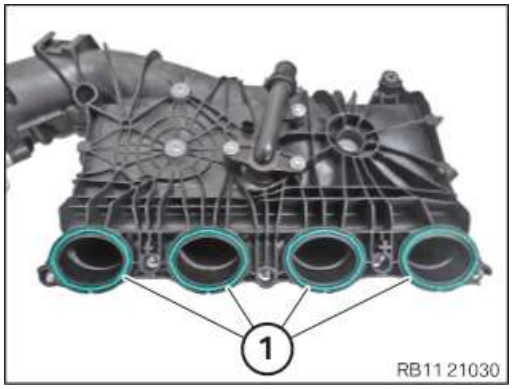
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

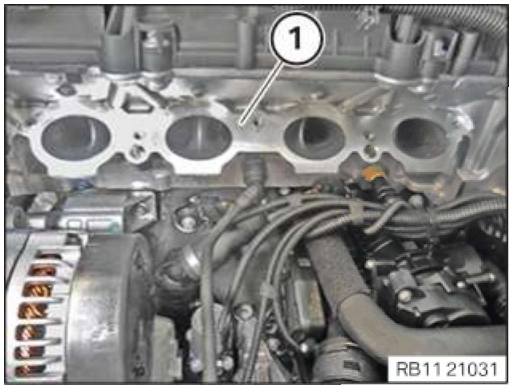
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

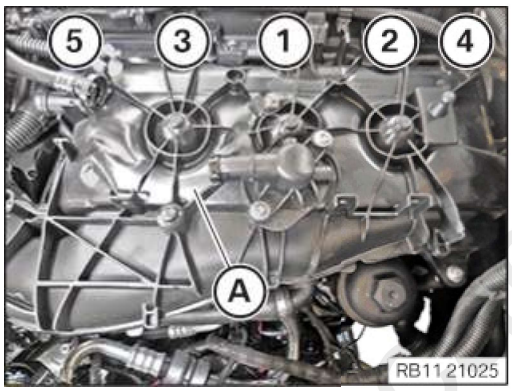


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

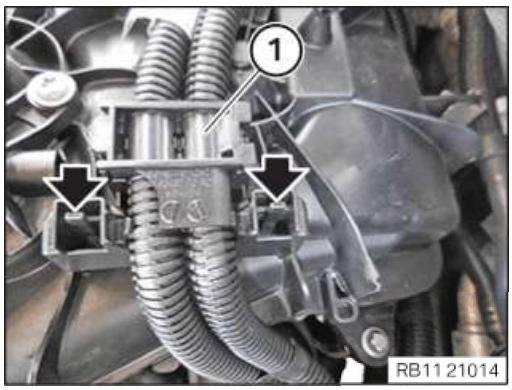
ertogen.com



- Tighten down screw (1).

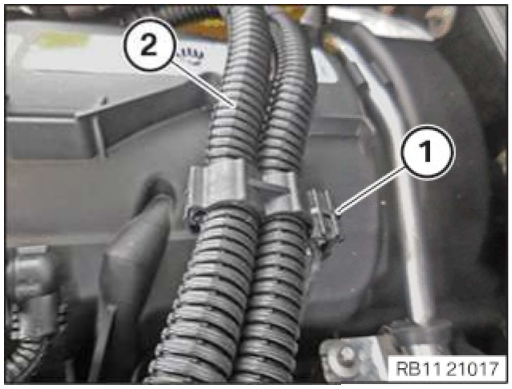
Intake plenum to support

M6X25		Tightening torque	8 Nm

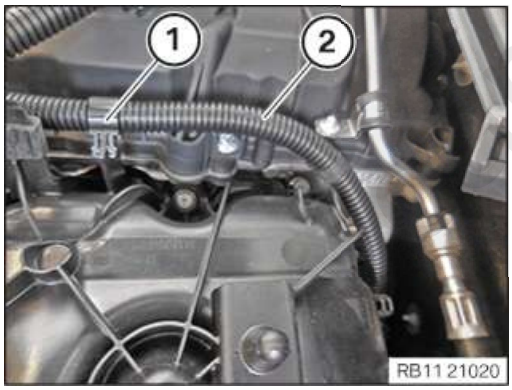


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

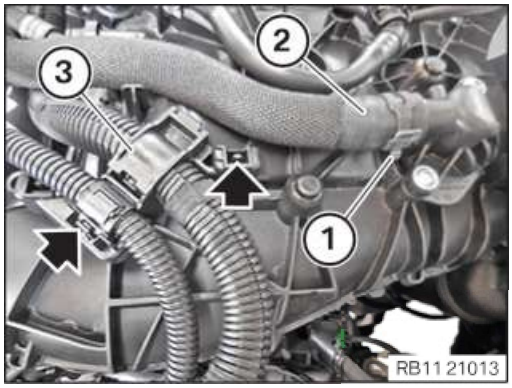
rdiagn.com



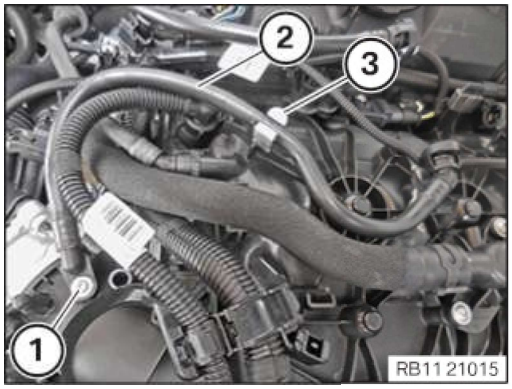
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



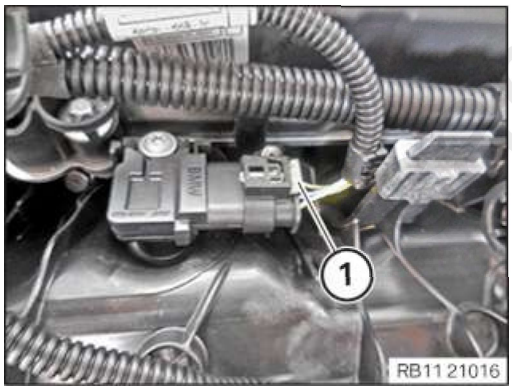
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

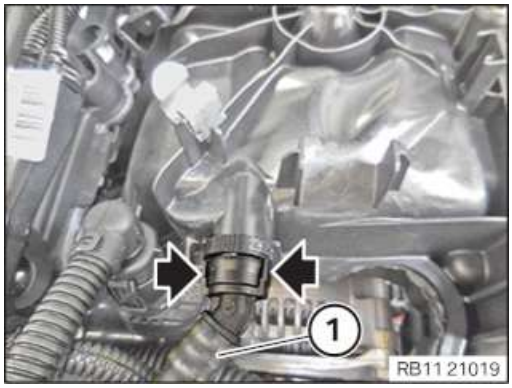
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

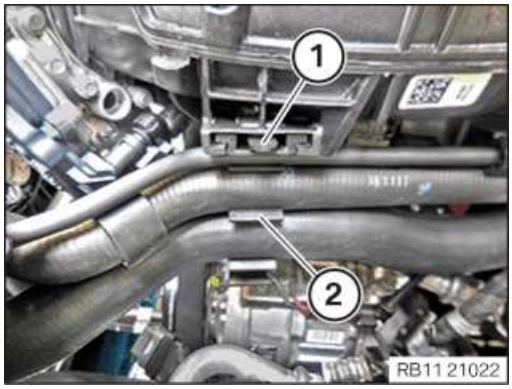
  The connector (1) must engage audibly.



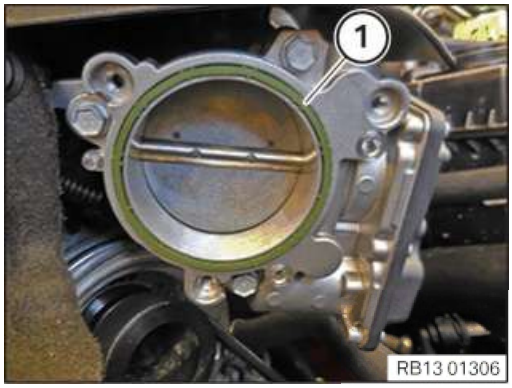
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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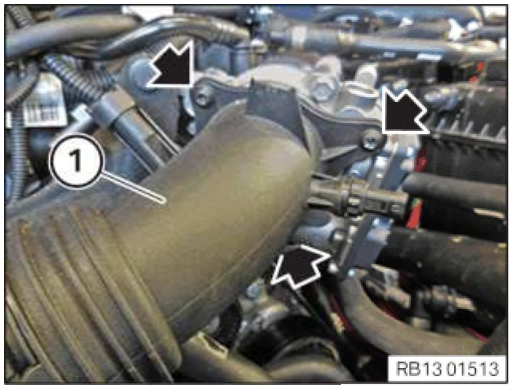


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

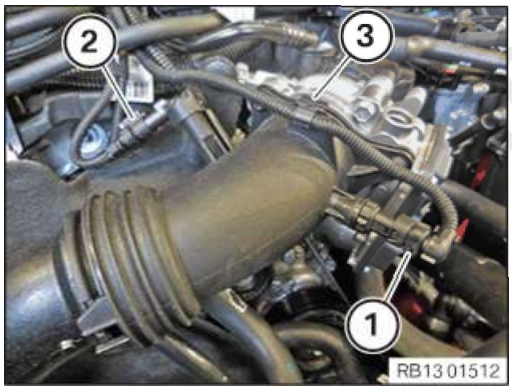
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

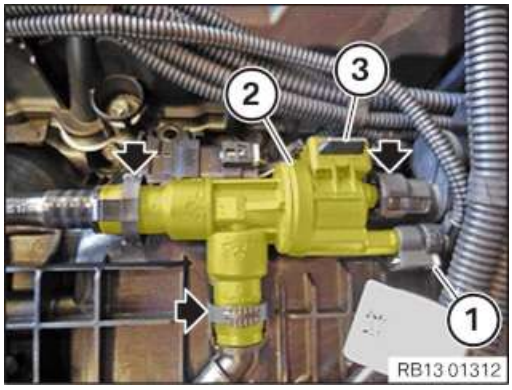
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

71 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

72 – Topping up the engine oil

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RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

TECHNICAL INFORMATION

- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

- Fill in engine oil at the oil filler neck.

Engine oil

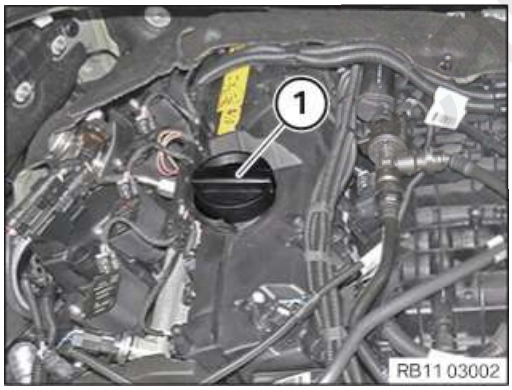
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

▸ **Installing the oil filler cap**

- Close oil filler cap (1).



73 – Remove the engine on an assembly stand

CAUTION

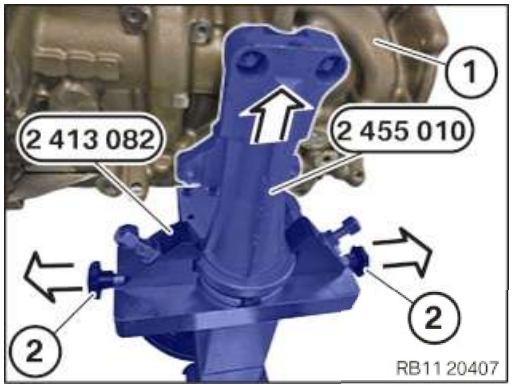
Heavy component.

Heavy components can lead to injury or damage.

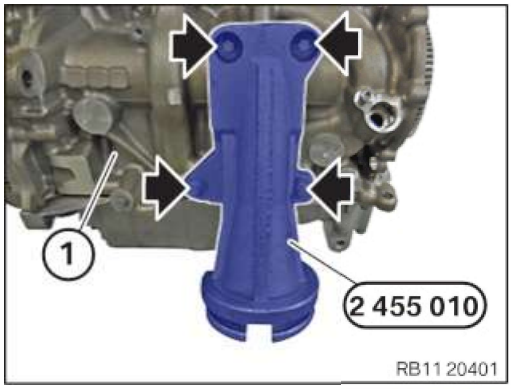
- Remove and install heavy components with the aid of another person/other persons.



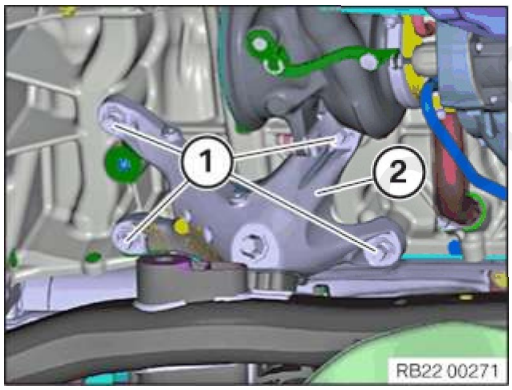
- Insert engine lifter with special tool and position engine (1).



- Unscrew the nuts on special tool .
- Detach the holder (2) in the direction of the arrow.
- Detach the engine (1) with special tool 2 455 010 out of the special tool in the direction of arrow.



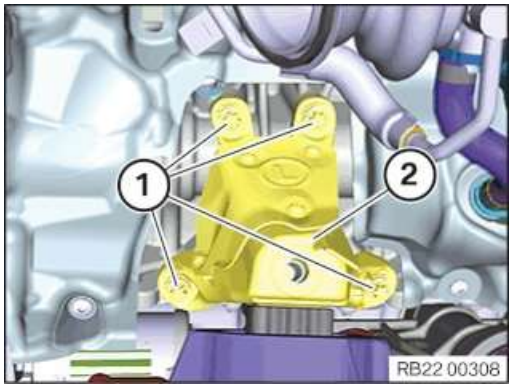
- Remove conventional screws (arrows).
- Feed out the special tool 2 455 010 on the engine (1) and remove.



- **Type: Rear-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm



- **Type: Four-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm

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- See additional information.

Additional Information

Overview of Tightening Torques

Special tool 2 455 010 to crankcase — Used in step 2

M10x30		Tightening torque	38 Nm

Special tool 11 8 930 to special tool 00 2 320 — Used in step 2

M14x35		Tightening torque	160 Nm

Oil drain plug — Used in step 4

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head — Used in step 174959

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 174959

M6		Tightening torque	8 Nm

Special tool to cylinder head — Used in step 26

M8		Tightening torque	21,5 Nm

Connecting rod bearing cap to connecting rod — Used in step 37

Renew screws.

Tighten screws crosswise.		Jointing torque	20 Nm
		1. Angle of rotation	70 °
		2. Angle of rotation	70 °

Oil deflector to crankcase — Used in step 38

M8 x 35		Renew screws.	15 Nm
			45 °

Camshaft sprocket to oil vacuum pump — Used in step 39

M8	Important - left-hand thread Renew screw.	1. Jointing torque	5 Nm
		2. Angle of rotation	90 °

Oil vacuum pump to crankcase — Used in step 40

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

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Oil sump to crankcase — Used in step 41

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 41

M8 x 50		Tightening torque	19 Nm

Flywheel to crankshaft — Used in step 42

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

Battery positive lead to starter — Used in step 43

M8		Tightening torque	13,5 Nm

Cylinder head to crankcase — Used in step 48

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

Cylinder head bolt to timing case cover — Used in step 48

M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head — Used in step 48

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head — Used in step 48

M6x16			8 Nm

Cable routing to cylinder head, rear — Used in step 48

M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head — Used in step 48

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 48

M6x16		Tightening torque	8 Nm

Manifold support for intake air to cylinder head — Used in step 48

M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head — Used in step 48

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 48

M6			8 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 48

M6x12		Tightening torque	8 Nm

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VANOS central valve to camshaft — Used in step 5556

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 58

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Oil return line to exhaust turbocharger/crankcase — Used in step 60

M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger — Used in step 6162

M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger — Used in step 61

M6		Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 62

M6 x 12		Tightening torque	8 Nm

Cylinder head cover to cylinder head — Used in step 63

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 63

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 63

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 66

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 67

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 68

M14		Tightening torque	33 Nm

Spark plugs — Used in step 69

M12x1.25		Tightening torque	23 Nm

Intake plenum to cylinder head — Used in step 70

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 70

M6X25		Tightening torque	8 Nm

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Throttle body to holder			Used in step 70
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 70
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body			Used in step 70
M6		Tightening torque	8 Nm

Engine support arm to engine			Used in step 73
M10		Tightening torque	38 Nm

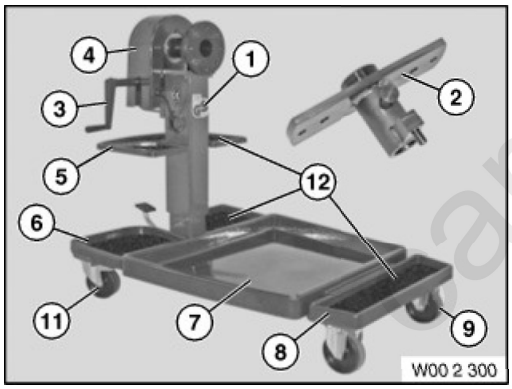
Overview of Special Tools

2 455 010 Engine support



Common	Used in step 273
Usage	For accommodating engine on assembly stand. Engine: B3x, B4x, N47.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 495 187 (00 2 300) Assembly stand



Common	Used in step 2
Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

Consisting of

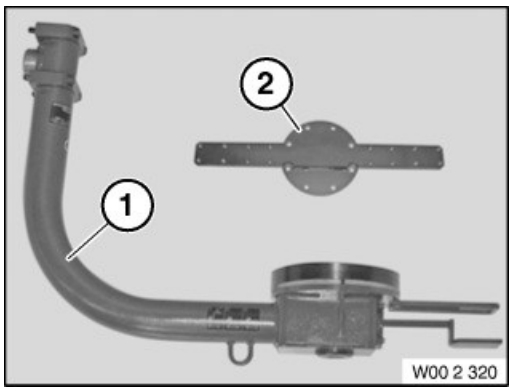
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	

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2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	
7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

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0 495 196 (00 2 320) Support arm



Common

Used in step 2

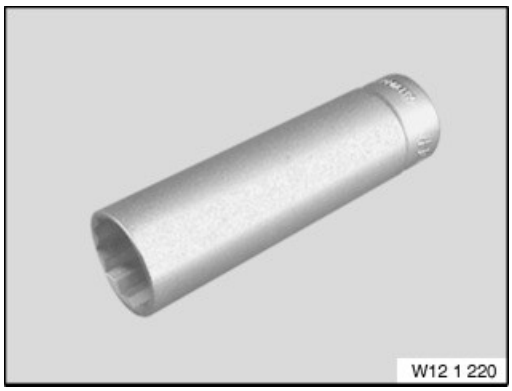
Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

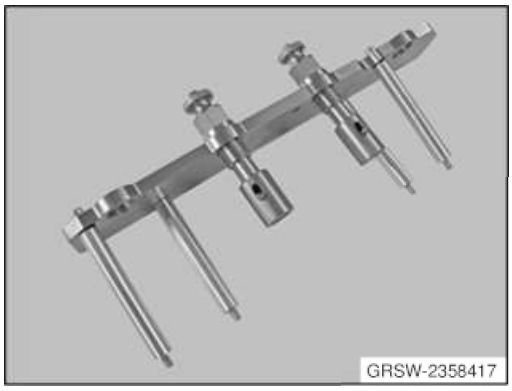
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0 495 560 (12 1 220) Socket



Common	Used in step 569
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

2 358 417 Device



Common	Used in step 8
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 8
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

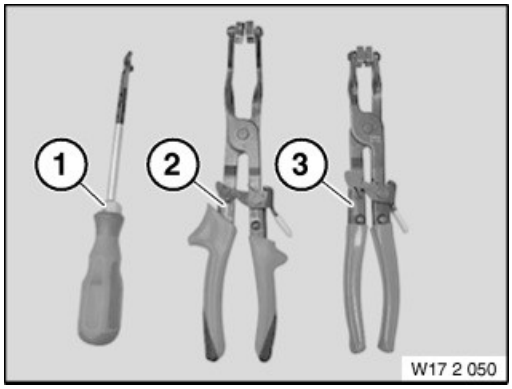
2 360 895 Pin wrench



Common	Used in step 964
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 794 (17 2 050) Pliers



Common Used in step 1270

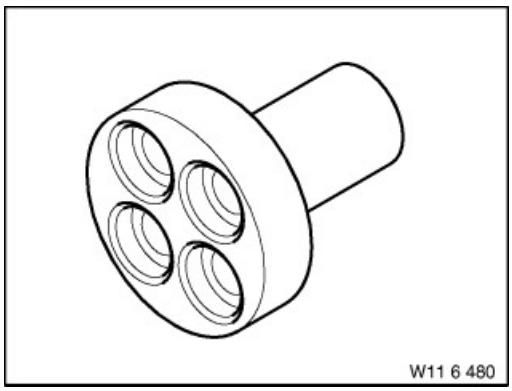
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 493 380 (11 6 480) Connector



Common Used in step 1744575967

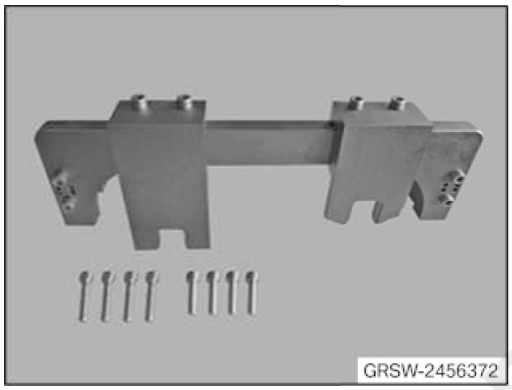
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 17445759
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 1725495759
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 172559
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



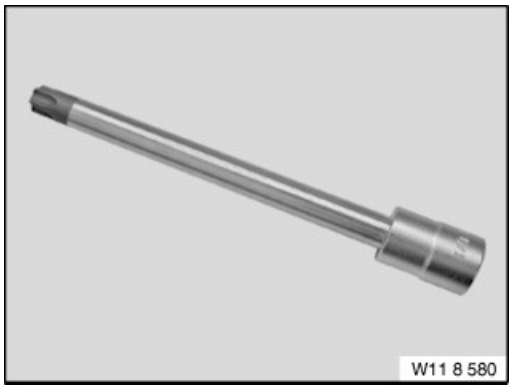
Common	Used in step 19205556
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 19205556
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

0 495 747 (11 8 580) Socket wrench



Common	Used in step 2648
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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2 220 718 Workshop crane



Common	Used in step 26
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

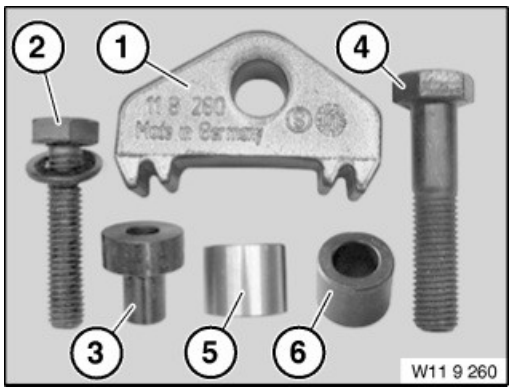
2 459 012 Holder



Common	Used in step 2648
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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0 493 938 (11 9 260) Holder



Common Used in step 2842

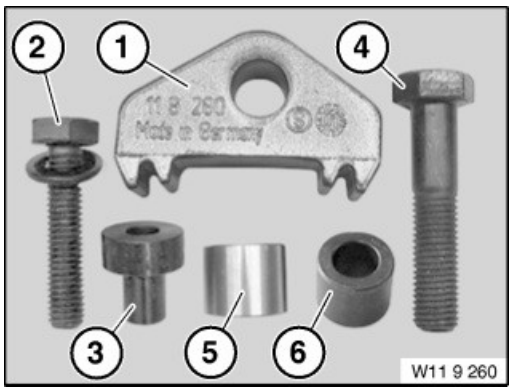
Usage	(Counter support with screw connection) For holding the flywheel when gearbox is removed
Included in the tool or work	
Storage location	A44
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 034 (11 9 261)		**Holder** (Individual counter support)	
2	0 494 035 (11 9 262)		**Screw** (Bolt (thread M10) with washer) For screwing counter support	
3	0 494 129 (11 9 263)		**Bush** (Bush for counter support) For counter support, for retaining flywheel when gearbox is removed Engine: N62, N73	
6	0 495 216 (11 9 266)		**Bush** For counter support, for retaining flywheel when gearbox is removed Engine: M57TU2	
4	0 494 130 (11 9 264)		**Screw** (Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed	
5	0 494 793 (11 9 265)		**Bush**	

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0 494 130 (11 9 264) Screw



Common Used in step 2842

Usage	(Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed
Included in the tool or work	0 493 938
Storage location	A44
Replaced by	
In connection with	
SI-Number	

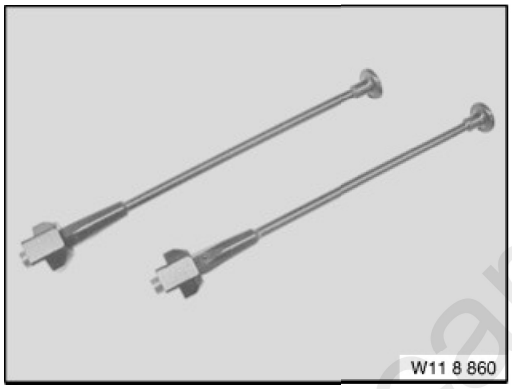
2 463 965 Socket wrench



Common Used in step 31

Usage	with T30, T40 and torx 45
Included in the tool or work	
Storage location	B6
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 496 144 (11 8 860) Assembly tool

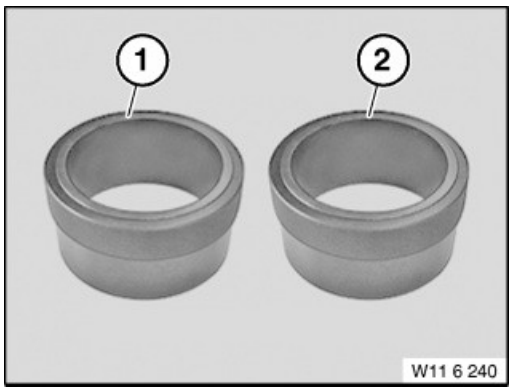


Common Used in step 3337

Usage	For installing piston with connecting rod in crankcase.
Included in the tool or work	
Storage location	A23
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

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0 495 373 (11 6 240) Bush



Common Used in step 37

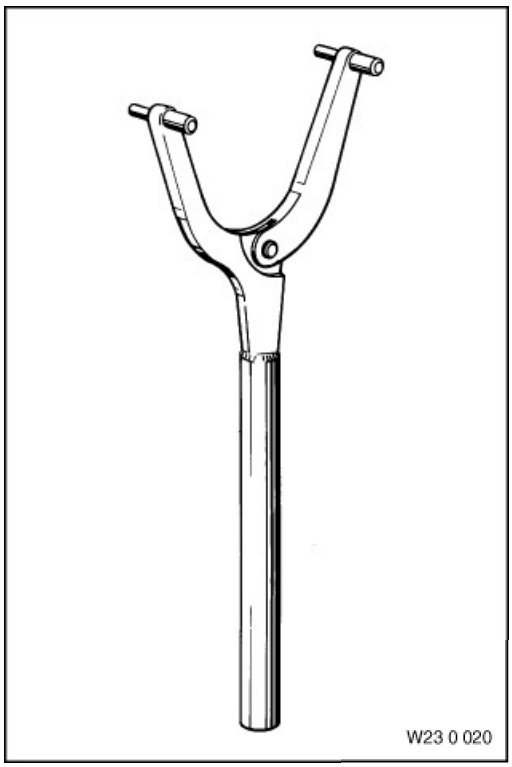
Usage	(Assembly bush set) For fitting pistons (diameter 82 mm) with connecting rod into the crankcase. Engine: N52B25
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 06 (244)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 527 (11 6 242)		**Bush** (assembly bush 82.25 mm)	
1	0 495 526 (11 6 241)		**Bush** (assembly bush 82.00 mm)	

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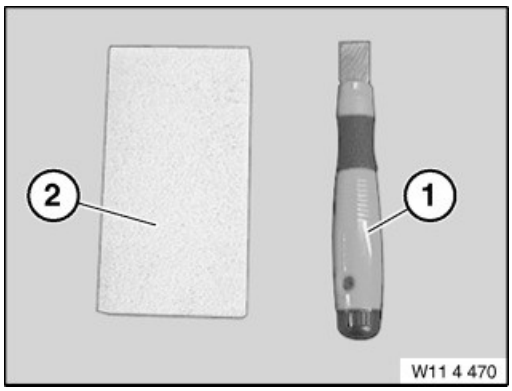
0 491 440 (23 0 020) Holder



Common	Used in step 39
Usage	(counter support) For all three- and four-hole flanges when releasing and tightening down
Included in the tool or work	
Storage location	B4
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool



Common Used in step 41

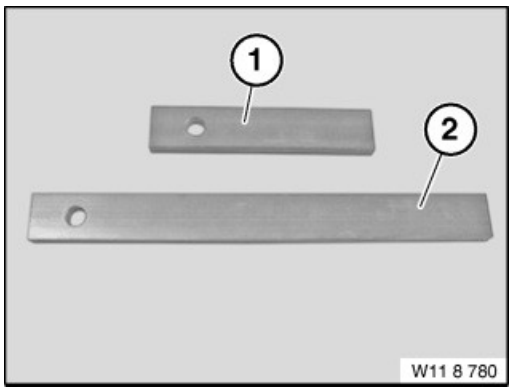
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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0 496 120 (11 8 780) Plate



Common Used in step 41

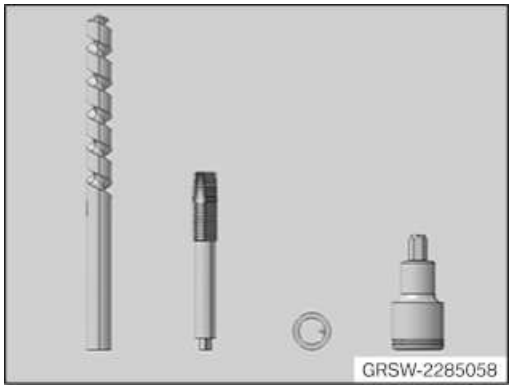
Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

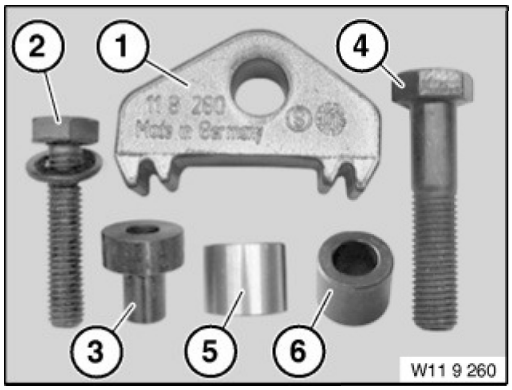
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2 285 058 Tool set



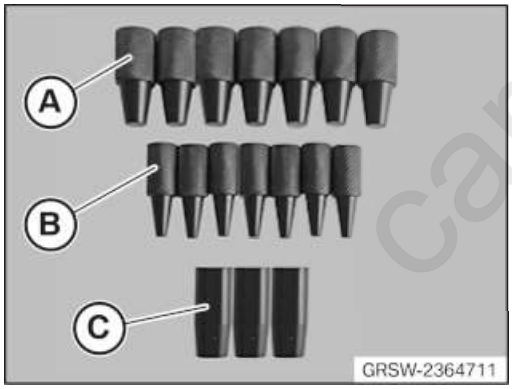
Common	Used in step 42
Usage	
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 14 (069)

0 494 034 (11 9 261) Holder



Common	Used in step 42
Usage	(Individual counter support)
Included in the tool or work	0 493 938
Storage location	
Replaced by	
In connection with	
SI-Number	

2 364 711 Plug



Common	Used in step 4546
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

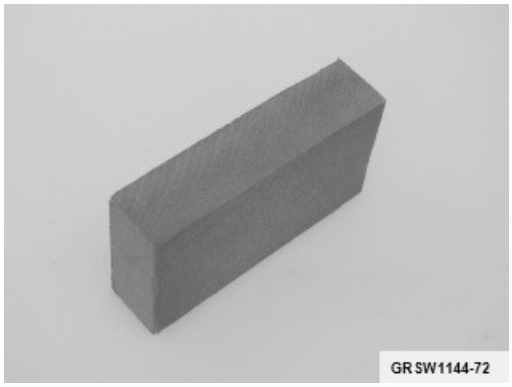
0 495 103 (11 4 471) Scraper



Common	Used in step 46
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

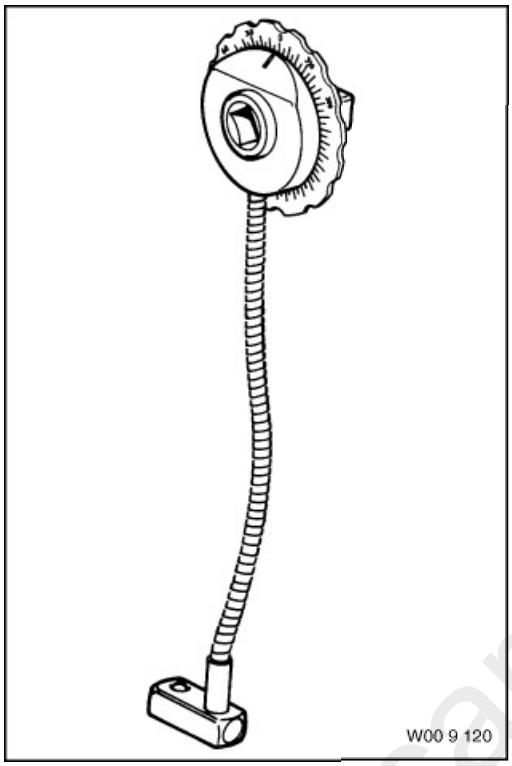
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0 495 104 (11 4 472) Extractor



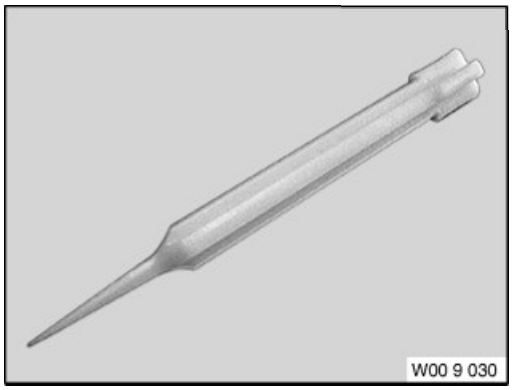
Common	Used in step 46
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 490 504 (00 9 120) Torque angle measuring dial



Common	Used in step 48
Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common	Used in step 486162
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

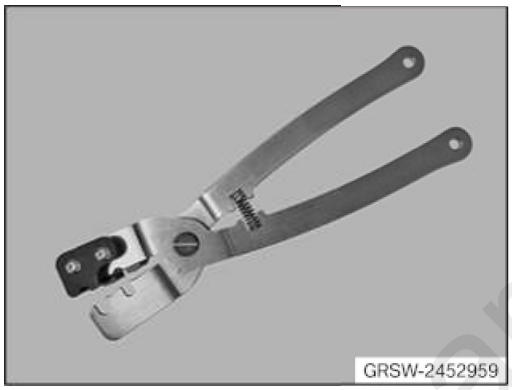
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2 455 654 Tensioning tool



Common	Used in step 5457
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 65
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 65
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

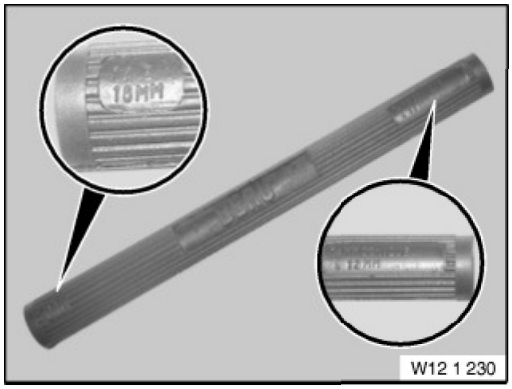
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2 358 022 Gauge



Common	Used in step 66
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

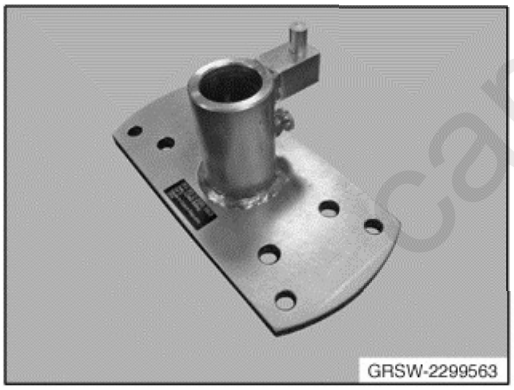
0 496 065 (12 1 230) Fitting aid



Common	Used in step 69
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

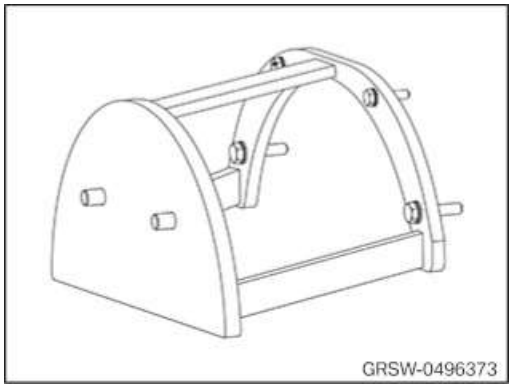
Replacement tools:

2 299 563 Adapter



Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

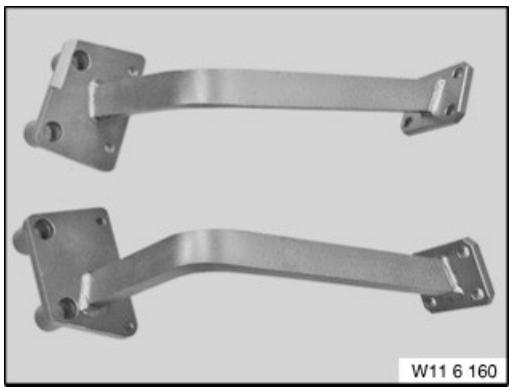
0 496 373 (11 5 420) Plate



Common	Used in step 2
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

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0 496 680 (11 6 160) Support



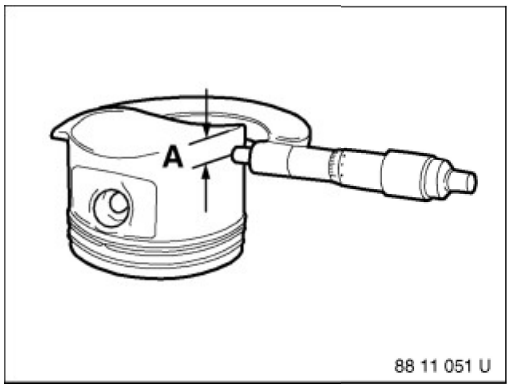
Common	Used in step 2
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

Overview Technical Data

Piston diameter Used in step 35

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Cylinder bore B38/B46/B48/B58 Used in step 36

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Engine oil Used in step 72

Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Engine oil B48B20O1/B46B20O1 Used in step 72

Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Screw-in depth of thread cutter Used in step 42

Screw-in depth	18 mm

Links

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11 00 050 Remove and install engine (Automatic)	174
11 00 050 Remove and install engine (Automatic)	174
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This documentation refers to special tools that were not yet available when going to press.

11 25 530 Removing and installing/replacing all pistons

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Removing engine



- See additional information.

2 – Mount engine on assembly stand

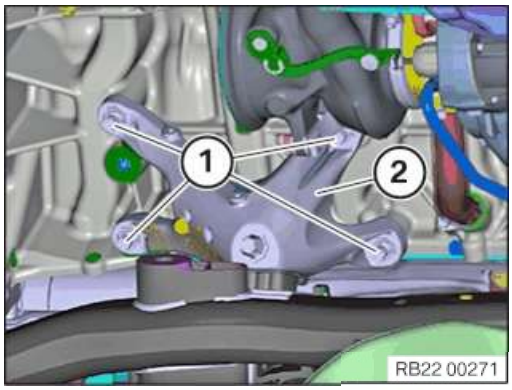
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CAUTION

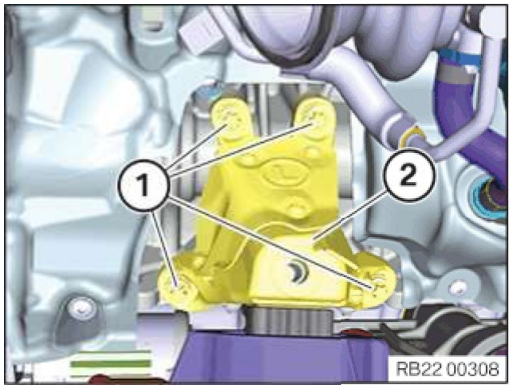
Heavy component.

Heavy components can lead to injury or damage.

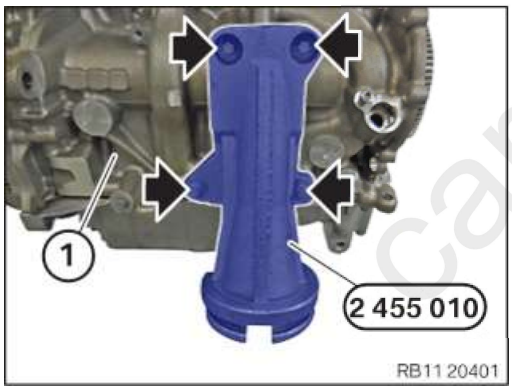
- Remove and install heavy components with the aid of another person/other persons.



- **Type: Rear-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



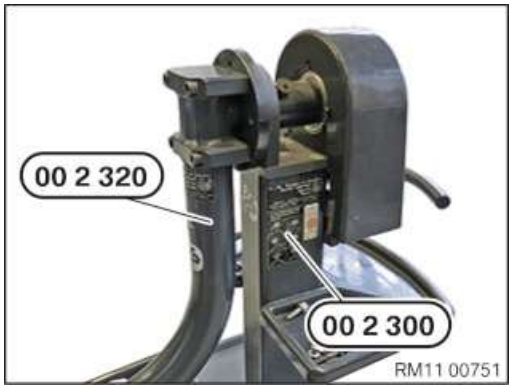
- **Type: Four-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



- Position the special tool 2 455 010 on the engine (1).
- Position the standard bolts **M10x30**.
- Tighten the standard bolts (arrows).

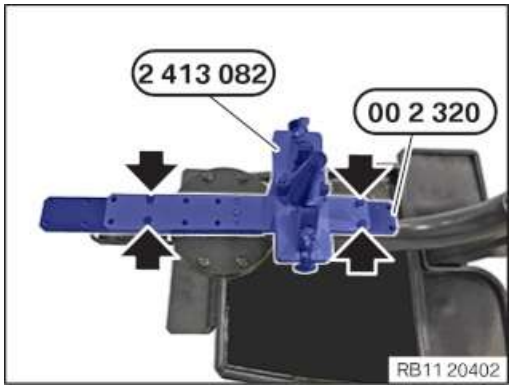
Special tool 2 455 010 to crankcase

M10x30		Tightening torque	38 Nm



- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).

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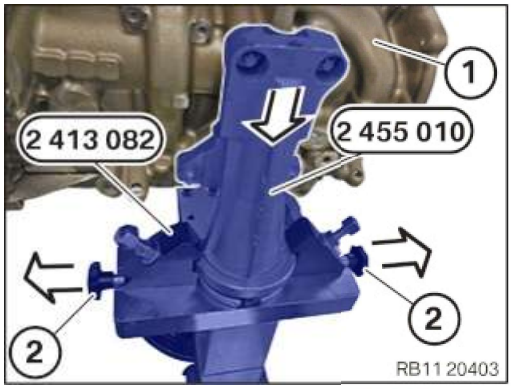
- Screw the special tool to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

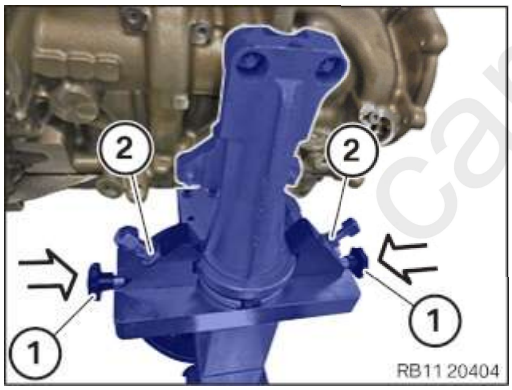
M14x35		Tightening torque	160 Nm



- Position the engine lifter with the special tool and the engine on the special tool 0 495 187 (00 2 300).



- Detach the holder (2) in the direction of the arrow.
- Position the engine (1) with the special tool 2 455 010 in the direction of the arrow on the special tool .



- Lock the holder (1) in direction of arrow.
- Tighten nuts (2).

3 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

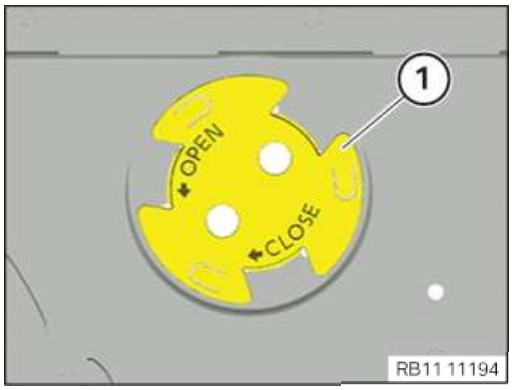
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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).



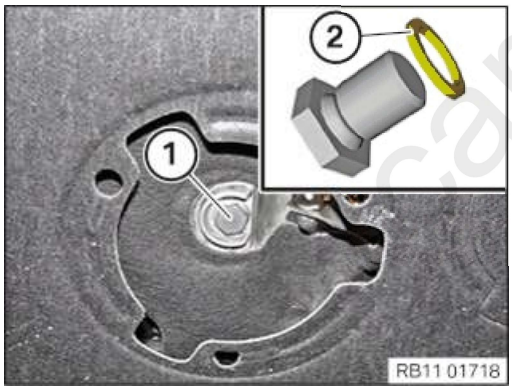
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

4 – Tightening the oil drain plug

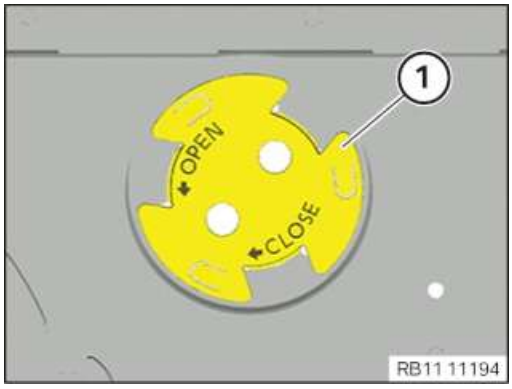


- Renew sealing ring (2).

  Parts: Sealing ring
- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

M12x16	Renew the sealing ring.	Tightening torque	25 Nm



- Install service cap (1).

5 – Removing all spark plugs

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

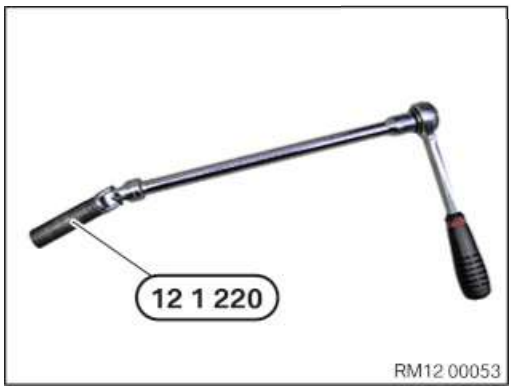
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

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- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

6 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

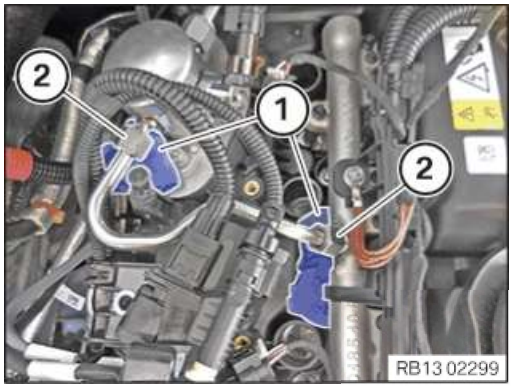
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

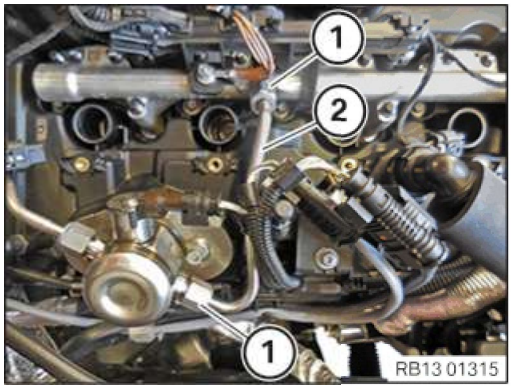
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- Have the special tool ready.



- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

7 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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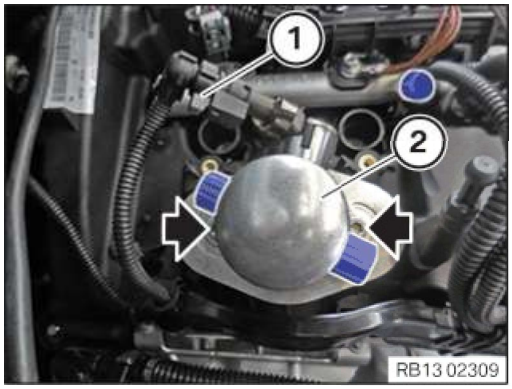
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

8 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

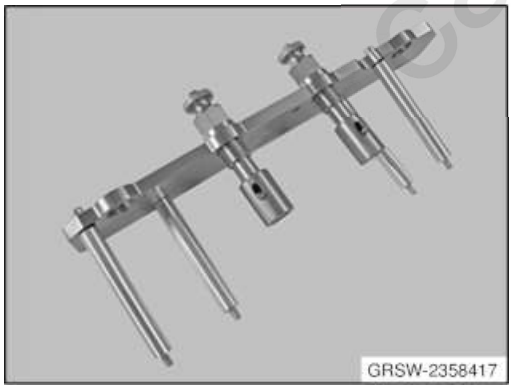
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Prepare special tool .

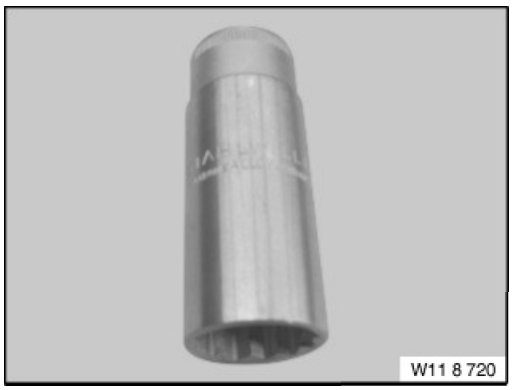


- Prepare special tool 2 358 417.

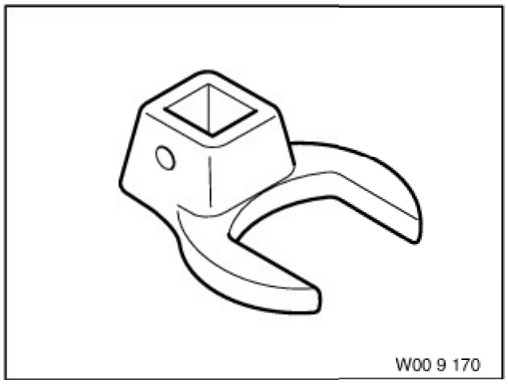
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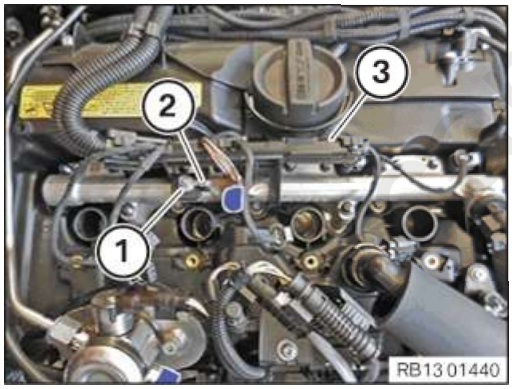
- Prepare special tool .



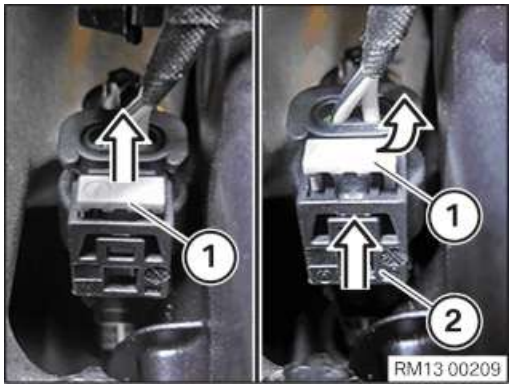
- Prepare special tool 0 496 106 (11 8 720).



- Prepare special tool .

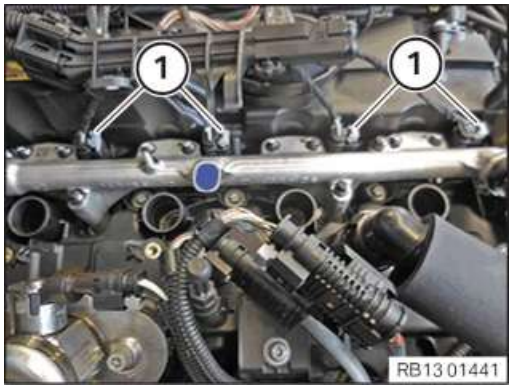


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.



- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.

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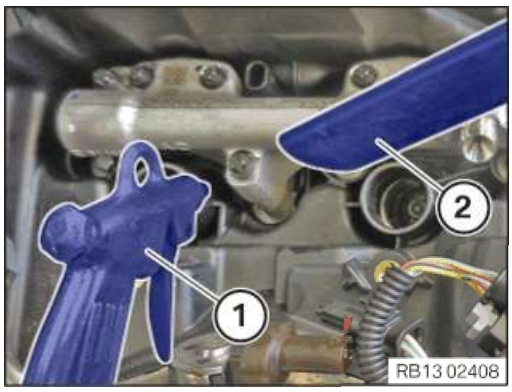
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

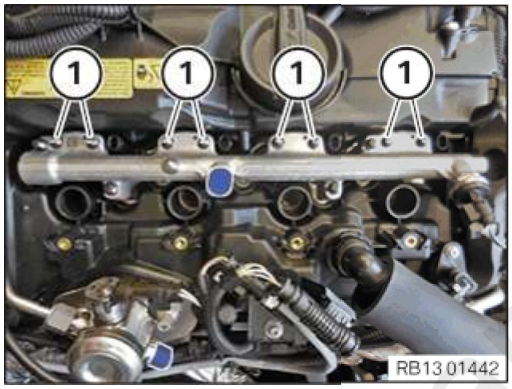


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

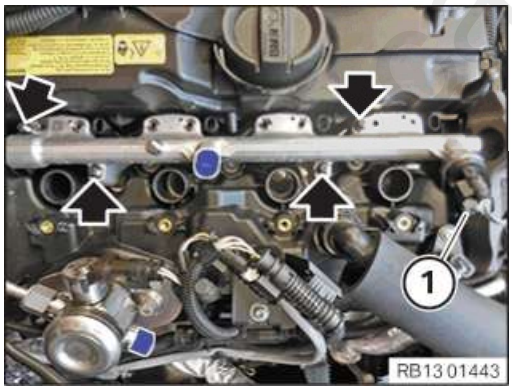
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

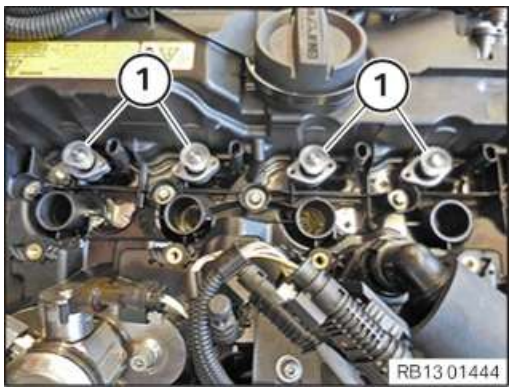


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

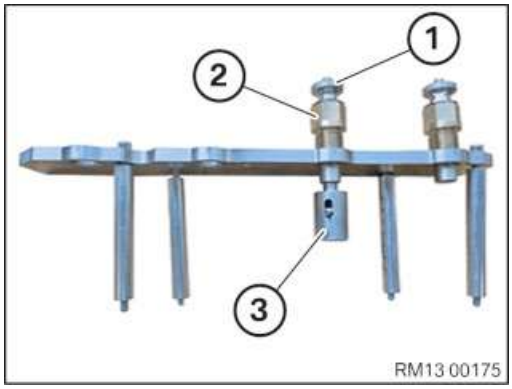
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

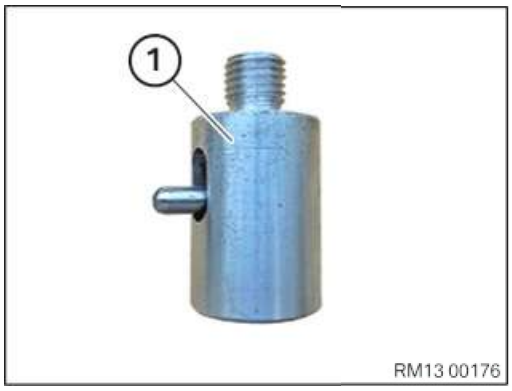
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

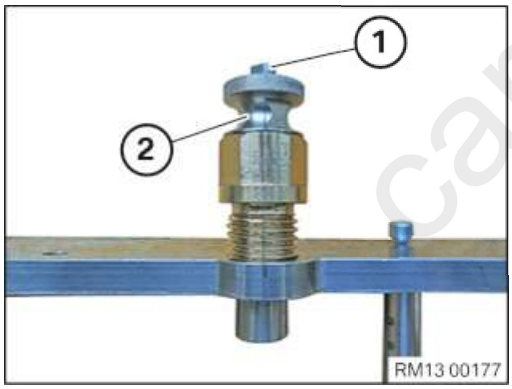
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

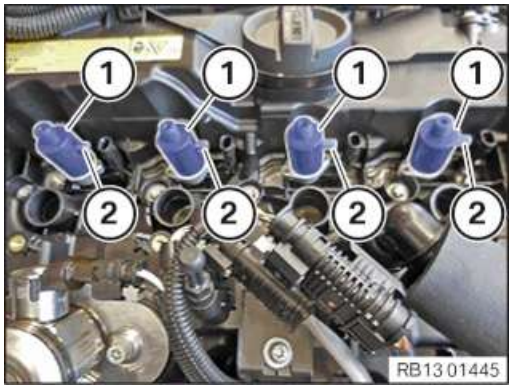
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



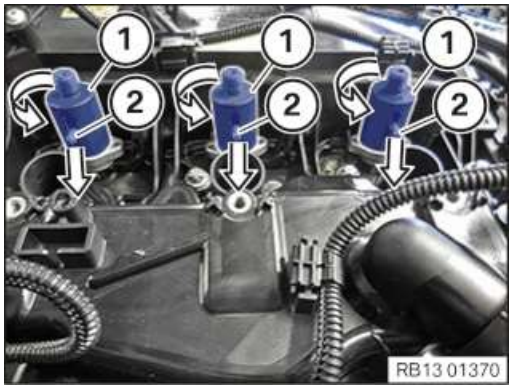
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



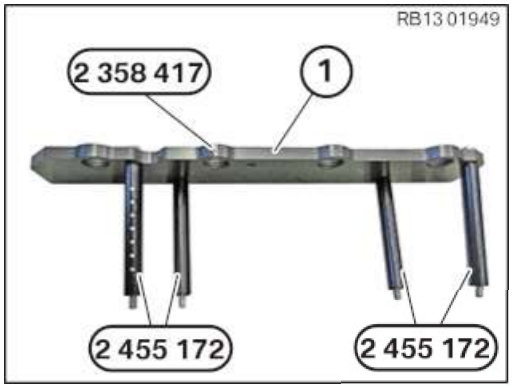
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

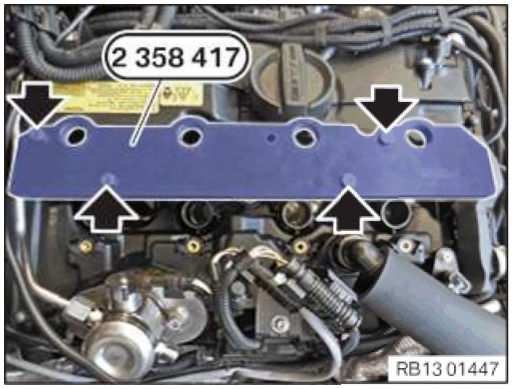
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



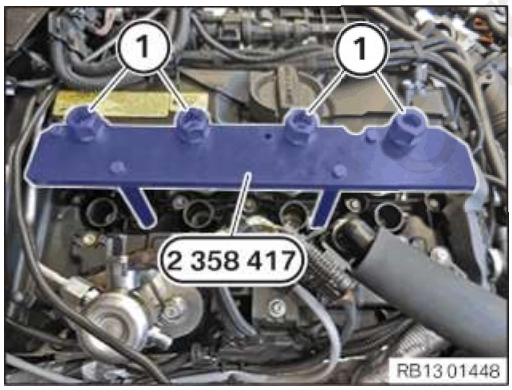
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

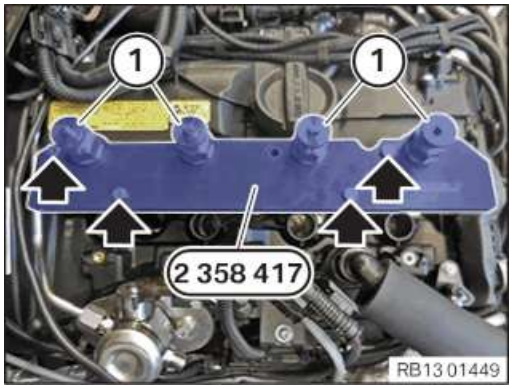
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

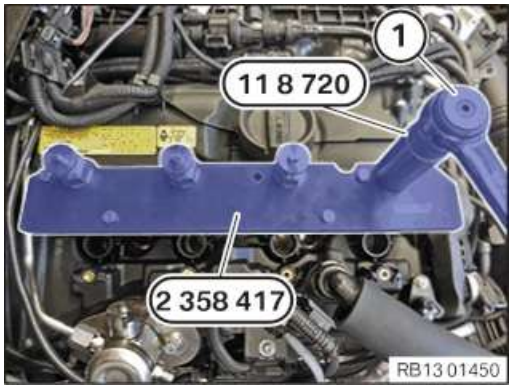
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

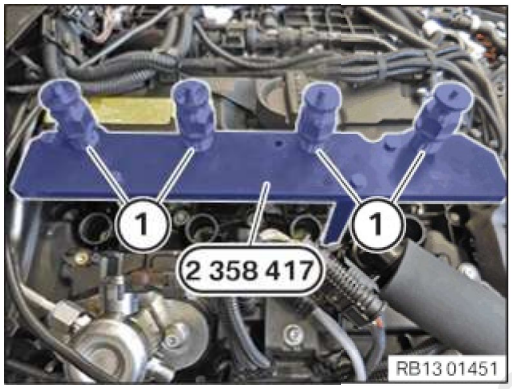


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

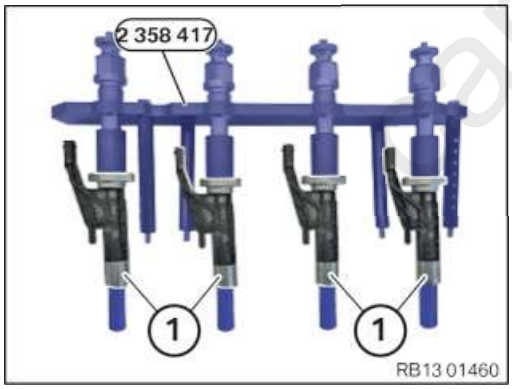
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

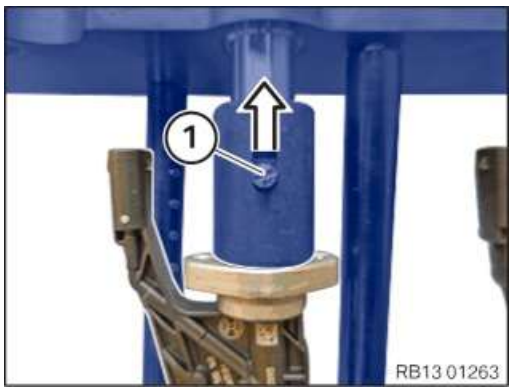


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

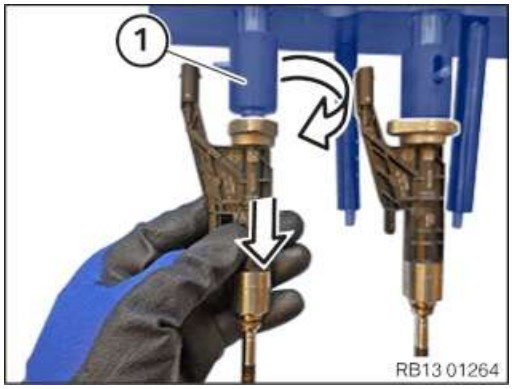


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

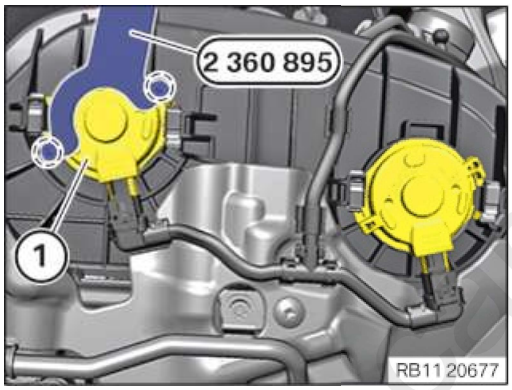
9 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

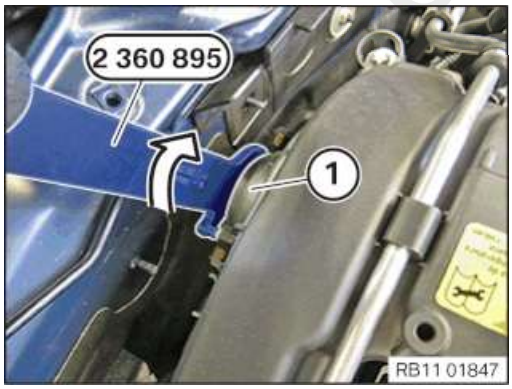
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



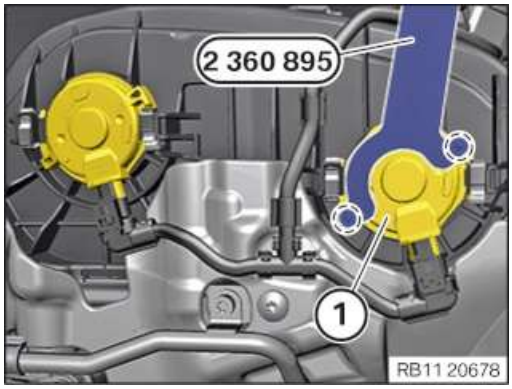
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



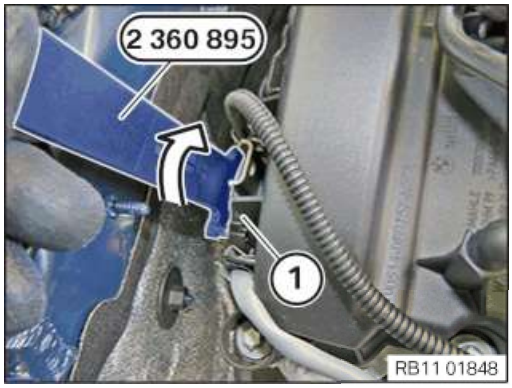
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



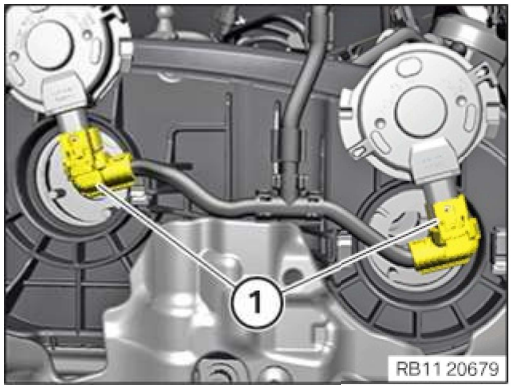
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

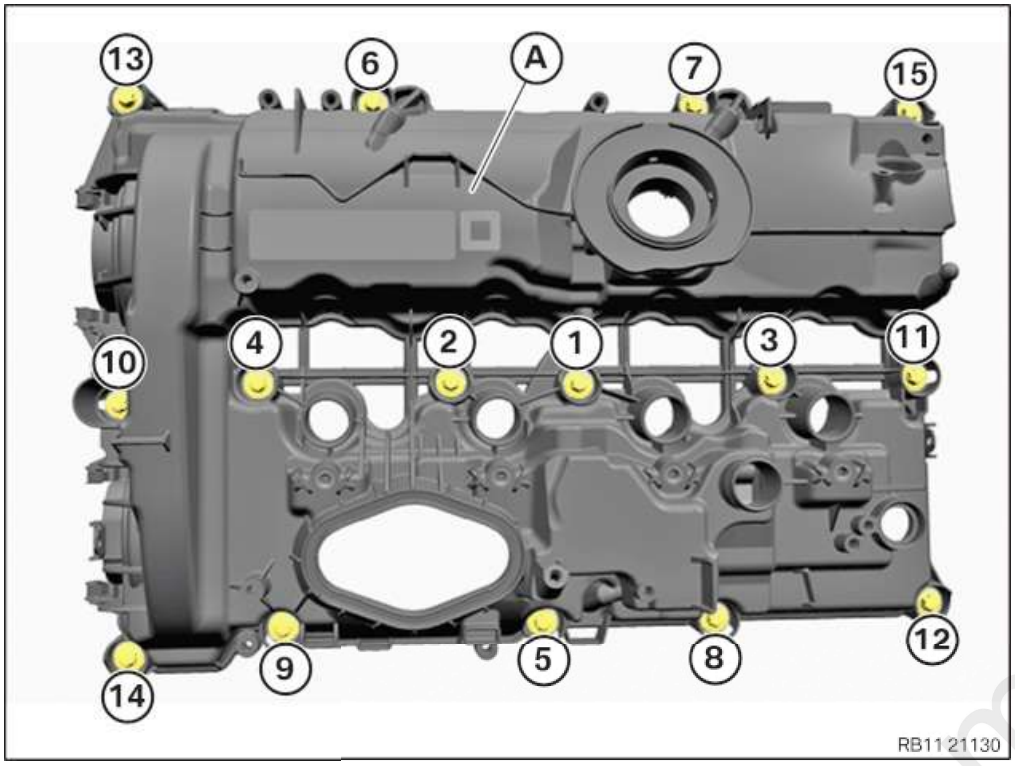
The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

10 – Removing the cylinder head cover

cardiagn.com

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

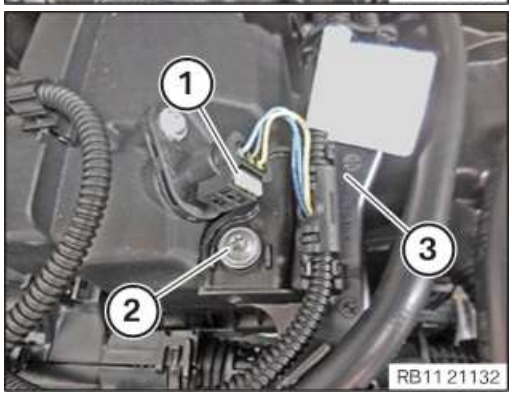
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

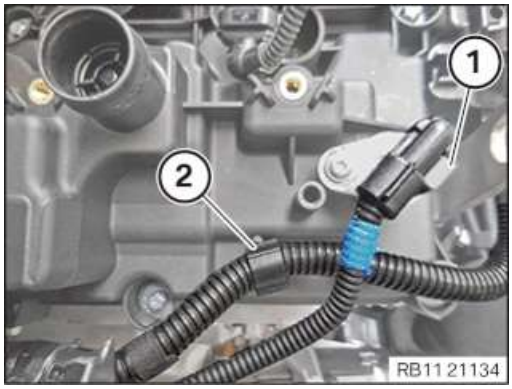
- Do not pull on the wires when disconnecting connectors and plug connections.



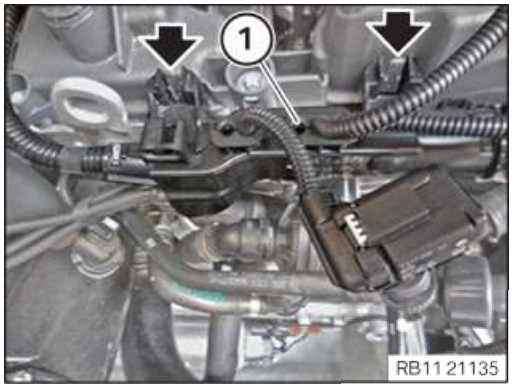
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



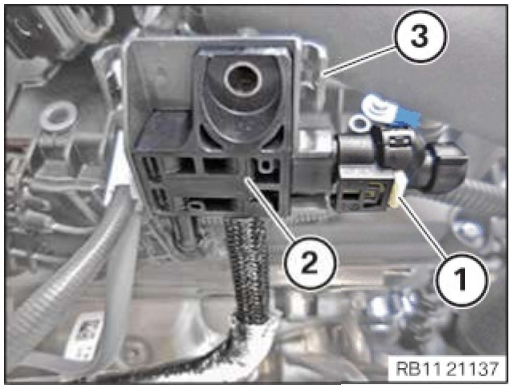
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



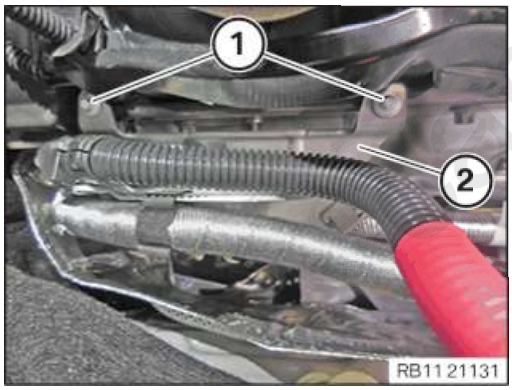
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



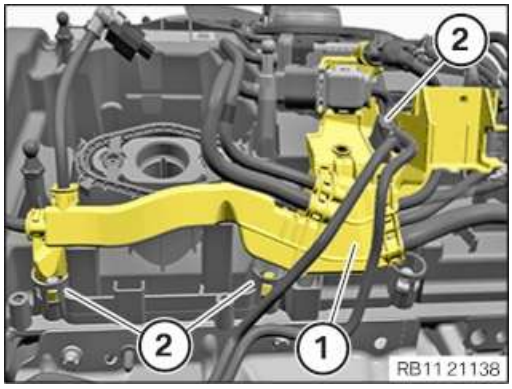
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.

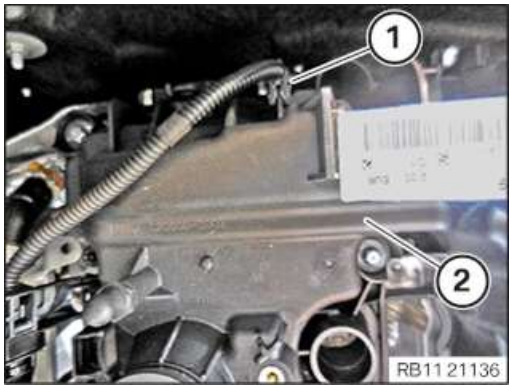


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

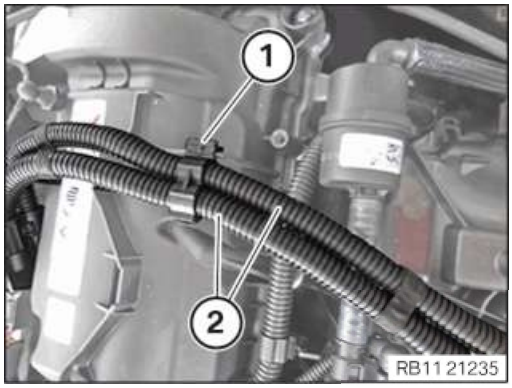


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

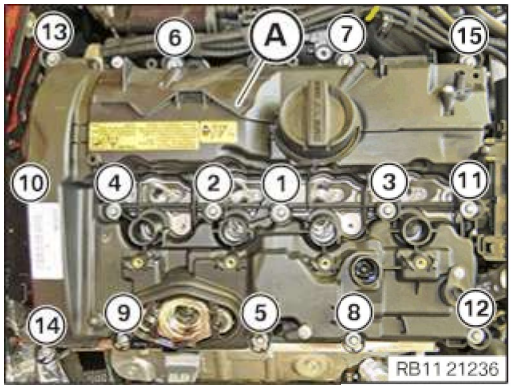
ardiagn.com



- Loosen clamp (1).



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

11 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

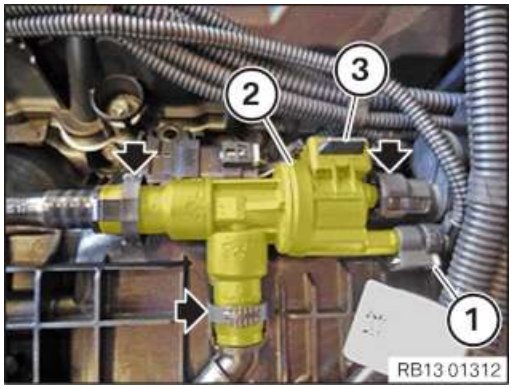
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

12 – Removing the intake plenum

RISK OF DAMAGE

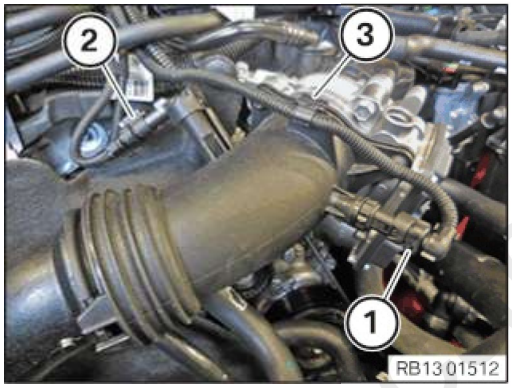
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

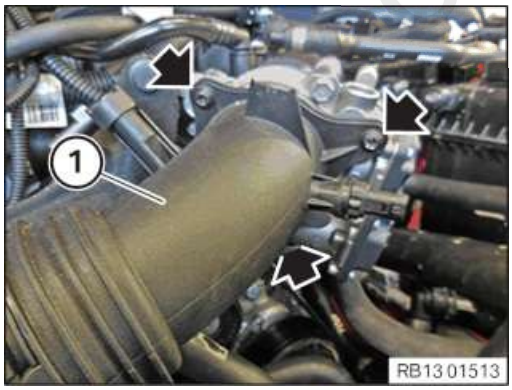
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

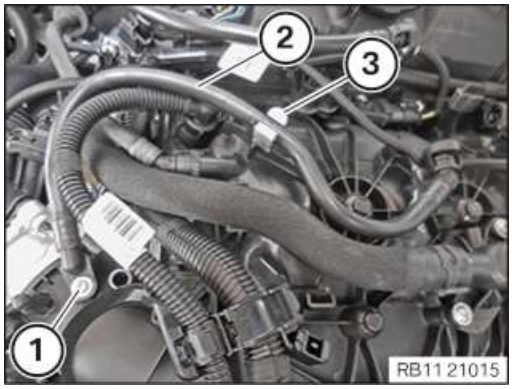
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



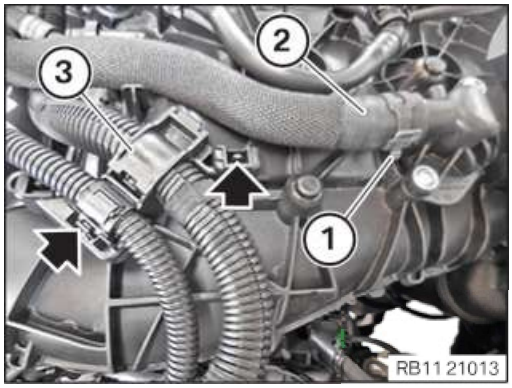
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



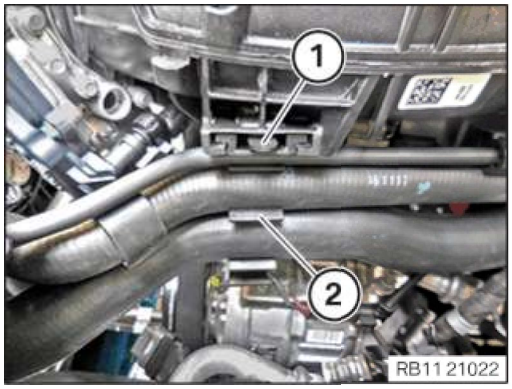
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



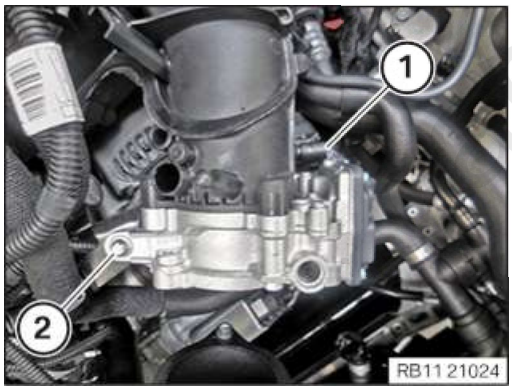
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



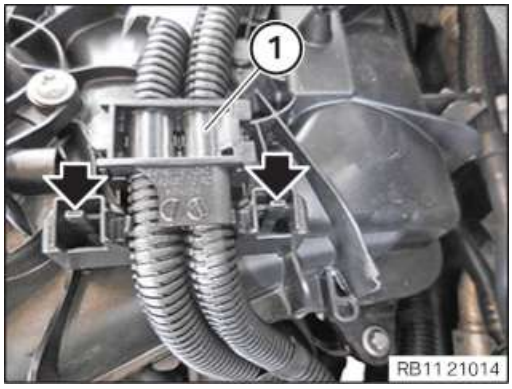
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

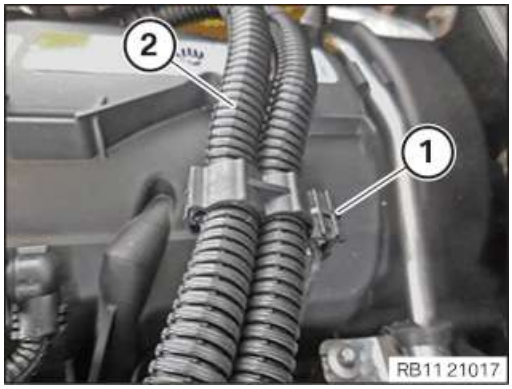


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

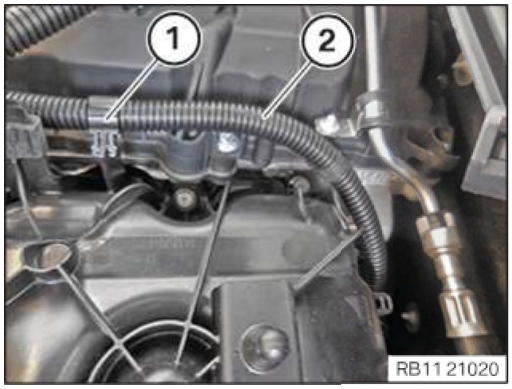
mdiagn.com



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



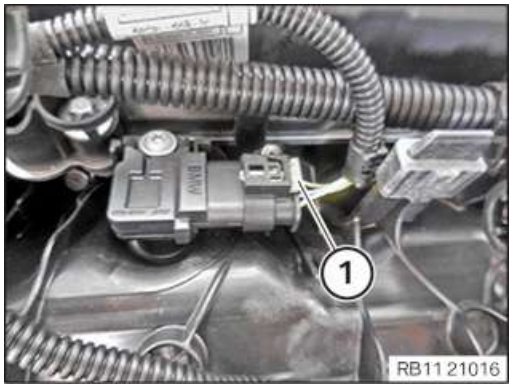
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

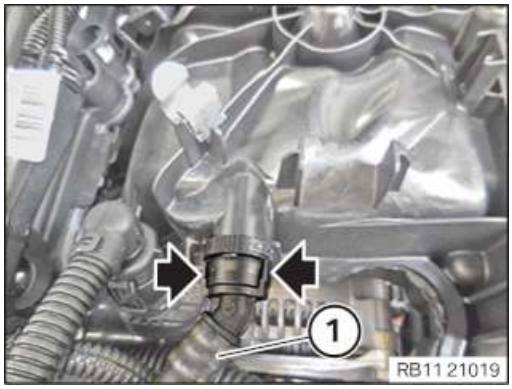


- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

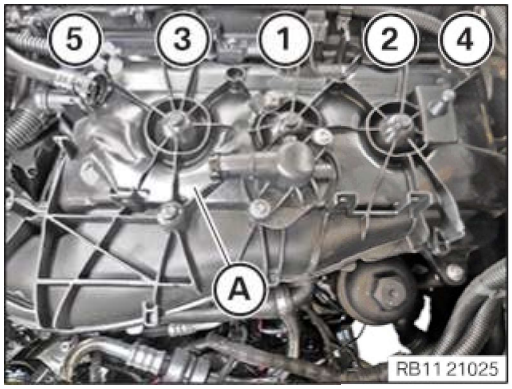
rdiagn.com



- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

13 – Remove the heat shield on the cylinder head

WARNING

Hot surfaces.

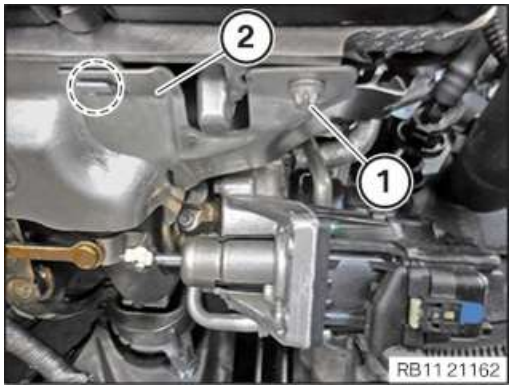
Risk of burning!

- Perform all work only on components that have cooled down.

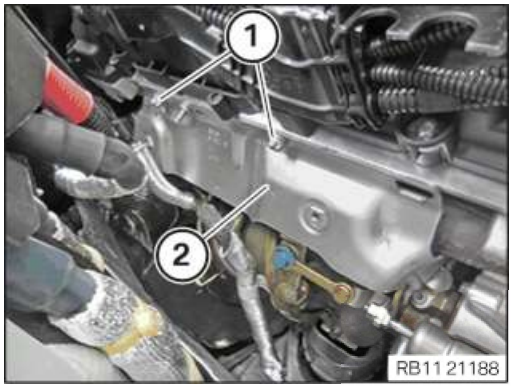


- Loosen screw (1).

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- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

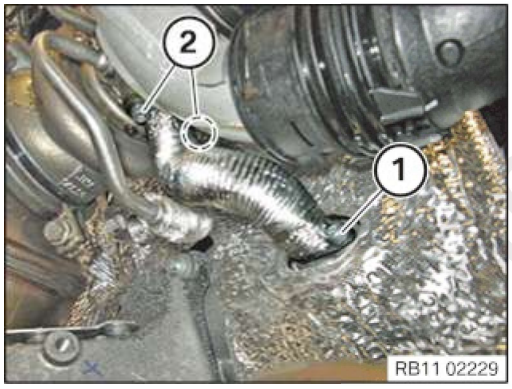


- Loosen screws (1).
- Feed out and remove the heat shield (2).

14 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

15 – Remove the coolant return line for the exhaust turbocharger

WARNING

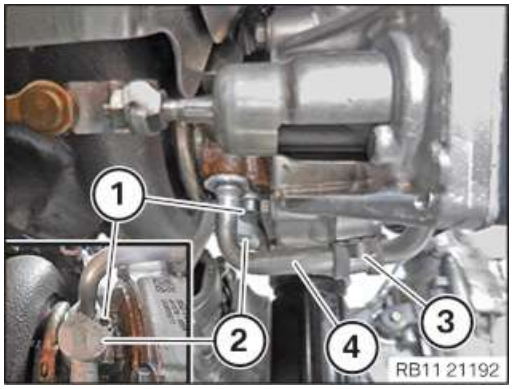
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

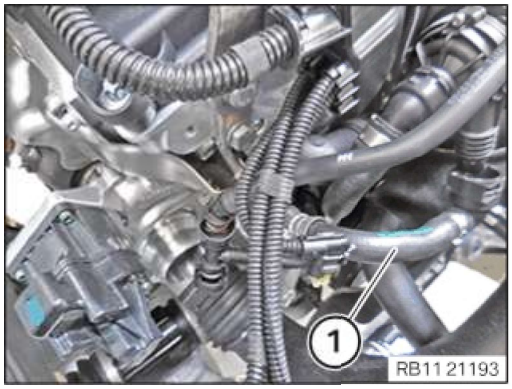
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

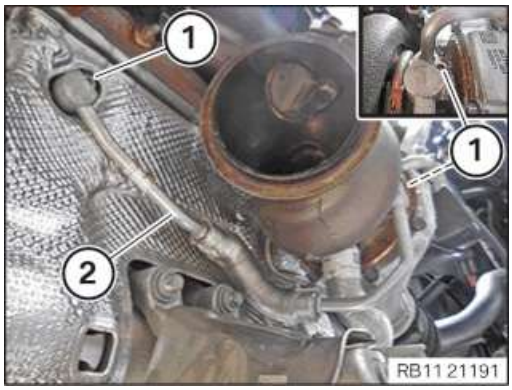


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

16 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

17 – Block the engine with the special tool in TDC firing position

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- Thread the sealing cap (1) out and remove.



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

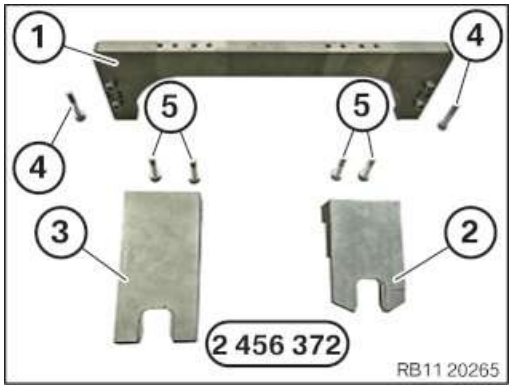


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

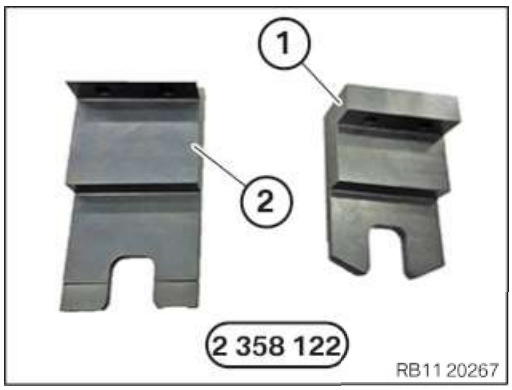
  The engine is in the TDC firing position of cylinder 1.

erdiagn.com



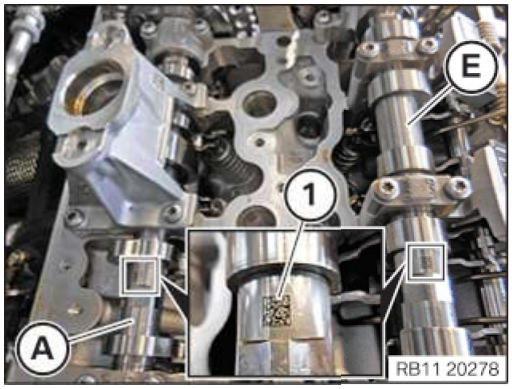
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

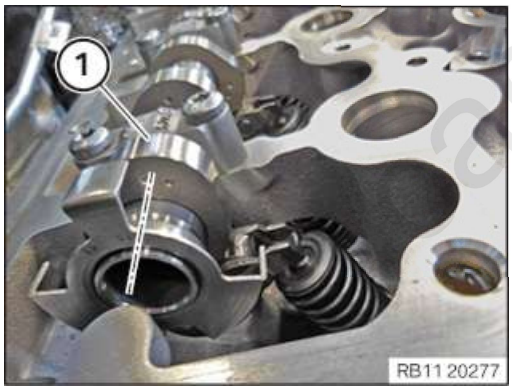


- Overview of the test gauges from the set of special tools 2 358 122:

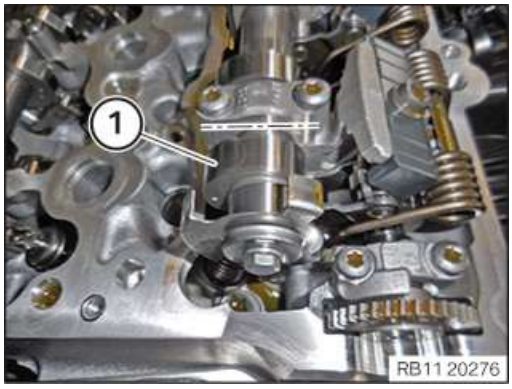
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

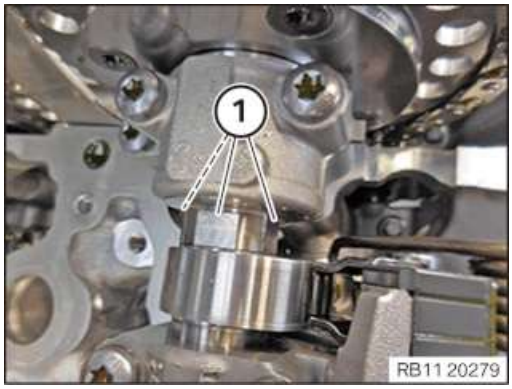


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

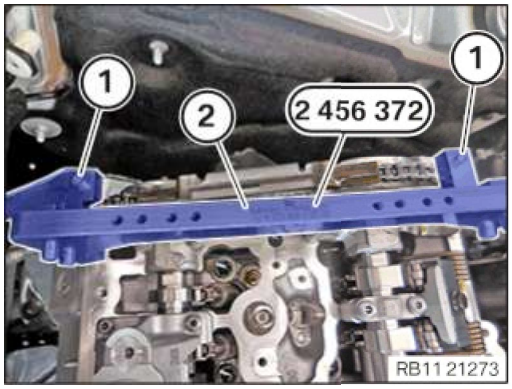
ardiagn.com



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



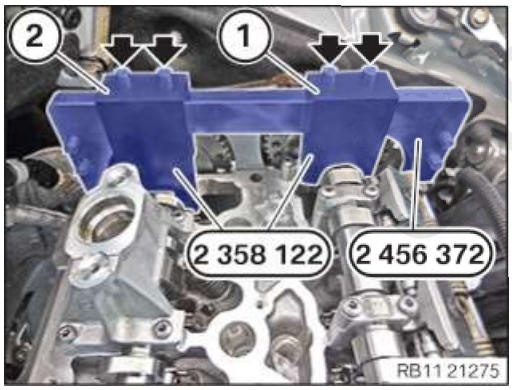
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

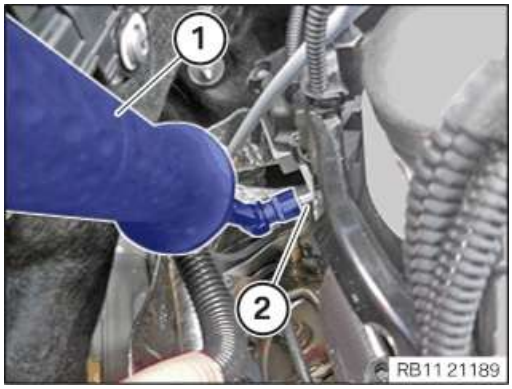
M6		Tightening torque	8 Nm

18 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

19 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

The figure shows the rear side of the engine.

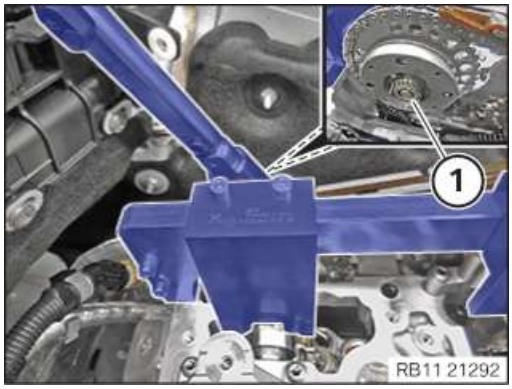
- Release the VANOS central valve (1) of the intake adjuster.

20 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

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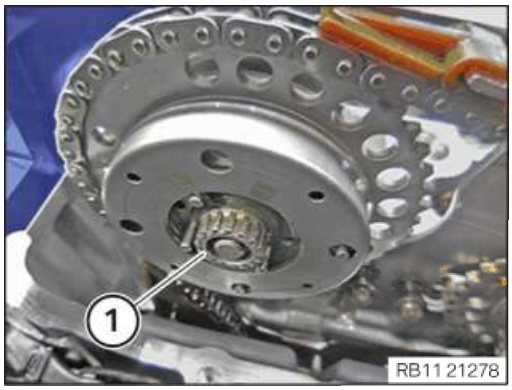


NOTICE

The figure shows the rear side of the engine.

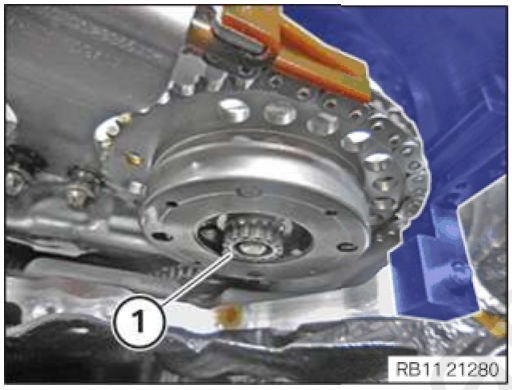
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

21 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

22 – Remove the VANOS central valve of the exhaust camshaft adjuster



- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

23 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.



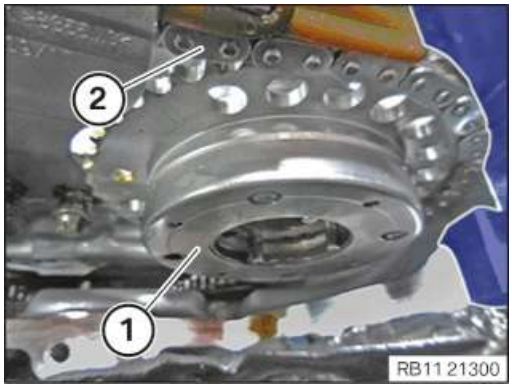
- Guide out the intake adjuster (1) from the timing chain (2) and remove.

24 – Remove exhaust camshaft adjuster

cardiagn.com

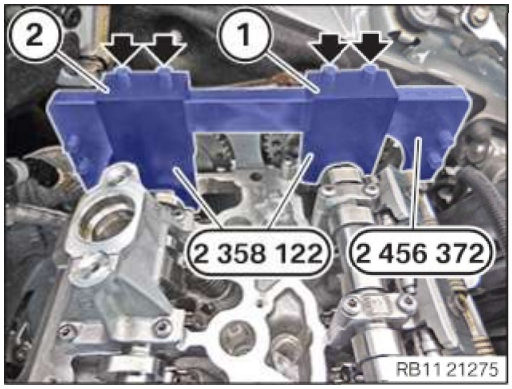
NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

25 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

26 – Remove cylinder head.

CAUTION

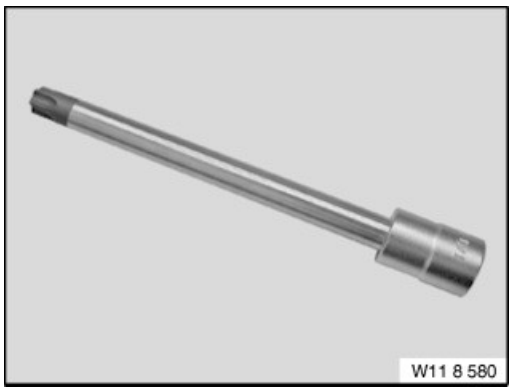
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

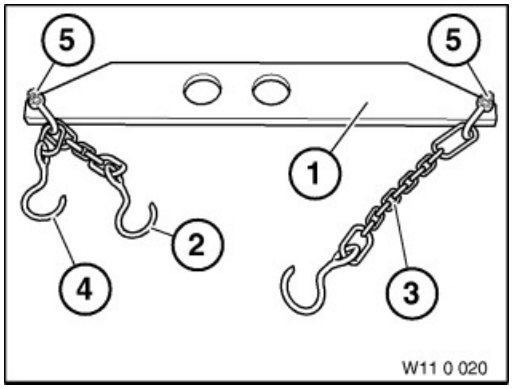
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Prepare special tool 0 495 747 (11 8 580).

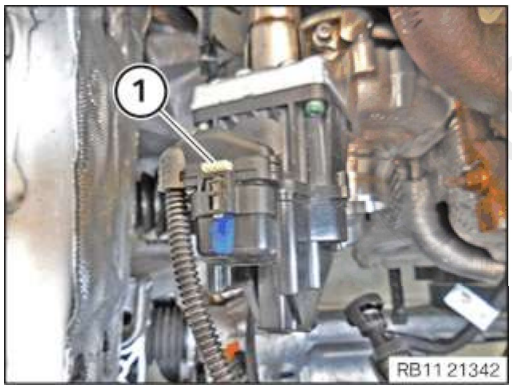
cardiagn.com



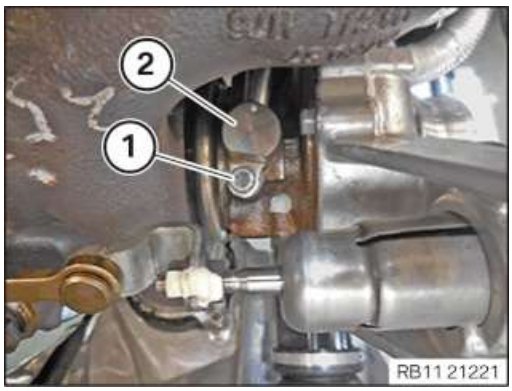
- Prepare special tool .



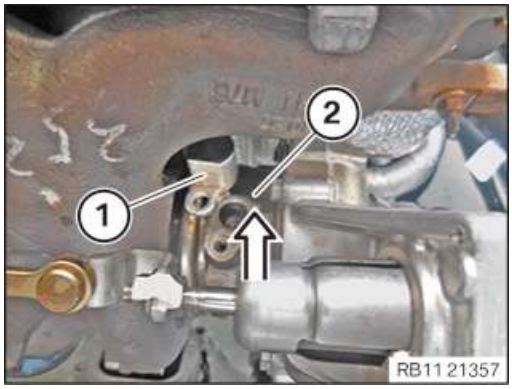
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.



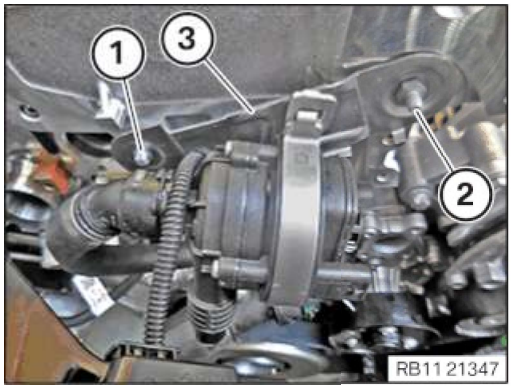
- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.



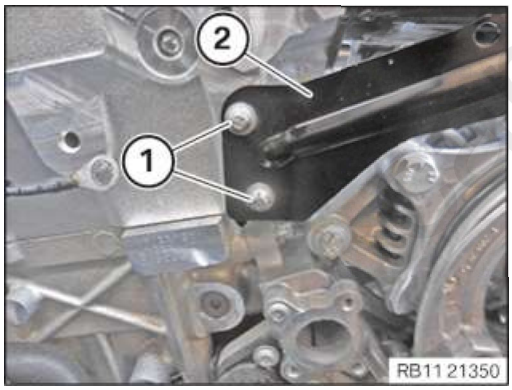
- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.

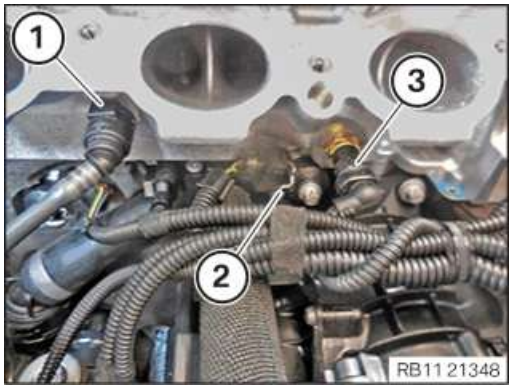


- Loosen screws (1).
- Thread out holder (2) and set aside.

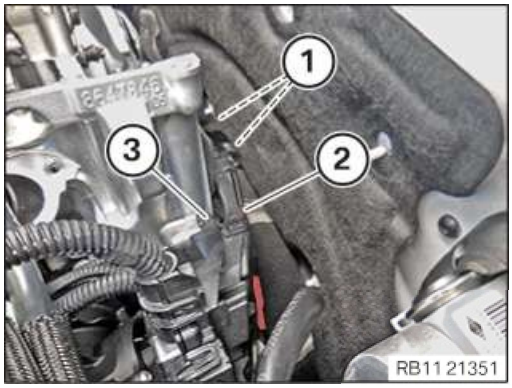


- Unlock plug connection (1) and disconnect.

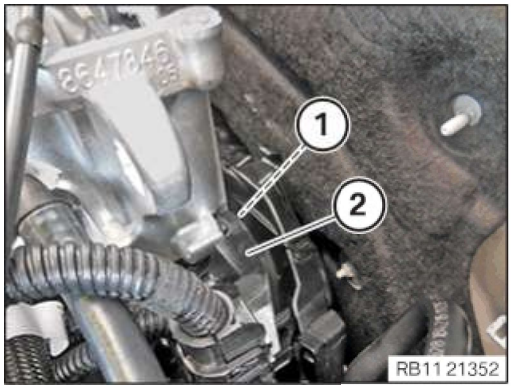
rdiagn.com



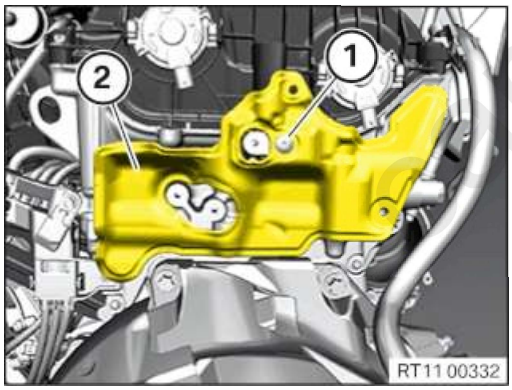
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



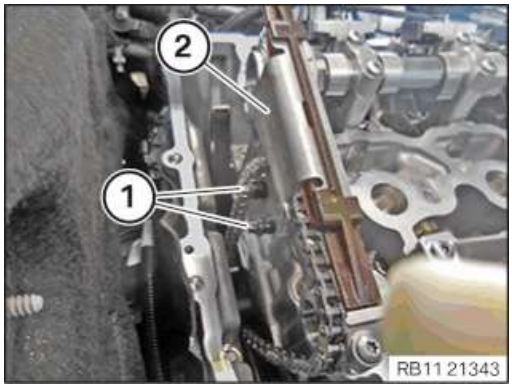
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



NOTICE

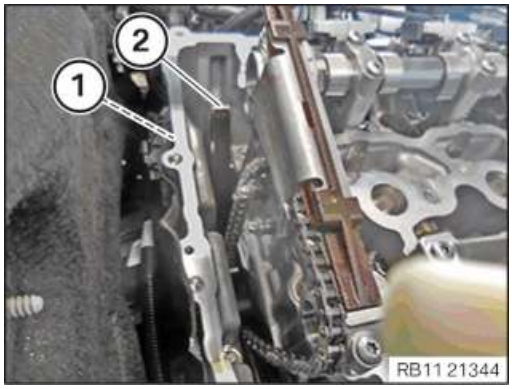
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

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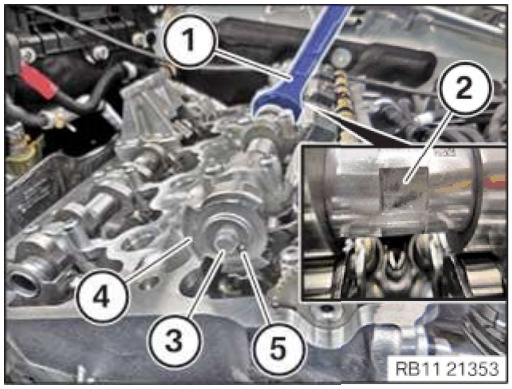
- Release the bearing journal (1) from the guide rail (2).



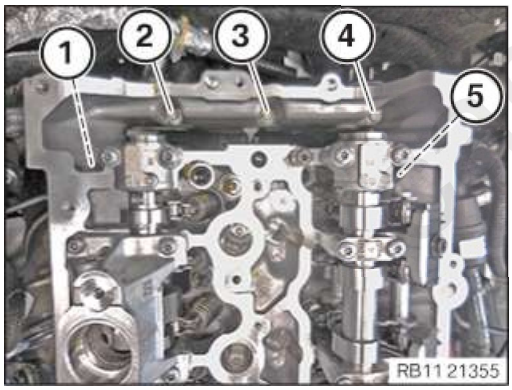
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm



- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.

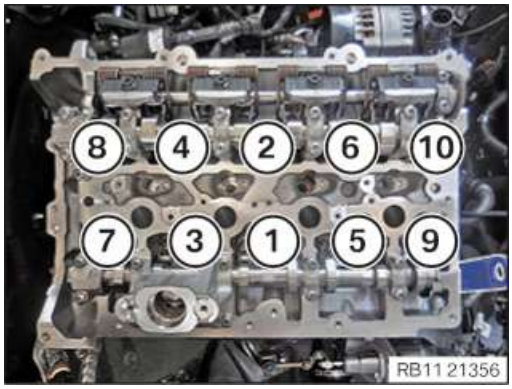


- Loosen the cylinder head bolts in the sequence from (5) to (1).

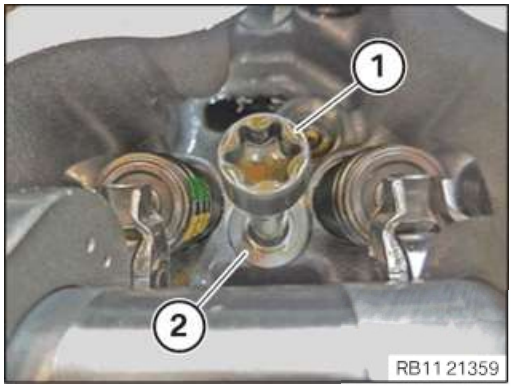


- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

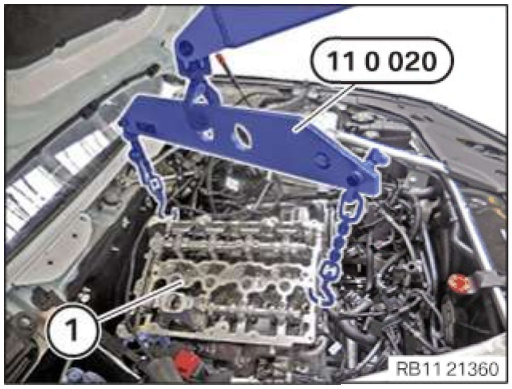
tdiagn.com



- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to the guide rails.

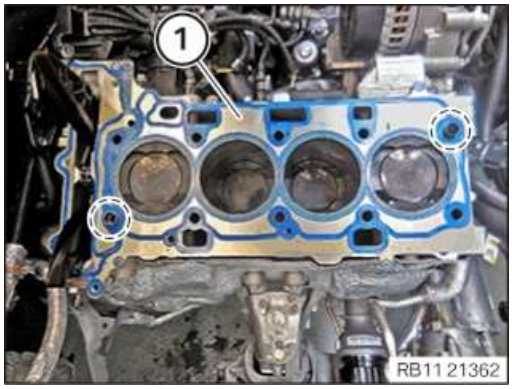
Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Attach special tool to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an **auxiliary person**, the workshop crane and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

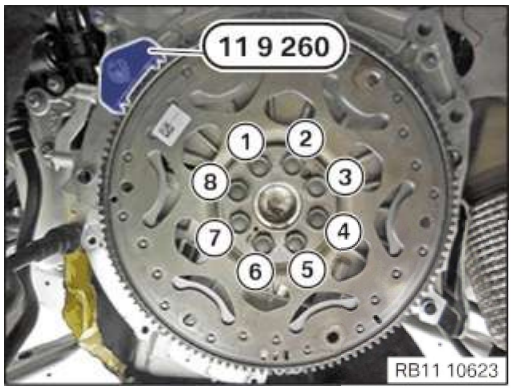
27 – Removing the cylinder head gasket

carmagn.com



- Guide out and remove cylinder head gasket (1) in the **marked** area.

28 – Removing flywheel

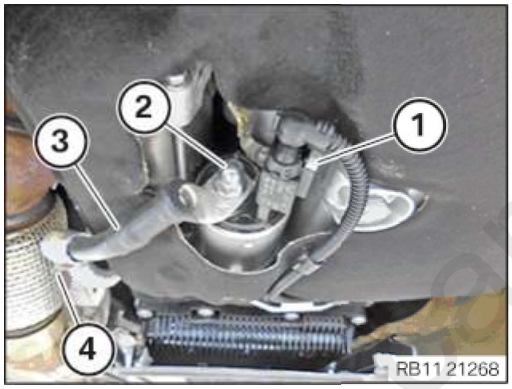


- Fasten the flywheel with the special tool 0 493 938 (11 9 260) and tighten with the special tool 0 494 130 (11 9 264).
- Loosen screws (1-8).

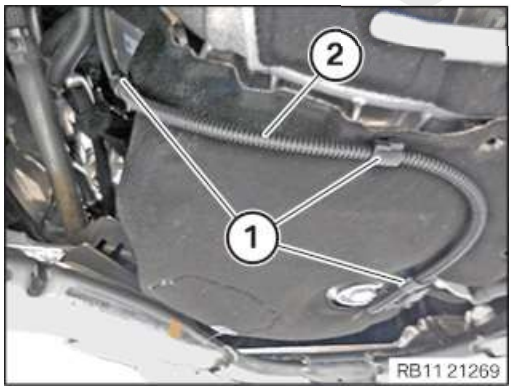
29 – Removing the acoustic cover of the oil sump

Prerequisite

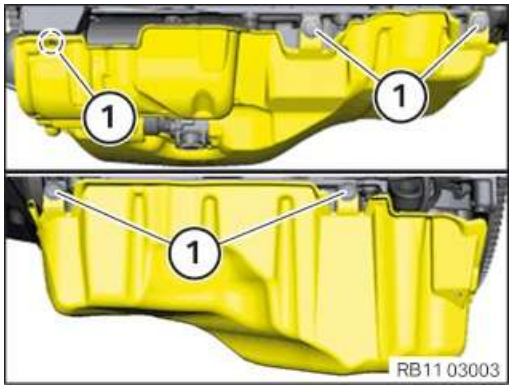
Disconnect all negative battery cables.



- Unlock and loosen connector (1).
- Loosen nut (2).
- Guide the positive battery cable (3) out of the clamp (4) and lay to one side.



- Unlock and loosen the clamps (1).
- Guide out the wiring harness section of automatic transmission (2) and set it aside.



- Detach all expanding rivets (1).



- Guide out acoustic cover (1) downwards to the rear and remove it.

30 – Remove oil sump

RISK OF DAMAGE

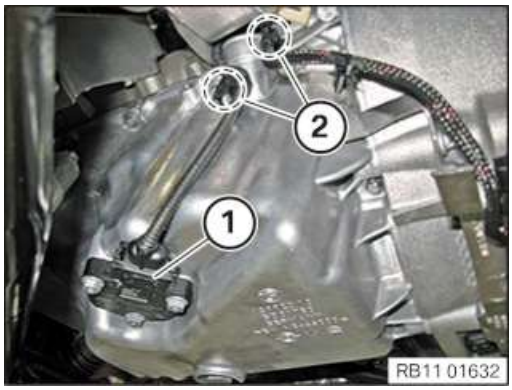
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

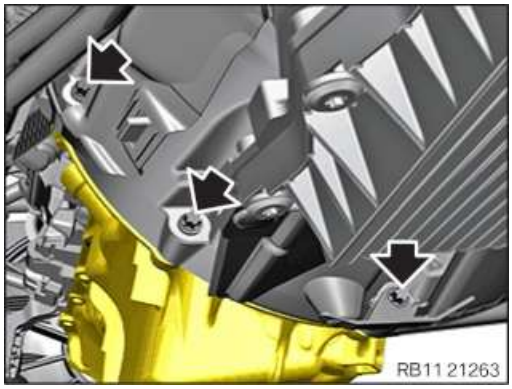
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

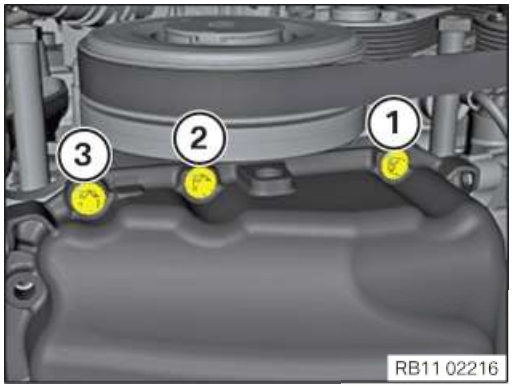


- Unlock and loosen connector (1).
- Release the cable from the clips (2) of the oil sump.

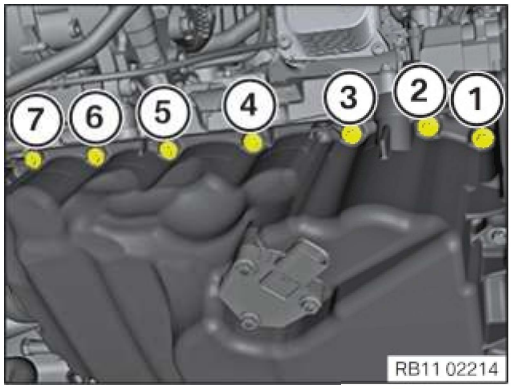
cardiagn.com



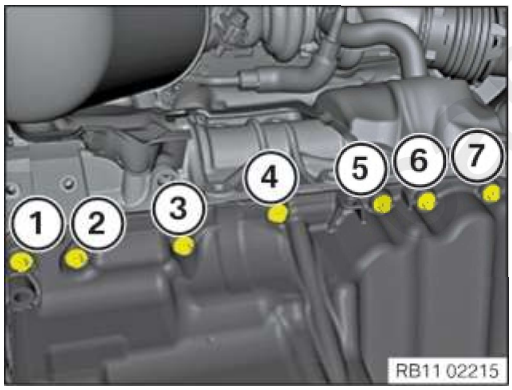
- Unscrew the transmission bolts (arrows).



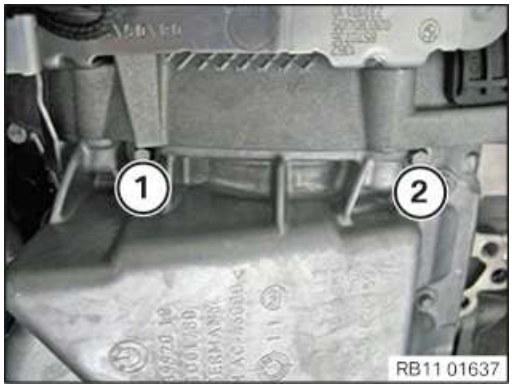
- Loosen screws (1), (2) and (3).



- Loosen screws (1) to (7).



- Loosen screws (1) to (7).



- Loosen screws (1) and (2).

rdiagn.com



TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump in the **marked** areas using suitable tools (1).



- Guide out the oil sump (1) downwards to the rear and remove.

31 – Remove the oil vacuum pump

RISK OF DAMAGE

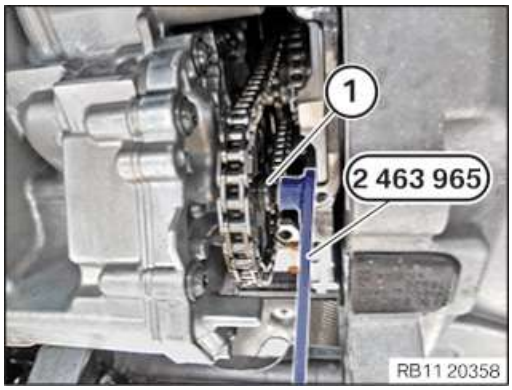
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

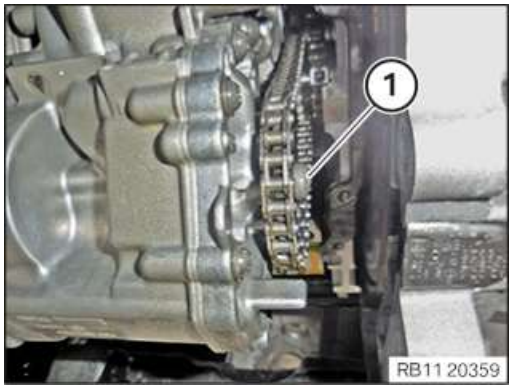
TECHNICAL INFORMATION

The thread is a left-hand thread.

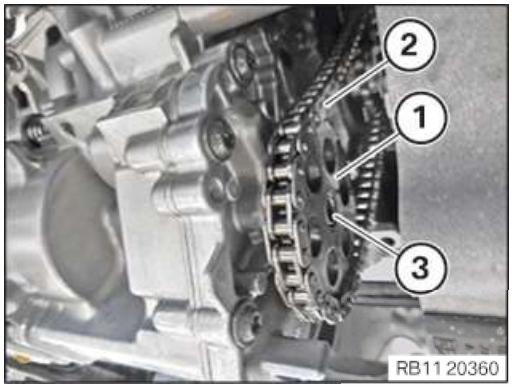


- Release bolt (1) with the special tool 2 463 965.

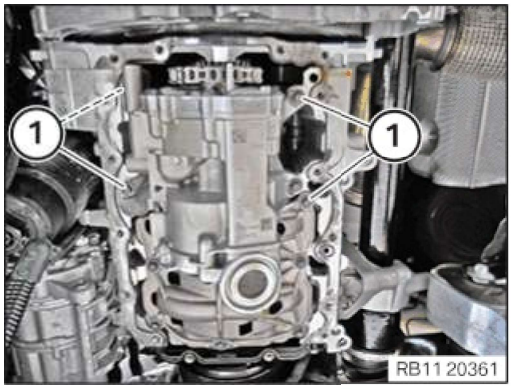
cardiagn.com



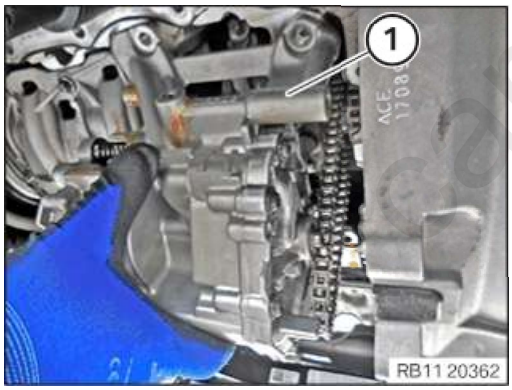
- Thread out the bolt (1) and remove it.



- Detach the camshaft sprocket (1) from the oil vacuum pump (3).
- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.

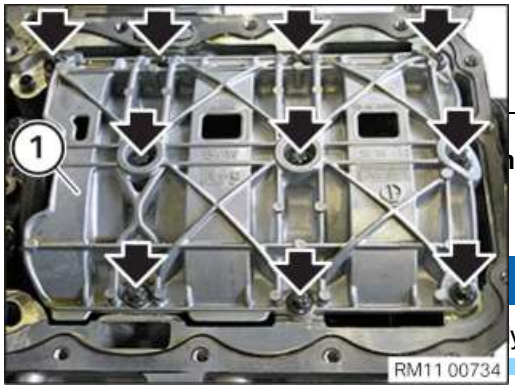


- Loosen screws (1).



- Feed out the oil vacuum pump (1) and remove it.

32 – Removing the oil deflector



- Release all bolts (arrows).
- Remove the oil deflector (1).

---

ng rod

y. The procedure is identical for all further components.

▸ **Removing the piston with connecting rod**

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TECHNICAL INFORMATION

Piston, gudgeon pin, connecting rod and connecting rod bearing shells are matched to each other and balanced.

Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

TECHNICAL INFORMATION

The connecting rods of the engine are balanced and are matched to each other.

A single connecting rod is not permitted to be replaced. Always replace all connecting rods.

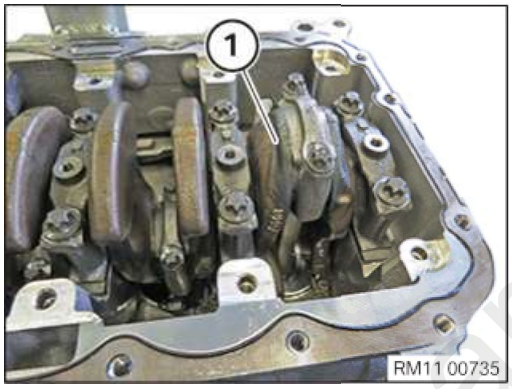
▷ **Detach the lower connecting rod bearing**

RISK OF DAMAGE

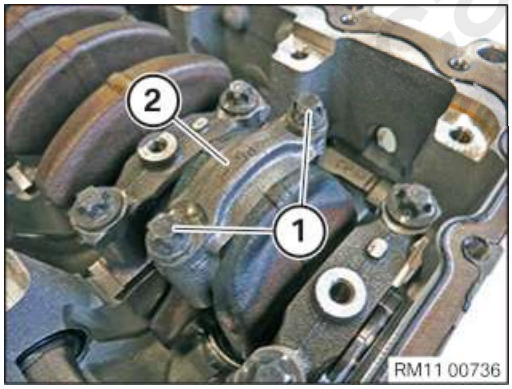
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.



- Turn the crankshaft until the connecting rod bearing journal (1) reaches a vertical position.



RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

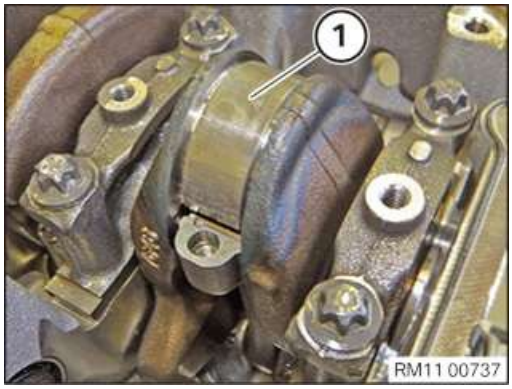
Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Unscrew the connecting rod bolts (1).
- Remove the connecting rod bearing cap (2) and put to one side in the correct order.

  Make sure that the connecting rod bearing cap (2) can be re-installed in the correct position.

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RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

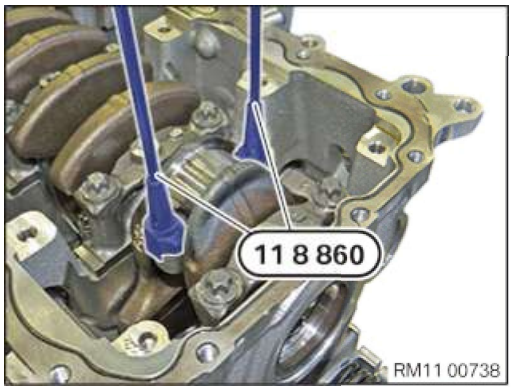
Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

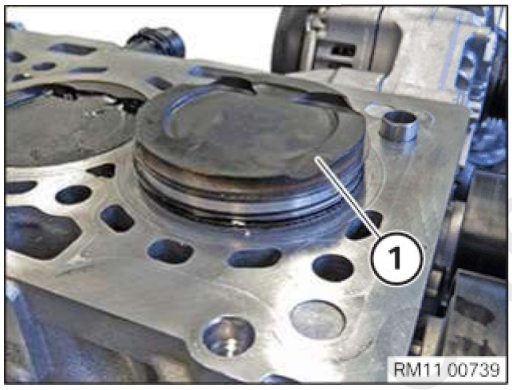
- Remove the connecting rod bearing (1).

  Make sure that the connecting rod bearing (1) can be re-installed in the correct position.

◁



- Screw special tool 0 496 144 (11 8 860) in at large connecting rod eye.



- Press piston (1) with connecting rod up and out of crankcase.

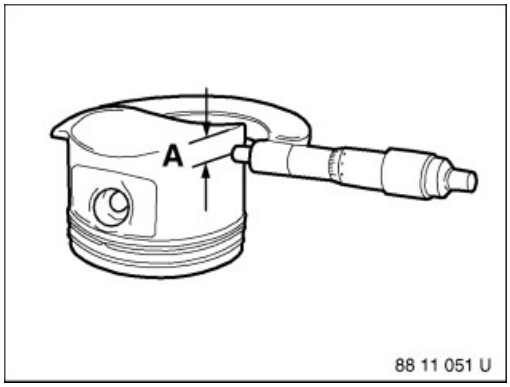
34 – Measuring piston

NOTICE

The description is for one component only. The procedure is identical for all further components.

Check

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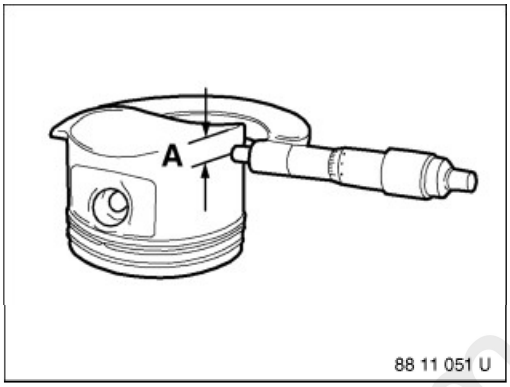


- Position measuring bolt in area (A) and measure piston installation clearance transversely to gudgeon pin.

Piston diameter

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Result

» Piston does not correspond to the specifications.

Measure

- Renew the piston.

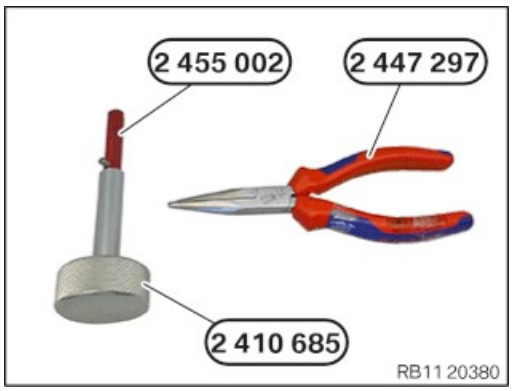
35 – Replacement: renew all pistons

TECHNICAL INFORMATION

- Wear safety goggles.

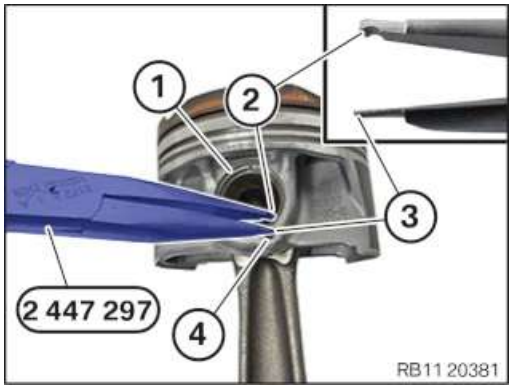
NOTICE

The description is for one component only. The procedure is identical for all further components.



- Use special tools , and to remove the piston from the connecting rod.

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CAUTION

Gudgeon pin circlip with preload.

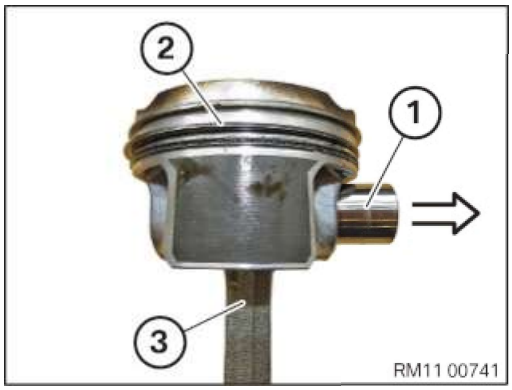
Danger of injury!

- The use of the specified special tool for the disassembly or installation is mandatory.

- Wear safety goggles.

- Use special tool to remove the gudgeon pin circlip.
- Insert the flat side (3) of special tool into the groove (4).
- Grab and remove the gudgeon pin circlip (1) with the arched side (2).

Check



TECHNICAL INFORMATION

Piston and gudgeon pin are matched to each other.

Always install piston and gudgeon pin together and do not switch by mistake.

- Check whether the gudgeon pin (1) demonstrates tangible play in the piston.

  Check whether the gudgeon pin (1) can be removed without excessive force.

Result

» It is very difficult to remove the gudgeon pin (1) or the gudgeon pin (1) demonstrates significant play.

Measure

- Renew the piston (2) and the gudgeon pin (1).

  Parts: piston, gudgeon pin



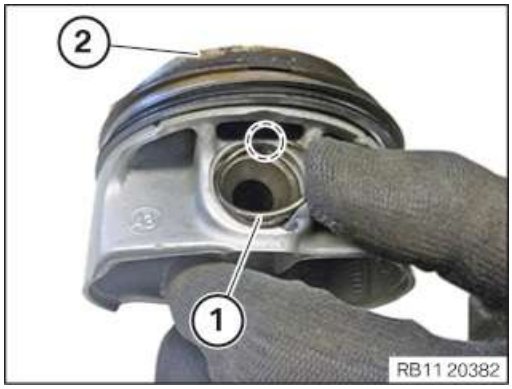
TECHNICAL INFORMATION

Piston and gudgeon pin are matched to each other.

Always install piston and gudgeon pin together and do not switch by mistake.

- Install a new gudgeon pin (1) in the new piston (2) and connecting rod (3).

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CAUTION

Gudgeon pin circlip with preload.

Danger of injury!

- The use of the specified special tool for the disassembly or installation is mandatory.

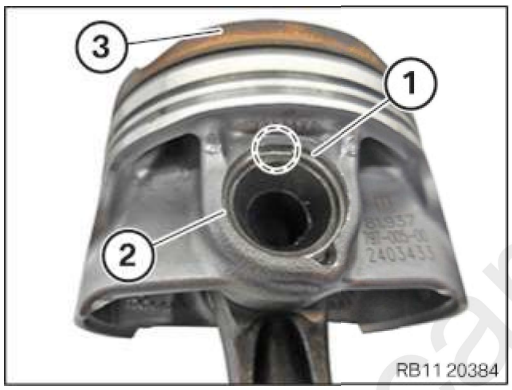
- Wear safety goggles.

- Position the gudgeon pin circlip (1).

  The opening (mark) of the gudgeon pin circlip must point towards the piston crown (2).



- Preload the gudgeon pin circlip (1) using your thumb.
- Simultaneously press the gudgeon pin circlip into the piston using special tools and .
- Twist and reposition special tool and completely press the gudgeon pin circlip into the piston.



- Check whether the gudgeon pin circlip (1) has been correctly positioned in the groove (2).
- Check whether the opening (mark) of the gudgeon pin circlip points towards the piston crown (3).

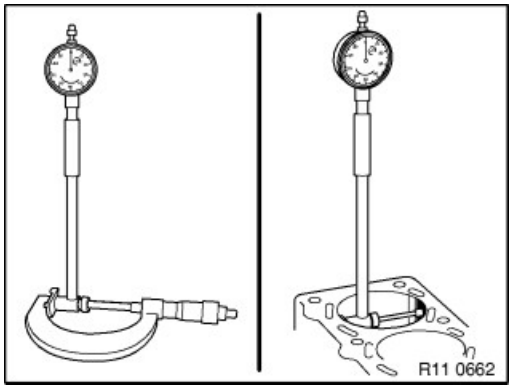
36 – Measuring a cylinder

Prerequisite

Cylinder barrel is cleaned.

Check

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- Carry out a measurement at all cylinders.
- Adjusting measuring screw to nominal dimension of cylinder bore.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

- Insert internal measuring device into measuring screw and set to zero.
- With the internal measuring device, measure the cylinder at the following points and check the deviations from the nominal dimension.
  - Lower third of the cylinder bore in direction of travel,
  - Lower third of the cylinder bore transversely to direction of travel,
  - Middle third of the cylinder bore in direction of travel,
  - Middle third of the cylinder bore transversely to direction of travel,
  - Upper third of the cylinder bore in direction of travel,
  - Upper third of the cylinder bore transversely to direction of travel.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Result

» Cylinder does not correspond to the specifications.

Measure

- Renew the crankcase.

37 – Installing all pistons with connecting rod

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Installing piston with connecting rod**

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RISK OF DAMAGE

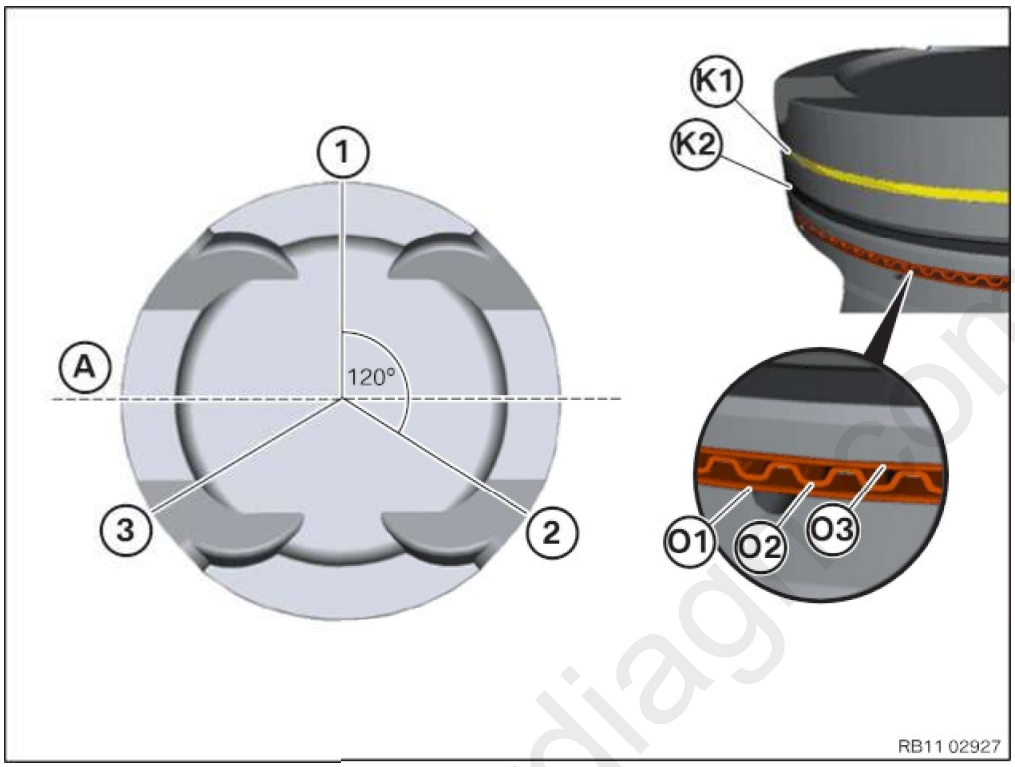
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

▷ **Aligning piston rings**

Aligning piston rings



1 12 o'clock position

2 4 o'clock position

3 8 o'clock position

A Axis of gudgeon pin

K1 Upper piston ring

K2 Middle piston ring

O1 Lower oil scraper ring

O2 Spring

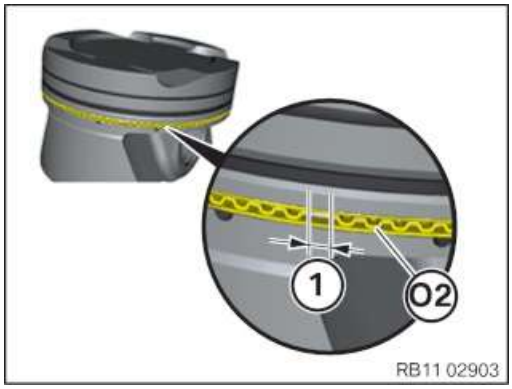
O3 Upper oil scraper ring

- Align the contact points of all piston rings rotated by 120° each.

  Do not position contact points over axis of gudgeon pin (A).

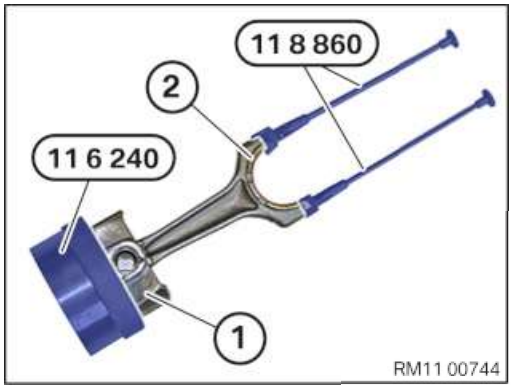
Piston ring	Align at the following position
Lower oil scraper ring (O3)	Align at the 12 o'clock position (1)
Spring (O2)	Align at the 4 o'clock position (2)
Upper oil scraper ring (O1)	Align at the 8 o'clock position (3)
Middle piston ring (K2)	Align at the 12 o'clock position (1)
Upper piston ring (K1)	Align at the 4 o'clock position (2)

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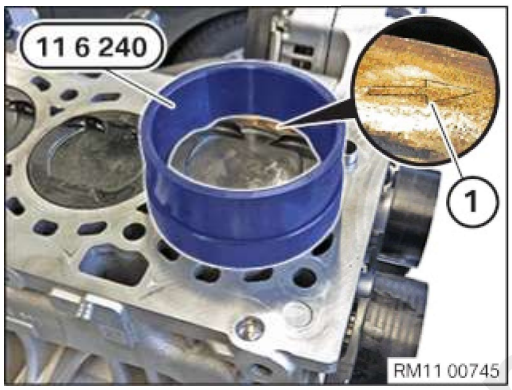


- Make sure that contact point (1) does not overlap spring (O2).

◁



- Coat the pistons (1) and piston rings lightly with oil.
- Insert the pistons (1) with the piston rings into the bush 0 495 373 (11 6 240).
- Screw special tool 0 496 144 (11 8 860) on at large connecting rod eye (2).



- Align the piston so that the arrow (1) points to cylinder 1.
- Insert the piston with the connecting rod into the special tool 0 495 373 (11 6 240) and guide it into the cylinder.

RISK OF DAMAGE

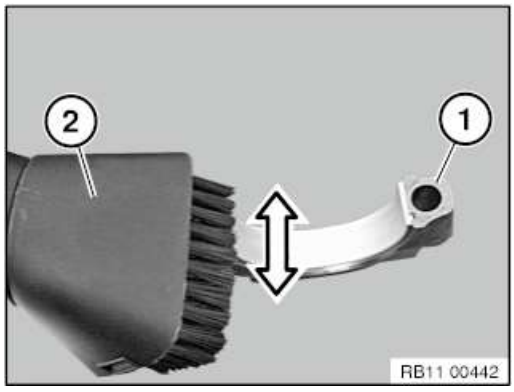
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

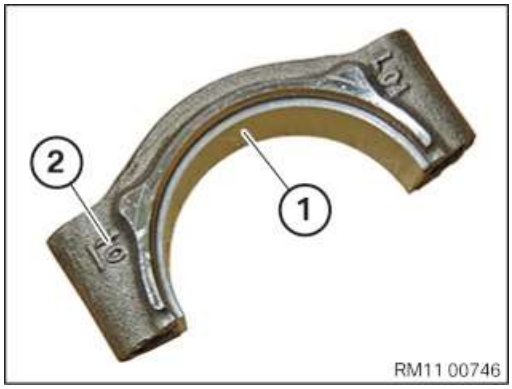
- Push in piston by hand with only little force. Do not use striking tools.

▷ **Install the lower connecting rod bearing**

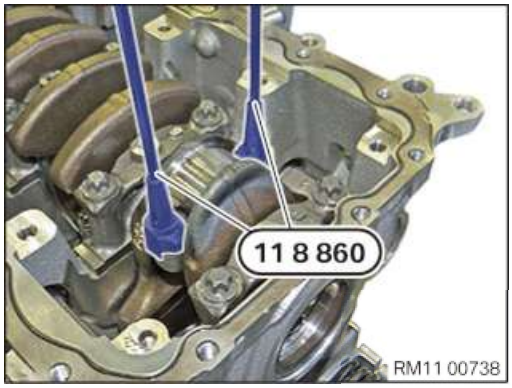


- Vacuum the connecting rod bearing shell and cracked surface (1) with a vacuum cleaner (2).

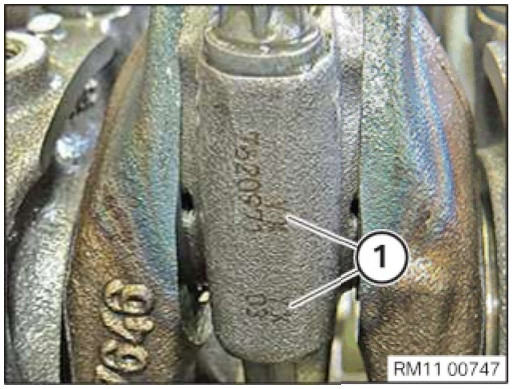
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- Insert the connecting rod bearing shell (1) into the connecting rod bearing cap (2).
- Apply a light coat of oil to the connecting rod bearing shell (1).



- If necessary, screw the assembly tool 0 496 144 (11 8 860) into the large connecting rod eye.
- Pull the connecting rod up to the connecting rod bearing journal.



RISK OF DAMAGE

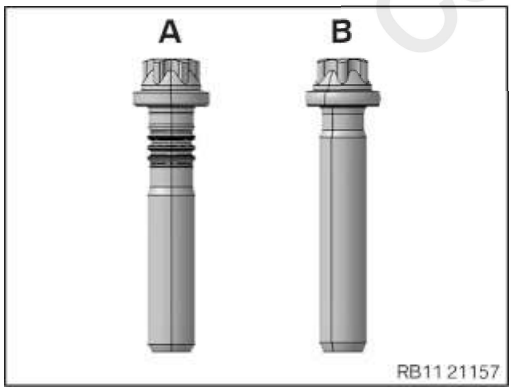
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

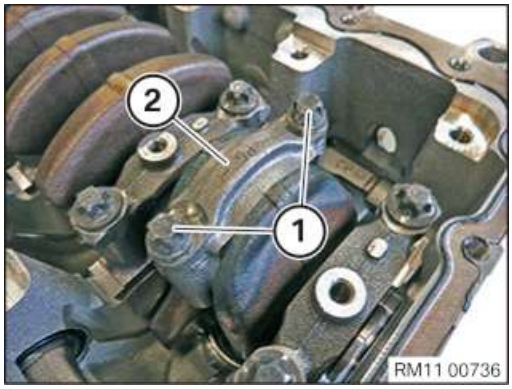
- Attach the connecting rod bearing caps to the connecting rod until the designations (1) match.

  Make sure that the connecting rod bearing (2) is attached to the same connecting rod that it was detached from.



- A mixed installation of connecting rod bolts (A) and (B) on a connecting rod bearing cap is **not** permitted.

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TECHNICAL INFORMATION

When installing new connecting rod bolts, ensure that two identical connecting rod bolts are used on one connecting rod bearing cap.

A mixed installation of different connecting rod bolts on one connecting rod bearing cap is not permitted.

- Renew screws (1).
- Tighten the screws.

  Make sure that the connecting rod bearing cap (2) rests completely on the connecting rod.

Connecting rod bearing cap to connecting rod

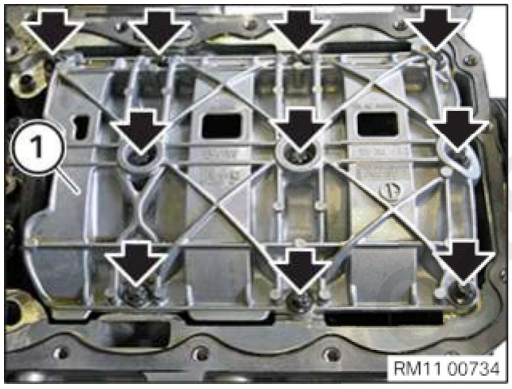
Renew screws.

Tighten screws crosswise.	Jointing torque	20 Nm
	1. Angle of rotation	70 °
	2. Angle of rotation	70 °

◁

POSTPROCESSES

38 – Installing the oil deflector



- Install the oil deflector (1).
- Renew screws.

  Parts: Bolts
- Tighten all bolts cross-wise.

Oil deflector to crankcase

M8 x 35		Renew screws.	15 Nm 45 °

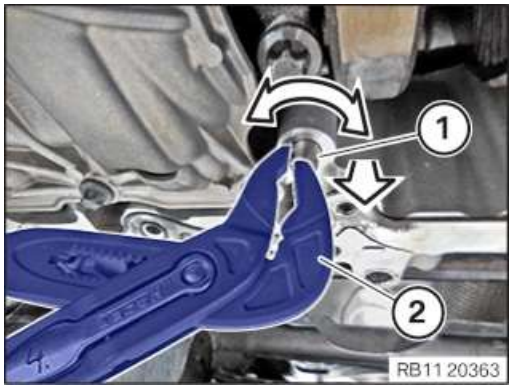
39 – Oil vacuum pump preparation

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

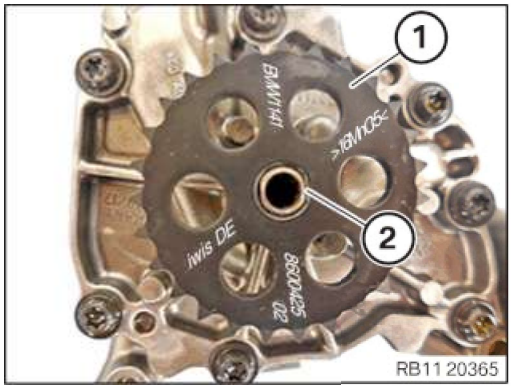


- Remove the centring sleeves (1) in direction of arrow using conventional tools (2).
- Renew the centring sleeves (1).

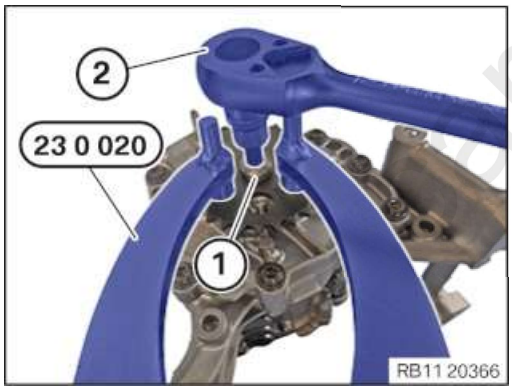
  Parts: Centring sleeves



- Insert and install new centring sleeves (1) on the oil vacuum pump (2).



- Insert and install the camshaft sprocket (1) on the oil vacuum pump (2).
- Make sure the **labelling** on the camshaft sprocket points to the **front**.



TECHNICAL INFORMATION

The thread is a left-hand thread.

- Insert and install the new screw (1).
- Hold camshaft sprocket with special tool 0 491 440 (23 0 020) and tighten screw (1) with conventional tools (2).

Note: Carry out work with a second person assisting.

Camshaft sprocket to oil vacuum pump

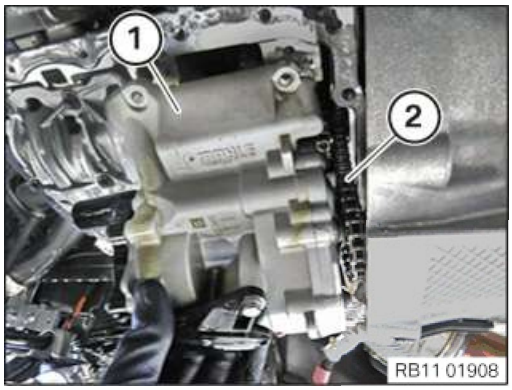
M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °



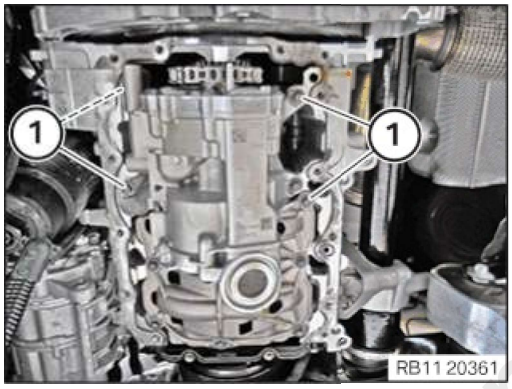
- Make sure the sealing ring (1) is installed correctly.

  The sealing ring (1) must not be damaged or missing.

40 – Install the oil vacuum pump



- Feed the oil vacuum pump (1) into the drive chain (2) and position it.



- Tighten the new bolts (1).

Oil vacuum pump to crankcase

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

41 – Refitting sump



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the rough seal remains on the sealing surface (1) of the crankcase with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



- Have the special tool ready.



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

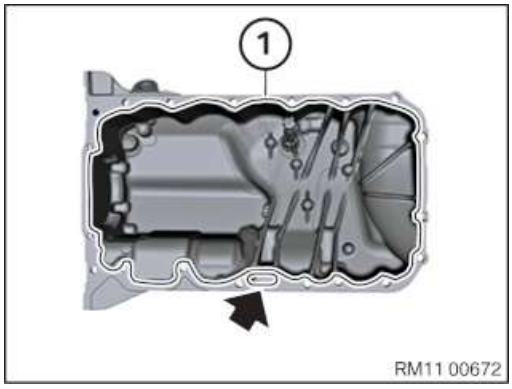
- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)



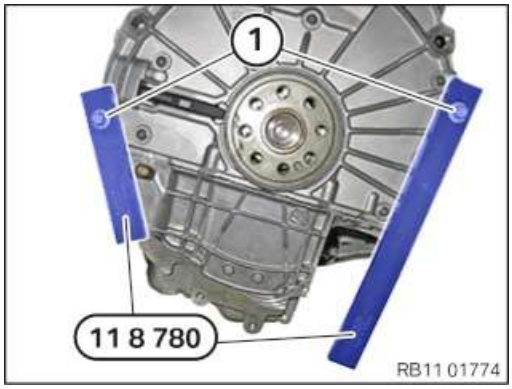
TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound along the line (1) with a thickness of 2 mm to 2.5 mm.

  Apply the sealing compound along the inner edge.
- Completely encircle the oil return orifice (arrow) with the sealing compound.

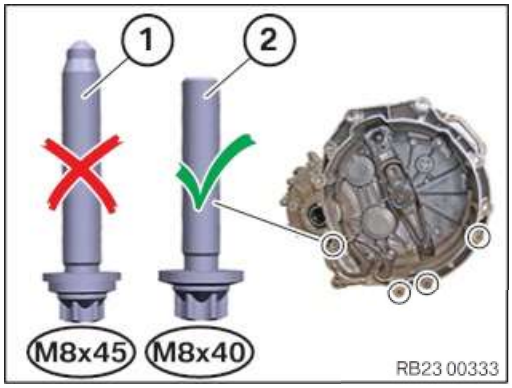
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TECHNICAL INFORMATION

The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with engine block.
- If necessary, renew fitting sleeves.



RISK OF DAMAGE

Component damage caused by incorrect screw length.

The use of screws with the incorrect screw length can damage the component.

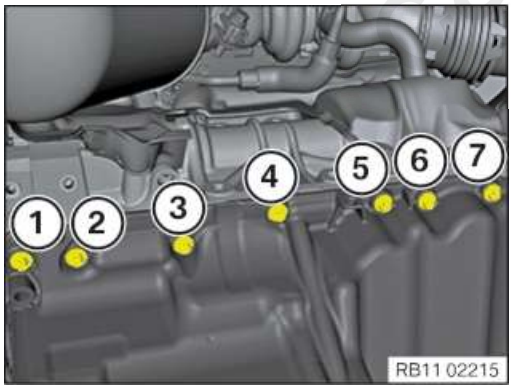
- Check for correct screw length.
- Re-install screws that correspond to the original screw length.

- Ensure that the **correct** screw (2) (M8x40) is used for mounting the oil sump on the transmission.

  The screw (1) (mounting bolt of the starter motor) may **never** be used for mounting the oil sump.



- Install oil sump (1) to top front.
- **Hand-tighten** all oil sump screws but do not tighten completely.

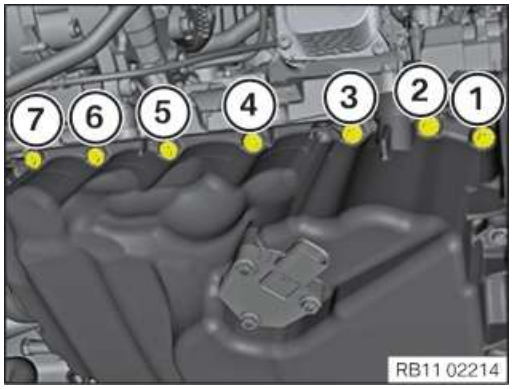


- Tighten the screws (1) to (7).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

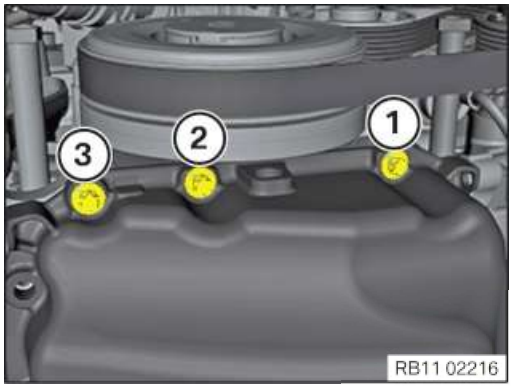
carldiagn.com



- Tighten the screws (1) to (7).

Oil sump to crankcase

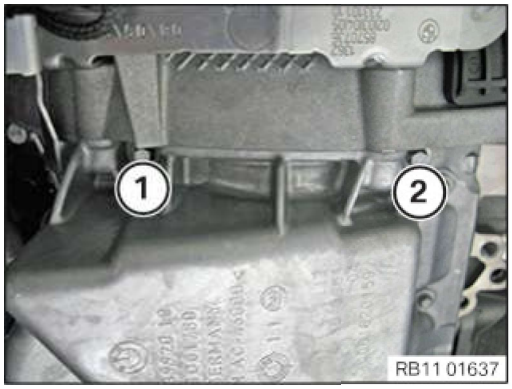
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1), (2) and (3).

Oil sump to crankcase

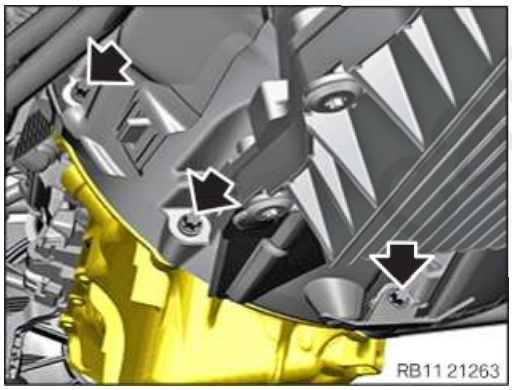
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten down screws (1) and (2).

Oil sump to crankcase

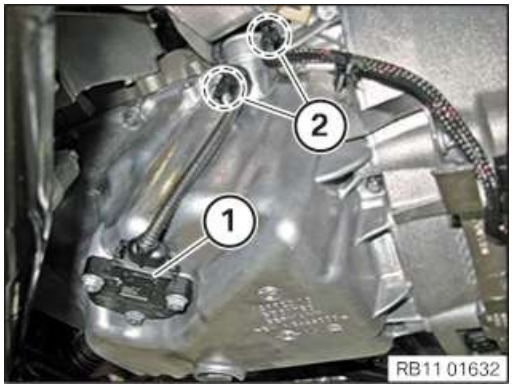
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm



- Fasten cable on the clips (2) from the oil sump.
- Connect and lock the connector (1).
- Make sure the connector 1 engages audibly.

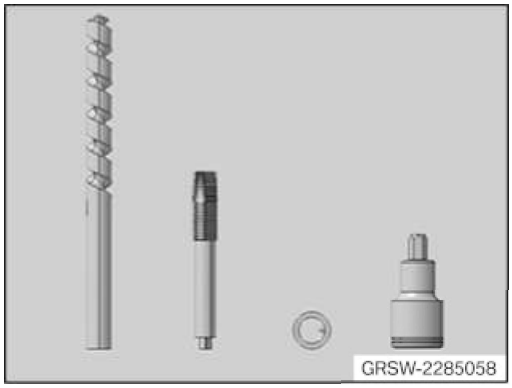
autodiagn.com



TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).



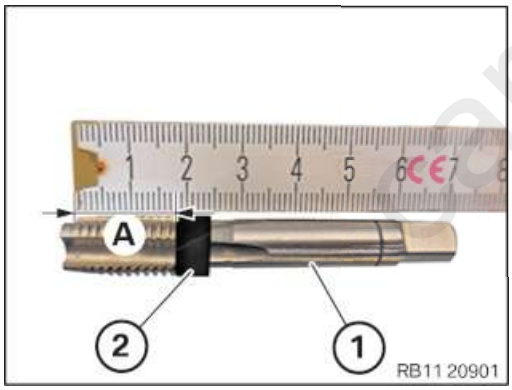
- Use the set of special tools 2 285 058.

Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool



- Assemble tool set.

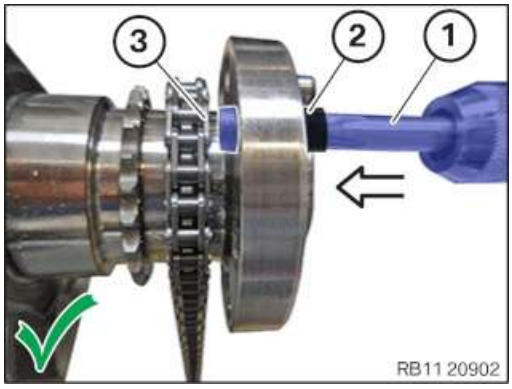
Number	Description
1	Tool holder
2	Thread cutter M12X1,5



- Mark the screw-in depth (A) on thread cutter (1) from the set of special tools 2 285 058 with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm



NOTICE

To provide a better overview: Shown with engine removed.

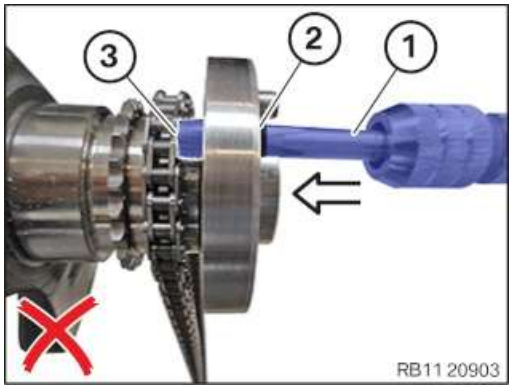
- Screw in the thread cutter (1) from the set of special tools 2 285 058 in direction of arrow up to the screw-in depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).

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TECHNICAL INFORMATION

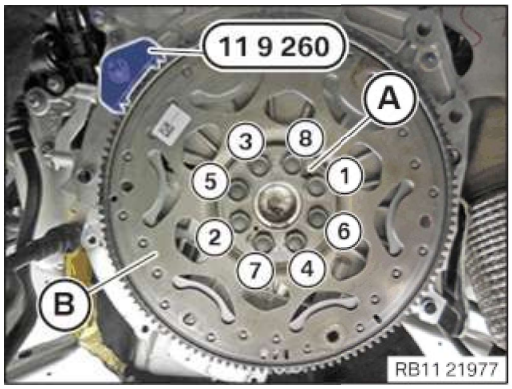
- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

- Make sure that the screw-in depth (2) of the screw tap (1) is not exceeded.

  The thread cutter (1) may not rest on the timing chain (3).



- Make sure the magnet wheel (1) is installed correctly.



- Renew screws (1) to (8).

  Parts: Bolts
- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool 0 494 034 (11 9 261) and screw the special tool 0 494 130 (11 9 264) tightly.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten flywheel bolts in sequence (1) to (8).

Flywheel to crankshaft

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

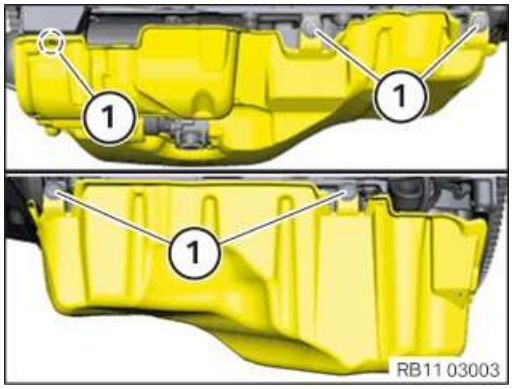
- Remove special tool 0 493 938 (11 9 260).

43 – Installing the acoustic cover for the oil sump

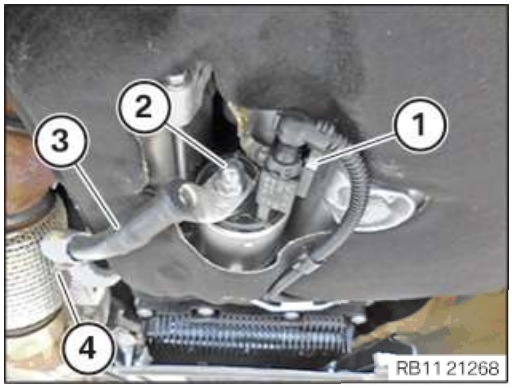


- Install acoustic cover (1) to the top front.

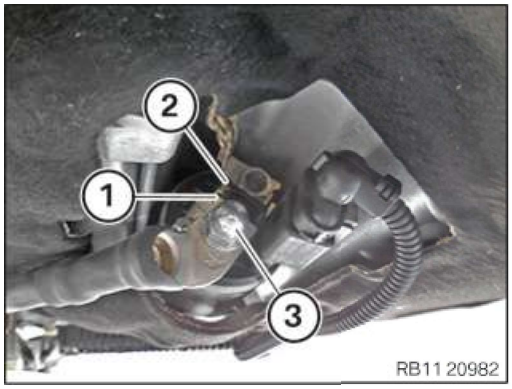
carflag1.com



- Secure all expanding rivets (1).



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.
- Insert and install the positive battery cable (3).
- Secure positive battery cable (3) at the clamp (4).
- Tighten the nut (2) hand-tight.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

44 – Block the crankshaft in he TDC firing position of cylinder 1



RISK OF DAMAGE

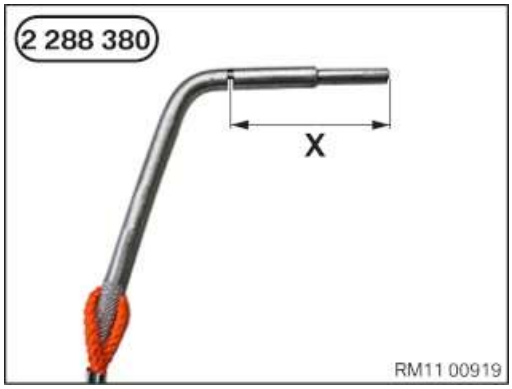
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

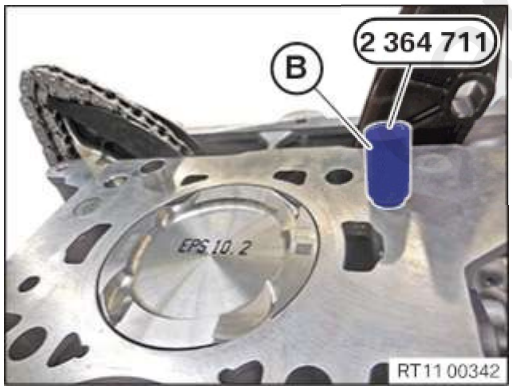


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

45 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

46 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

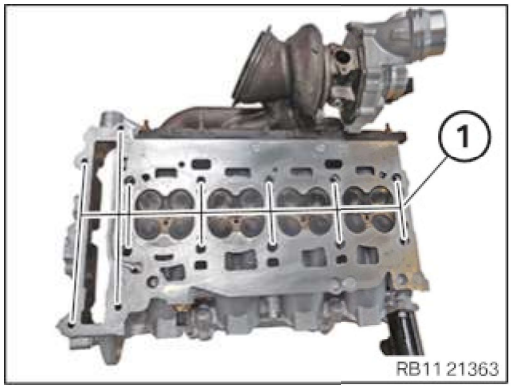
- Do not use any metal-cutting tools.



- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.

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CAUTION

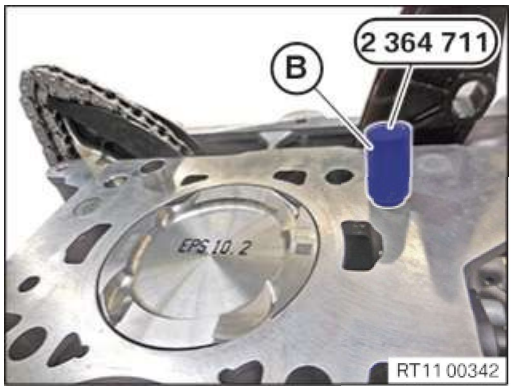
Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

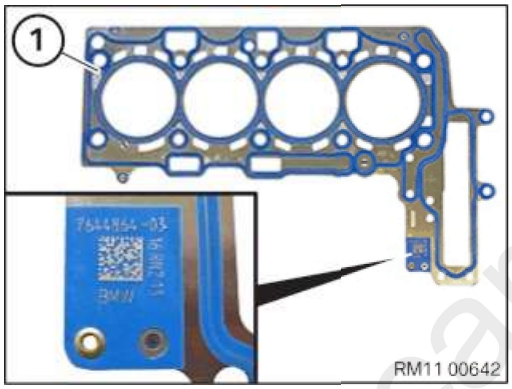
- Wear safety goggles.

- Clean all the threaded holes in the **marked** area of the crankcase with compressed air.



- Remove special tool (B) contained in the set of special tools 2 364 711.

47 – Renewing the cylinder head gasket



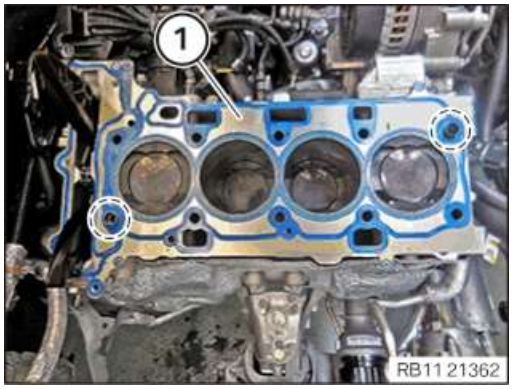
- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional thicker gasket 0.3 mm is available for service personnel.



- Check fitting sleeves (1) in the **marked** area for damage and, if necessary, renew them.

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- Guide cylinder head gasket (1) into the **marked** area and install it.

48 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

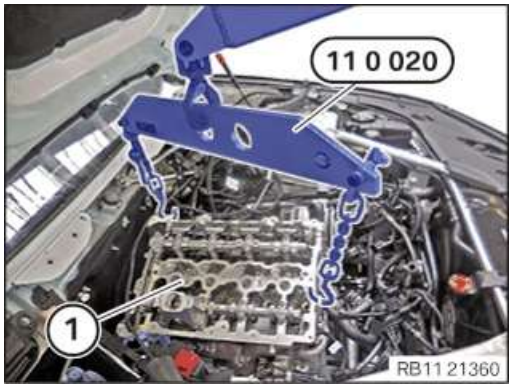
- Dry threaded holes (e.g. using compressed air).

TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



RISK OF DAMAGE

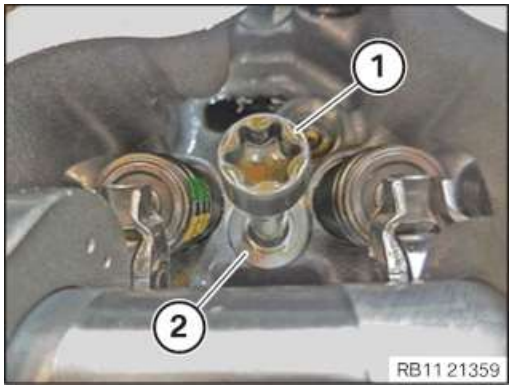
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

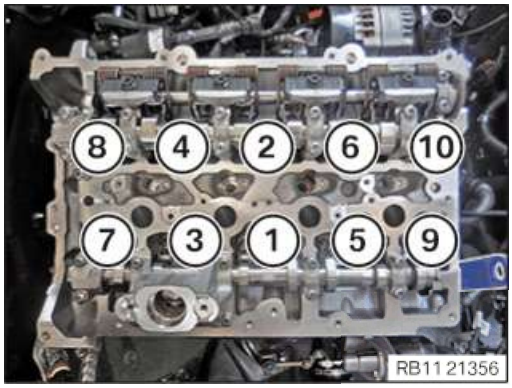
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- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of engine block.
- Guide in and install cylinder head bolts (1).



TECHNICAL INFORMATION

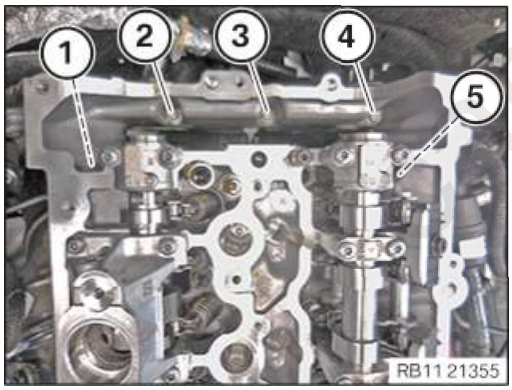
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °



- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

Cylinder head bolt to timing case cover

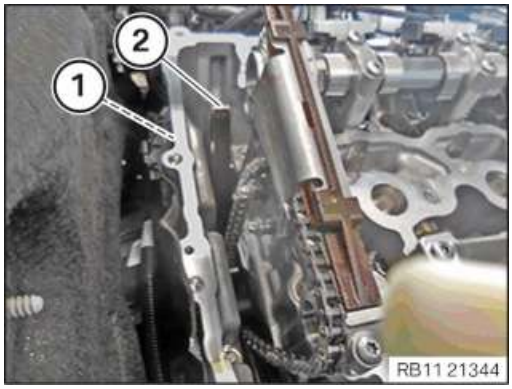
M8x40	Renew screws.	Tightening torque	19 Nm



- Renew bearing journal (1).

  Parts: Bearing journal

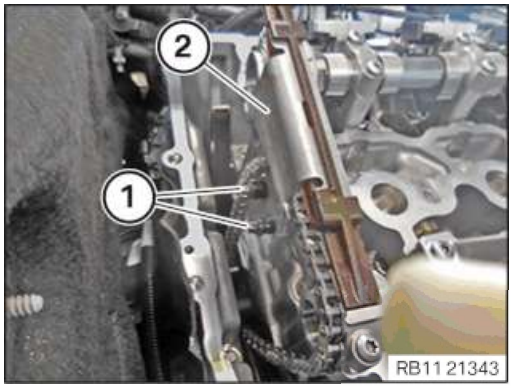
tdiagn.com



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

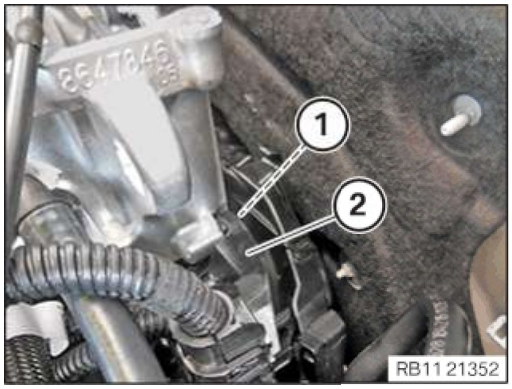
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

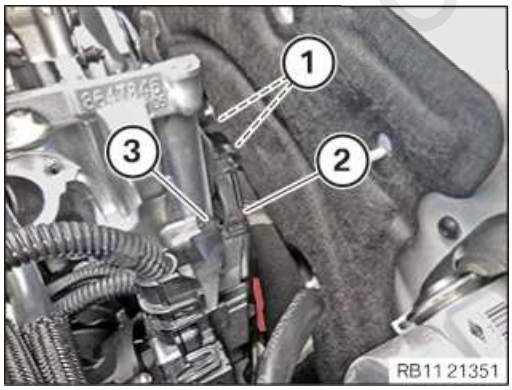
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

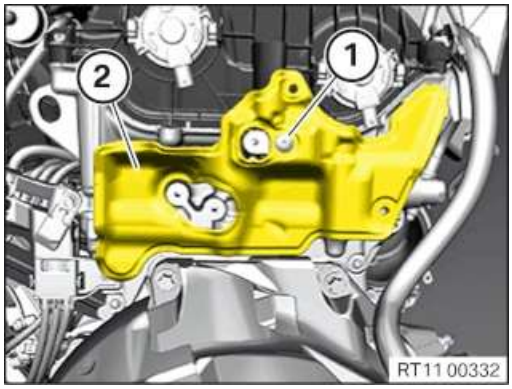
- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm

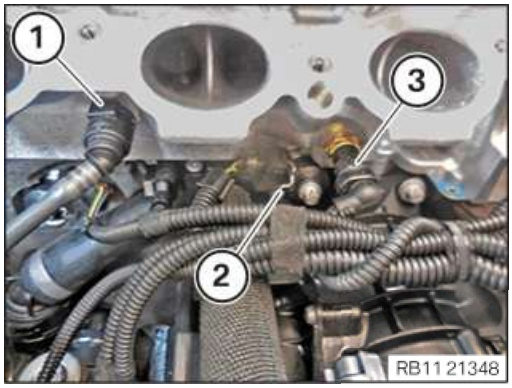
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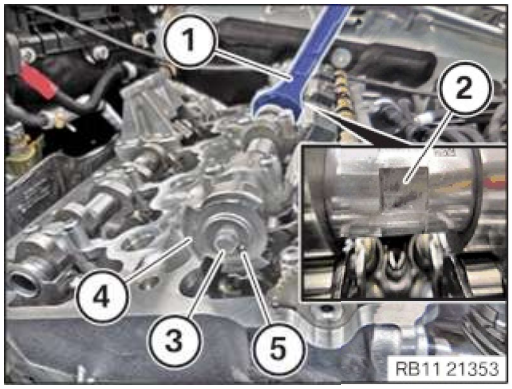
- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



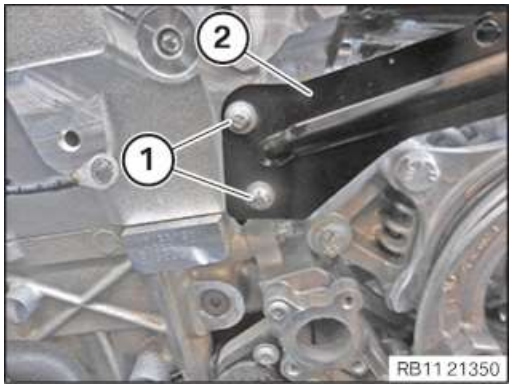
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

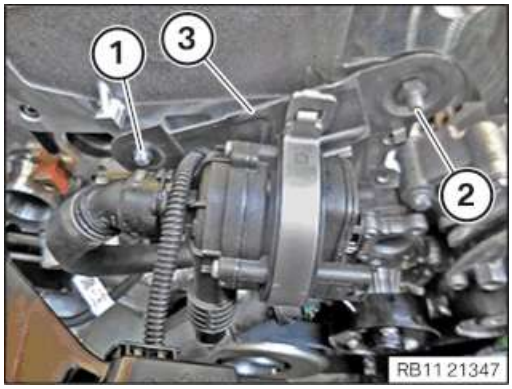


- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm

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- Insert and position the holders (3).
- Tighten down screws (1) and (2).

Holder for electrical auxiliary coolant pump on cylinder head

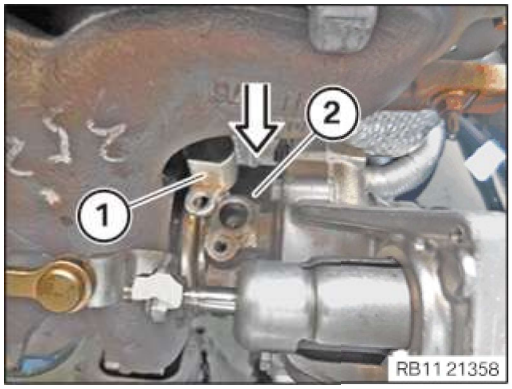
M6		Tightening torque	7 Nm



- Thread in ground cable (2) and install.
- Tighten nut (1).

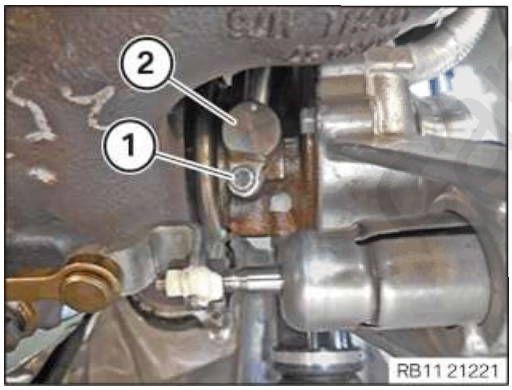
Standard screw connection M6

M6		8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

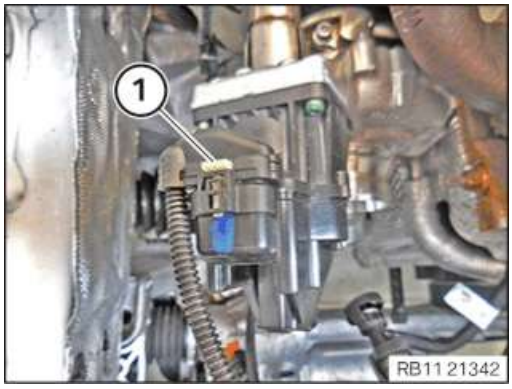
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm



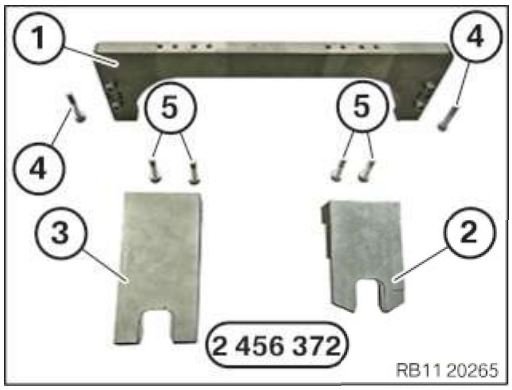
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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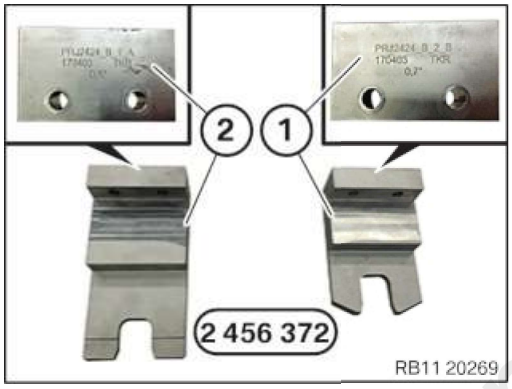
- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

49 – Adjust the camshafts with the special tool

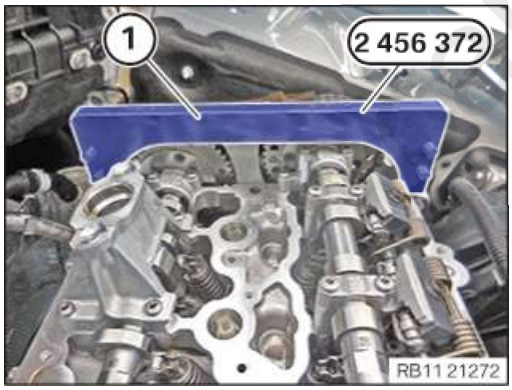


- Overview of the set of special tools 2 456 372:

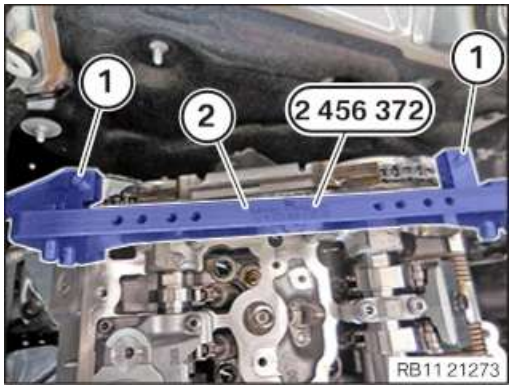
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



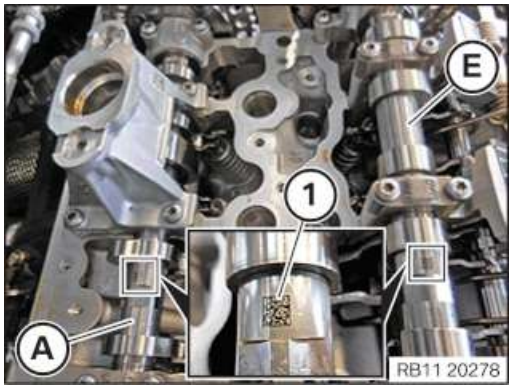
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



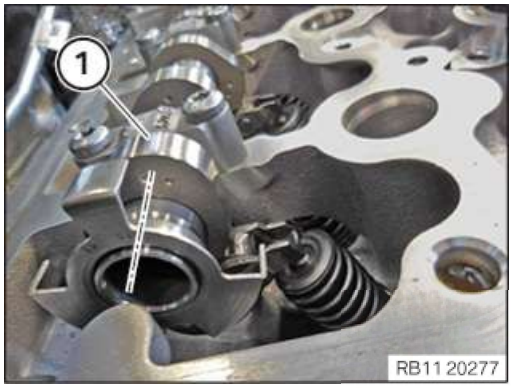
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

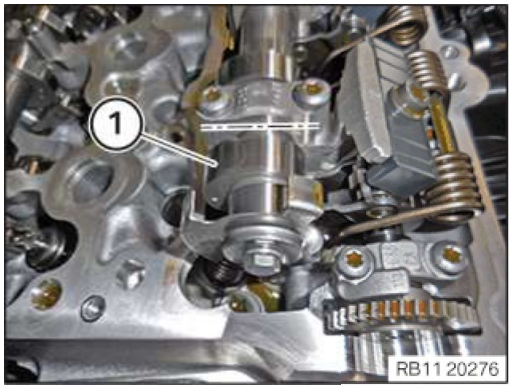
M6		Tightening torque	8 Nm



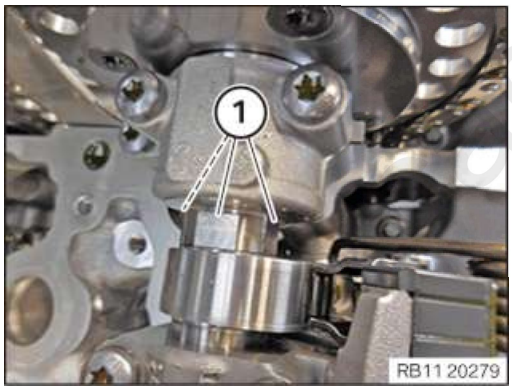
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



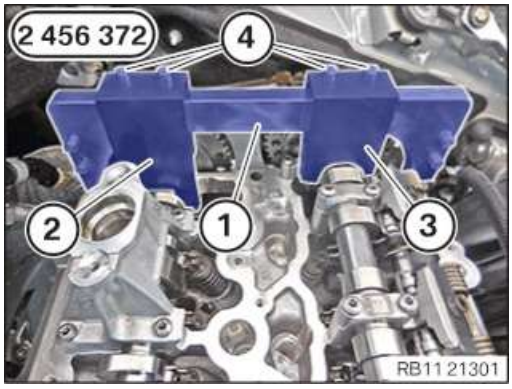
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

50 – Install exhaust camshaft adjuster

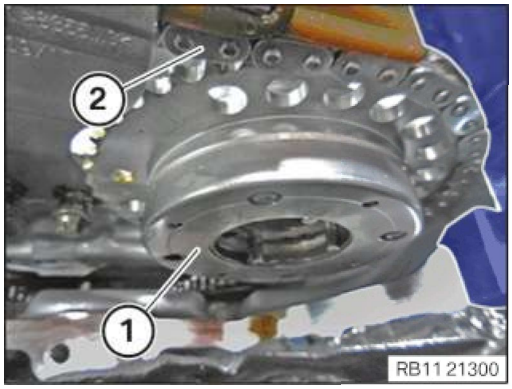
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NOTICE

The figure shows the rear side of the engine.



- Keep exhaust camshaft adjuster (1) marked EX ready.



- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

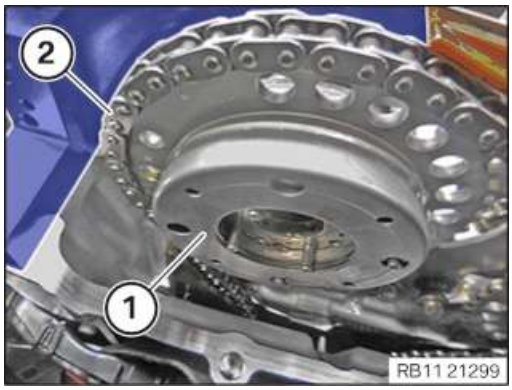
51 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.



- Keep intake adjuster (1) marked IN ready.

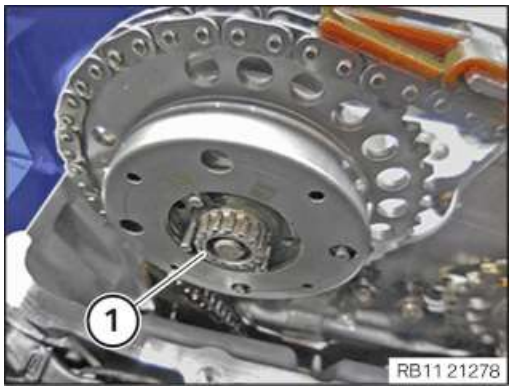


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

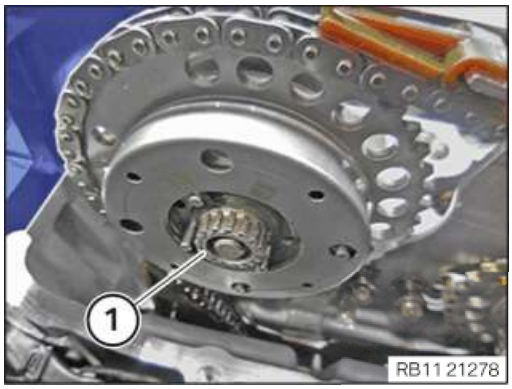
52 – Install the VANOS central valve of the intake adjuster

cardiagn.com

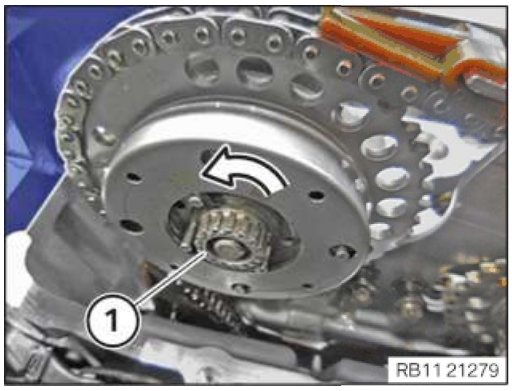
– Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.

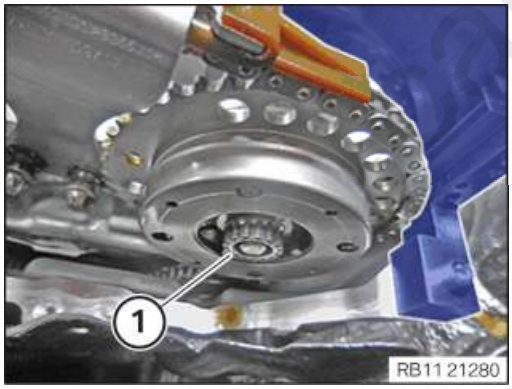


- Hand-tighten the VANOS central valve (1) of the intake adjuster.

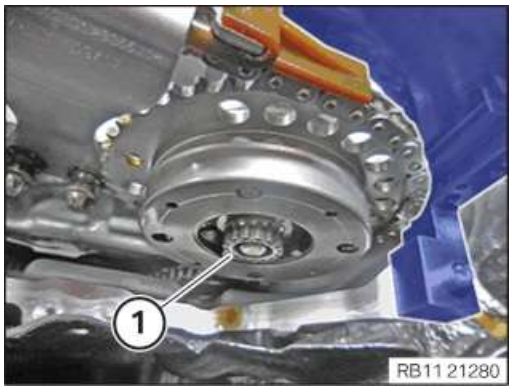


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

53 – Installing the VANOS central valve of the exhaust camshaft adjuster

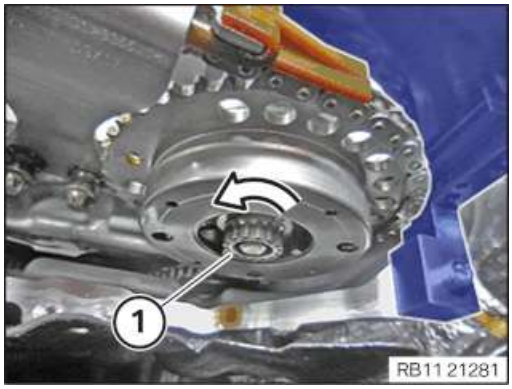


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



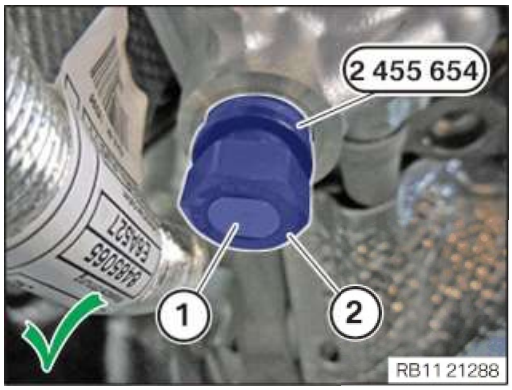
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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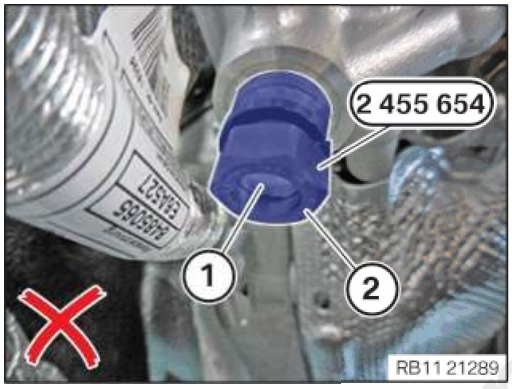
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

54 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

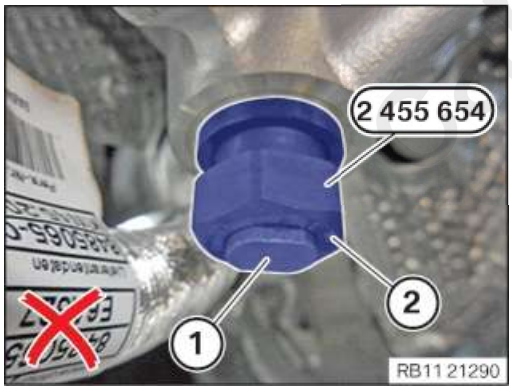
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

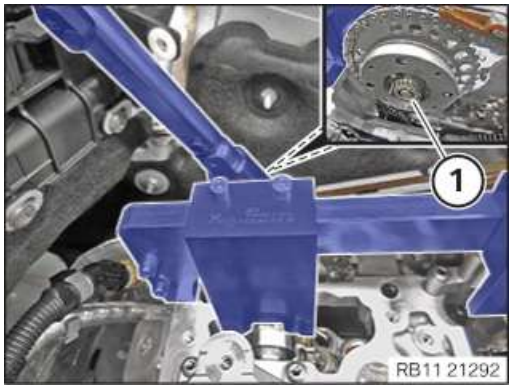
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

55 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

56 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

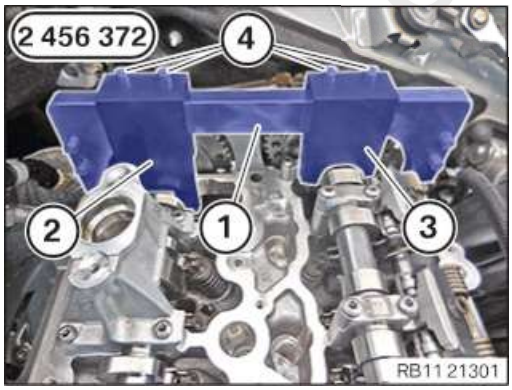


- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

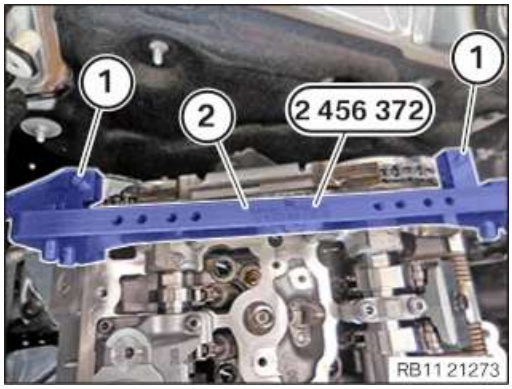
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

57 – Disassembling all special tools

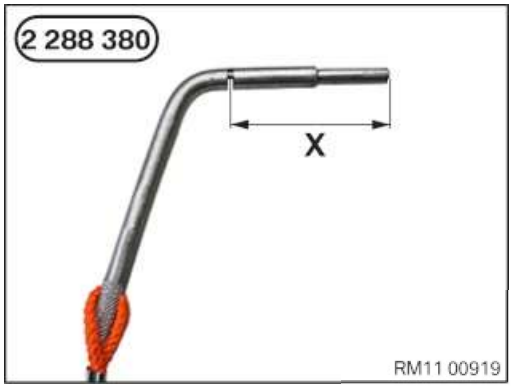


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

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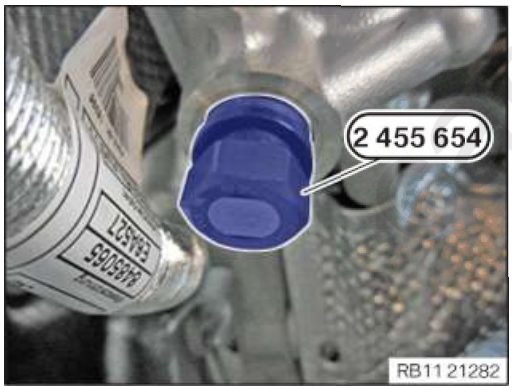
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

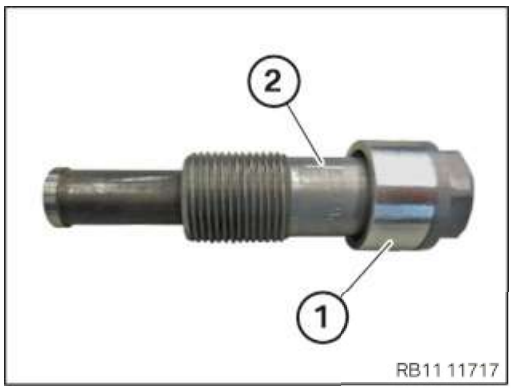
58 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

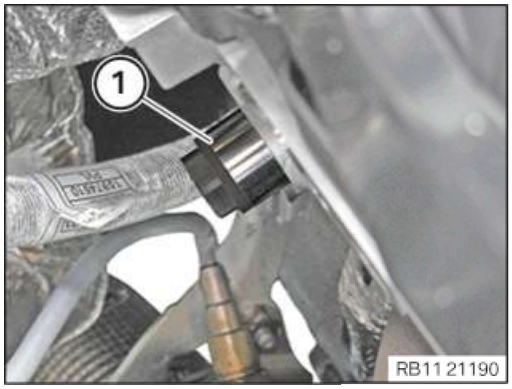


- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

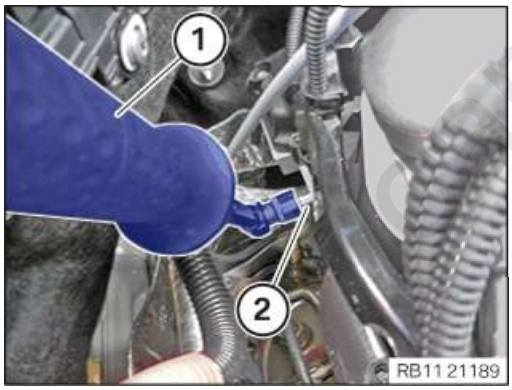


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

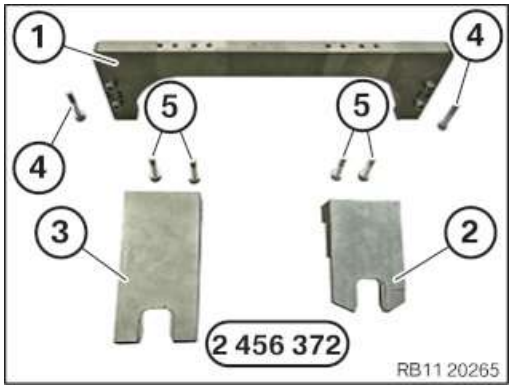


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

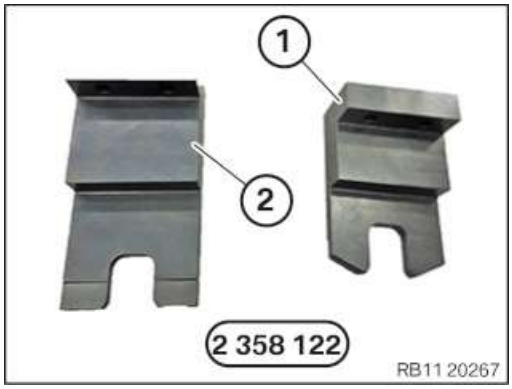
59 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



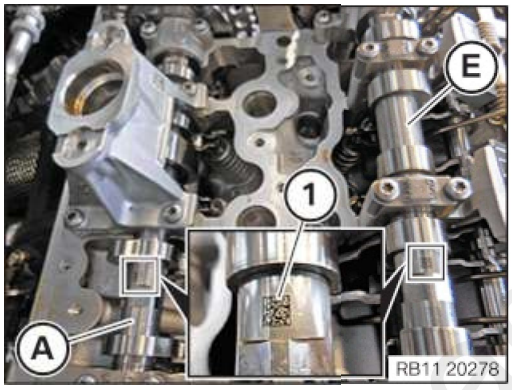
RISK OF DAMAGE

Damage to the engine.

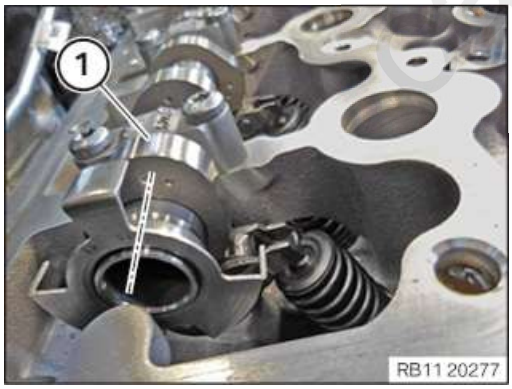
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

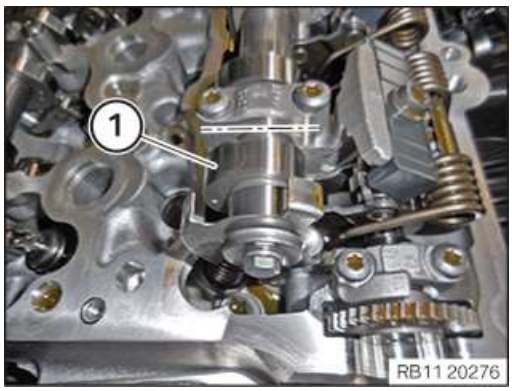
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.

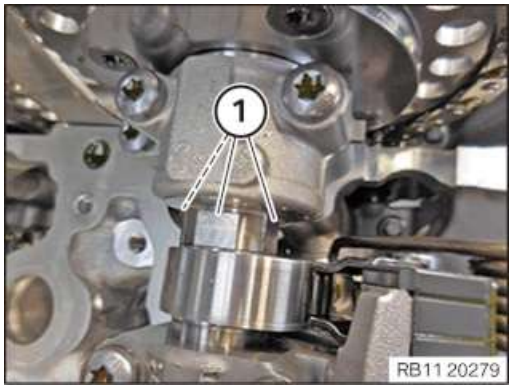


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

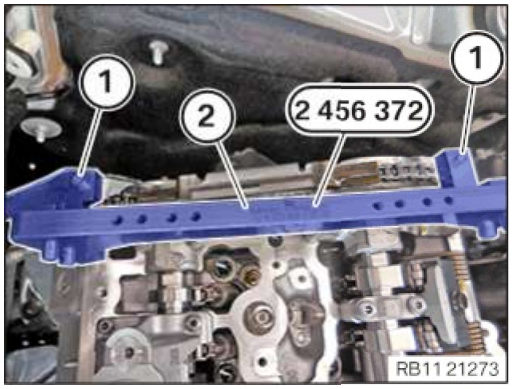
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- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



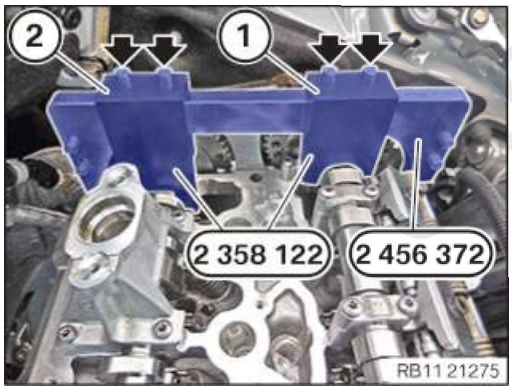
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

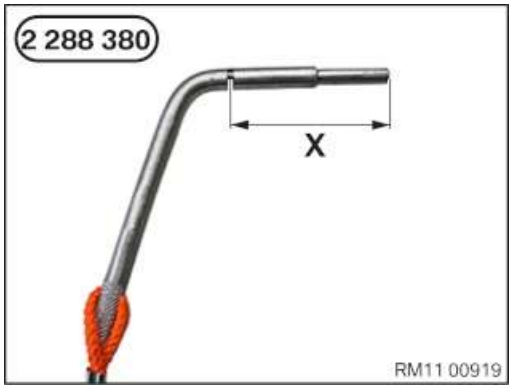
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

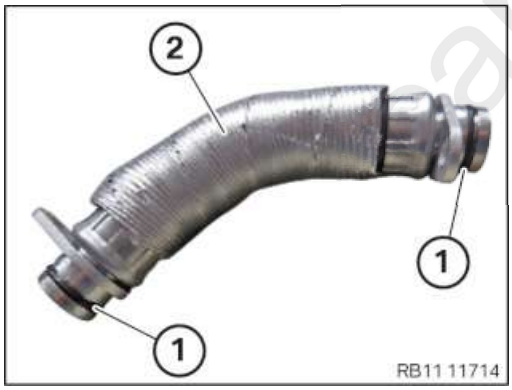


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

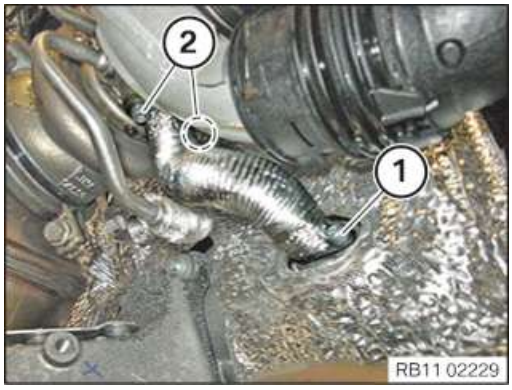
  The engine **is in the** TDC firing position of cylinder 1.

60 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

Oil return line to exhaust turbocharger/crankcase

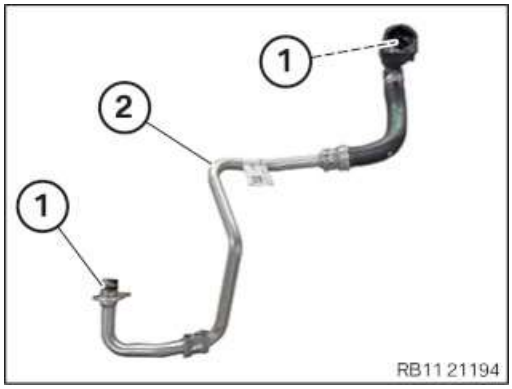
M6x14		Tightening torque	8 Nm

61 – Install the coolant return line for the exhaust turbocharger

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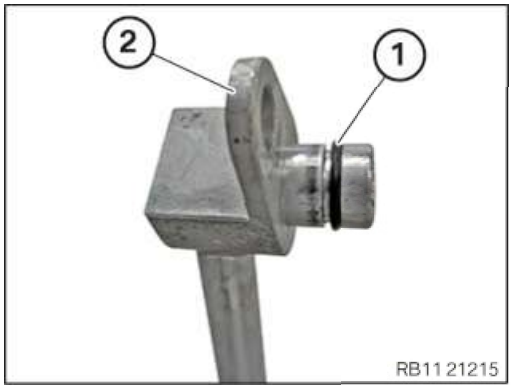
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



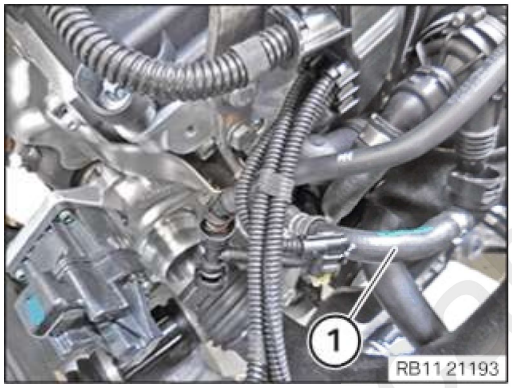
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-ring

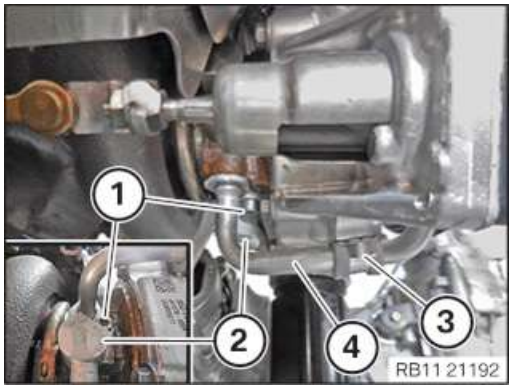


- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.

.com



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

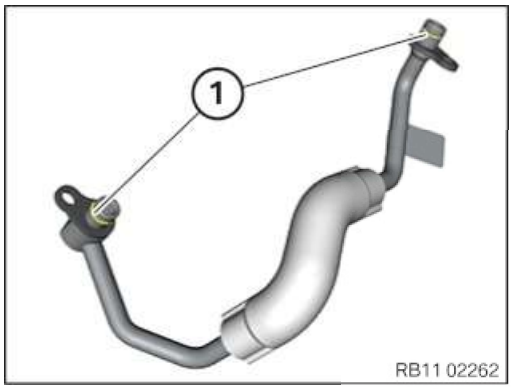
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

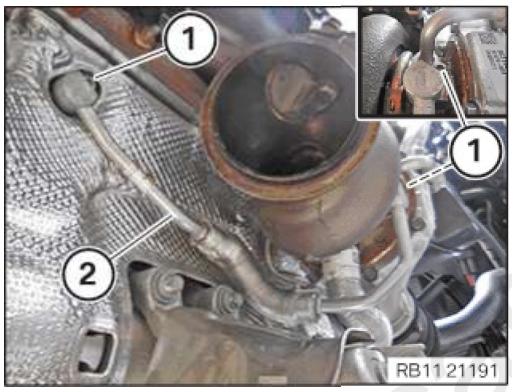
M6		Tightening torque	8 Nm

62 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

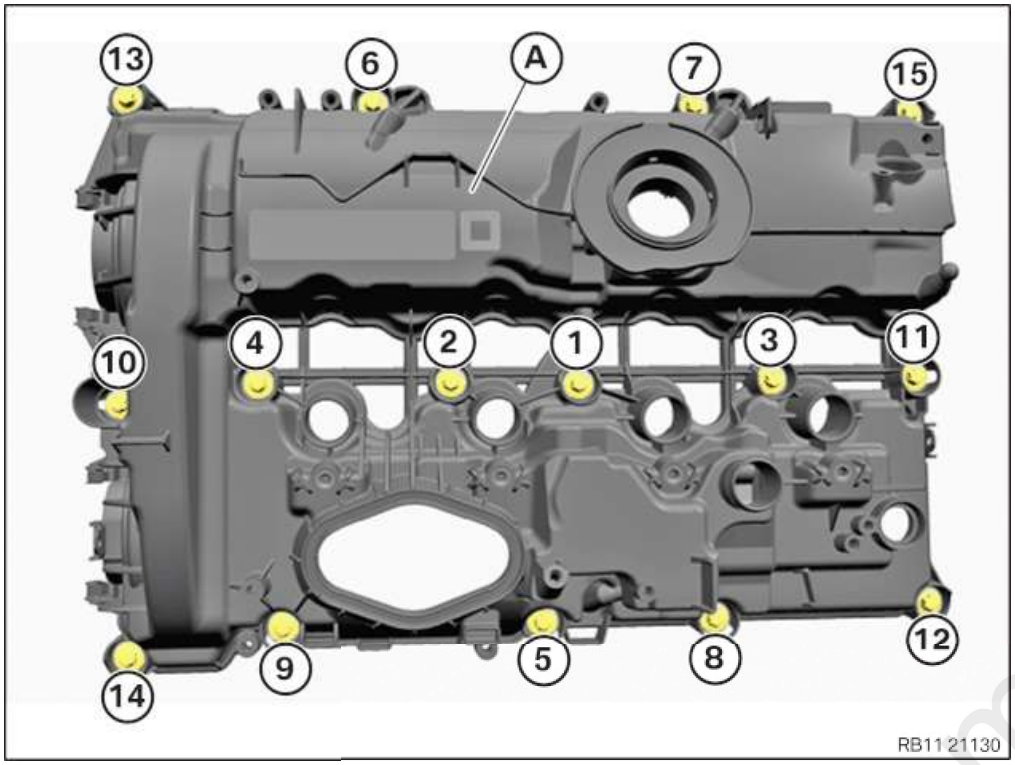
Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

63 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

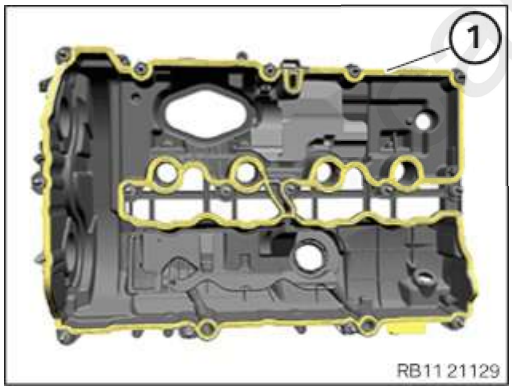
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

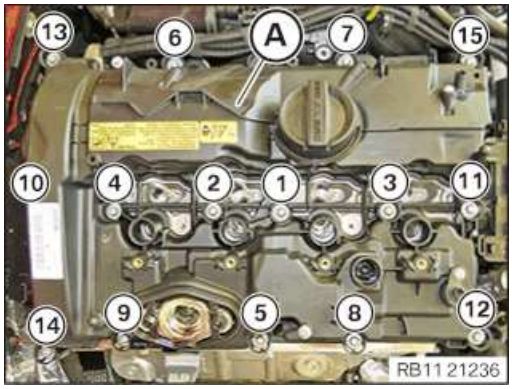
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).

erdiagn.com



TECHNICAL INFORMATION

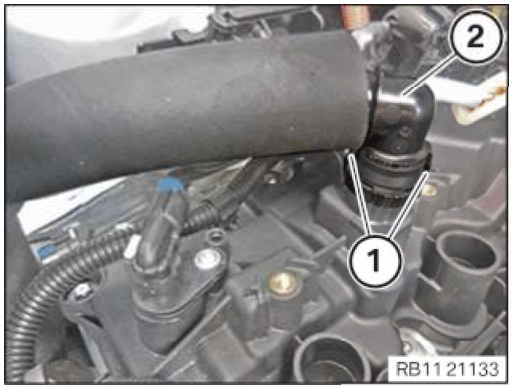
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

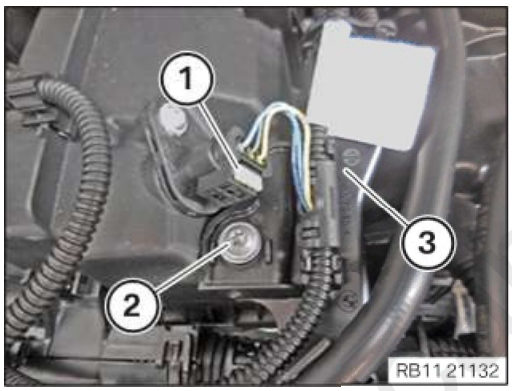
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

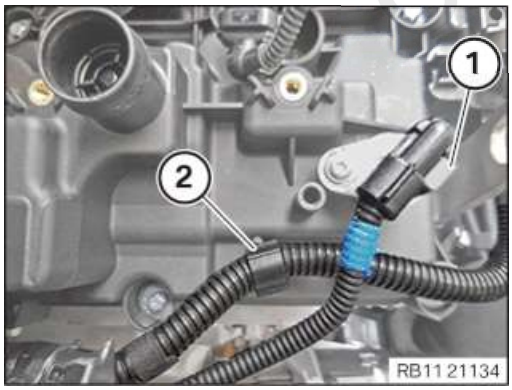


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

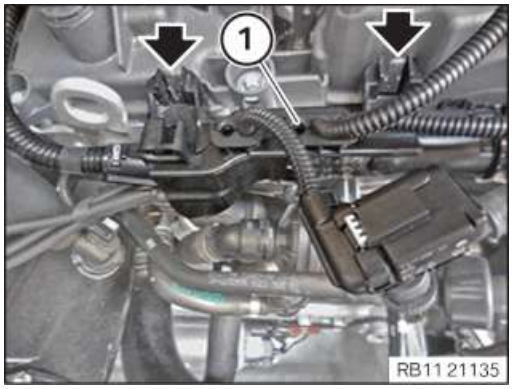
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

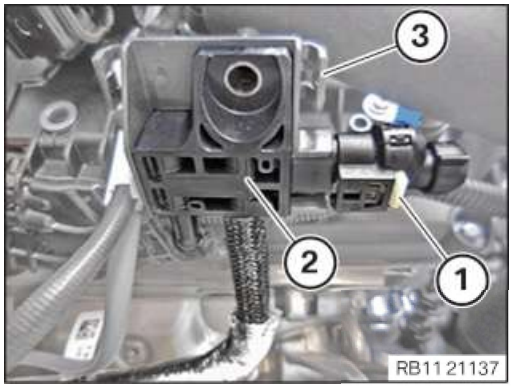


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

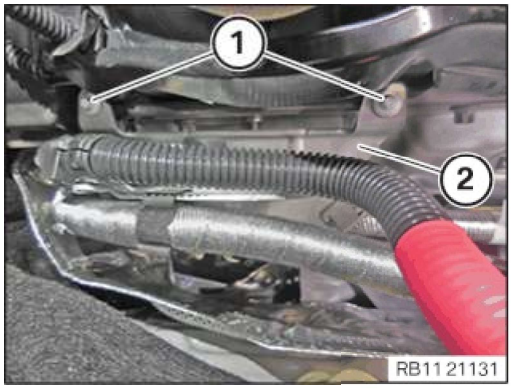
mdiagn.com



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

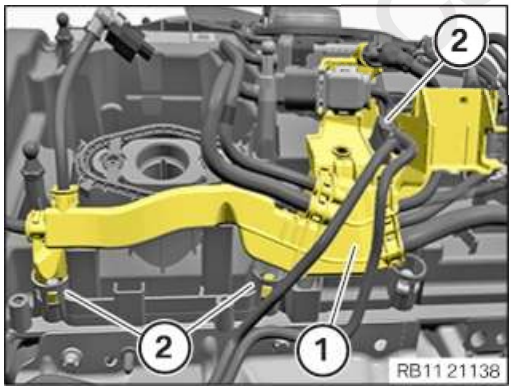
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

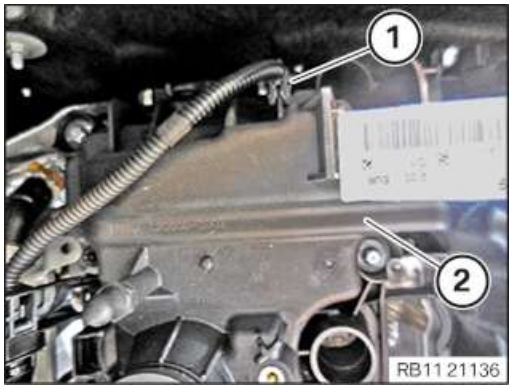
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

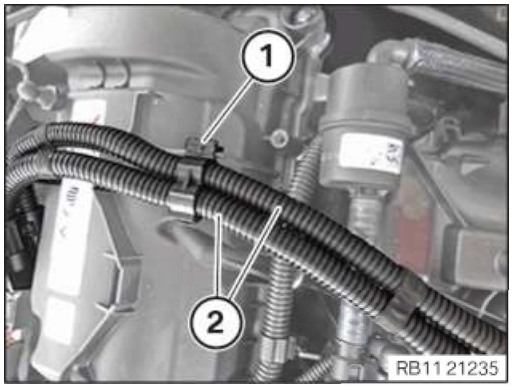


- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

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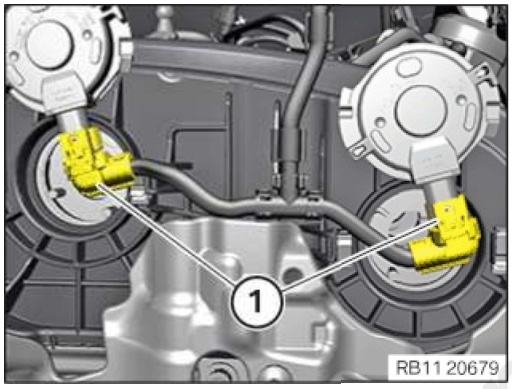


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

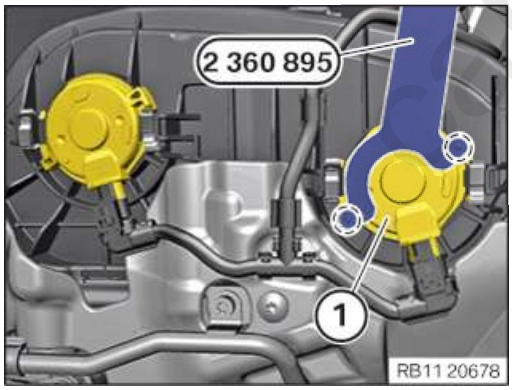
64 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

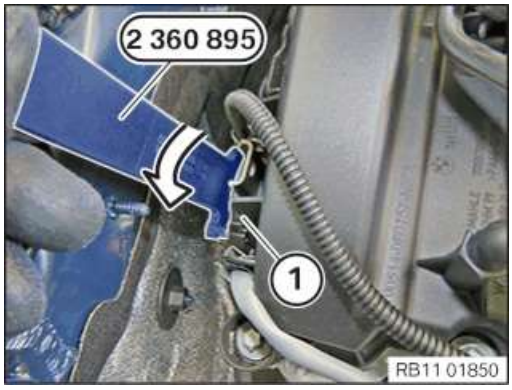
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



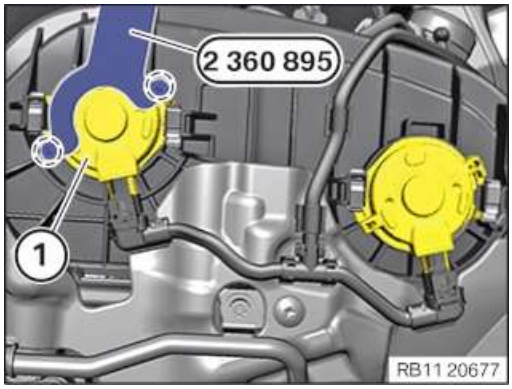
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



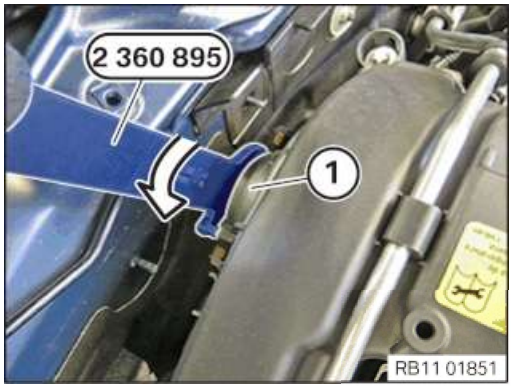
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

65 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

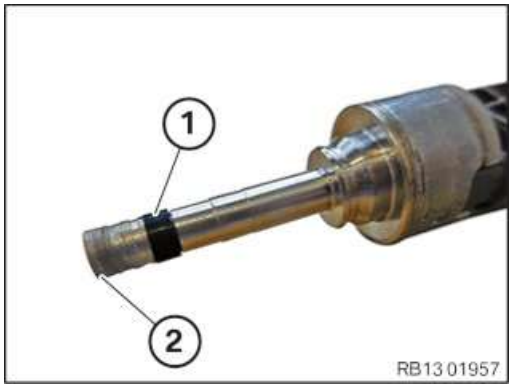
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.

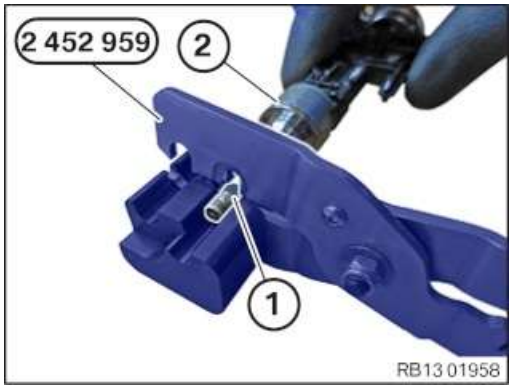


- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).

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- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

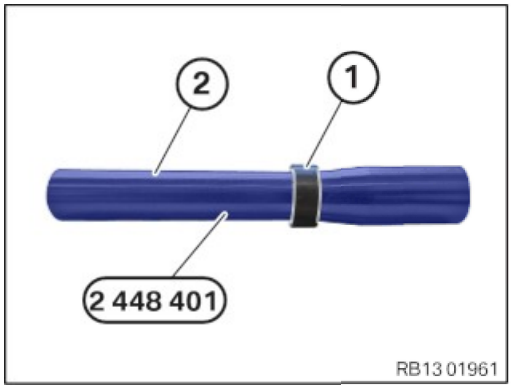


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

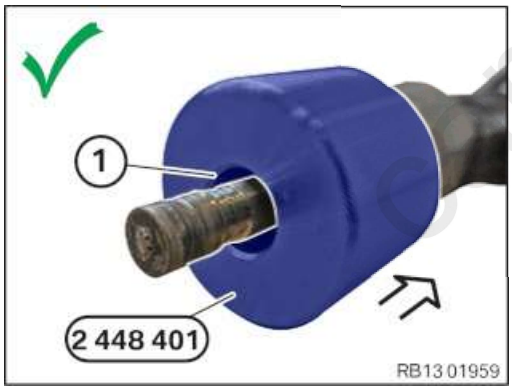
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

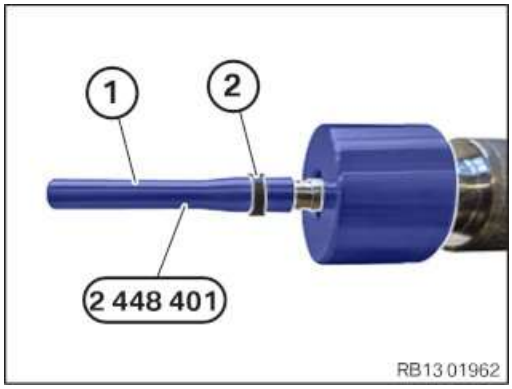
  The larger diameter of the assembly sleeve (1) must point to the injector tip.



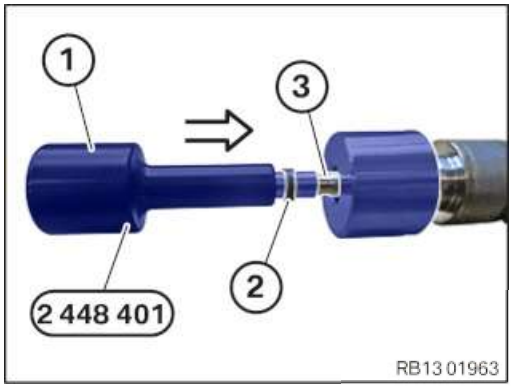
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

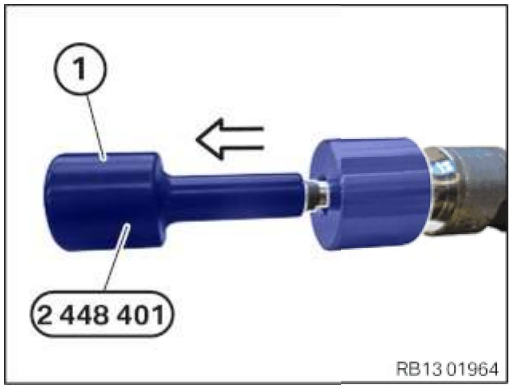
ardiagn.com



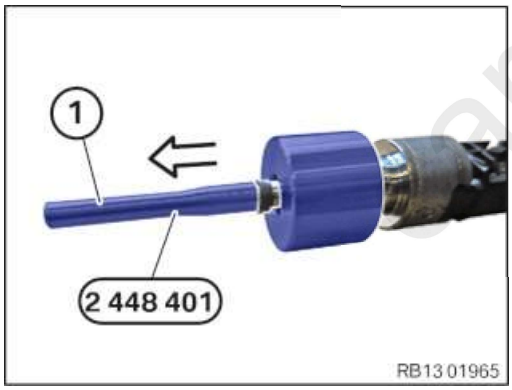
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



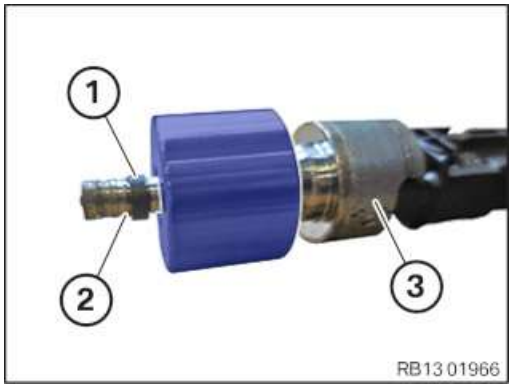
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

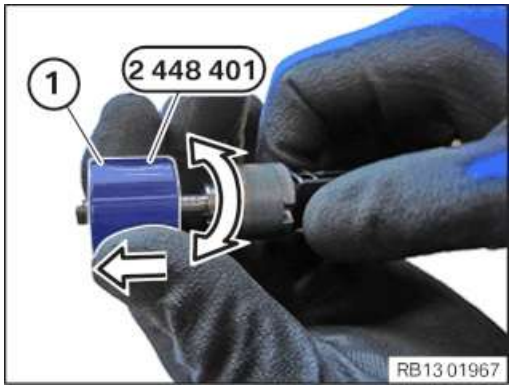


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



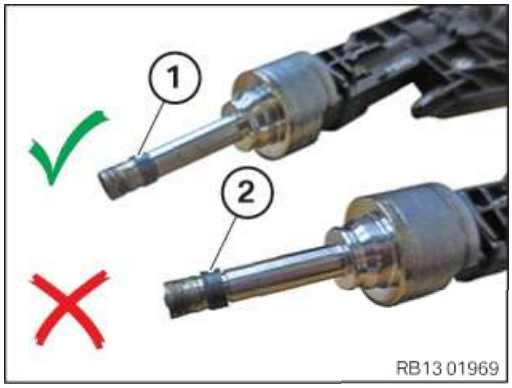
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

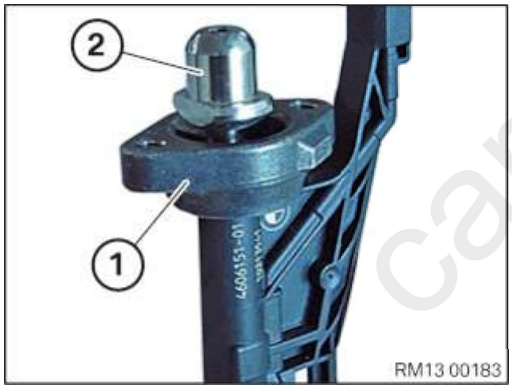


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

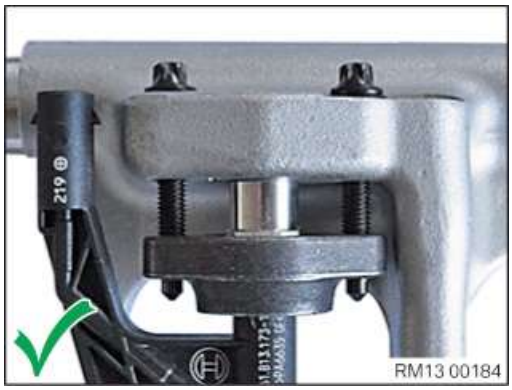
66 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



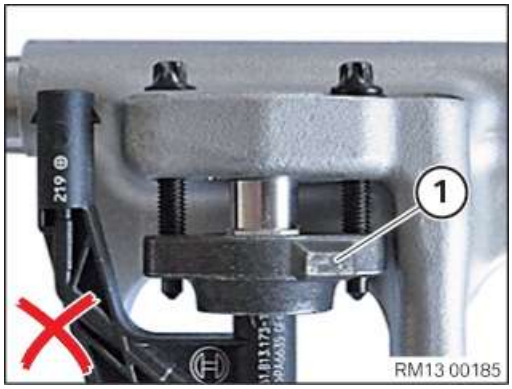
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

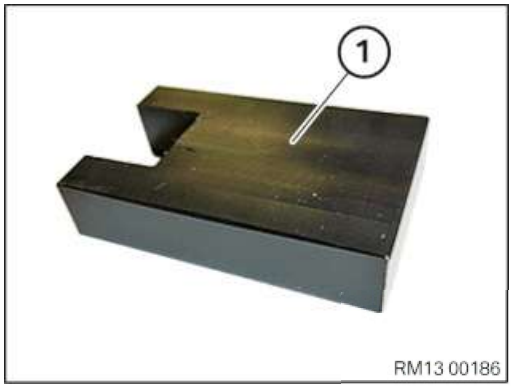
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



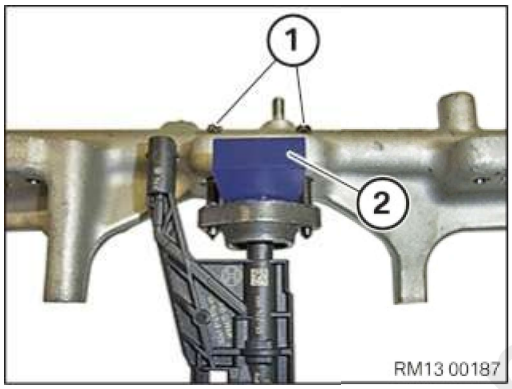
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



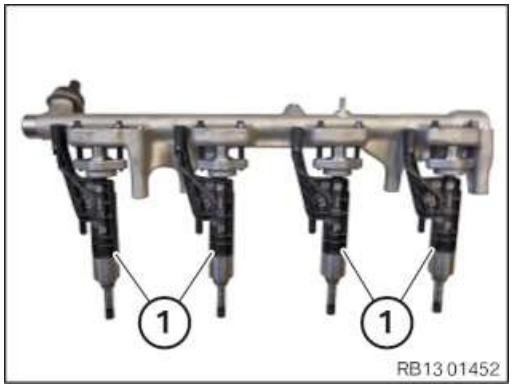
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

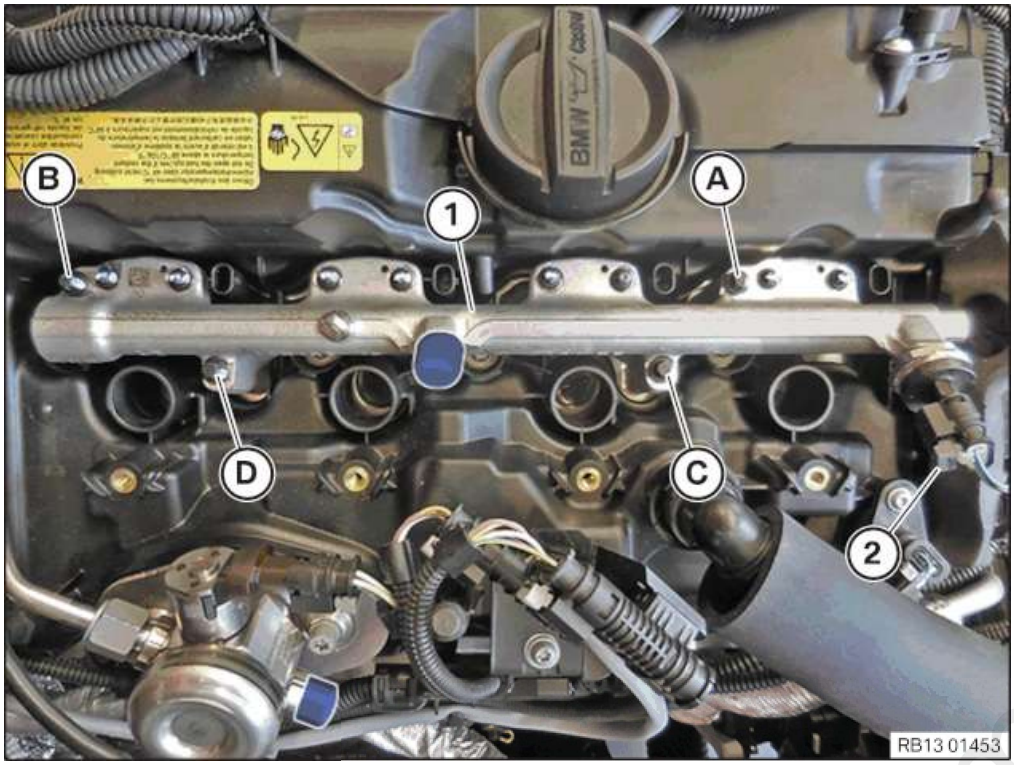


- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

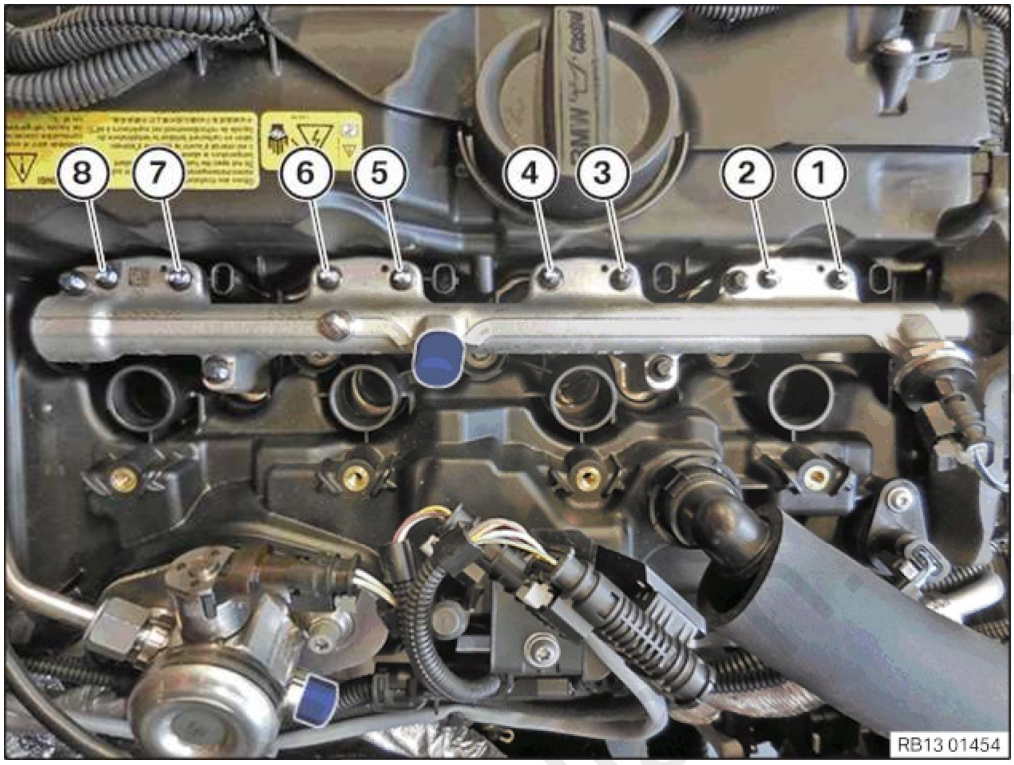
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.

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- Make sure that the rail (1) rests flat against the cylinder head.



- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

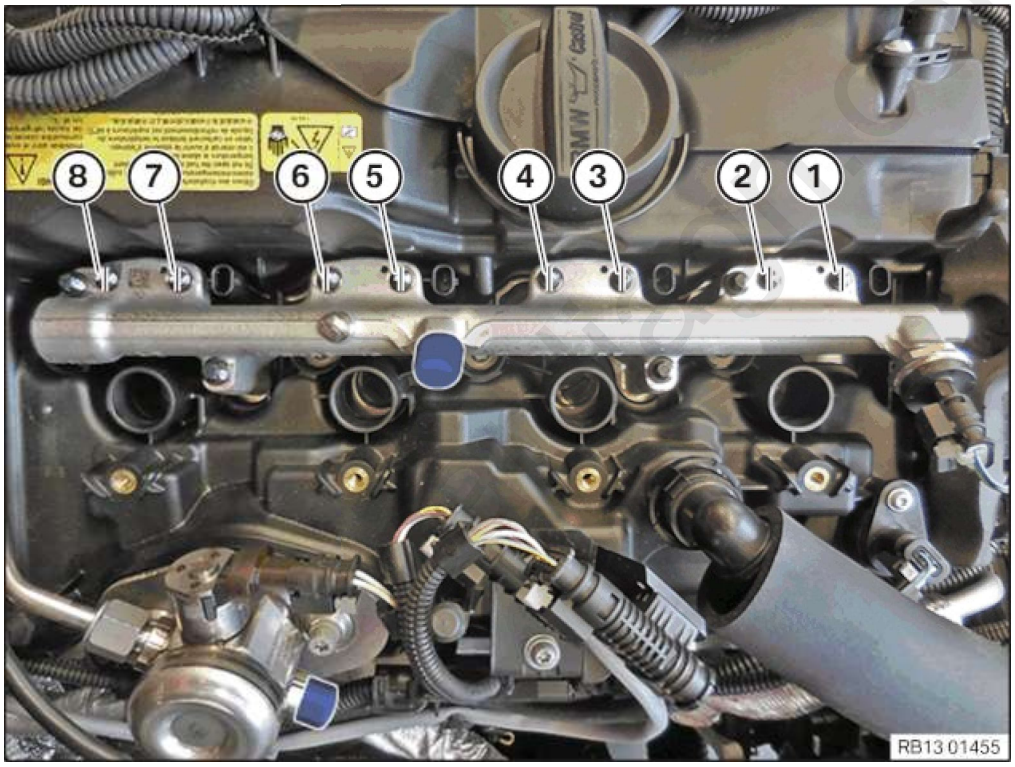
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

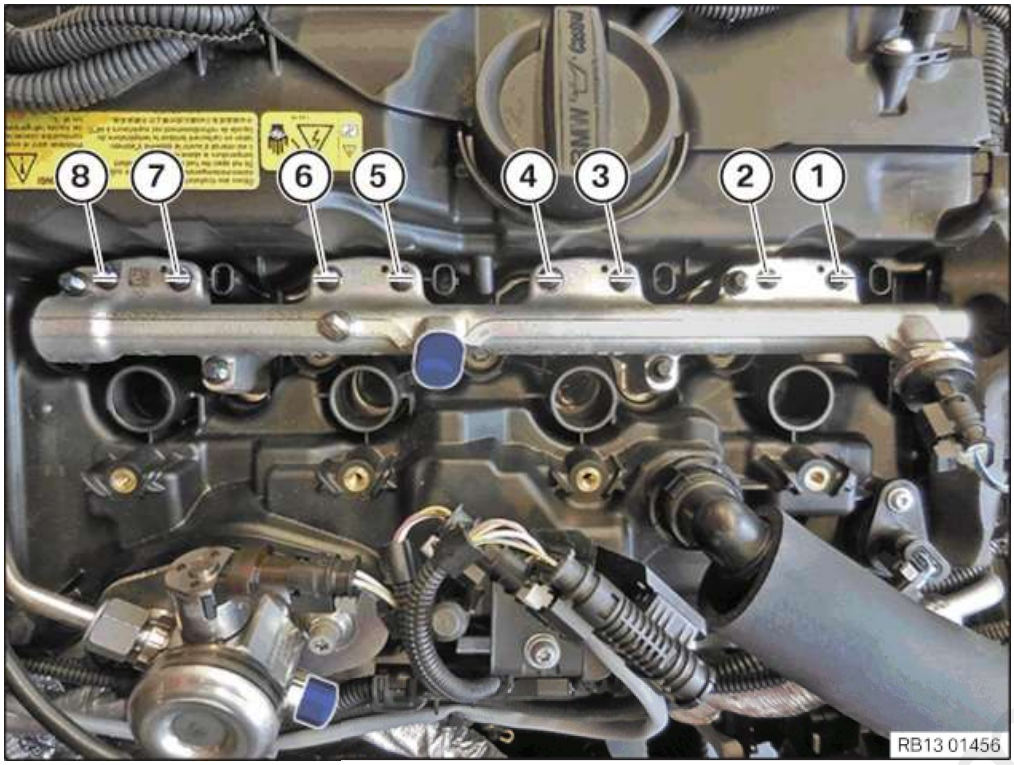
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.

- **Fuel injector 3:**
- Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
- **Fuel injector 4:**
- Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

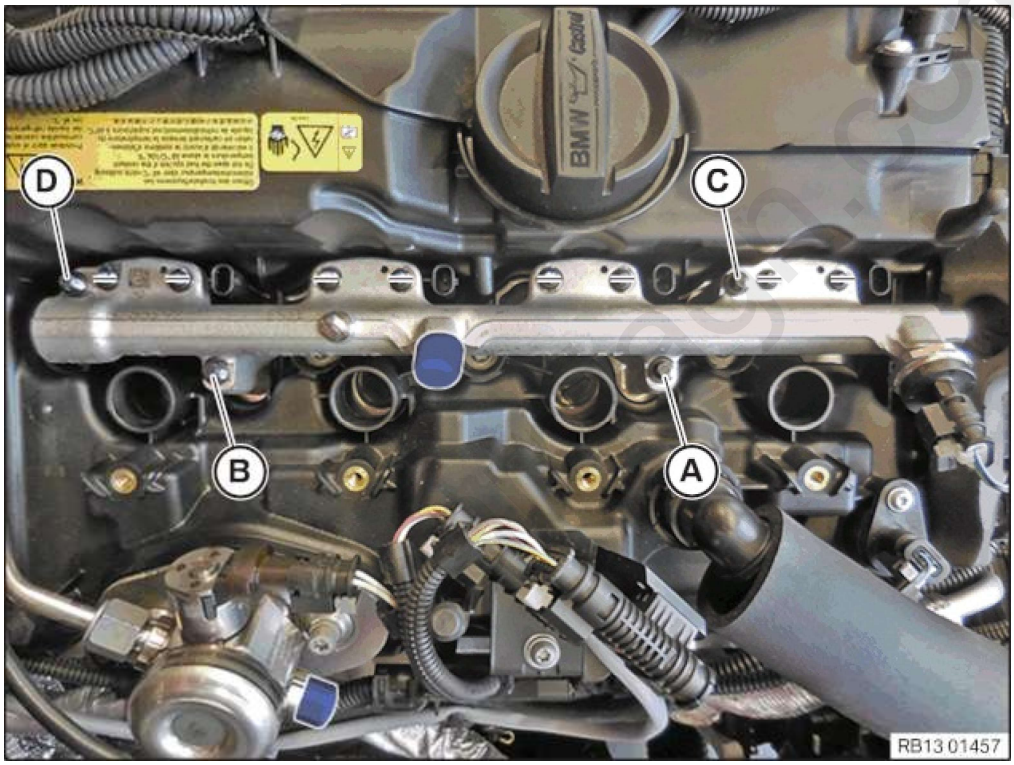


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

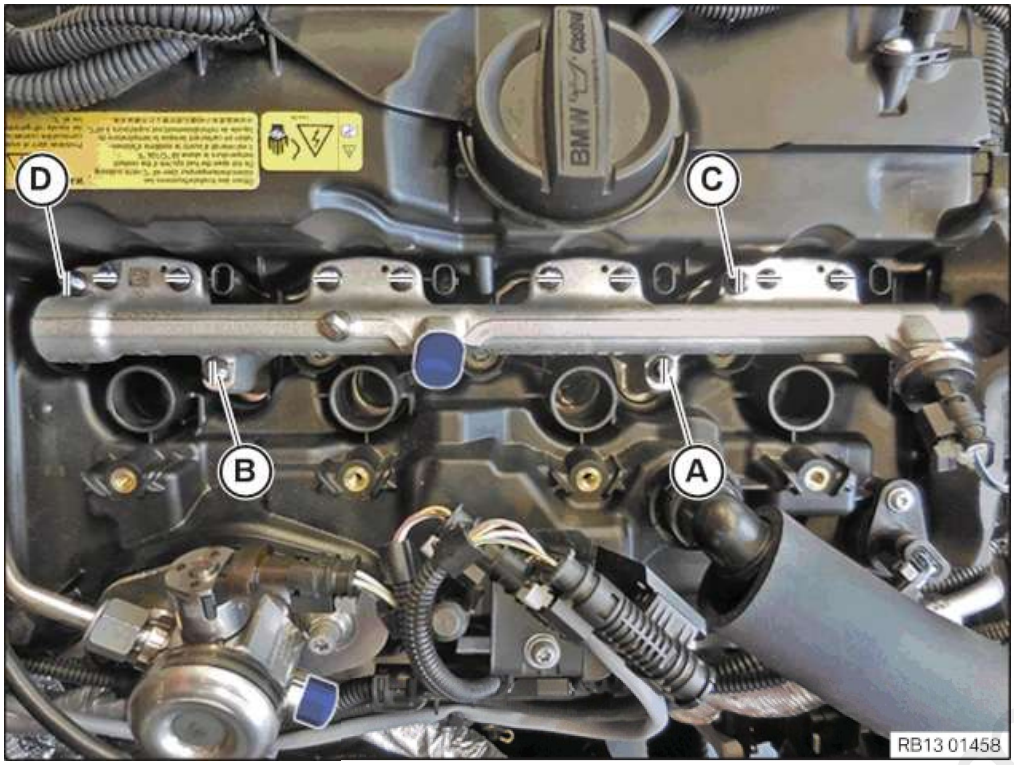
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

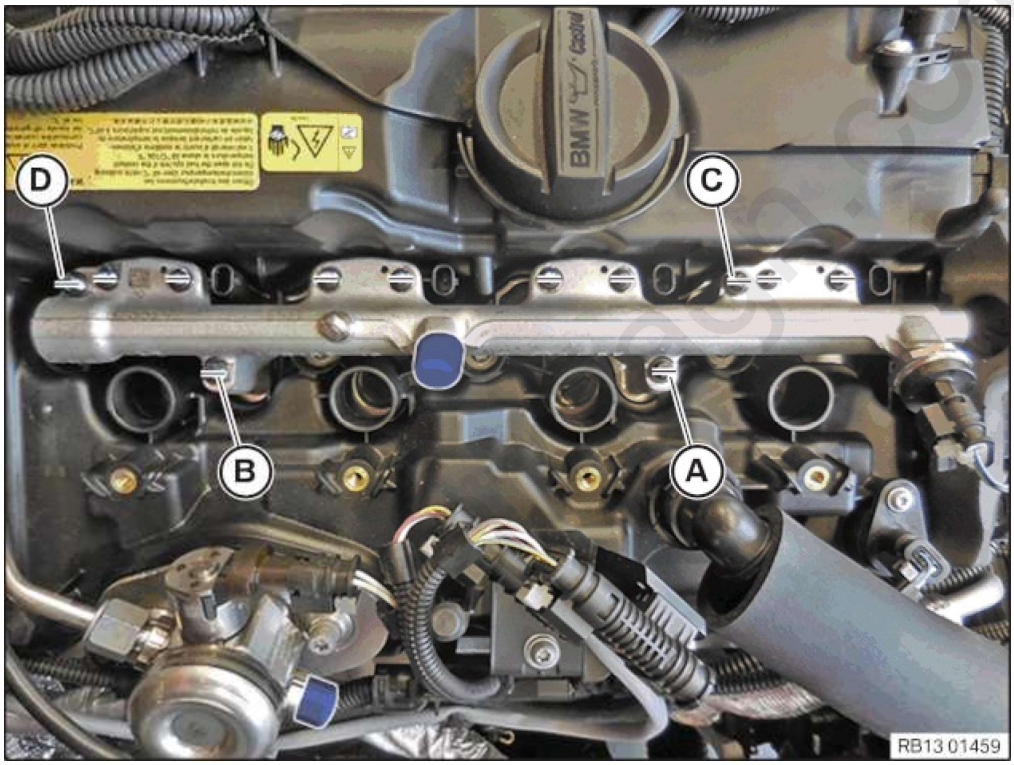
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

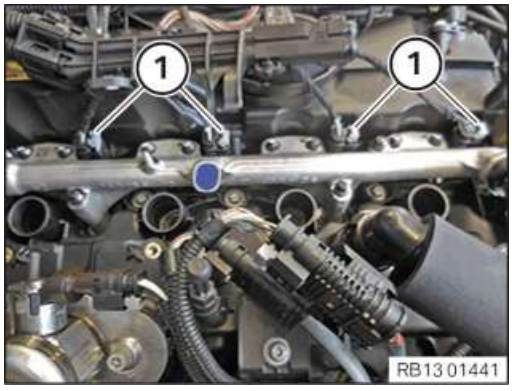


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



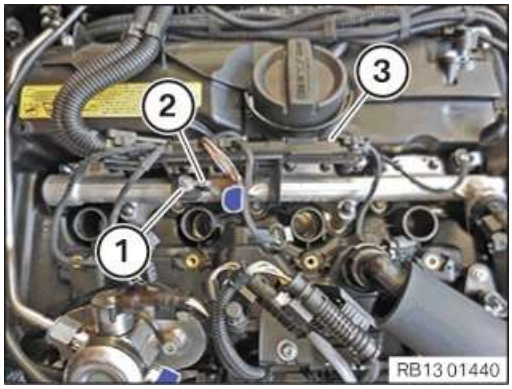
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

67 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

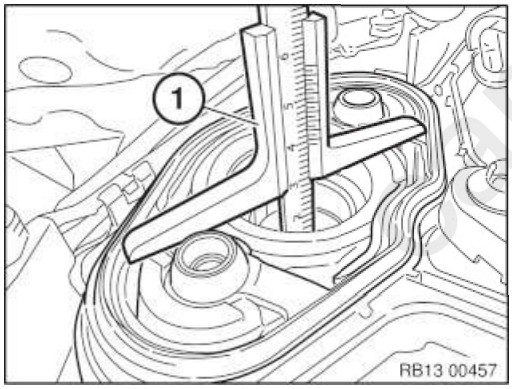
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

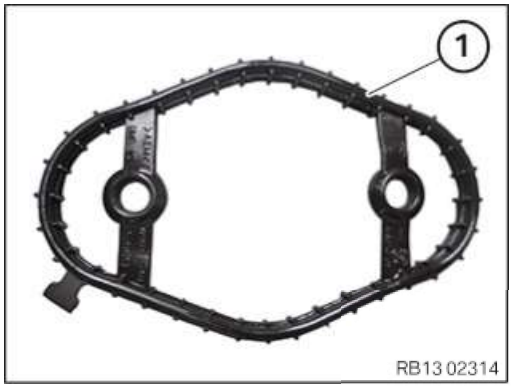
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



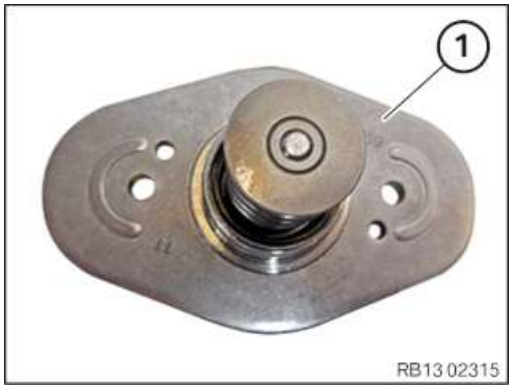
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

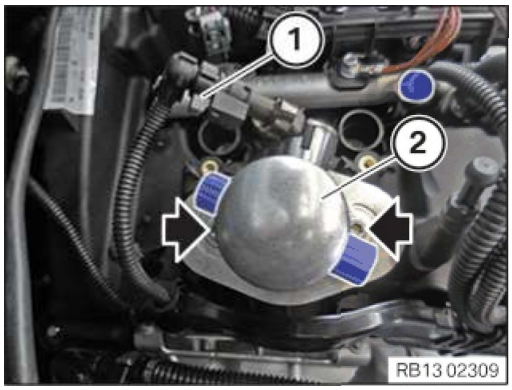
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

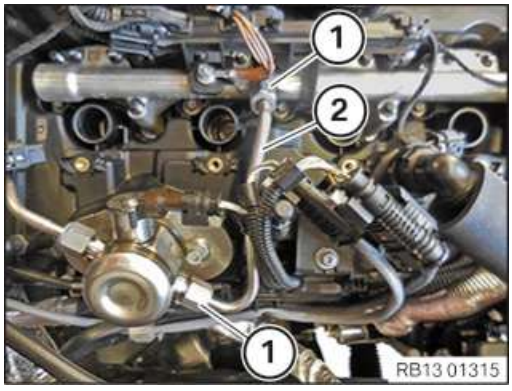
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

68 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

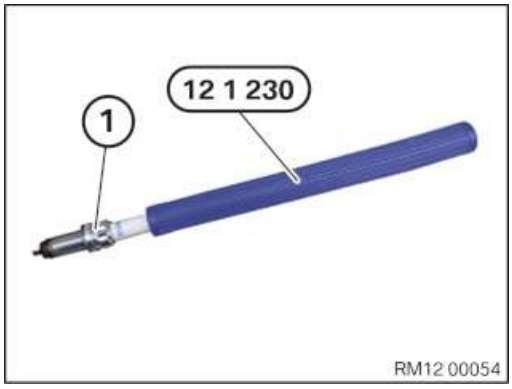
High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

69 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

M12x1.25		Tightening torque	23 Nm

70 – Installing the intake plenum

RISK OF DAMAGE

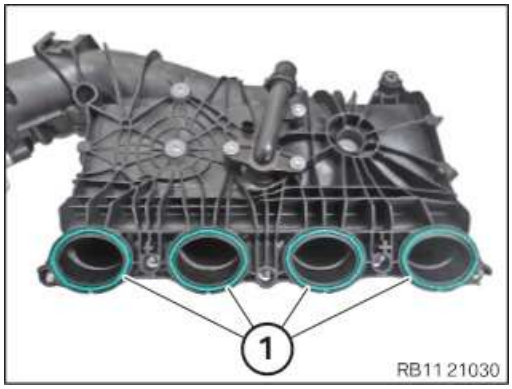
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

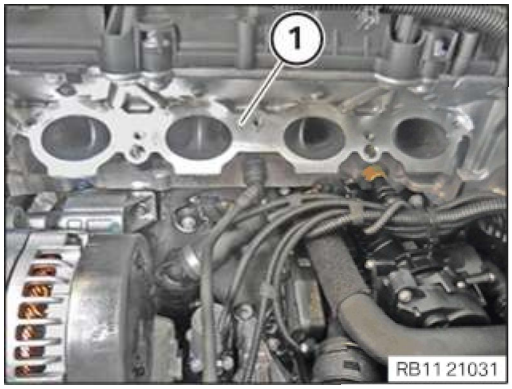
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

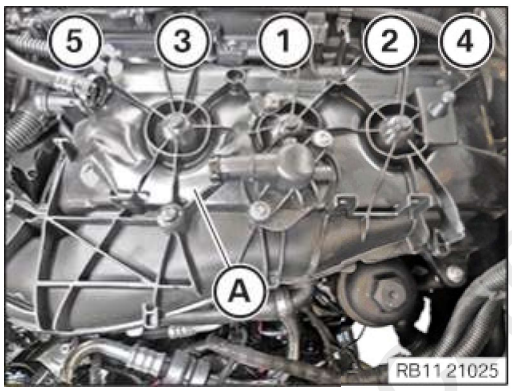


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

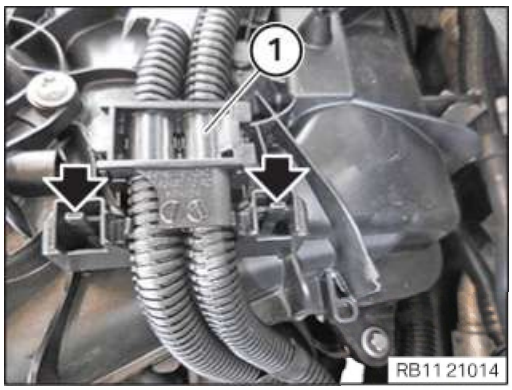
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- Tighten down screw (1).

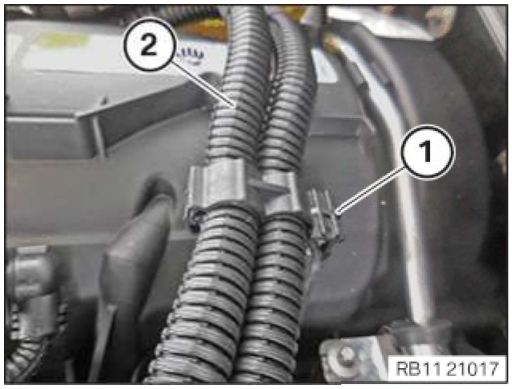
Intake plenum to support

M6X25		Tightening torque	8 Nm

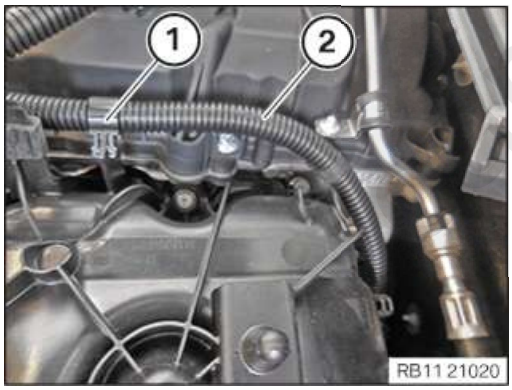


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

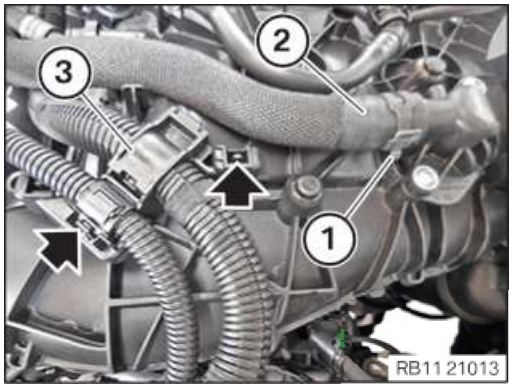
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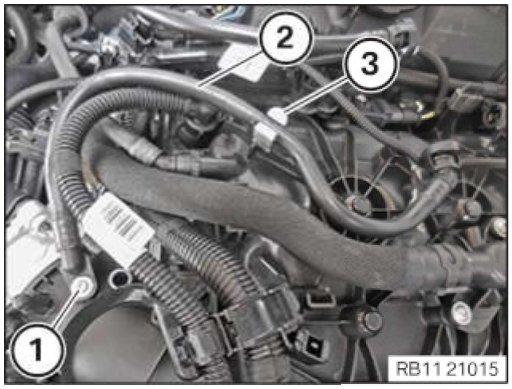
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



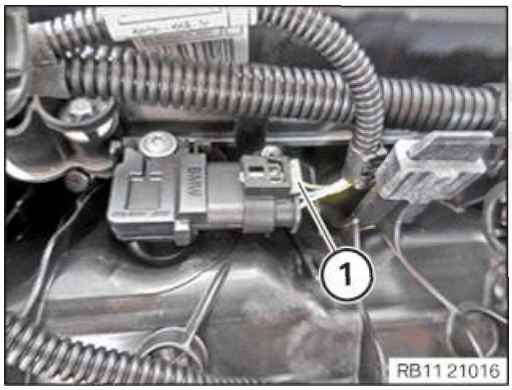
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

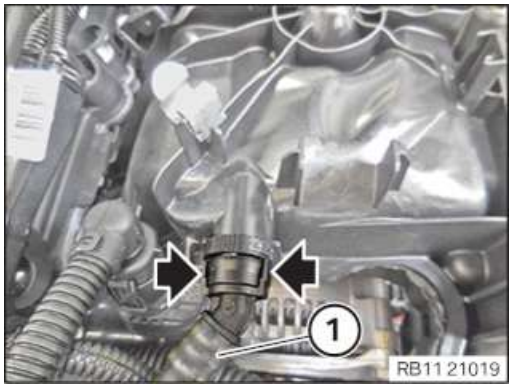
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

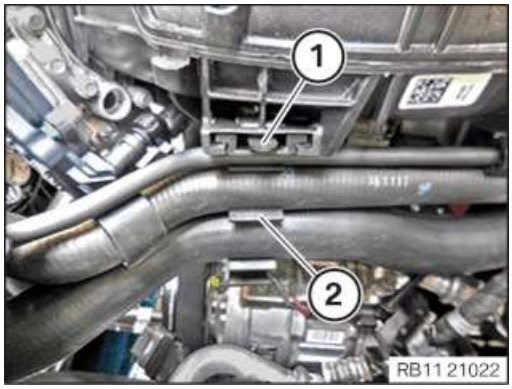
  The connector (1) must engage audibly.



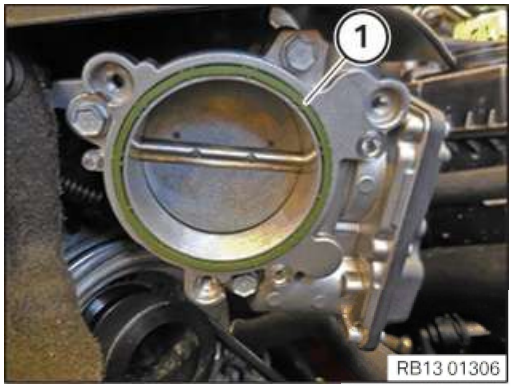
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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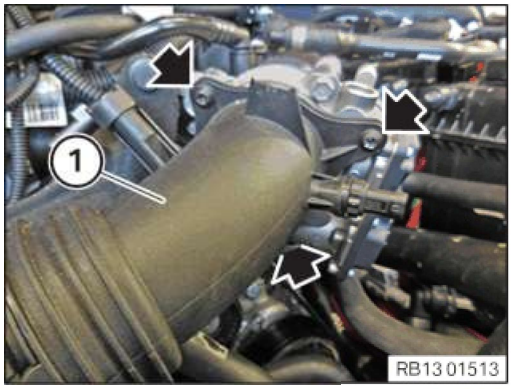


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

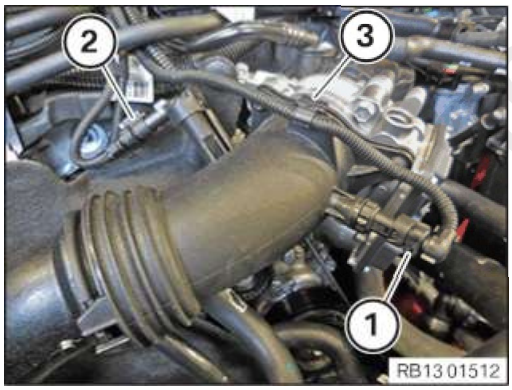
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

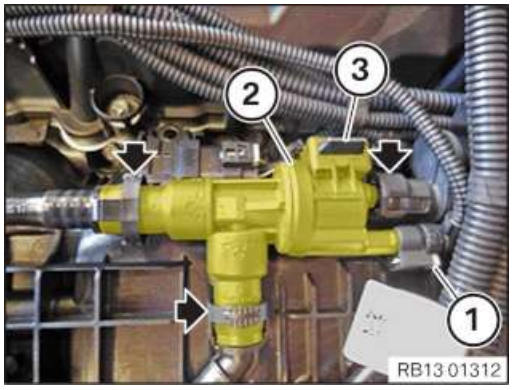
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

71 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

72 – Topping up the engine oil

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RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

TECHNICAL INFORMATION

- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

- Fill in engine oil at the oil filler neck.

Engine oil

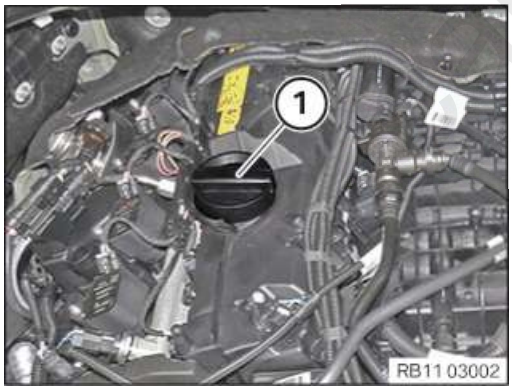
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

▸ **Installing the oil filler cap**

- Close oil filler cap (1).



73 – Remove the engine on an assembly stand

CAUTION

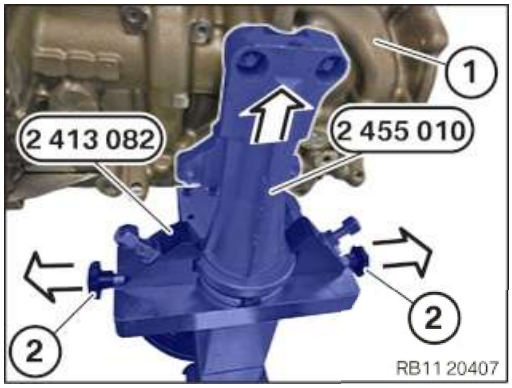
Heavy component.

Heavy components can lead to injury or damage.

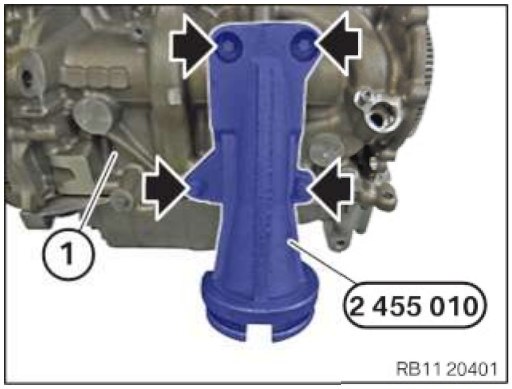
- Remove and install heavy components with the aid of another person/other persons.



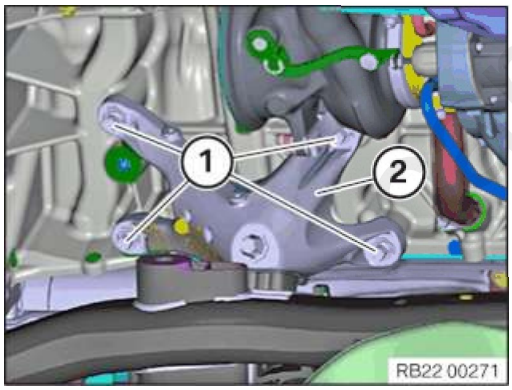
- Insert engine lifter with special tool and position engine (1).



- Unscrew the nuts on special tool .
- Detach the holder (2) in the direction of the arrow.
- Detach the engine (1) with special tool 2 455 010 out of the special tool in the direction of arrow.



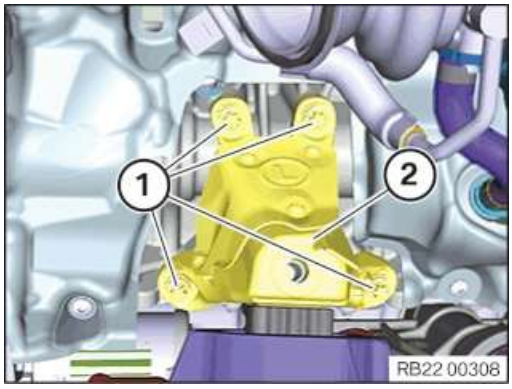
- Remove conventional screws (arrows).
- Feed out the special tool 2 455 010 on the engine (1) and remove.



- **Type: Rear-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm



- **Type: Four-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm

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- See additional information.

Additional Information

Overview of Tightening Torques

Special tool 2 455 010 to crankcase — Used in step 2

M10x30		Tightening torque	38 Nm

Special tool 11 8 930 to special tool 00 2 320 — Used in step 2

M14x35		Tightening torque	160 Nm

Oil drain plug — Used in step 4

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head — Used in step 174959

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 174959

M6		Tightening torque	8 Nm

Special tool to cylinder head — Used in step 26

M8		Tightening torque	21,5 Nm

Connecting rod bearing cap to connecting rod — Used in step 37

Renew screws.

Tighten screws crosswise.		Jointing torque	20 Nm
		1. Angle of rotation	70 °
		2. Angle of rotation	70 °

Oil deflector to crankcase — Used in step 38

M8 x 35		Renew screws.	15 Nm
			45 °

Camshaft sprocket to oil vacuum pump — Used in step 39

M8	Important - left-hand thread Renew screw.	1. Jointing torque	5 Nm
		2. Angle of rotation	90 °

Oil vacuum pump to crankcase — Used in step 40

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

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Oil sump to crankcase — Used in step 41

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 41

M8 x 50		Tightening torque	19 Nm

Flywheel to crankshaft — Used in step 42

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

Battery positive lead to starter — Used in step 43

M8		Tightening torque	13,5 Nm

Cylinder head to crankcase — Used in step 48

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

Cylinder head bolt to timing case cover — Used in step 48

M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head — Used in step 48

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head — Used in step 48

M6x16			8 Nm

Cable routing to cylinder head, rear — Used in step 48

M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head — Used in step 48

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 48

M6x16		Tightening torque	8 Nm

Manifold support for intake air to cylinder head — Used in step 48

M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head — Used in step 48

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 48

M6			8 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 48

M6x12		Tightening torque	8 Nm

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VANOS central valve to camshaft — Used in step 5556

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 58

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Oil return line to exhaust turbocharger/crankcase — Used in step 60

M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger — Used in step 6162

M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger — Used in step 61

M6		Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 62

M6 x 12		Tightening torque	8 Nm

Cylinder head cover to cylinder head — Used in step 63

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 63

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 63

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 66

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 67

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 68

M14		Tightening torque	33 Nm

Spark plugs — Used in step 69

M12x1.25		Tightening torque	23 Nm

Intake plenum to cylinder head — Used in step 70

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 70

M6X25		Tightening torque	8 Nm

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Throttle body to holder			Used in step 70
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 70
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body			Used in step 70
M6		Tightening torque	8 Nm

Engine support arm to engine			Used in step 73
M10		Tightening torque	38 Nm

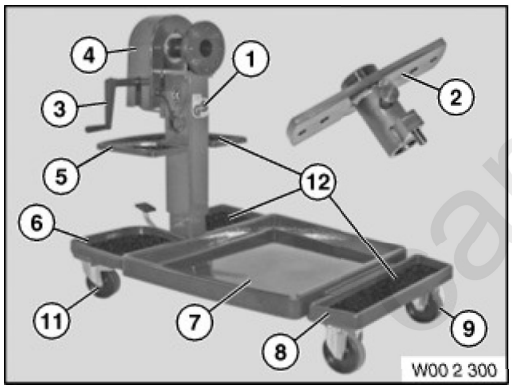
Overview of Special Tools

2 455 010 Engine support



Common	Used in step 273
Usage	For accommodating engine on assembly stand. Engine: B3x, B4x, N47.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 495 187 (00 2 300) Assembly stand



Common	Used in step 2
Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

Consisting of

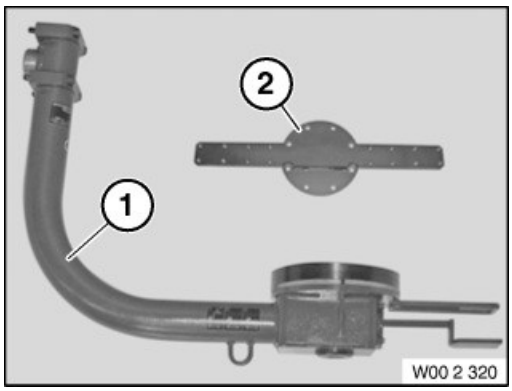
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	

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2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	
7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

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0 495 196 (00 2 320) Support arm



Common

Used in step 2

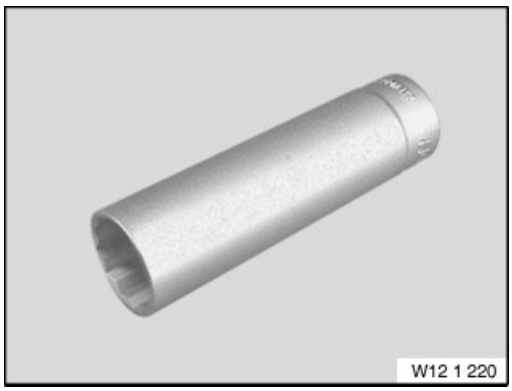
Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

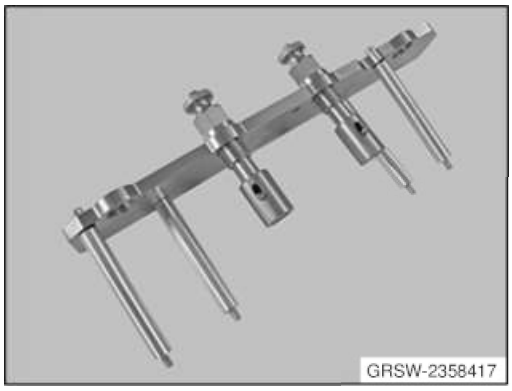
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0 495 560 (12 1 220) Socket



Common	Used in step 569
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

2 358 417 Device



Common	Used in step 8
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 8
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

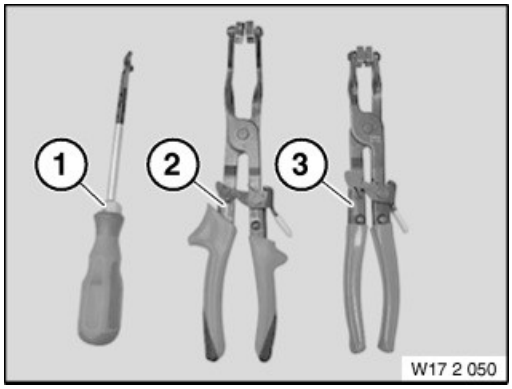
2 360 895 Pin wrench



Common	Used in step 964
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 794 (17 2 050) Pliers



Common Used in step 1270

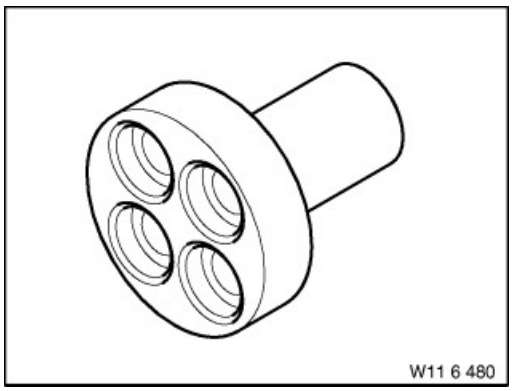
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 493 380 (11 6 480) Connector



Common Used in step 1744575967

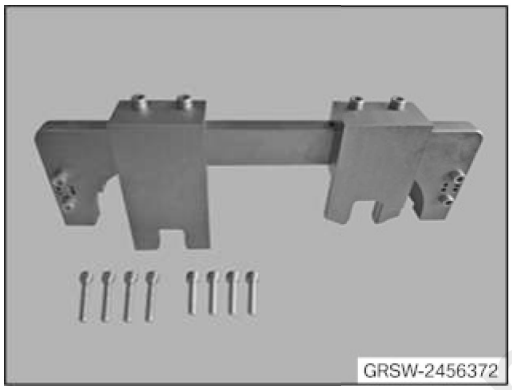
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 17445759
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 1725495759
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 172559
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



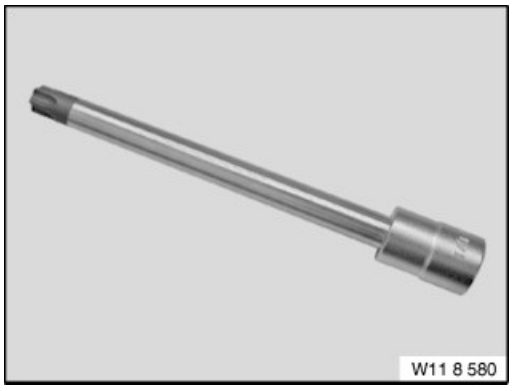
Common	Used in step 19205556
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 19205556
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

0 495 747 (11 8 580) Socket wrench



Common	Used in step 2648
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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2 220 718 Workshop crane



Common	Used in step 26
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

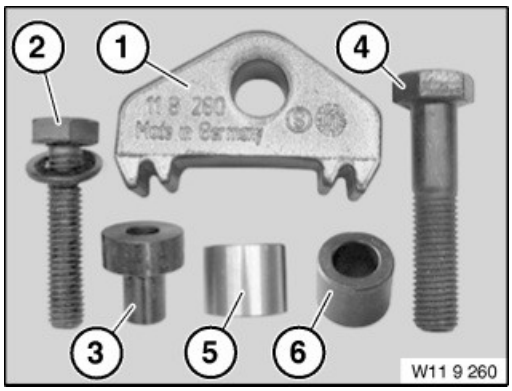
2 459 012 Holder



Common	Used in step 2648
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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0 493 938 (11 9 260) Holder



Common Used in step 2842

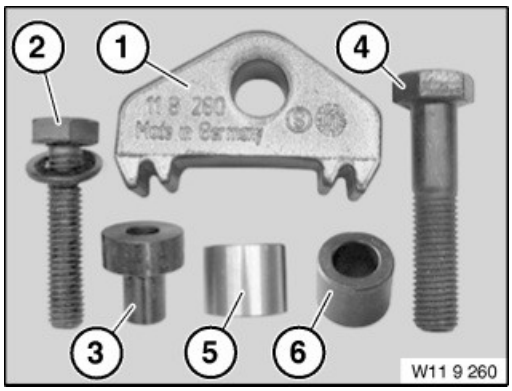
Usage	(Counter support with screw connection) For holding the flywheel when gearbox is removed
Included in the tool or work	
Storage location	A44
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 034 (11 9 261)		**Holder** (Individual counter support)	
2	0 494 035 (11 9 262)		**Screw** (Bolt (thread M10) with washer) For screwing counter support	
3	0 494 129 (11 9 263)		**Bush** (Bush for counter support) For counter support, for retaining flywheel when gearbox is removed Engine: N62, N73	
6	0 495 216 (11 9 266)		**Bush** For counter support, for retaining flywheel when gearbox is removed Engine: M57TU2	
4	0 494 130 (11 9 264)		**Screw** (Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed	
5	0 494 793 (11 9 265)		**Bush**	

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0 494 130 (11 9 264) Screw



Common Used in step 2842

Usage	(Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed
Included in the tool or work	0 493 938
Storage location	A44
Replaced by	
In connection with	
SI-Number	

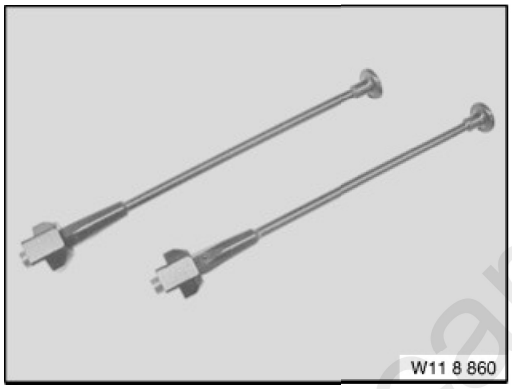
2 463 965 Socket wrench



Common Used in step 31

Usage	with T30, T40 and torx 45
Included in the tool or work	
Storage location	B6
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 496 144 (11 8 860) Assembly tool

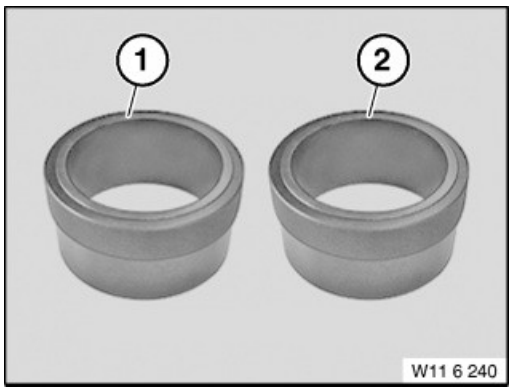


Common Used in step 3337

Usage	For installing piston with connecting rod in crankcase.
Included in the tool or work	
Storage location	A23
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

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0 495 373 (11 6 240) Bush



Common Used in step 37

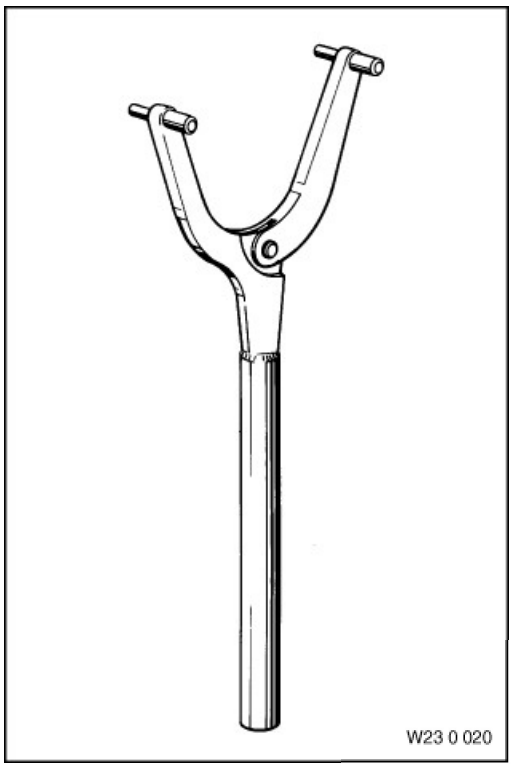
Usage	(Assembly bush set) For fitting pistons (diameter 82 mm) with connecting rod into the crankcase. Engine: N52B25
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 06 (244)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 527 (11 6 242)		**Bush** (assembly bush 82.25 mm)	
1	0 495 526 (11 6 241)		**Bush** (assembly bush 82.00 mm)	

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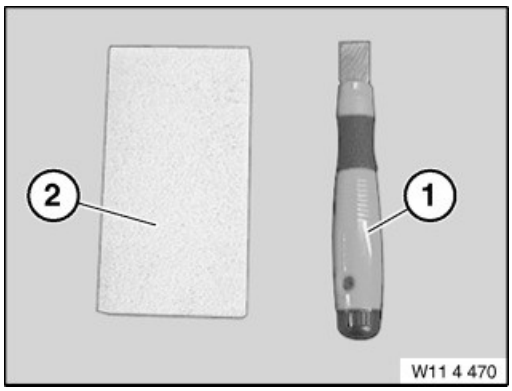
0 491 440 (23 0 020) Holder



Common	Used in step 39
Usage	(counter support) For all three- and four-hole flanges when releasing and tightening down
Included in the tool or work	
Storage location	B4
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool



Common Used in step 41

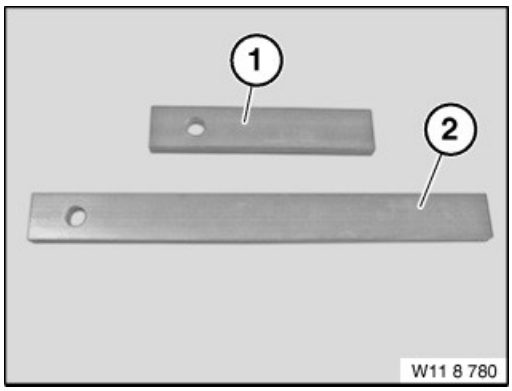
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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0 496 120 (11 8 780) Plate



Common Used in step 41

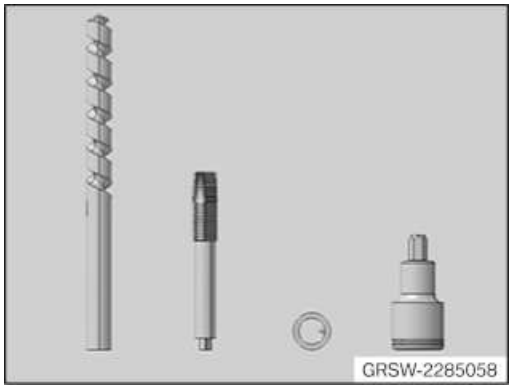
Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

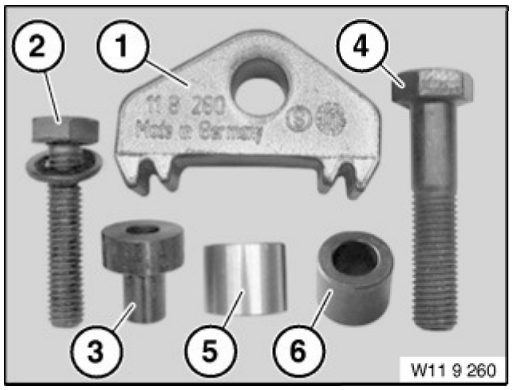
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2 285 058 Tool set



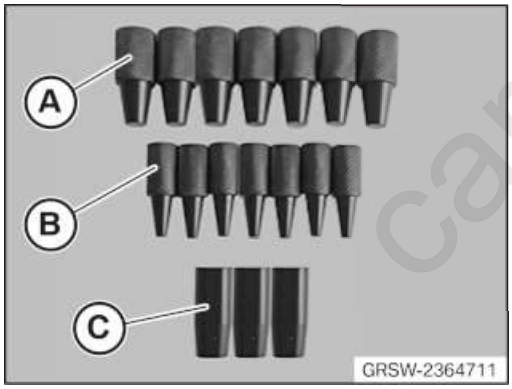
Common	Used in step 42
Usage	
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 14 (069)

0 494 034 (11 9 261) Holder



Common	Used in step 42
Usage	(Individual counter support)
Included in the tool or work	0 493 938
Storage location	
Replaced by	
In connection with	
SI-Number	

2 364 711 Plug



Common	Used in step 4546
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

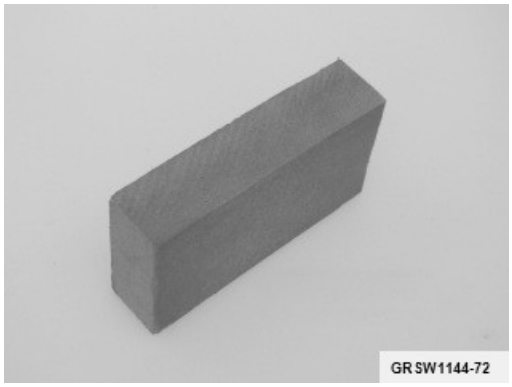
0 495 103 (11 4 471) Scraper



Common	Used in step 46
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

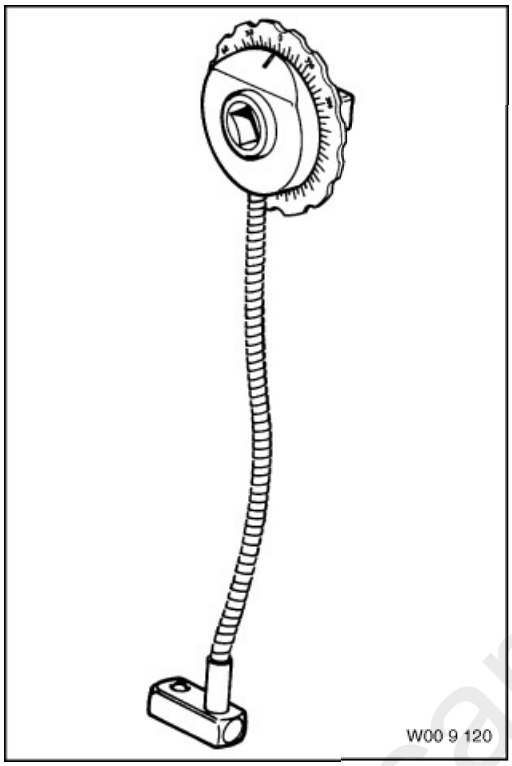
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0 495 104 (11 4 472) Extractor



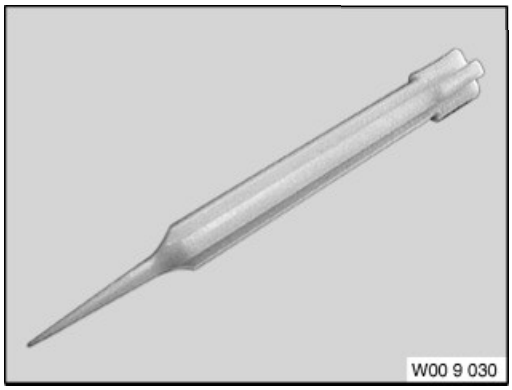
Common	Used in step 46
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 490 504 (00 9 120) Torque angle measuring dial



Common	Used in step 48
Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common	Used in step 486162
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

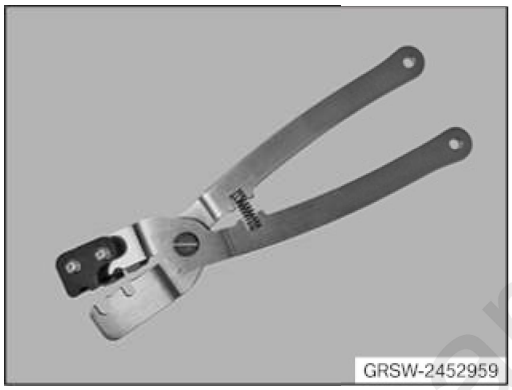
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2 455 654 Tensioning tool



Common	Used in step 5457
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 65
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 65
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

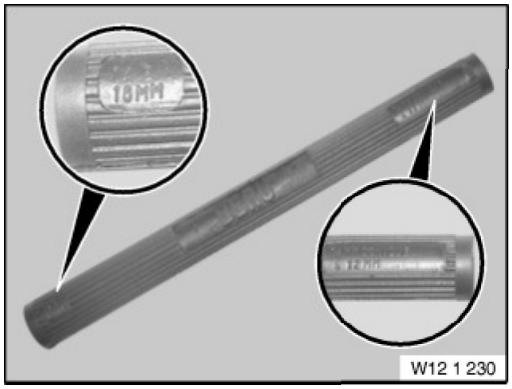
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2 358 022 Gauge



Common	Used in step 66
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

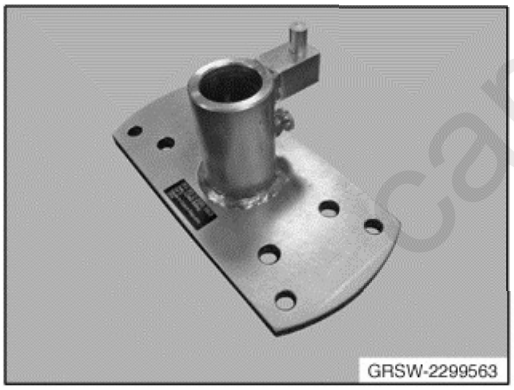
0 496 065 (12 1 230) Fitting aid



Common	Used in step 69
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

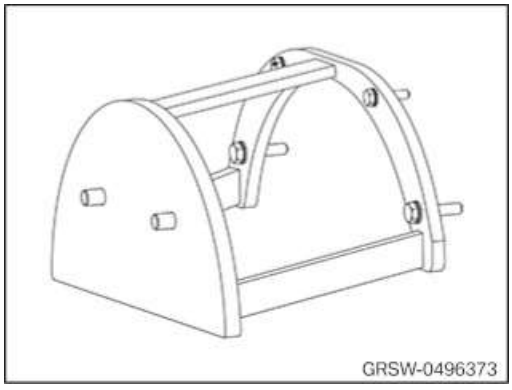
Replacement tools:

2 299 563 Adapter



Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

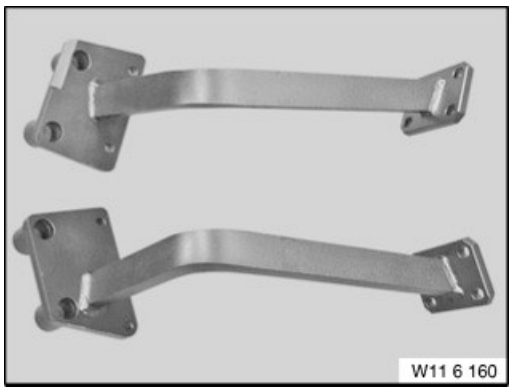
0 496 373 (11 5 420) Plate



Common	Used in step 2
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

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0 496 680 (11 6 160) Support



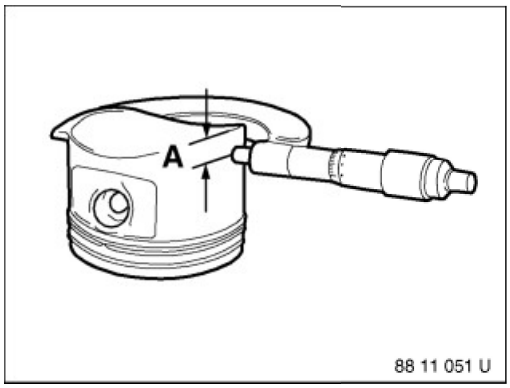
Common	Used in step 2
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

Overview Technical Data

Piston diameter Used in step 34

Measure the piston diameter at distance (A) from the lower end of the piston skirt.

Distance (A) to the lower end of the piston skirt	10 mm
Nominal dimension of piston diameter	81,958 mm ... 81,996 mm



Cylinder bore B38/B46/B48/B58 Used in step 36

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Engine oil Used in step 72

Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Engine oil B48B20O1/B46B20O1 Used in step 72

Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Screw-in depth of thread cutter Used in step 42

Screw-in depth	18 mm

Links

Functional descriptions	Used in step

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Petrol particulate filter	72

General repair instructions	Used in step
11 00 ... Overview of consumables (Electronic Parts Catalogue)	41

Repair instructions	Used in step
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11 00 050 Remove and install engine	174
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11 00 050 Remove and install engine	174
11 00 050 Remove and install engine	174

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11 00 050 Remove and install engine	174
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11 00 050 Removing and installing engine	174
11 00 050 Removing and installing engine	174
11 00 050 Removing and installing engine	174
11 00 050 Remove and install engine	174
11 00 050 Remove and install engine (Automatic)	174
11 00 050 Remove and install engine (Automatic)	174
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11 00 050 Remove and install engine (Automatic)	174
11 00 050 Remove and install engine	174
11 00 050 Remove and install engine	174
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13 53 ... Clean the cylinder head around the injectors due to grit / dust	8
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61 35 ... Notes on ESD protection (Electro Static Discharge)	911

Operating materials	**Used in step**
3.0 Technically appropriate engine oils for BMW Group engines	72

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This documentation refers to special tools that were not yet available when going to press.

11 25 671 Replace the piston rings for all pistons

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

The following engine requires a renewal of the piston rings in combination with new pistons only.

The following repair instructions explain the installation and removal including the renewal of the piston with the piston rings.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Removing engine



- See additional information.

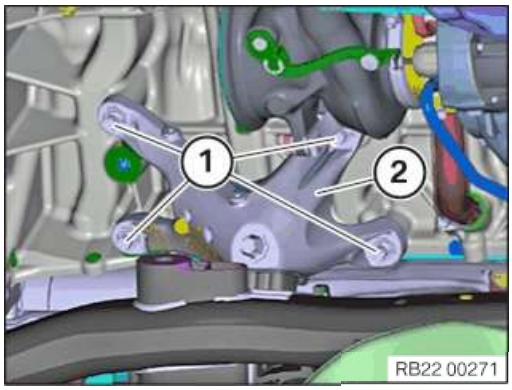
2 – Mount engine on assembly stand

CAUTION

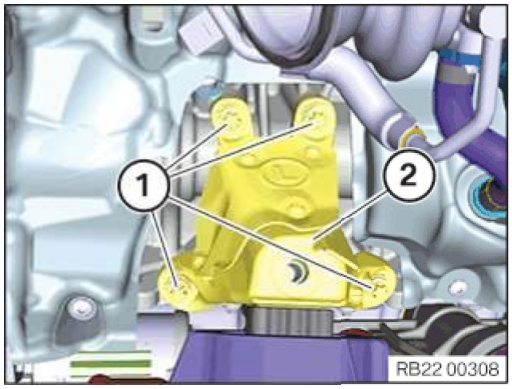
Heavy component.

Heavy components can lead to injury or damage.

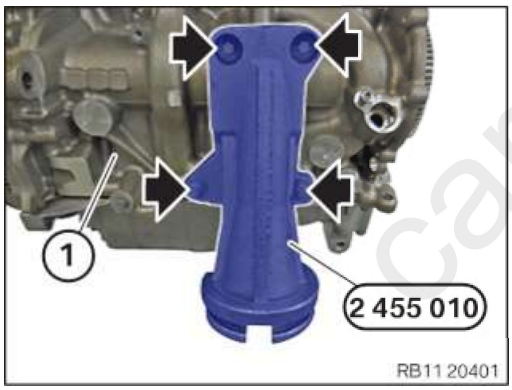
- Remove and install heavy components with the aid of another person/other persons.



- **Type: Rear-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



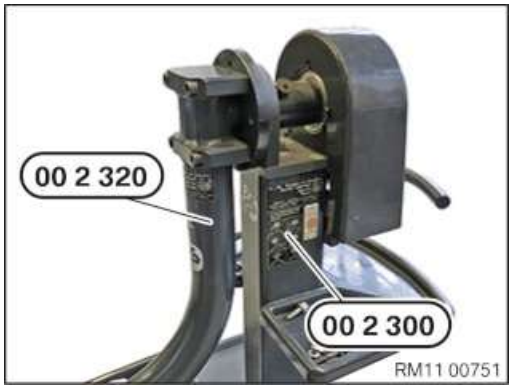
- **Type: Four-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



- Position the special tool 2 455 010 on the engine (1).
- Position the standard bolts **M10x30**.
- Tighten the standard bolts (arrows).

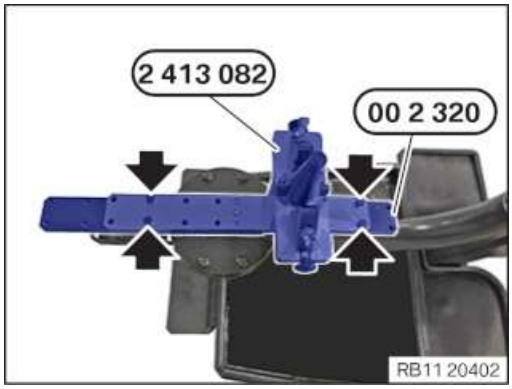
Special tool 2 455 010 to crankcase

M10x30		Tightening torque	38 Nm



- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).

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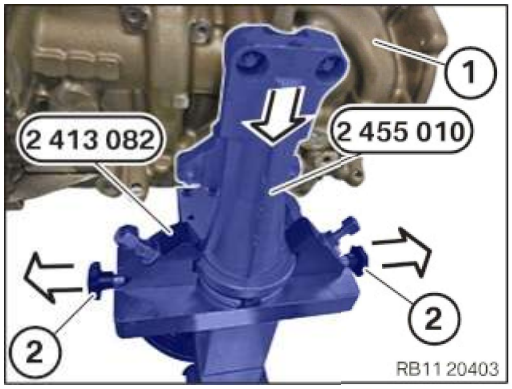
- Screw the special tool to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

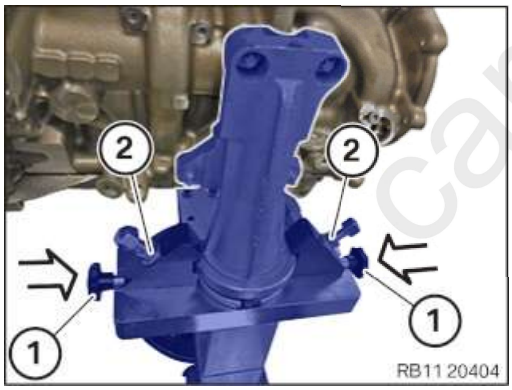
M14x35		Tightening torque	160 Nm



- Position the engine lifter with the special tool and the engine on the special tool 0 495 187 (00 2 300).



- Detach the holder (2) in the direction of the arrow.
- Position the engine (1) with the special tool 2 455 010 in the direction of the arrow on the special tool .



- Lock the holder (1) in direction of arrow.
- Tighten nuts (2).

3 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

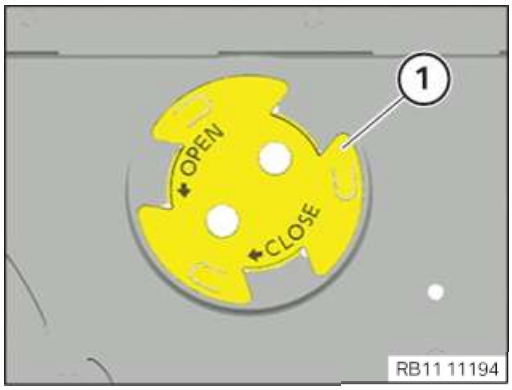
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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).



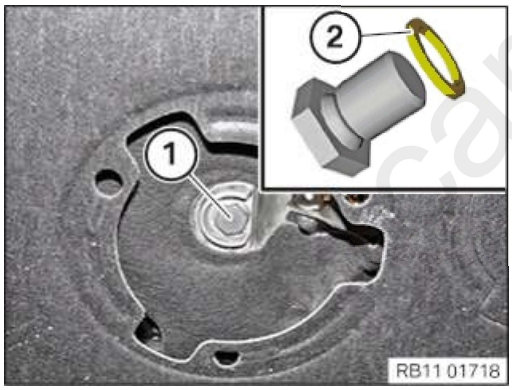
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

4 – Tightening the oil drain plug

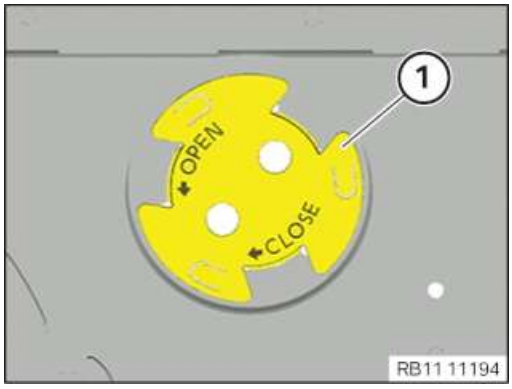


- Renew sealing ring (2).

  Parts: Sealing ring
- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

M12x16	Renew the sealing ring.	Tightening torque	25 Nm



- Install service cap (1).

5 – Removing all spark plugs

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

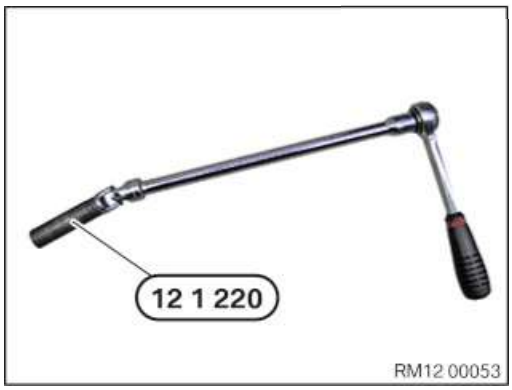
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

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- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

6 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

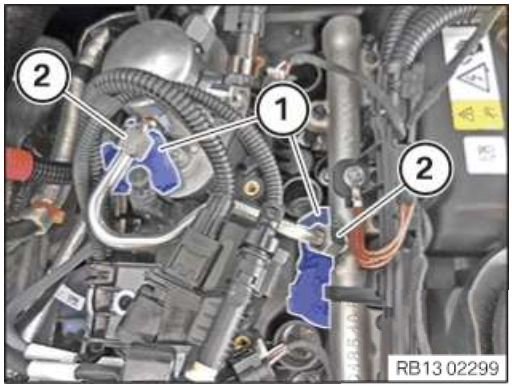
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

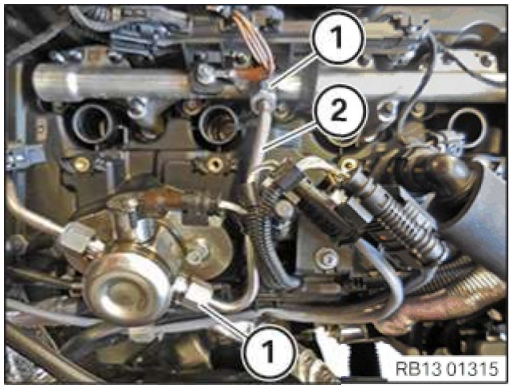
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- Have the special tool ready.



- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

7 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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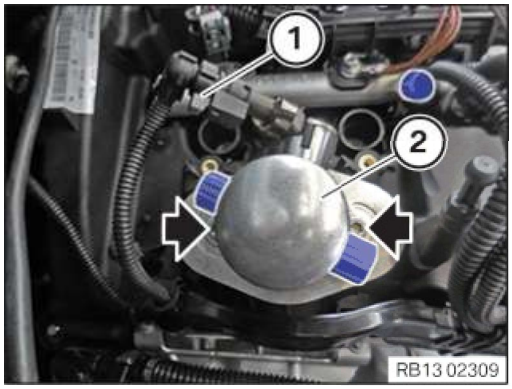
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

8 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

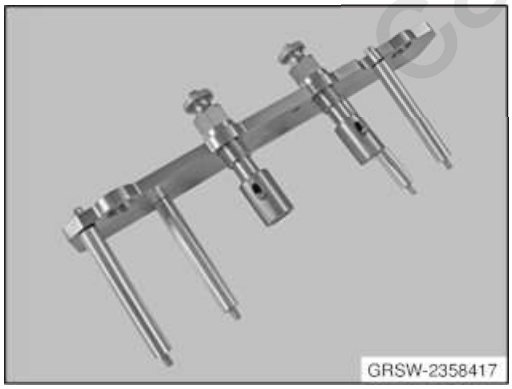
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Prepare special tool .

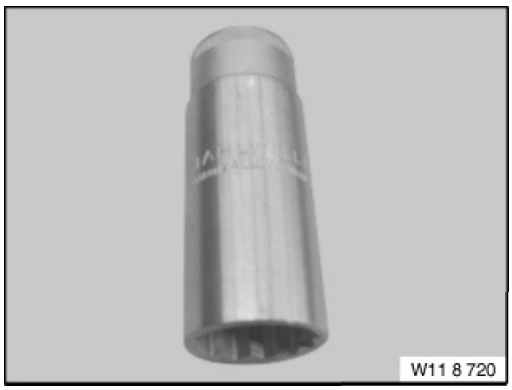


- Prepare special tool 2 358 417.

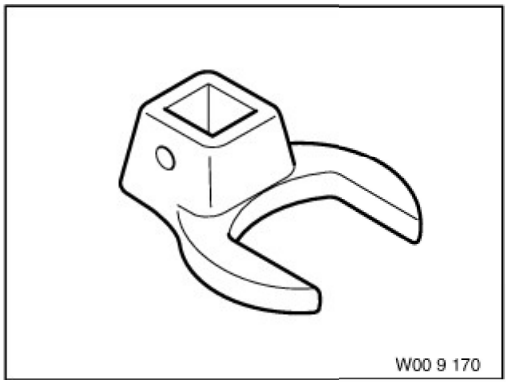
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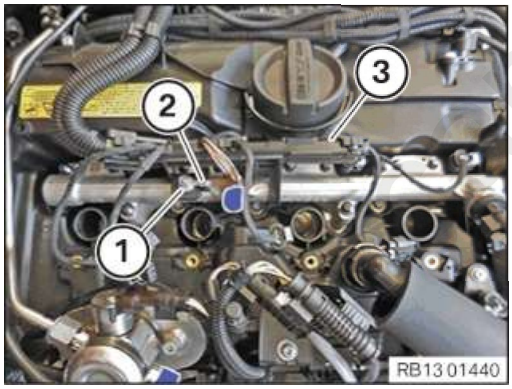
- Prepare special tool .



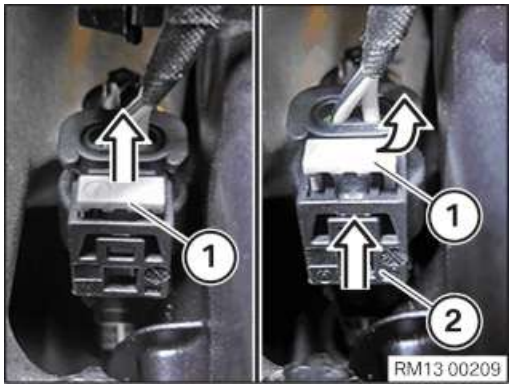
- Prepare special tool 0 496 106 (11 8 720).



- Prepare special tool .

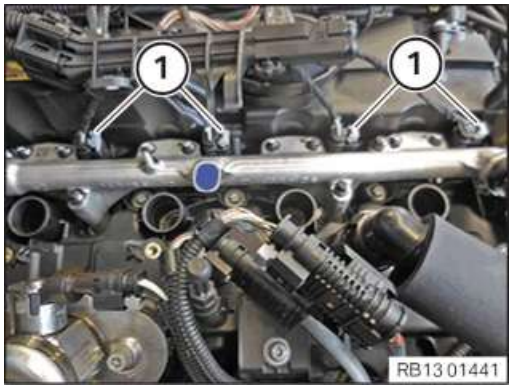


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.



- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.

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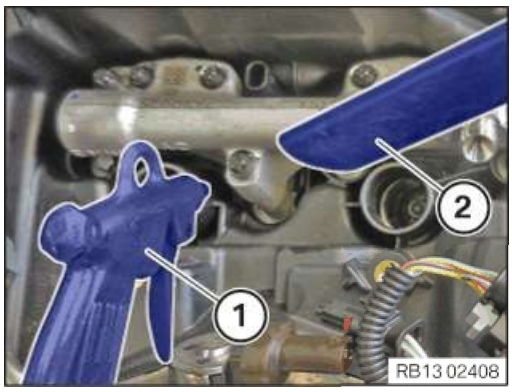
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

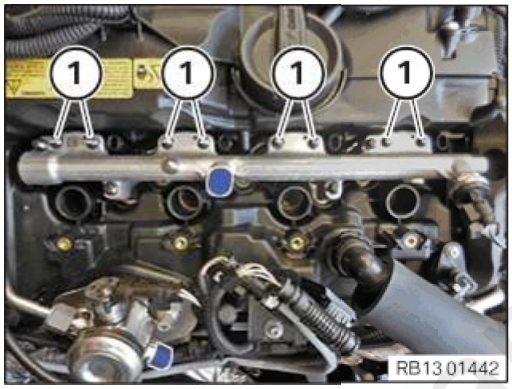


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

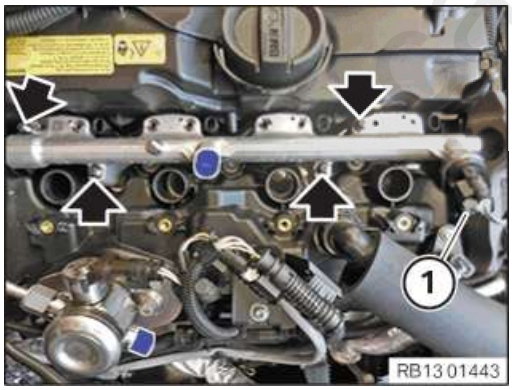
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

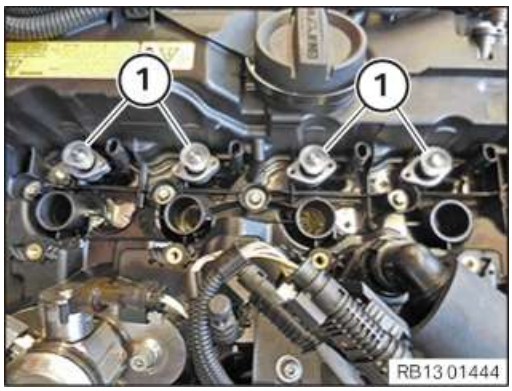


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

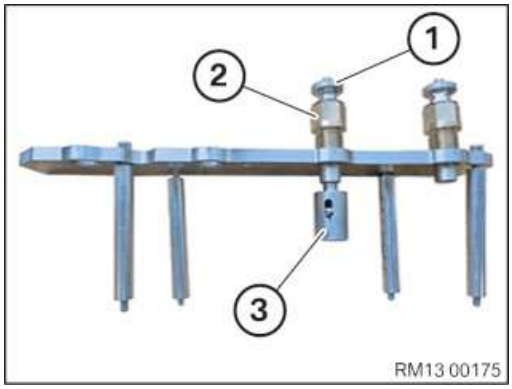
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

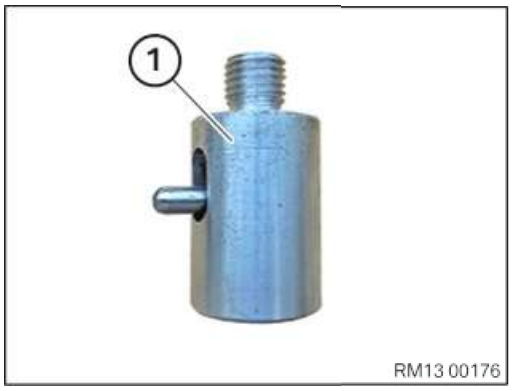
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

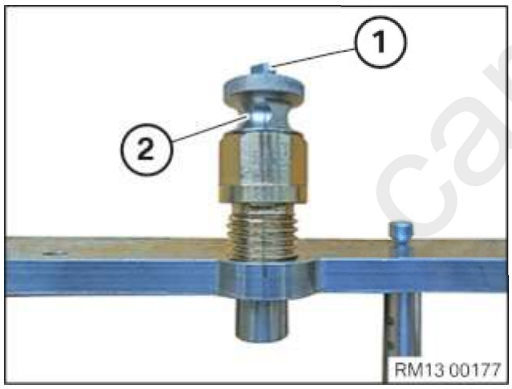
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

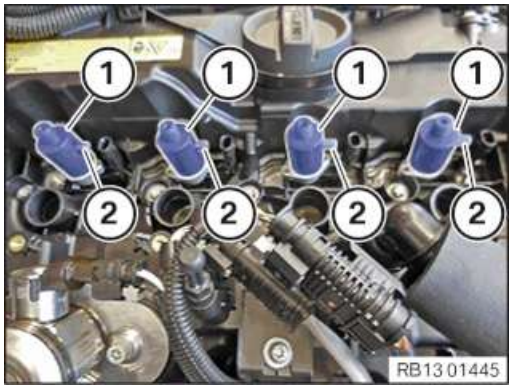
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



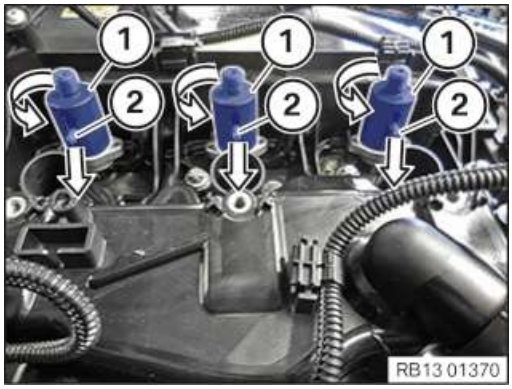
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



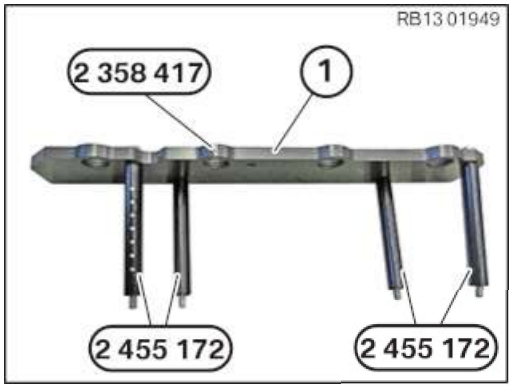
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

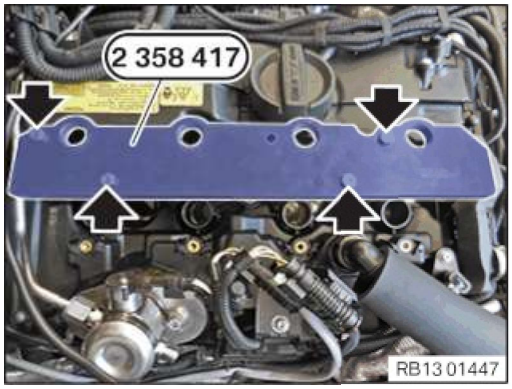
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



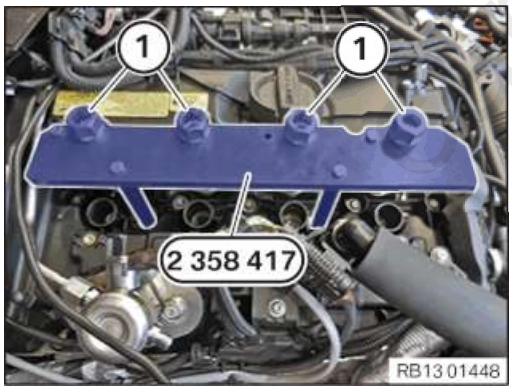
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

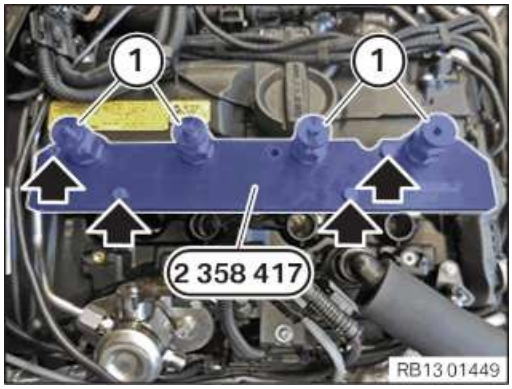
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

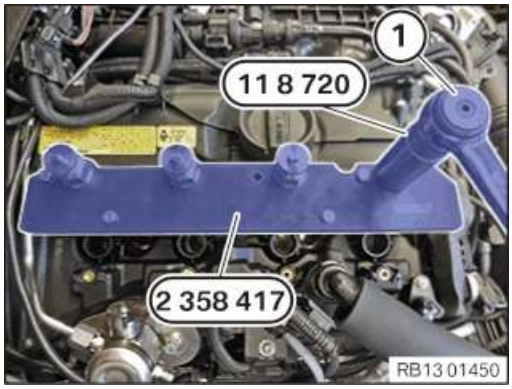
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

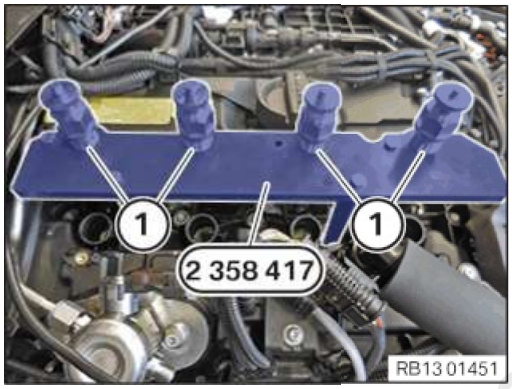


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

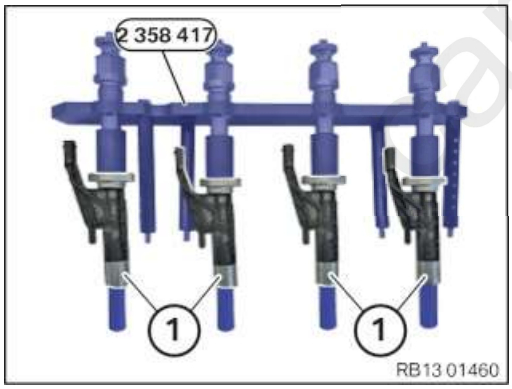
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

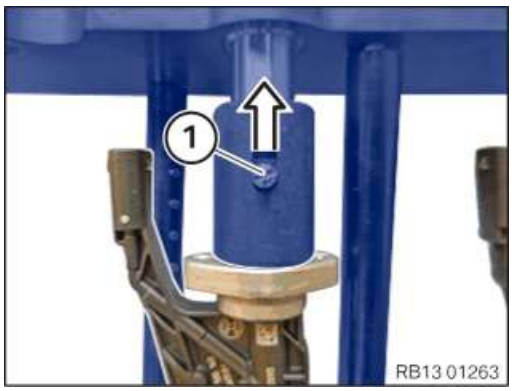


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

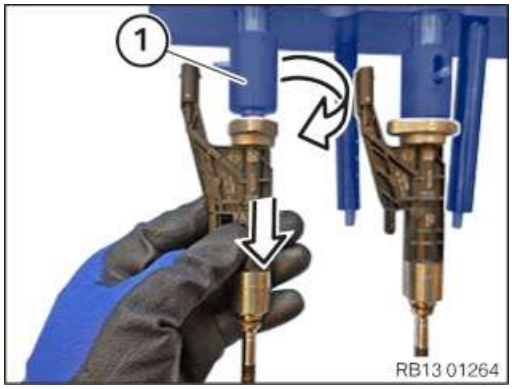


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

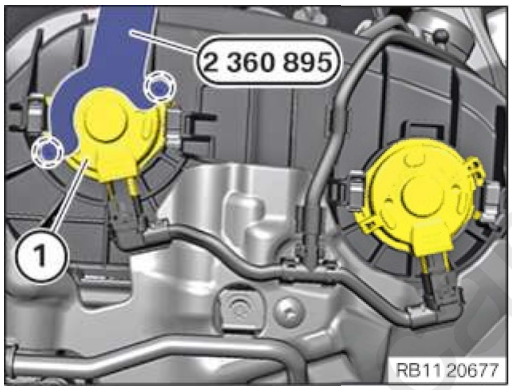
9 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

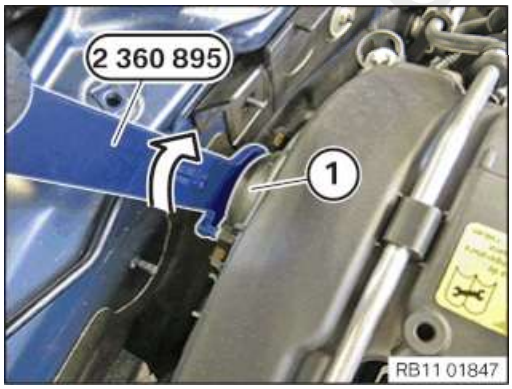
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



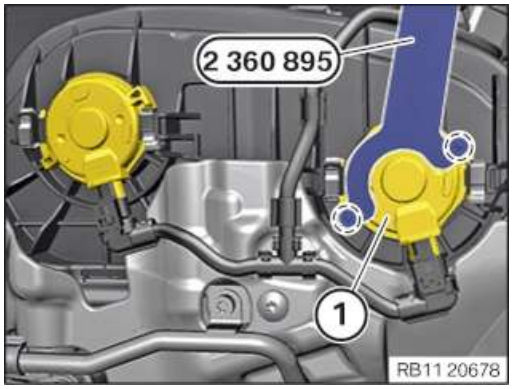
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



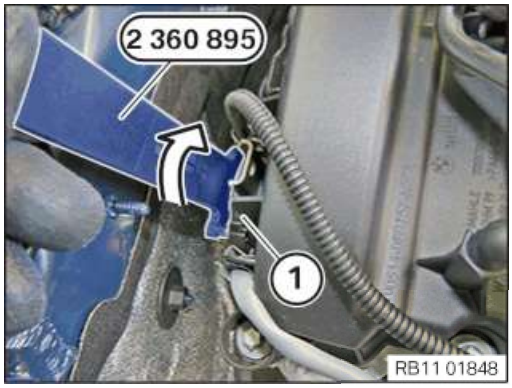
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



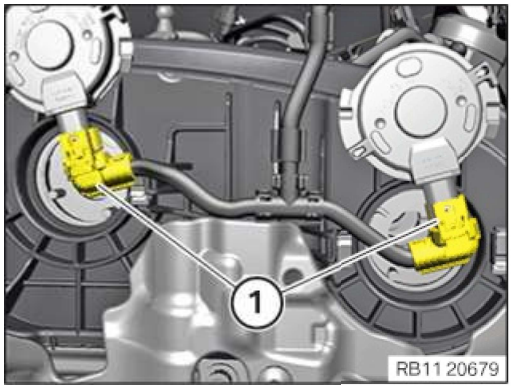
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

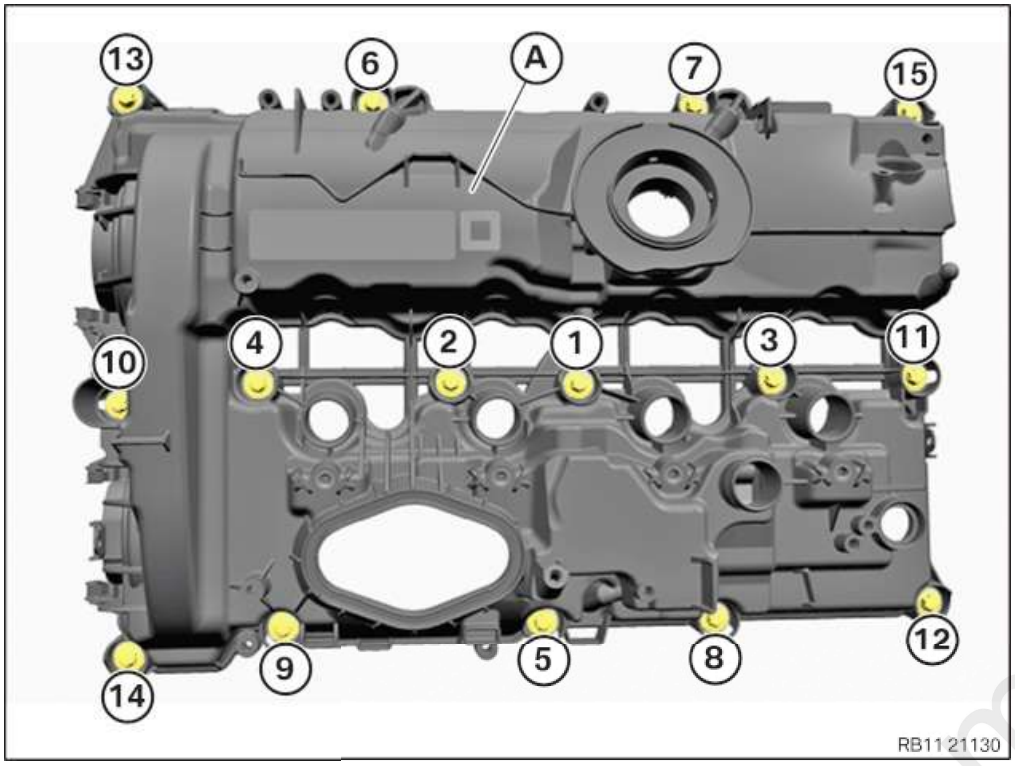
The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

10 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

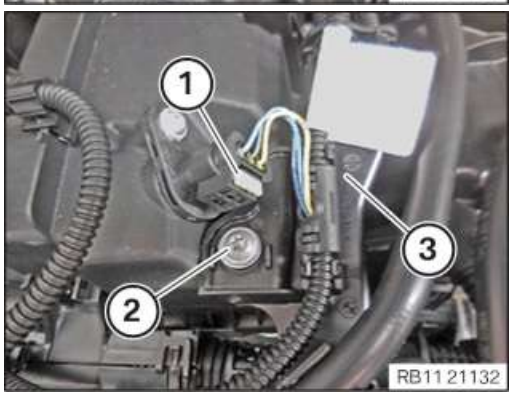
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

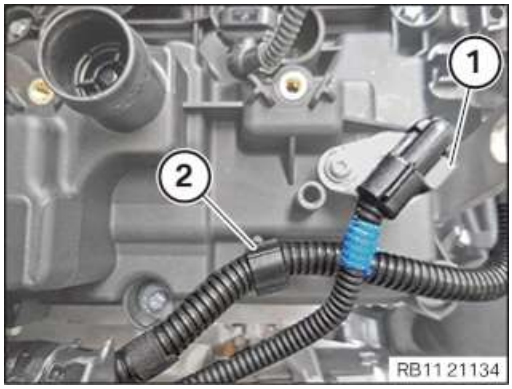
- Do not pull on the wires when disconnecting connectors and plug connections.



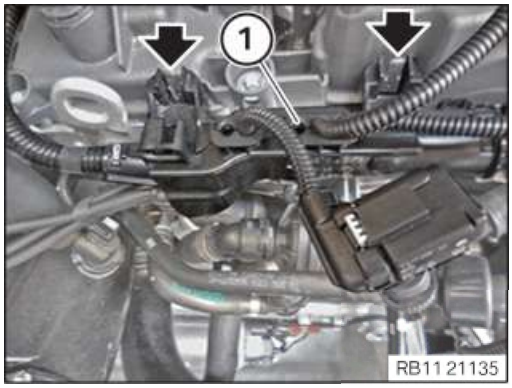
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



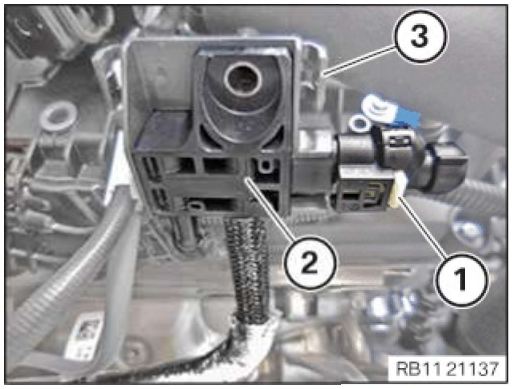
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



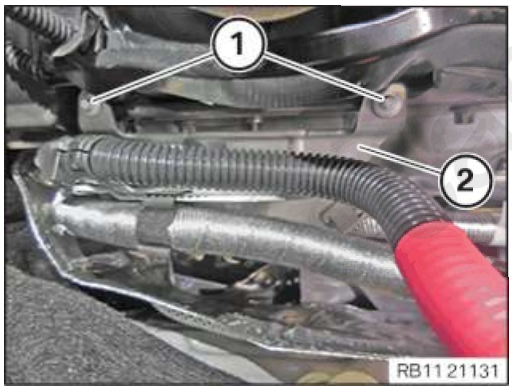
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



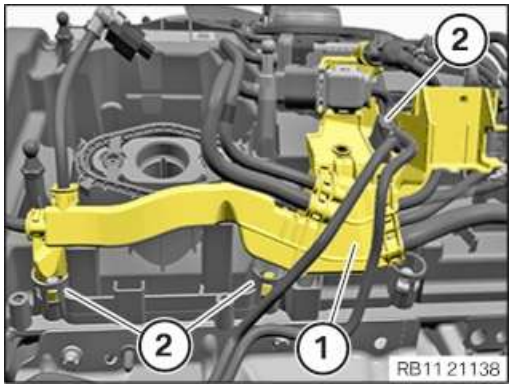
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.

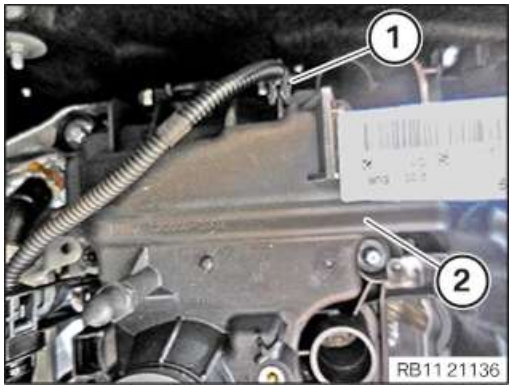


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

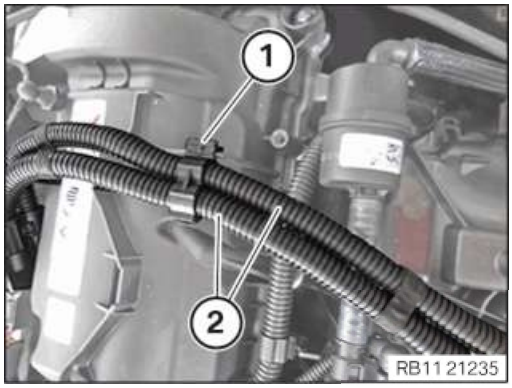


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

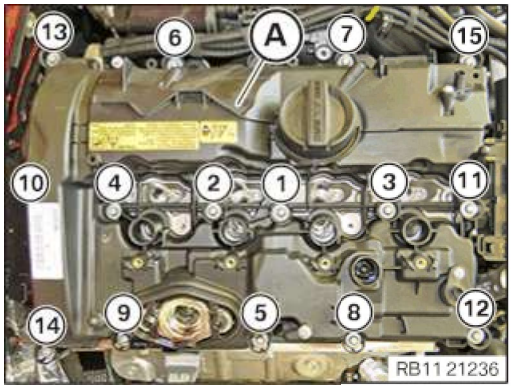
ardiagn.com



- Loosen clamp (1).



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

11 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

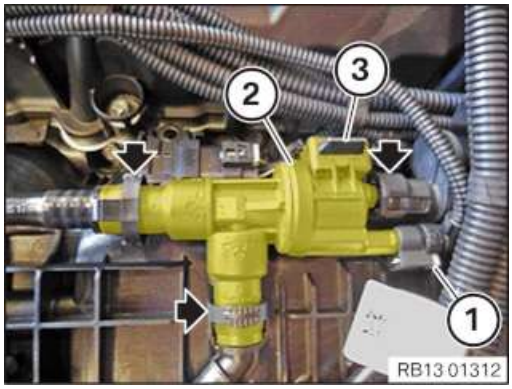
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

cardiagn.com



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

12 – Removing the intake plenum

RISK OF DAMAGE

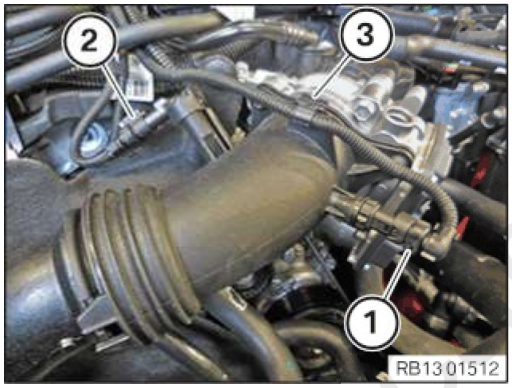
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

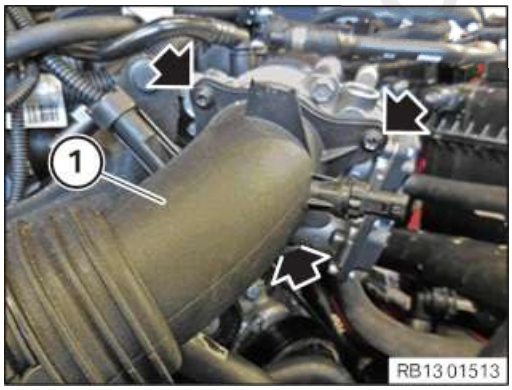
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

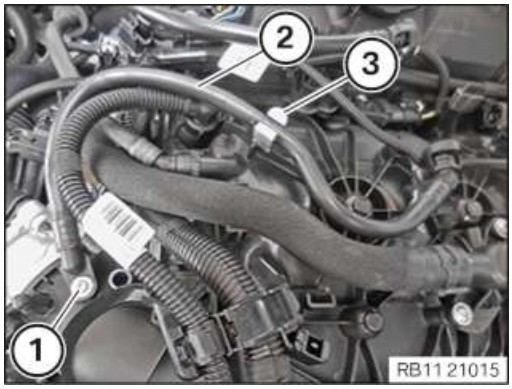
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



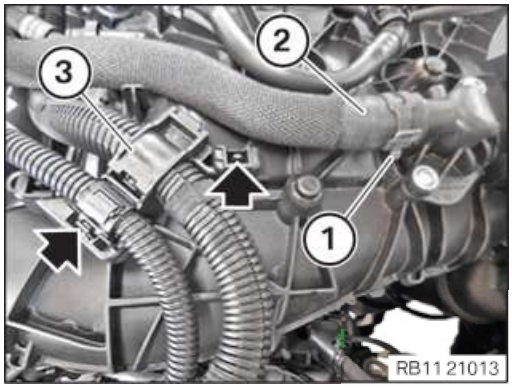
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



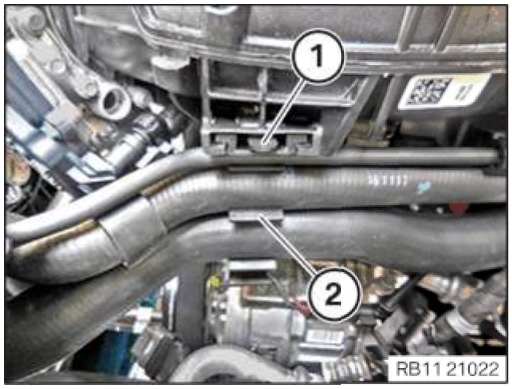
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



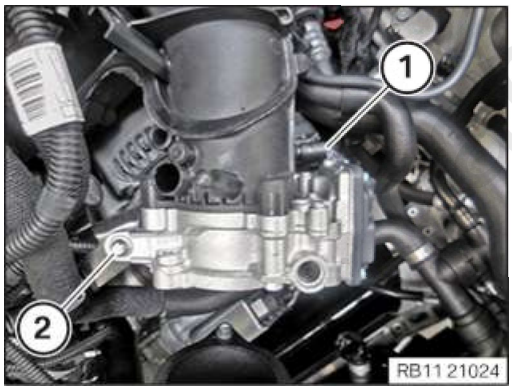
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



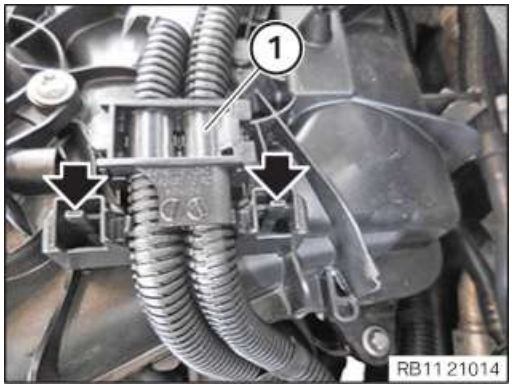
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

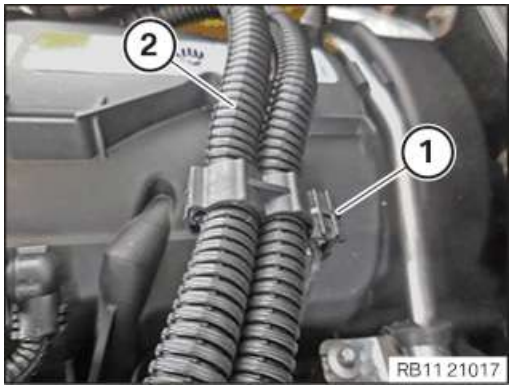


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

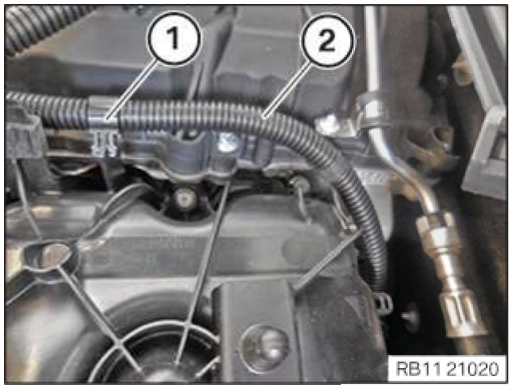
mdiagn.com



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



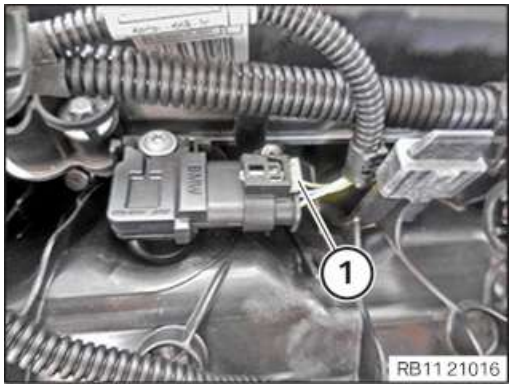
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

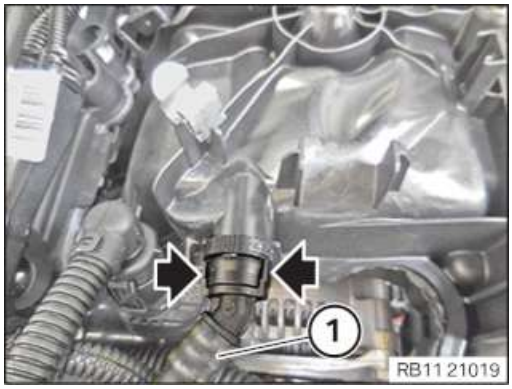


- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

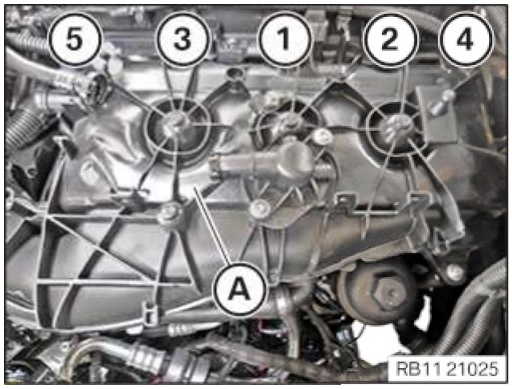
rdiagn.com



- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

13 – Remove the heat shield on the cylinder head

WARNING

Hot surfaces.

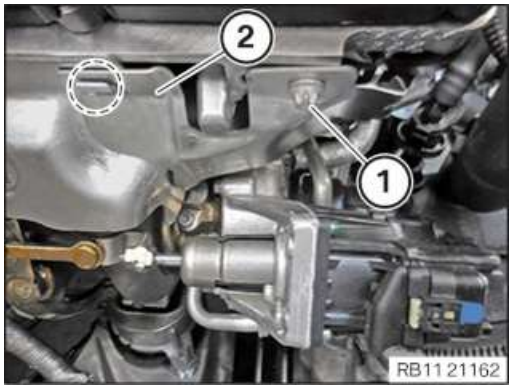
Risk of burning!

- Perform all work only on components that have cooled down.

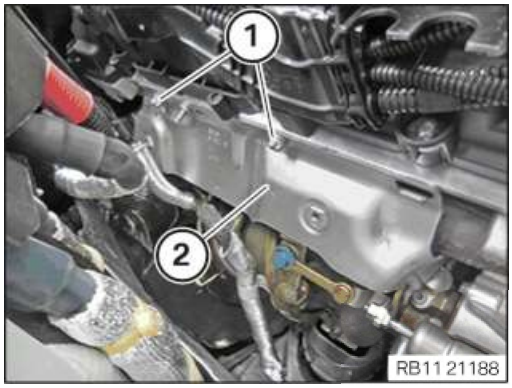


- Loosen screw (1).

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- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

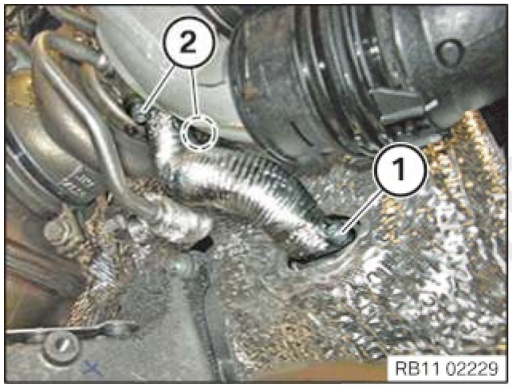


- Loosen screws (1).
- Feed out and remove the heat shield (2).

14 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

15 – Remove the coolant return line for the exhaust turbocharger

WARNING

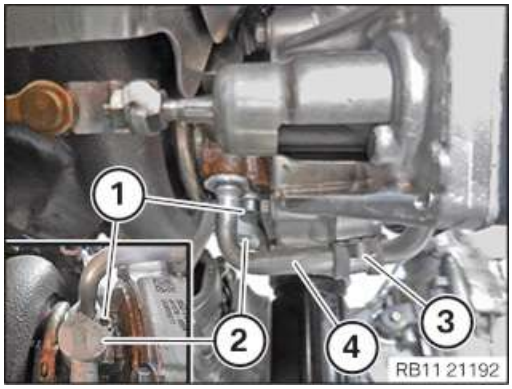
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

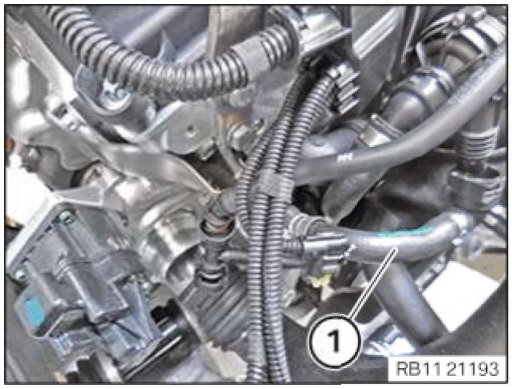
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

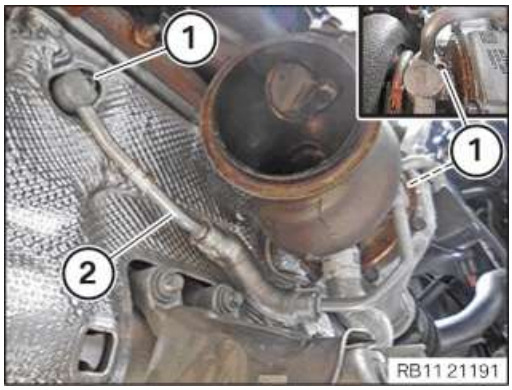


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

16 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

17 – Block the engine with the special tool in TDC firing position

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- Thread the sealing cap (1) out and remove.



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

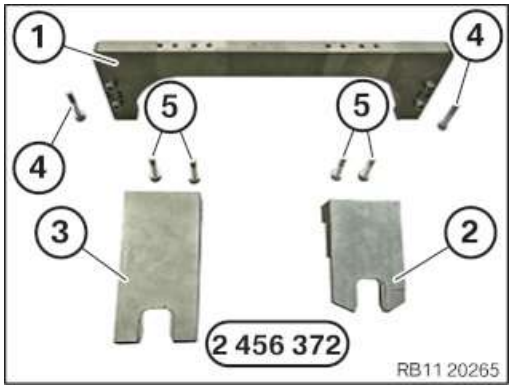


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

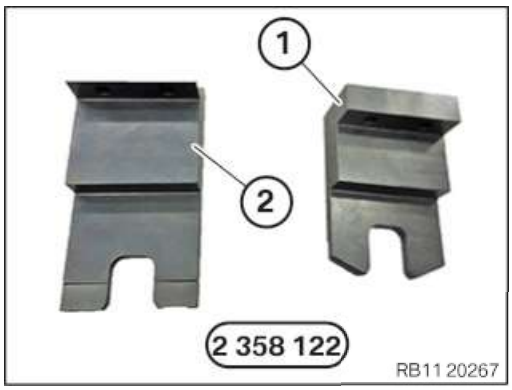
  The engine is in the TDC firing position of cylinder 1.

erdiagn.com



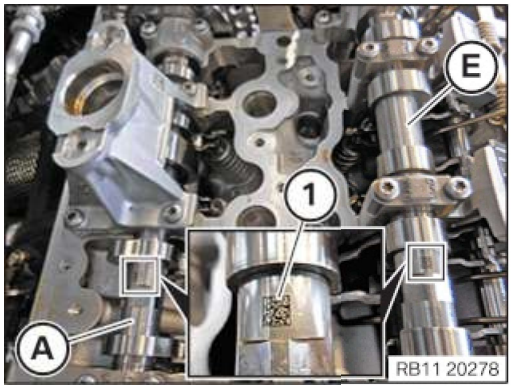
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

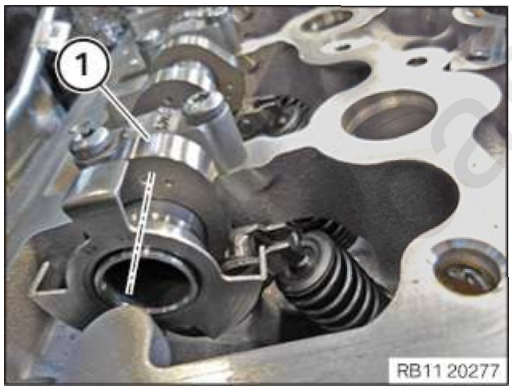


- Overview of the test gauges from the set of special tools 2 358 122:

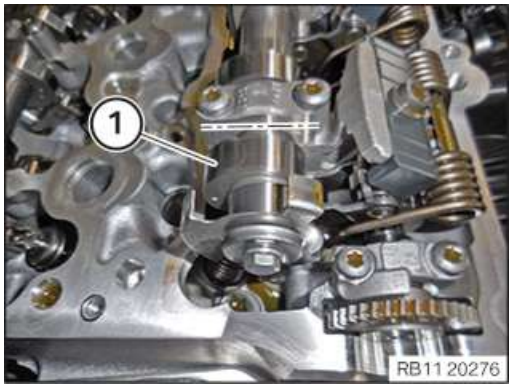
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

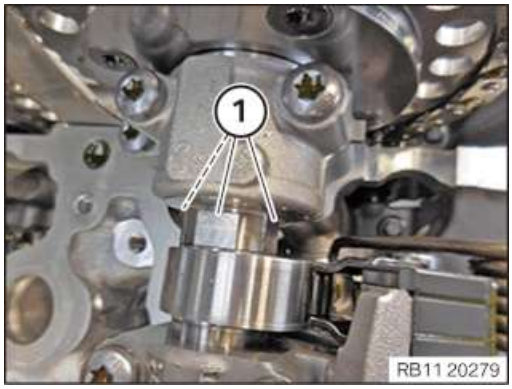


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

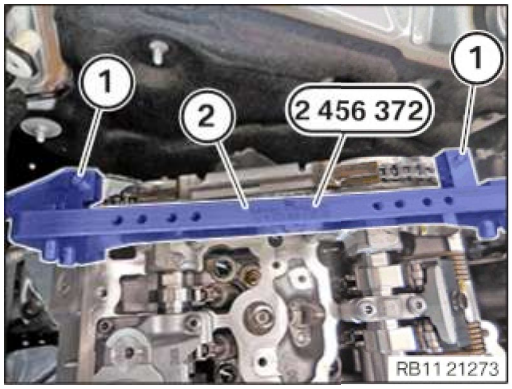
ardiagn.com



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



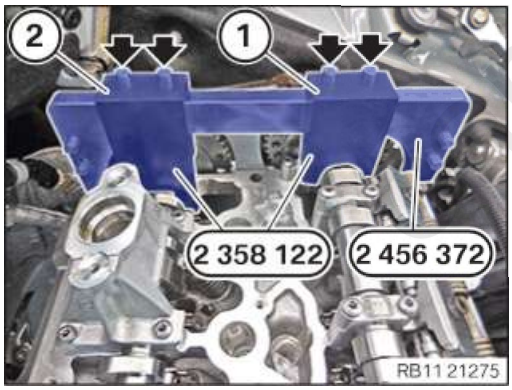
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

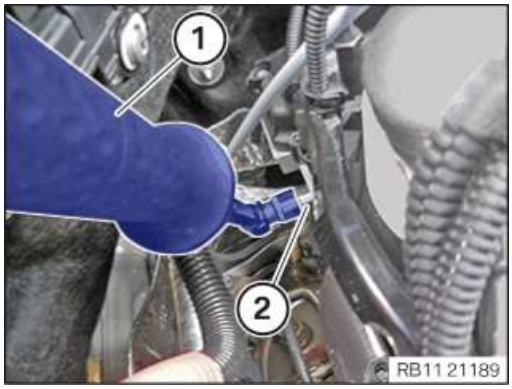
M6		Tightening torque	8 Nm

18 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

diagn.com



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

19 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

The figure shows the rear side of the engine.

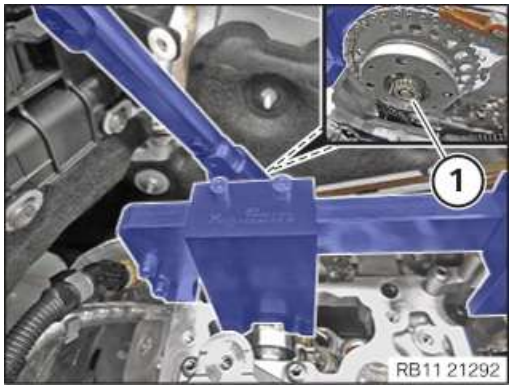
- Release the VANOS central valve (1) of the intake adjuster.

20 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

carsdiagn.com

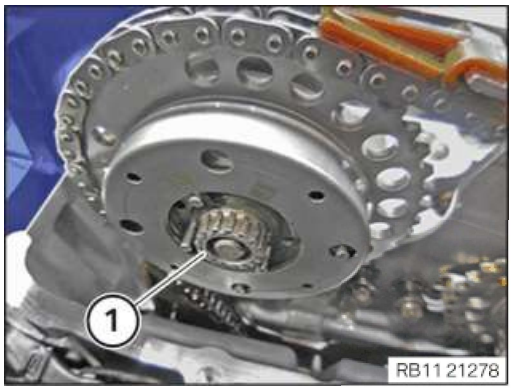


NOTICE

The figure shows the rear side of the engine.

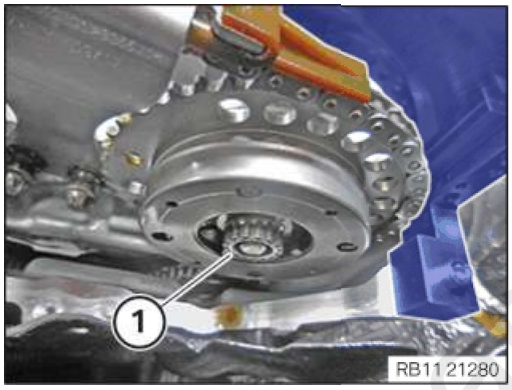
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

21 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

22 – Remove the VANOS central valve of the exhaust camshaft adjuster



- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

23 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.



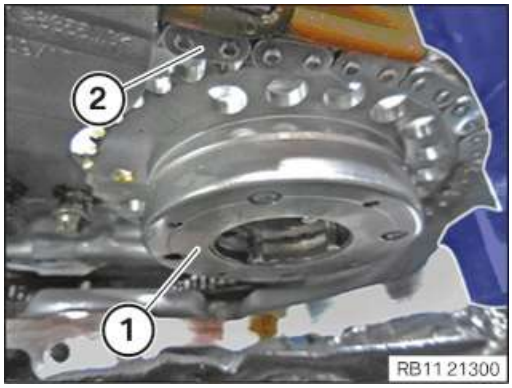
- Guide out the intake adjuster (1) from the timing chain (2) and remove.

24 – Remove exhaust camshaft adjuster

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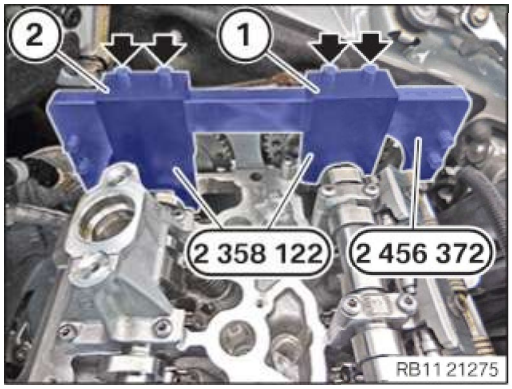
NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

25 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

26 – Remove cylinder head.

CAUTION

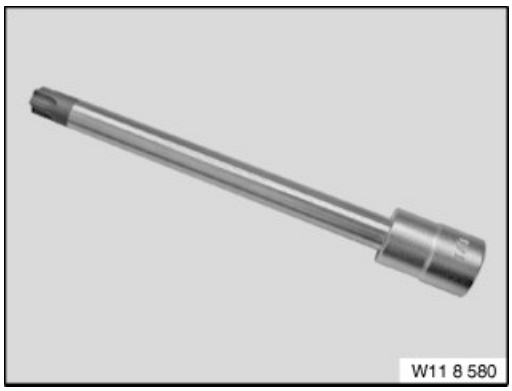
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

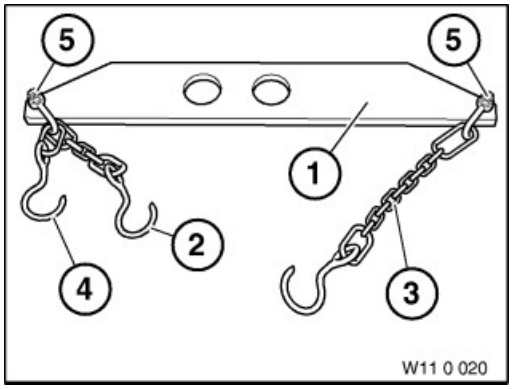
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Prepare special tool 0 495 747 (11 8 580).

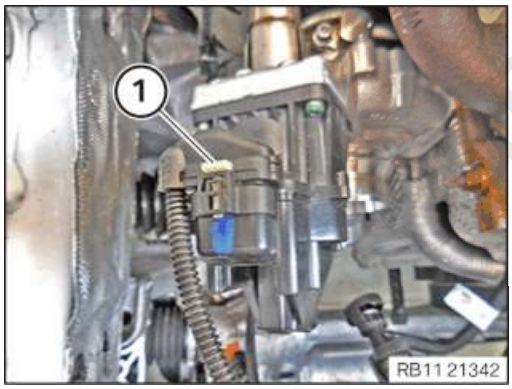
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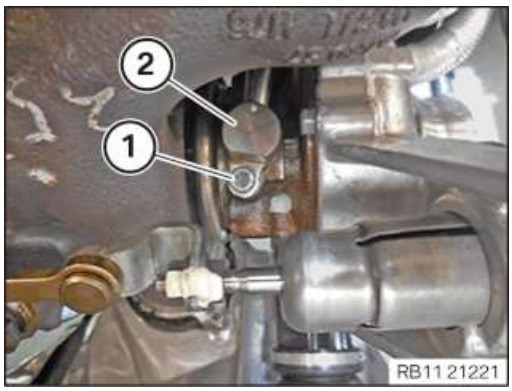
- Prepare special tool .



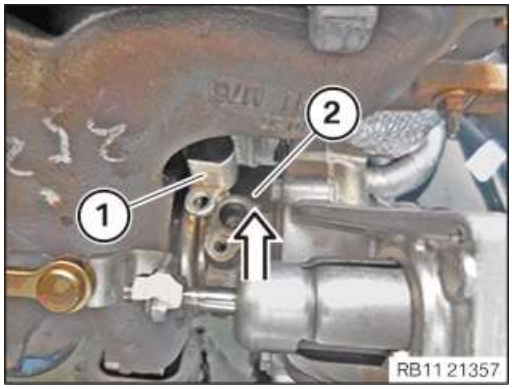
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.



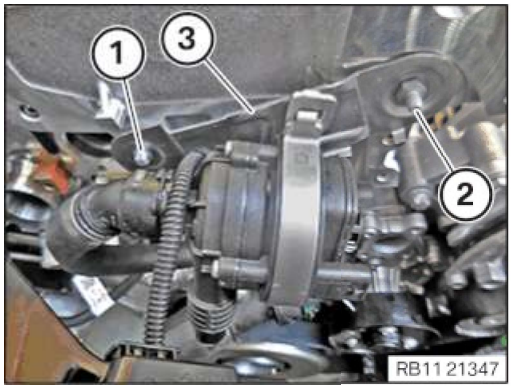
- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.



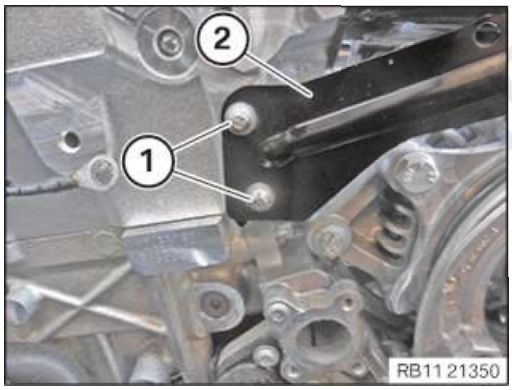
- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.

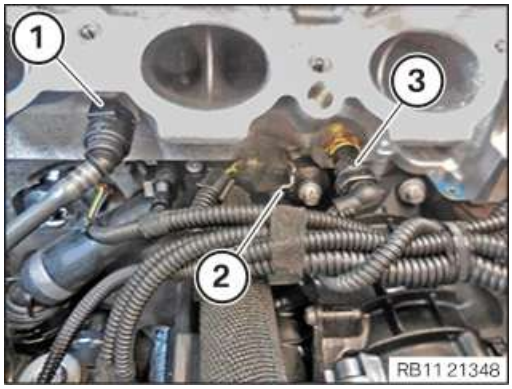


- Loosen screws (1).
- Thread out holder (2) and set aside.

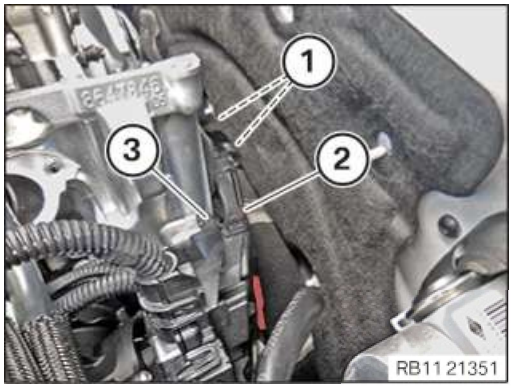


- Unlock plug connection (1) and disconnect.

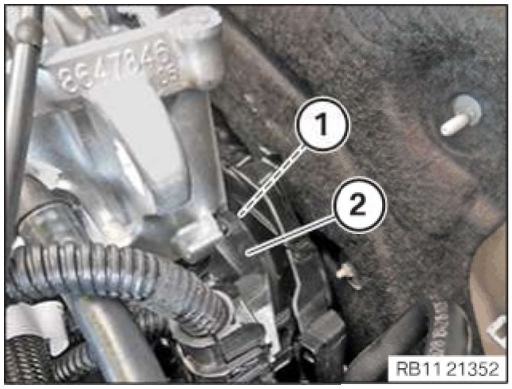
rdiagn.com



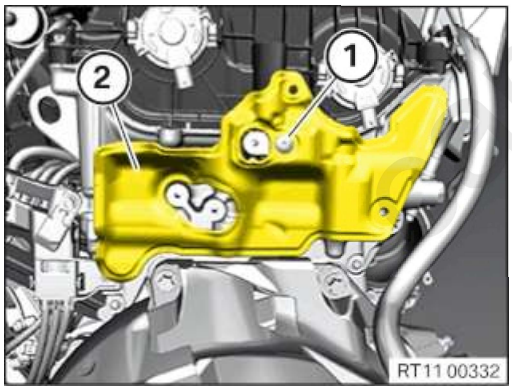
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



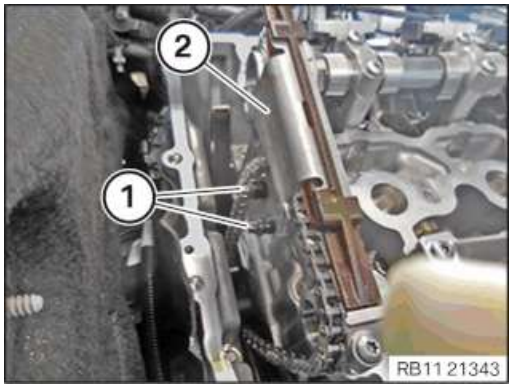
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



NOTICE

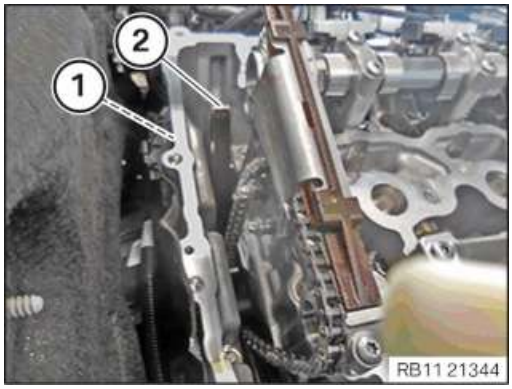
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

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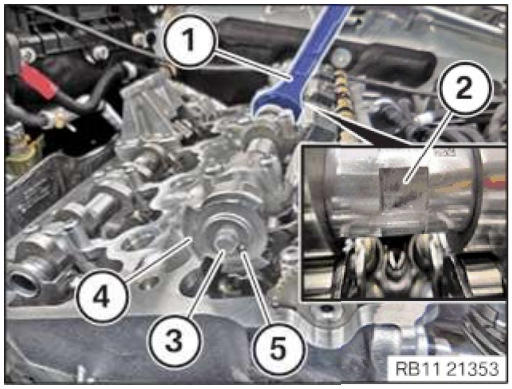
- Release the bearing journal (1) from the guide rail (2).



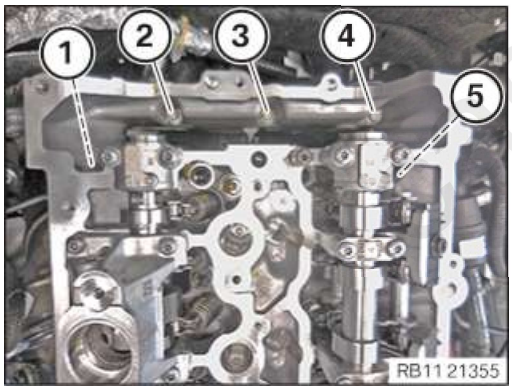
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm



- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.

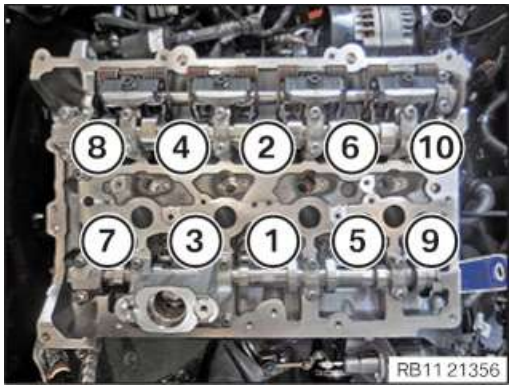


- Loosen the cylinder head bolts in the sequence from (5) to (1).

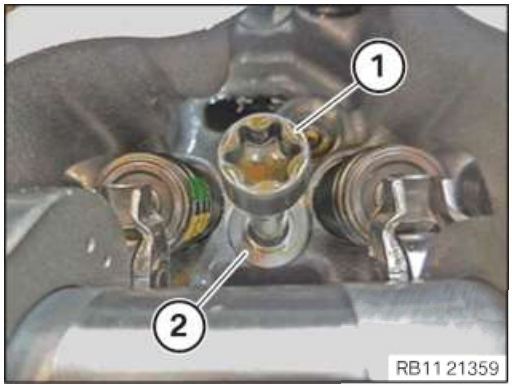


- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

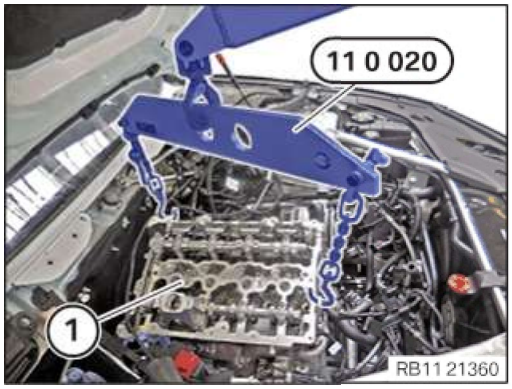
tdiagn.com



- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to the guide rails.

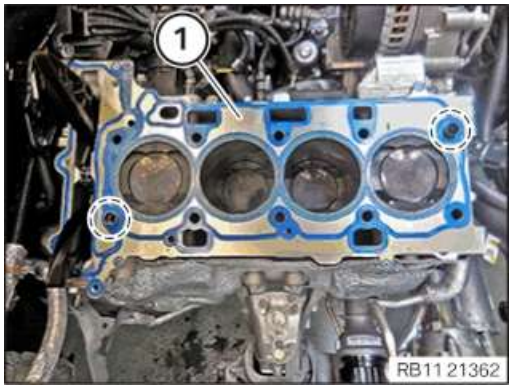
Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Attach special tool to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an **auxiliary person**, the workshop crane and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

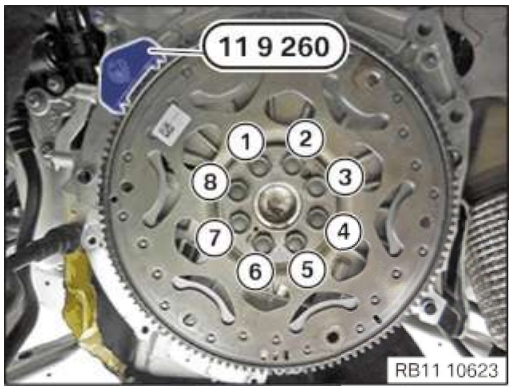
27 – Removing the cylinder head gasket

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- Guide out and remove cylinder head gasket (1) in the **marked** area.

28 – Removing flywheel

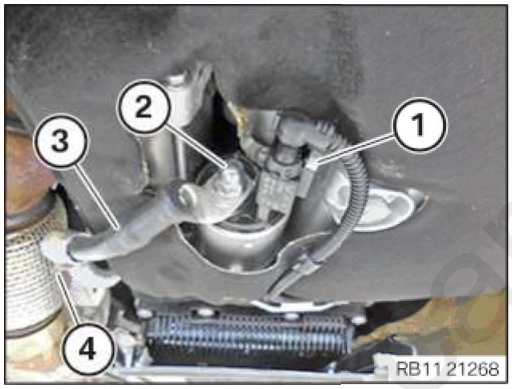


- Fasten the flywheel with the special tool 0 493 938 (11 9 260) and tighten with the special tool 0 494 130 (11 9 264).
- Loosen screws (1-8).

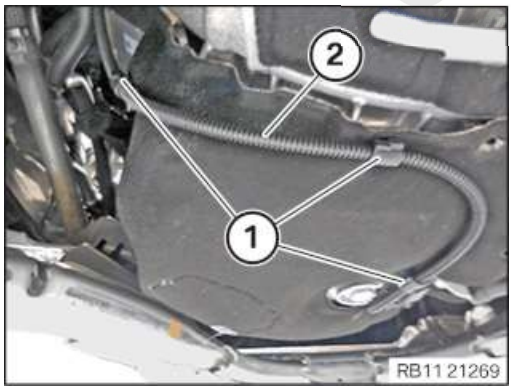
29 – Removing the acoustic cover of the oil sump

Prerequisite

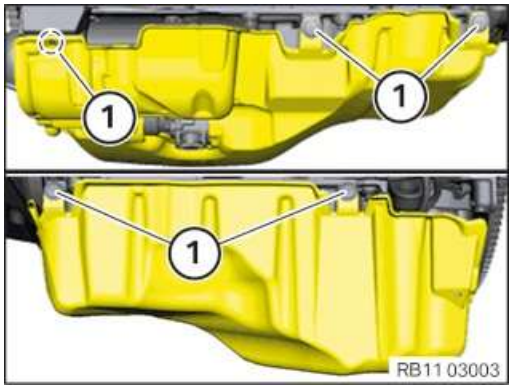
Disconnect all negative battery cables.



- Unlock and loosen connector (1).
- Loosen nut (2).
- Guide the positive battery cable (3) out of the clamp (4) and lay to one side.



- Unlock and loosen the clamps (1).
- Guide out the wiring harness section of automatic transmission (2) and set it aside.



- Detach all expanding rivets (1).



- Guide out acoustic cover (1) downwards to the rear and remove it.

30 – Remove oil sump

RISK OF DAMAGE

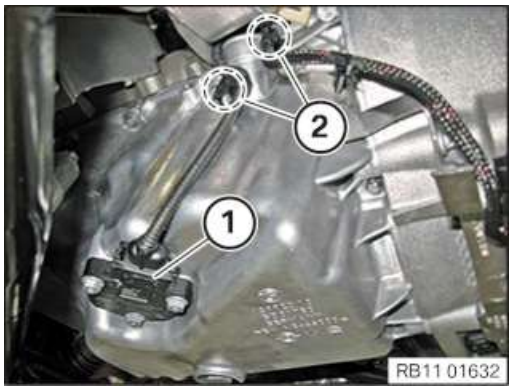
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

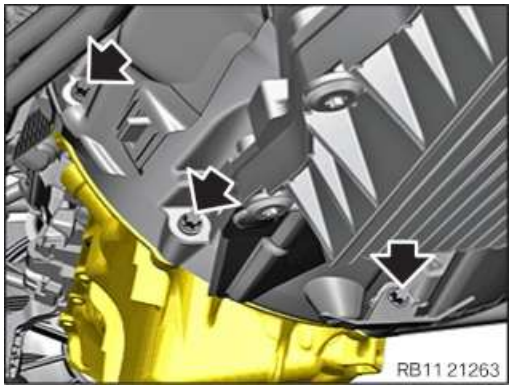
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

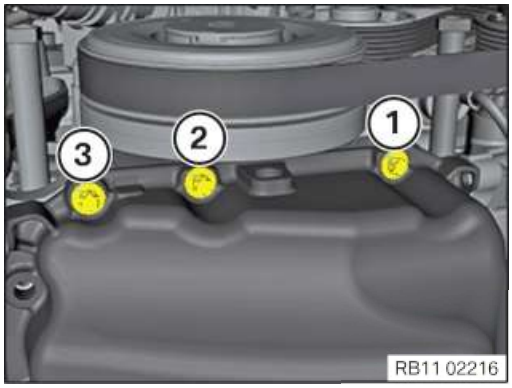


- Unlock and loosen connector (1).
- Release the cable from the clips (2) of the oil sump.

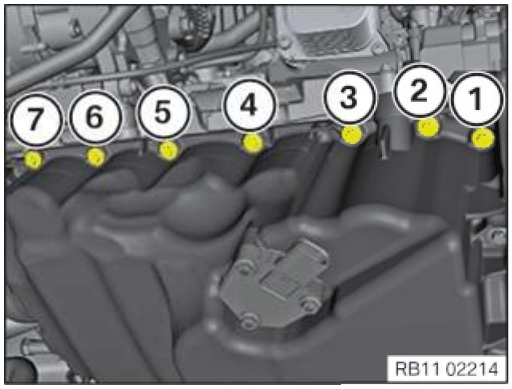
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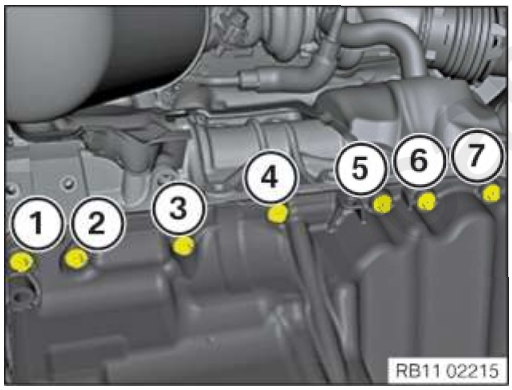
- Unscrew the transmission bolts (arrows).



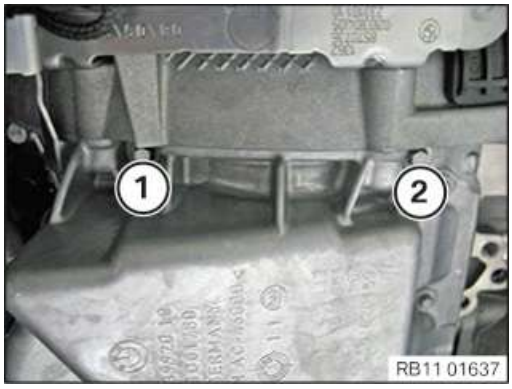
- Loosen screws (1), (2) and (3).



- Loosen screws (1) to (7).



- Loosen screws (1) to (7).



- Loosen screws (1) and (2).

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TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump in the **marked** areas using suitable tools (1).



- Guide out the oil sump (1) downwards to the rear and remove.

31 – Remove the oil vacuum pump

RISK OF DAMAGE

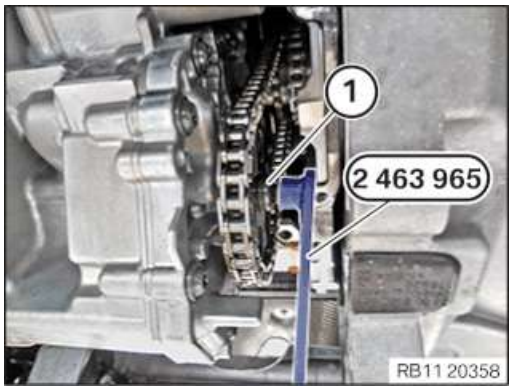
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

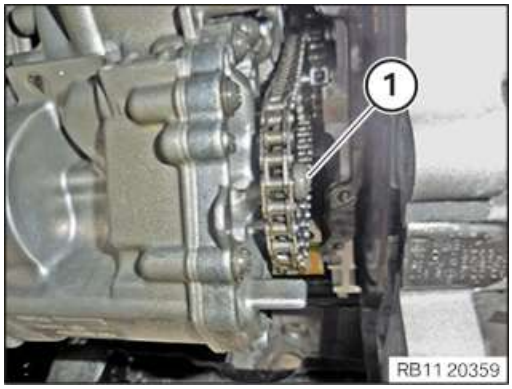
TECHNICAL INFORMATION

The thread is a left-hand thread.

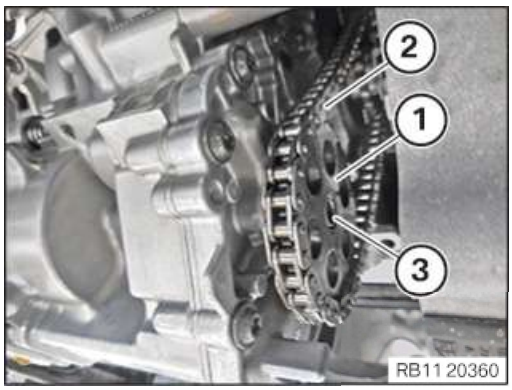


- Release bolt (1) with the special tool 2 463 965.

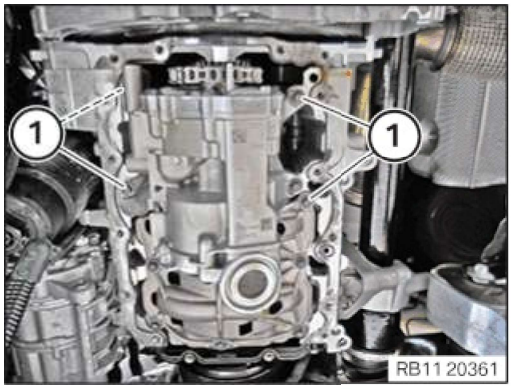
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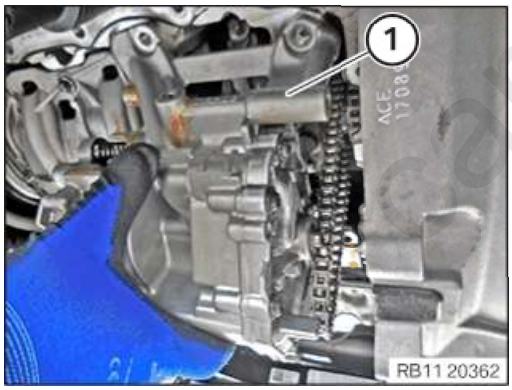
- Thread out the bolt (1) and remove it.



- Detach the camshaft sprocket (1) from the oil vacuum pump (3).
- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.

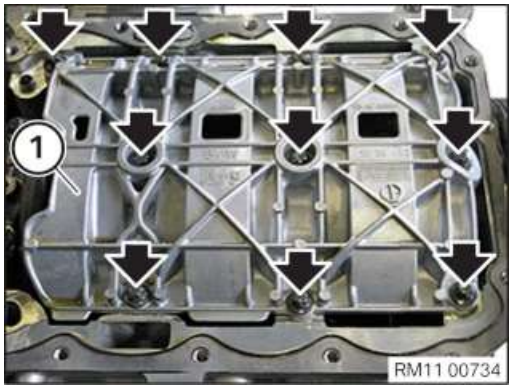


- Loosen screws (1).



- Feed out the oil vacuum pump (1) and remove it.

32 – Removing the oil deflector



- Release all bolts (arrows).
- Remove the oil deflector (1).

33 – Removing all pistons with connecting rod

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NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Removing the piston with connecting rod**

TECHNICAL INFORMATION

Piston, gudgeon pin, connecting rod and connecting rod bearing shells are matched to each other and balanced.

Always install the piston, gudgeon pin, connecting rod and connecting rod bearing shells in the cylinder from which they were removed.

TECHNICAL INFORMATION

The connecting rods of the engine are balanced and are matched to each other.

A single connecting rod is not permitted to be replaced. Always replace all connecting rods.

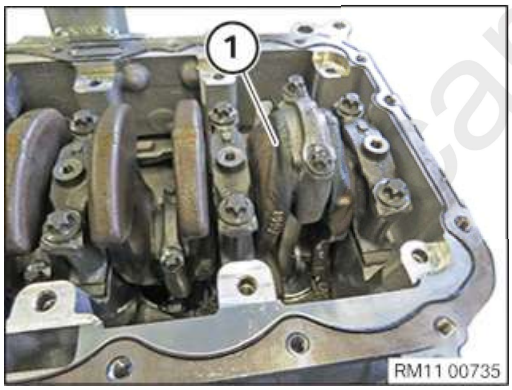
▷ **Detach the lower connecting rod bearing**

RISK OF DAMAGE

Damage on the cylinder wall and oil spray nozzles.

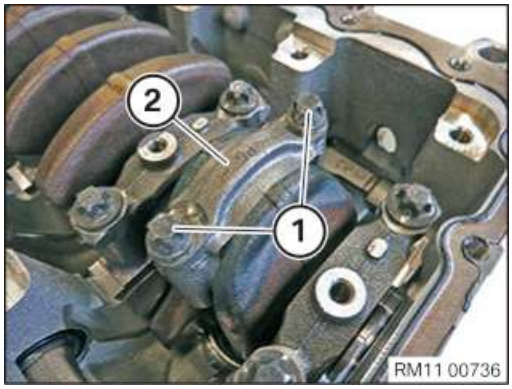
Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.



- Turn the crankshaft until the connecting rod bearing journal (1) reaches a vertical position.

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RISK OF DAMAGE

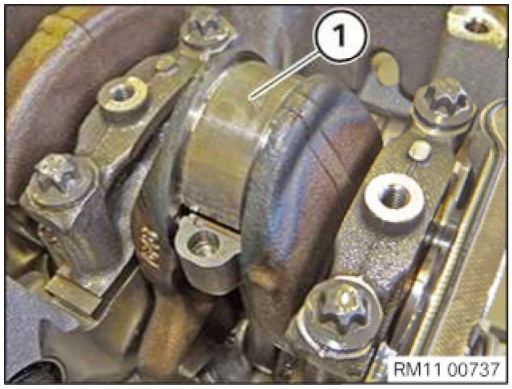
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Unscrew the connecting rod bolts (1).
- Remove the connecting rod bearing cap (2) and put to one side in the correct order.

  Make sure that the connecting rod bearing cap (2) can be re-installed in the correct position.



RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

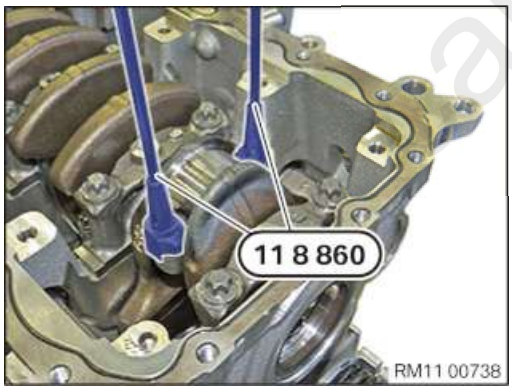
Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

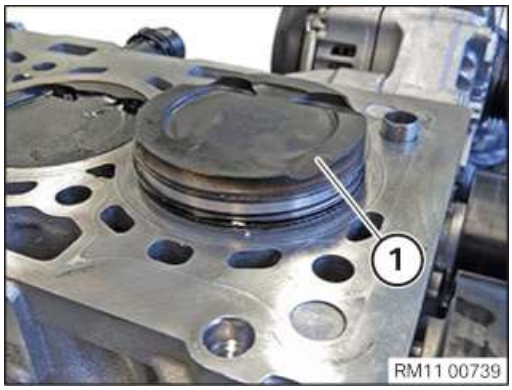
- Remove the connecting rod bearing (1).

  Make sure that the connecting rod bearing (1) can be re-installed in the correct position.

◁



- Screw special tool 0 496 144 (11 8 860) in at large connecting rod eye.



- Press piston (1) with connecting rod up and out of crankcase.

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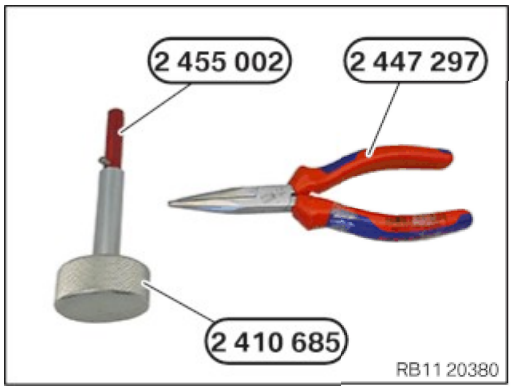
34 – Replacement: renew all pistons

TECHNICAL INFORMATION

- Wear safety goggles.

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Use special tools , and to remove the piston from the connecting rod.



CAUTION

Gudgeon pin circlip with preload.

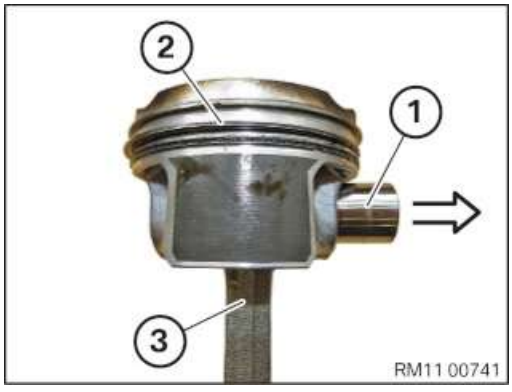
Danger of injury!

- The use of the specified special tool for the disassembly or installation is mandatory.

- Wear safety goggles.

- Use special tool to remove the gudgeon pin circlip.
- Insert the flat side (3) of special tool into the groove (4).
- Grab and remove the gudgeon pin circlip (1) with the arched side (2).

Check



TECHNICAL INFORMATION

Piston and gudgeon pin are matched to each other.
Always install piston and gudgeon pin together and do not switch by mistake.

- Check whether the gudgeon pin (1) demonstrates tangible play in the piston.

  Check whether the gudgeon pin (1) can be removed without excessive force.

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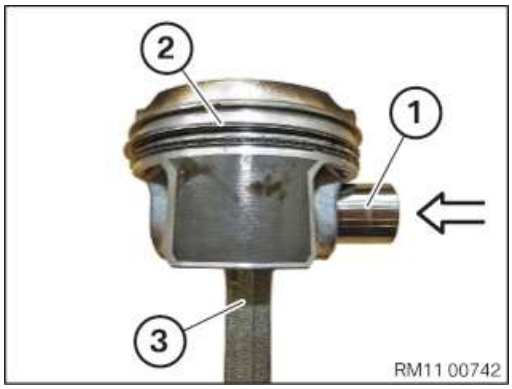
Result

» It is very difficult to remove the gudgeon pin (1) or the gudgeon pin (1) demonstrates significant play.

Measure

- Renew the piston (2) and the gudgeon pin (1).

  Parts: piston, gudgeon pin

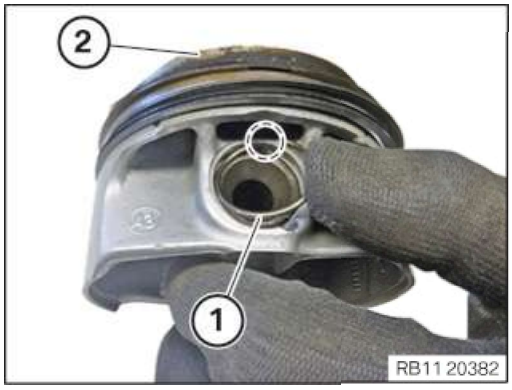


TECHNICAL INFORMATION

Piston and gudgeon pin are matched to each other.

Always install piston and gudgeon pin together and do not switch by mistake.

- Install a new gudgeon pin (1) in the new piston (2) and connecting rod (3).



CAUTION

Gudgeon pin circlip with preload.

Danger of injury!

- The use of the specified special tool for the disassembly or installation is mandatory.

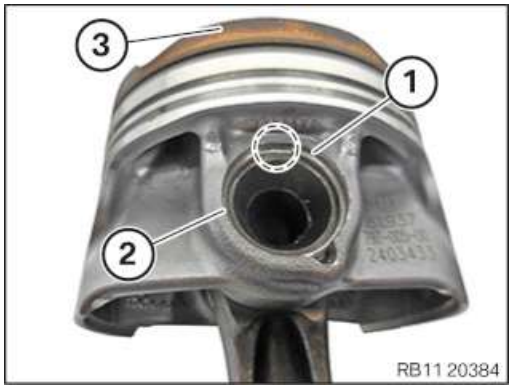
- Wear safety goggles.

- Position the gudgeon pin circlip (1).

  The opening (mark) of the gudgeon pin circlip must point towards the piston crown (2).



- Preload the gudgeon pin circlip (1) using your thumb.
- Simultaneously press the gudgeon pin circlip into the piston using special tools and .
- Twist and reposition special tool and completely press the gudgeon pin circlip into the piston.



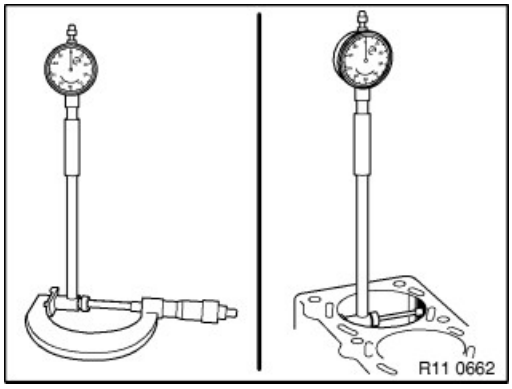
- Check whether the gudgeon pin circlip (1) has been correctly positioned in the groove (2).
- Check whether the opening (mark) of the gudgeon pin circlip points towards the piston crown (3).

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35 – Measuring a cylinder

Prerequisite

Cylinder barrel is cleaned.



Check

- Carry out a measurement at all cylinders.
- Adjusting measuring screw to nominal dimension of cylinder bore.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

- Insert internal measuring device into measuring screw and set to zero.
- With the internal measuring device, measure the cylinder at the following points and check the deviations from the nominal dimension.
  - Lower third of the cylinder bore in direction of travel,
  - Lower third of the cylinder bore transversely to direction of travel,
  - Middle third of the cylinder bore in direction of travel,
  - Middle third of the cylinder bore transversely to direction of travel,
  - Upper third of the cylinder bore in direction of travel,
  - Upper third of the cylinder bore transversely to direction of travel.

Cylinder bore B38/B46/B48/B58

Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Result

» Cylinder does not correspond to the specifications.

Measure

- Renew the crankcase.

36 – Installing all pistons with connecting rod

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Installing piston with connecting rod**

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RISK OF DAMAGE

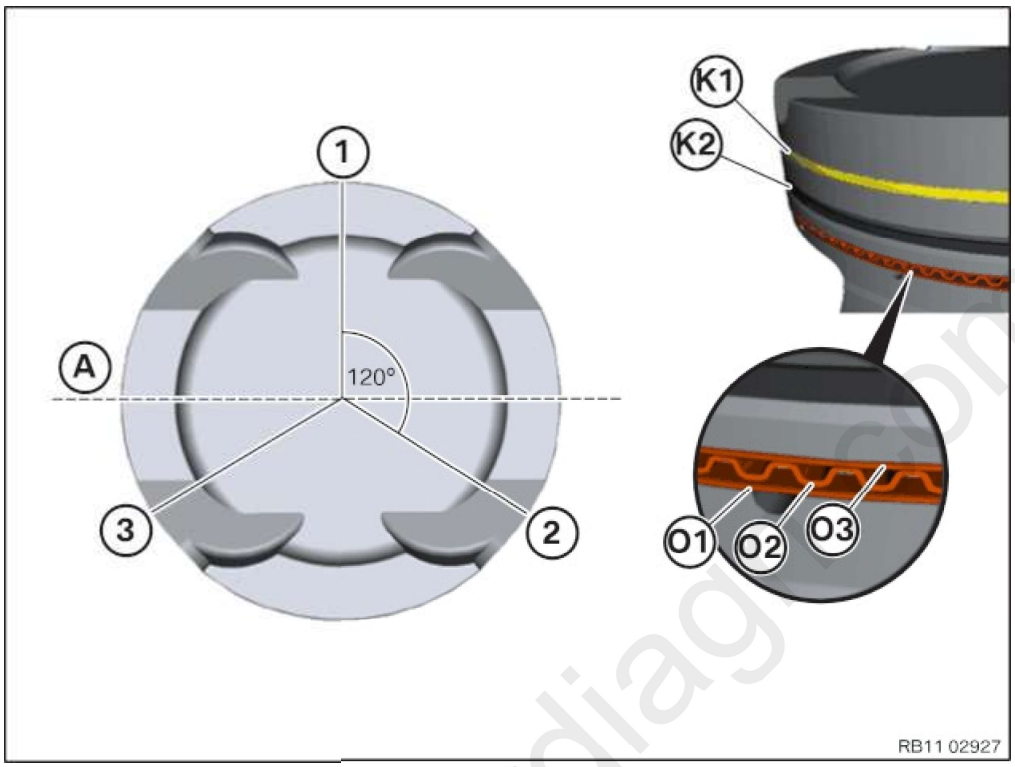
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

▷ **Aligning piston rings**

Aligning piston rings



1 12 o'clock position

2 4 o'clock position

3 8 o'clock position

A Axis of gudgeon pin

K1 Upper piston ring

K2 Middle piston ring

O1 Lower oil scraper ring

O2 Spring

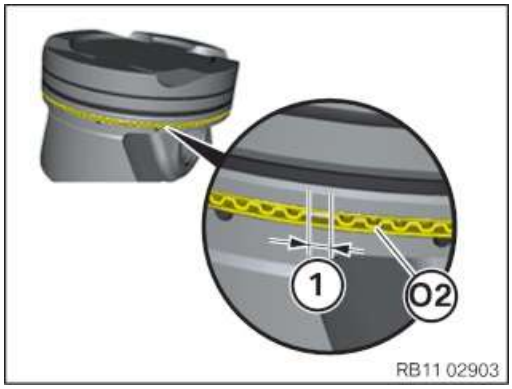
O3 Upper oil scraper ring

- Align the contact points of all piston rings rotated by 120° each.

  Do not position contact points over axis of gudgeon pin (A).

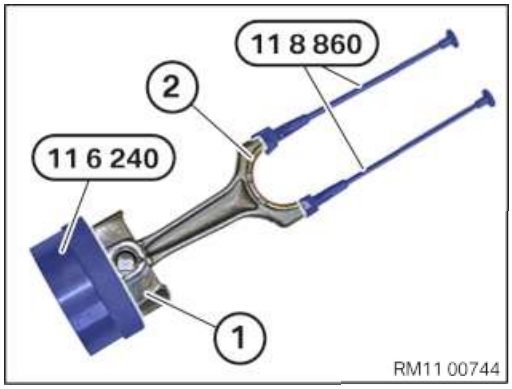
Piston ring	Align at the following position
Lower oil scraper ring (O3)	Align at the 12 o'clock position (1)
Spring (O2)	Align at the 4 o'clock position (2)
Upper oil scraper ring (O1)	Align at the 8 o'clock position (3)
Middle piston ring (K2)	Align at the 12 o'clock position (1)
Upper piston ring (K1)	Align at the 4 o'clock position (2)

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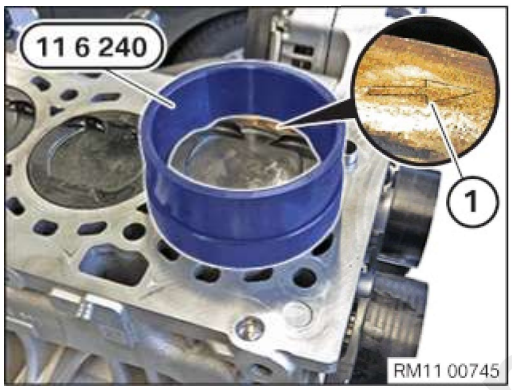


- Make sure that contact point (1) does not overlap spring (O2).

◁



- Coat the pistons (1) and piston rings lightly with oil.
- Insert the pistons (1) with the piston rings into the bush 0 495 373 (11 6 240).
- Screw special tool 0 496 144 (11 8 860) on at large connecting rod eye (2).



- Align the piston so that the arrow (1) points to cylinder 1.
- Insert the piston with the connecting rod into the special tool 0 495 373 (11 6 240) and guide it into the cylinder.

RISK OF DAMAGE

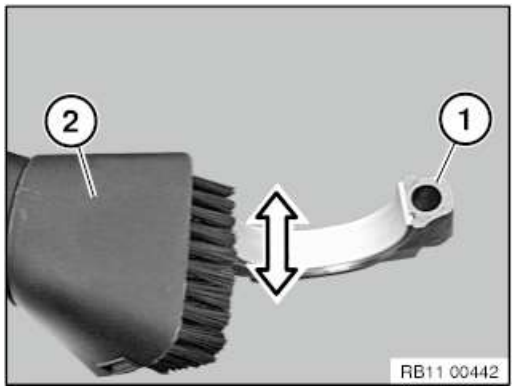
Damage on the cylinder wall and oil spray nozzles.

Major force can scratch the cylinder wall and bend the oil spray nozzles.

- Carefully move the piston and connecting rod in the engine block.

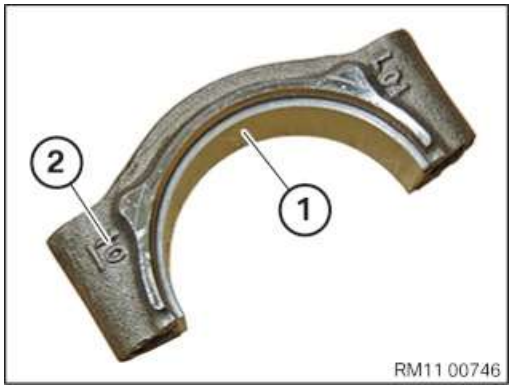
- Push in piston by hand with only little force. Do not use striking tools.

▷ **Install the lower connecting rod bearing**

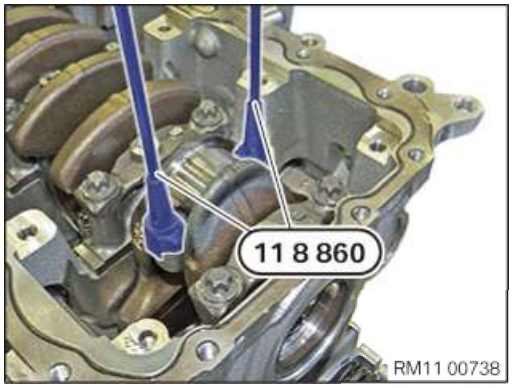


- Vacuum the connecting rod bearing shell and cracked surface (1) with a vacuum cleaner (2).

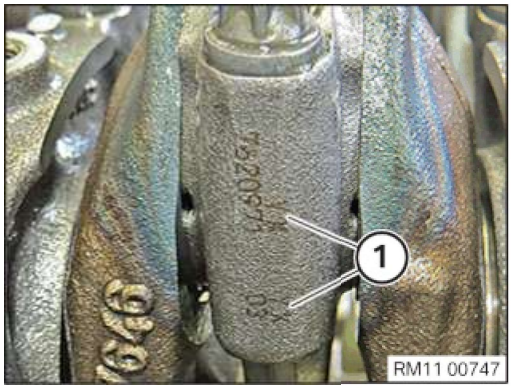
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- Insert the connecting rod bearing shell (1) into the connecting rod bearing cap (2).
- Apply a light coat of oil to the connecting rod bearing shell (1).



- If necessary, screw the assembly tool 0 496 144 (11 8 860) into the large connecting rod eye.
- Pull the connecting rod up to the connecting rod bearing journal.



RISK OF DAMAGE

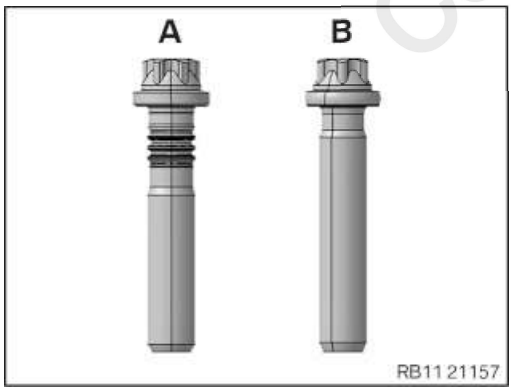
Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

- Always install all bearing shells and bearing supports in the same position from which they were removed.

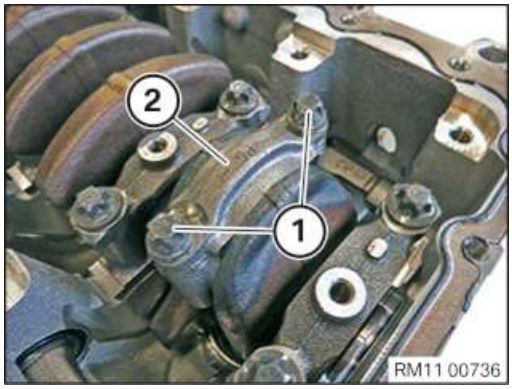
- Attach the connecting rod bearing caps to the connecting rod until the designations (1) match.

  Make sure that the connecting rod bearing (2) is attached to the same connecting rod that it was detached from.



- A mixed installation of connecting rod bolts (A) and (B) on a connecting rod bearing cap is **not** permitted.

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TECHNICAL INFORMATION

When installing new connecting rod bolts, ensure that two identical connecting rod bolts are used on one connecting rod bearing cap.

A mixed installation of different connecting rod bolts on one connecting rod bearing cap is not permitted.

- Renew screws (1).
- Tighten the screws.

  Make sure that the connecting rod bearing cap (2) rests completely on the connecting rod.

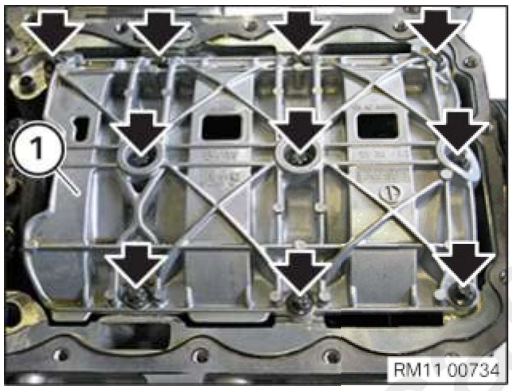
Connecting rod bearing cap to connecting rod

Renew screws.

Tighten screws crosswise.	Jointing torque	20 Nm
	1. Angle of rotation	70 °
	2. Angle of rotation	70 °

◁

37 – Installing the oil deflector



- Install the oil deflector (1).
- Renew screws.

  Parts: Bolts
- Tighten all bolts cross-wise.

Oil deflector to crankcase

M8 x 35		Renew screws.	15 Nm
			45 °

38 – Oil vacuum pump preparation

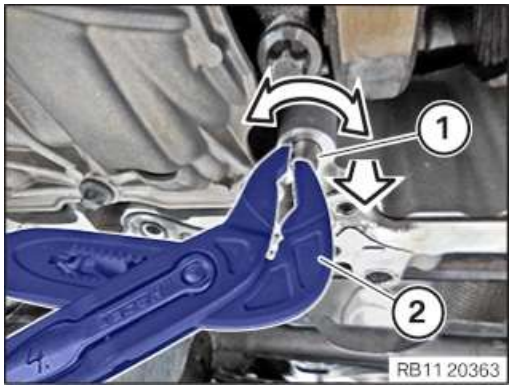
RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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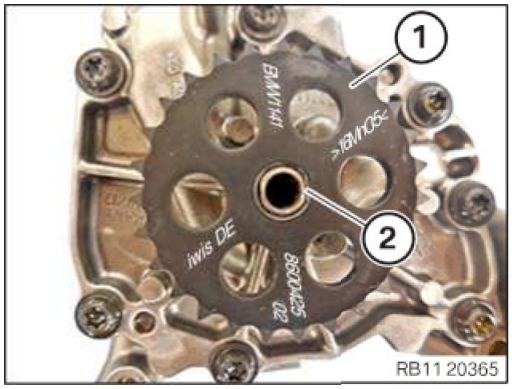


- Remove the centring sleeves (1) in direction of arrow using conventional tools (2).
- Renew the centring sleeves (1).

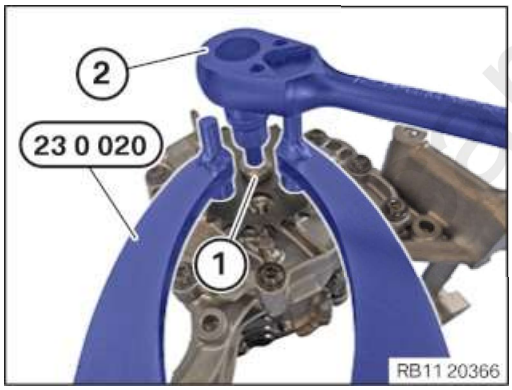
  Parts: Centring sleeves



- Insert and install new centring sleeves (1) on the oil vacuum pump (2).



- Insert and install the camshaft sprocket (1) on the oil vacuum pump (2).
- Make sure the **labelling** on the camshaft sprocket points to the **front**.



TECHNICAL INFORMATION

The thread is a left-hand thread.

- Insert and install the new screw (1).
- Hold camshaft sprocket with special tool 0 491 440 (23 0 020) and tighten screw (1) with conventional tools (2).

Note: Carry out work with a second person assisting.

Camshaft sprocket to oil vacuum pump

M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °

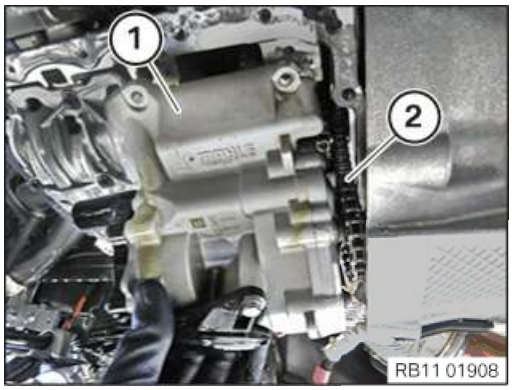
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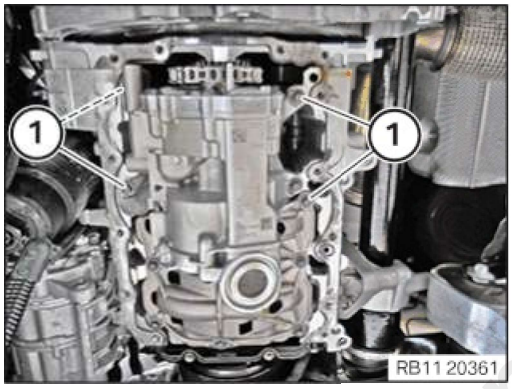
- Make sure the sealing ring (1) is installed correctly.

  The sealing ring (1) must not be damaged or missing.

39 – Install the oil vacuum pump



- Feed the oil vacuum pump (1) into the drive chain (2) and position it.



- Tighten the new bolts (1).

Oil vacuum pump to crankcase

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

40 – Refitting sump



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the rough seal remains on the sealing surface (1) of the crankcase with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



- Have the special tool ready.



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

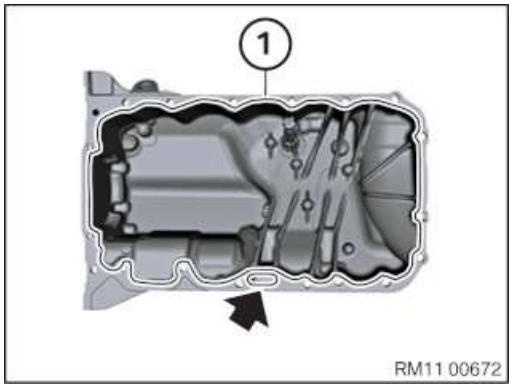
- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)



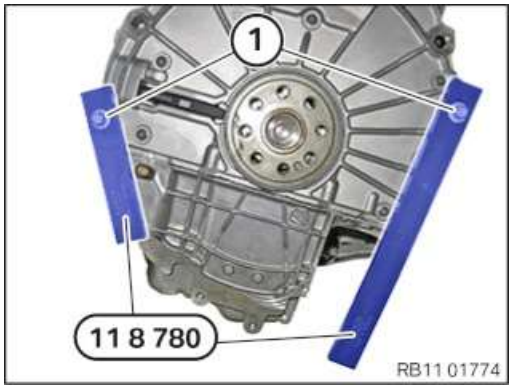
TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound along the line (1) with a thickness of 2 mm to 2.5 mm.

  Apply the sealing compound along the inner edge.
- Completely encircle the oil return orifice (arrow) with the sealing compound.

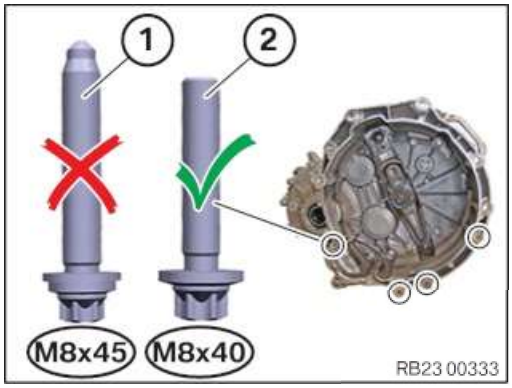
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TECHNICAL INFORMATION

The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with engine block.
- If necessary, renew fitting sleeves.



RISK OF DAMAGE

Component damage caused by incorrect screw length.

The use of screws with the incorrect screw length can damage the component.

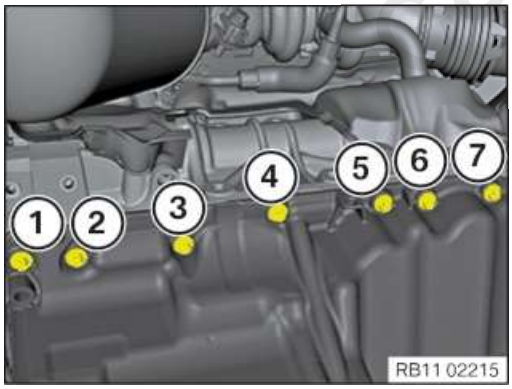
- Check for correct screw length.
- Re-install screws that correspond to the original screw length.

- Ensure that the **correct** screw (2) (M8x40) is used for mounting the oil sump on the transmission.

  The screw (1) (mounting bolt of the starter motor) may **never** be used for mounting the oil sump.



- Install oil sump (1) to top front.
- **Hand-tighten** all oil sump screws but do not tighten completely.

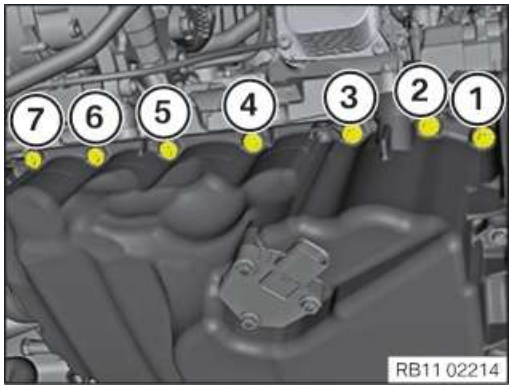


- Tighten the screws (1) to (7).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

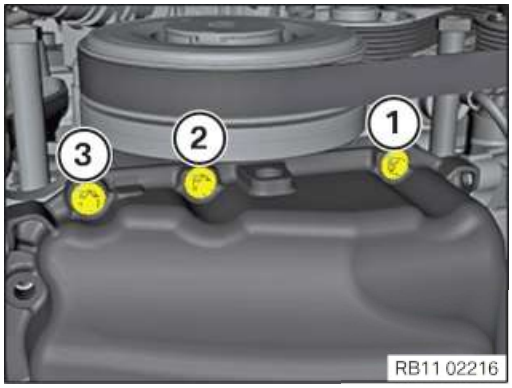
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- Tighten the screws (1) to (7).

Oil sump to crankcase

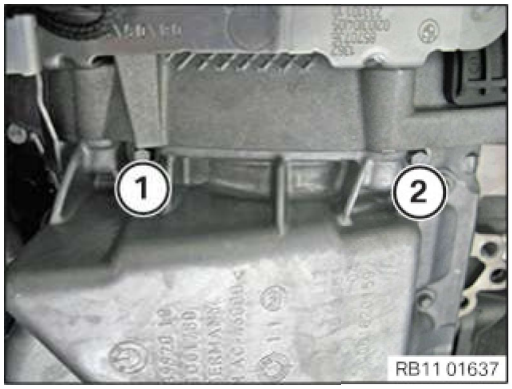
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1), (2) and (3).

Oil sump to crankcase

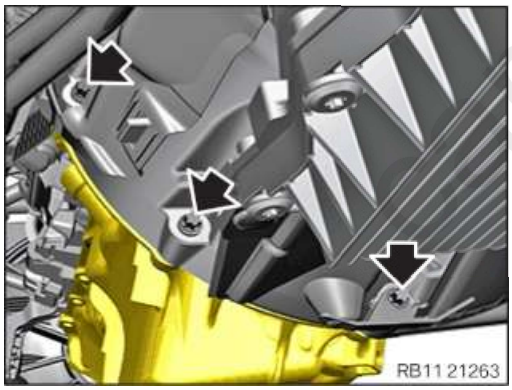
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten down screws (1) and (2).

Oil sump to crankcase

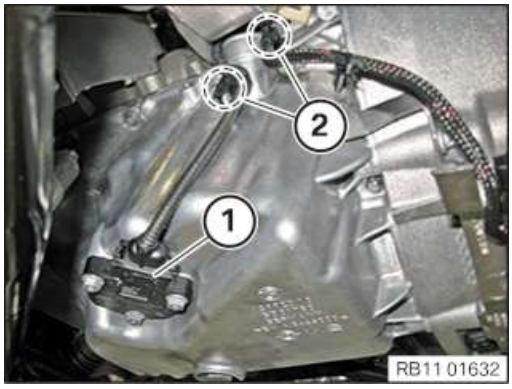
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm



- Fasten cable on the clips (2) from the oil sump.
- Connect and lock the connector (1).
- Make sure the connector 1 engages audibly.

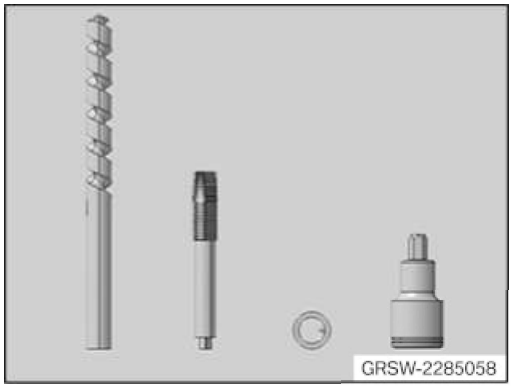
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TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).



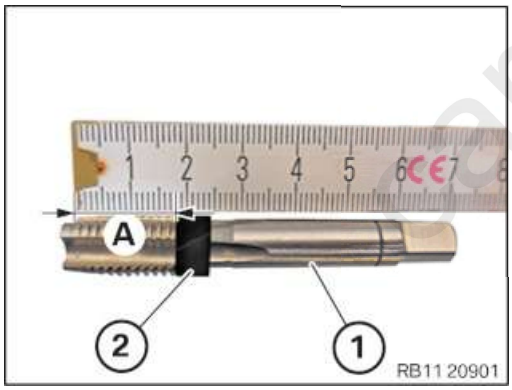
- Use the set of special tools 2 285 058.

Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool



- Assemble tool set.

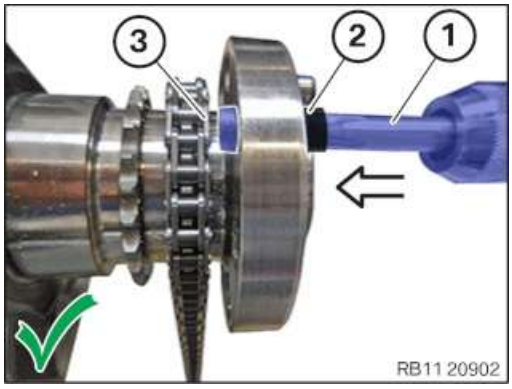
Number	Description
1	Tool holder
2	Thread cutter M12X1,5



- Mark the screw-in depth (A) on thread cutter (1) from the set of special tools 2 285 058 with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm



NOTICE

To provide a better overview: Shown with engine removed.

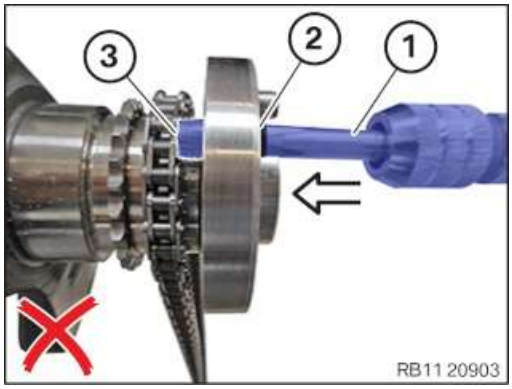
- Screw in the thread cutter (1) from the set of special tools 2 285 058 in direction of arrow up to the screw-in depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).

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TECHNICAL INFORMATION

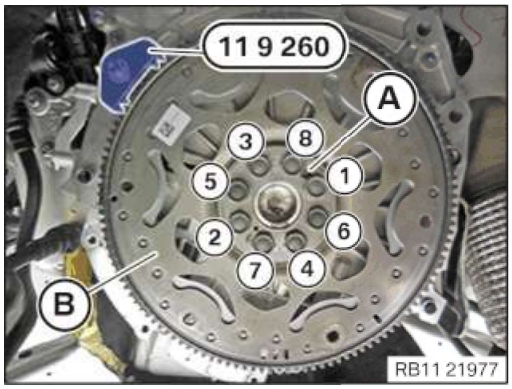
- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

- Make sure that the screw-in depth (2) of the screw tap (1) is not exceeded.

  The thread cutter (1) may not rest on the timing chain (3).



- Make sure the magnet wheel (1) is installed correctly.



- Renew screws (1) to (8).

  Parts: Bolts
- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool 0 494 034 (11 9 261) and screw the special tool 0 494 130 (11 9 264) tightly.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten flywheel bolts in sequence (1) to (8).

Flywheel to crankshaft

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

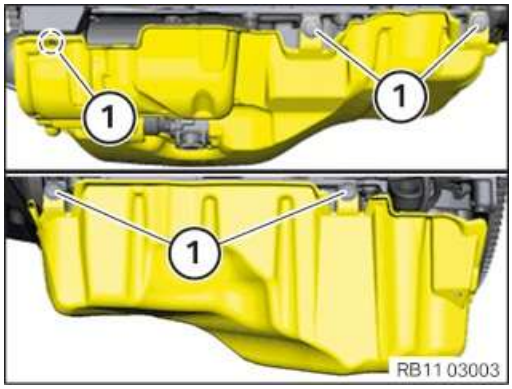
- Remove special tool 0 493 938 (11 9 260).

42 – Installing the acoustic cover for the oil sump

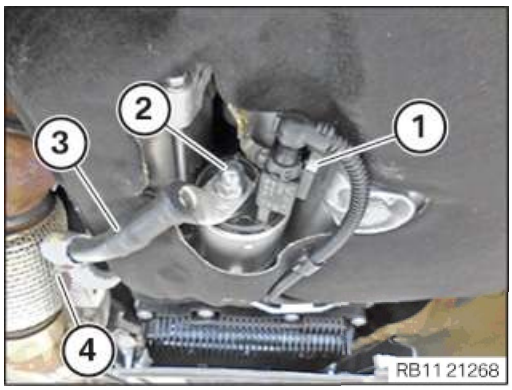


- Install acoustic cover (1) to the top front.

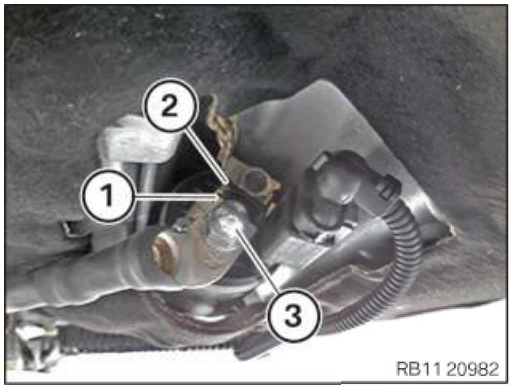
carflash.com



- Secure all expanding rivets (1).



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.
- Insert and install the positive battery cable (3).
- Secure positive battery cable (3) at the clamp (4).
- Tighten the nut (2) hand-tight.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

43 – Block the crankshaft in he TDC firing position of cylinder 1



RISK OF DAMAGE

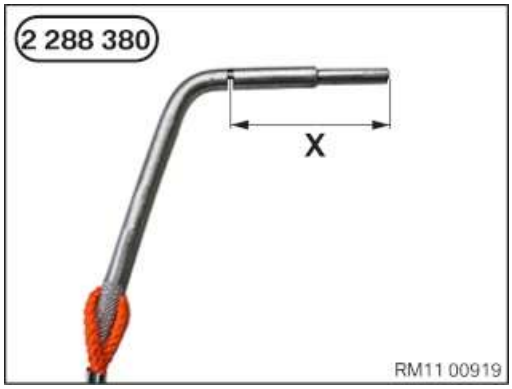
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

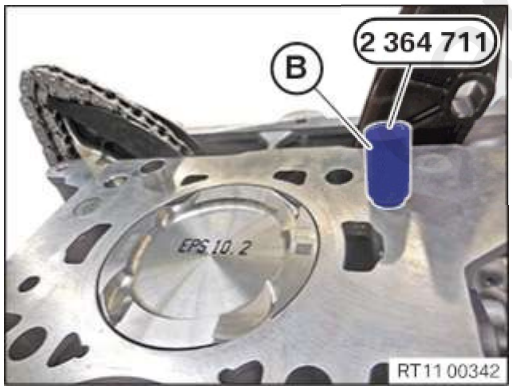


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

44 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

45 – Clean sealing surfaces

RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

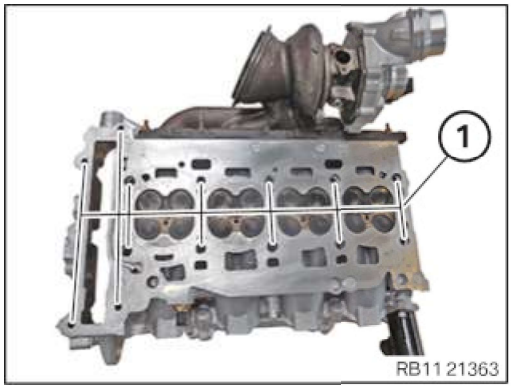
- Do not use any metal-cutting tools.



- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).



- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.

.diagn.com



CAUTION

Swirling dirt particles caused by compressed air.

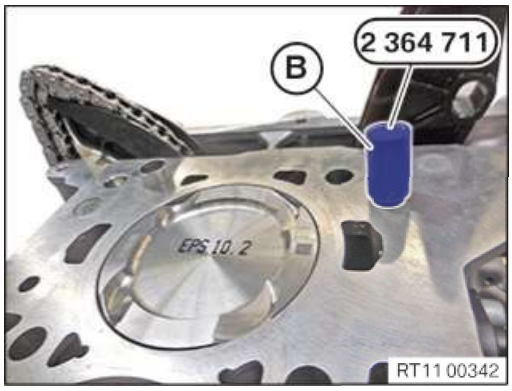
Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



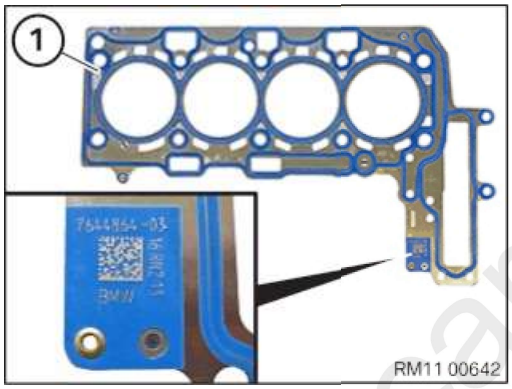
- Wear safety goggles.

- Clean all the threaded holes in the **marked** area of the crankcase with compressed air.



- Remove special tool (B) contained in the set of special tools 2 364 711.

46 – Renewing the cylinder head gasket



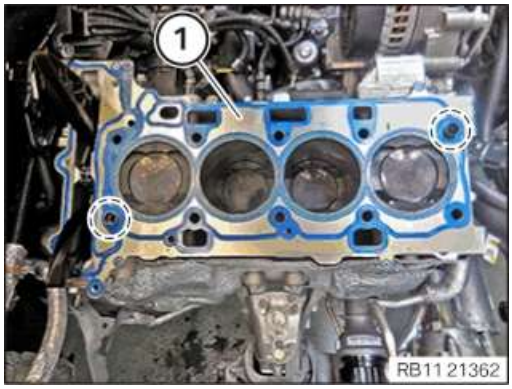
- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional thicker gasket 0.3 mm is available for service personnel.



- Check fitting sleeves (1) in the **marked** area for damage and, if necessary, renew them.

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- Guide cylinder head gasket (1) into the **marked** area and install it.

47 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

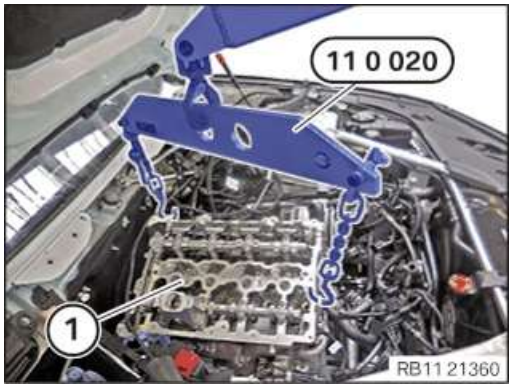
- Dry threaded holes (e.g. using compressed air).

TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



RISK OF DAMAGE

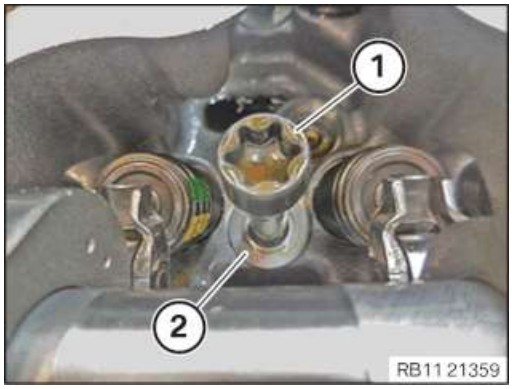
Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

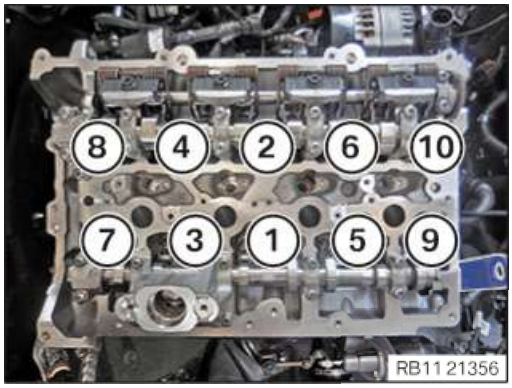
cardiagn.com



- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of engine block.
- Guide in and install cylinder head bolts (1).



TECHNICAL INFORMATION

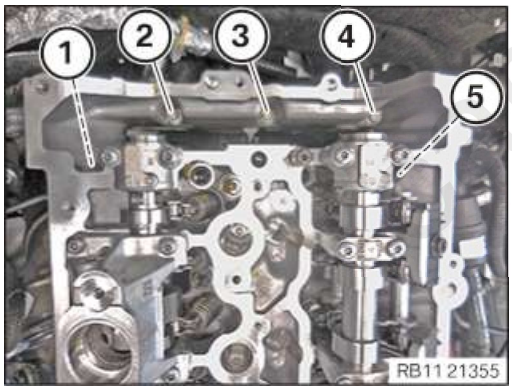
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °



- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

Cylinder head bolt to timing case cover

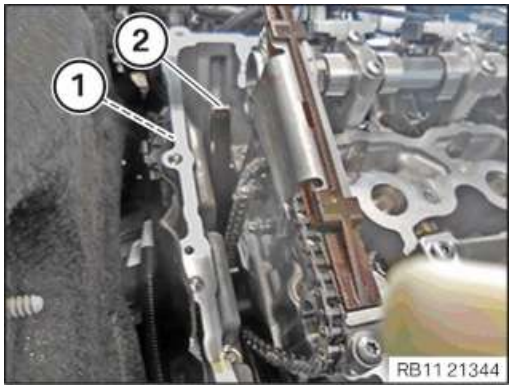
M8x40	Renew screws.	Tightening torque	19 Nm



- Renew bearing journal (1).

  Parts: Bearing journal

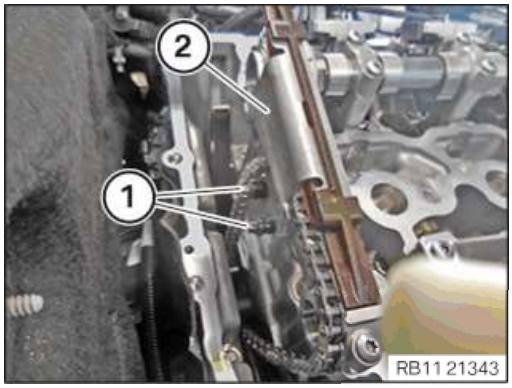
tdiagn.com



- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

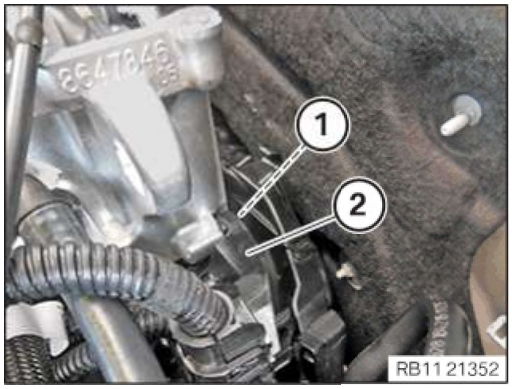
Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm



- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

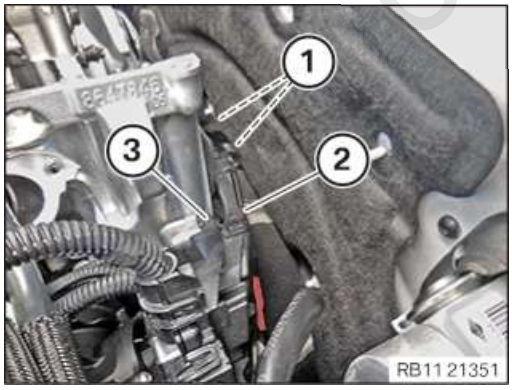
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

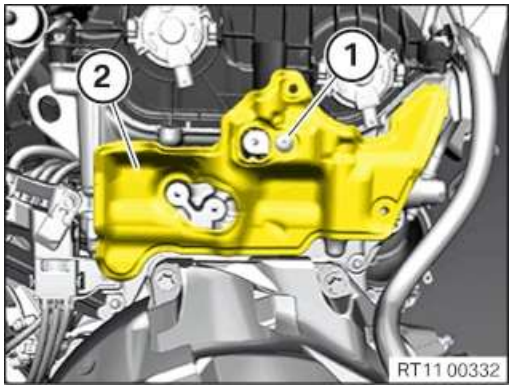
- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm

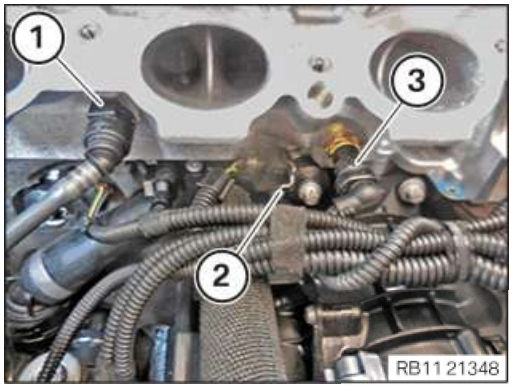
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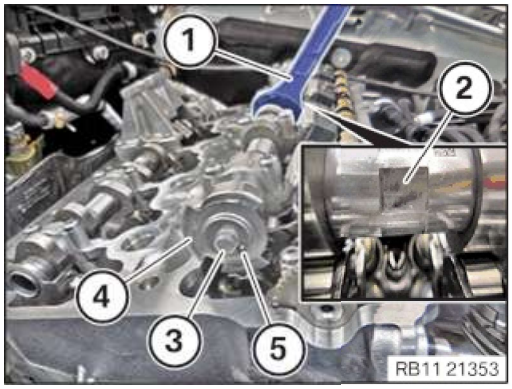
- Guide in and install cover (2).
- Tighten down screw (1).

Cover on rear cylinder head

M6		Tightening torque	8 Nm



- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



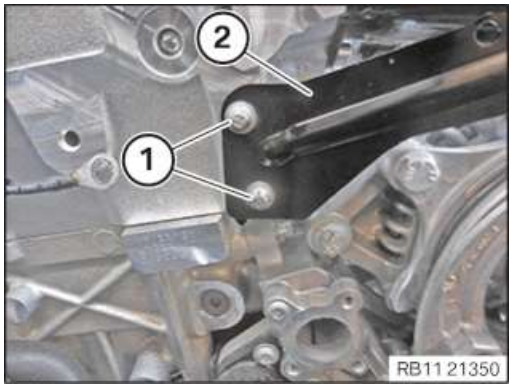
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm



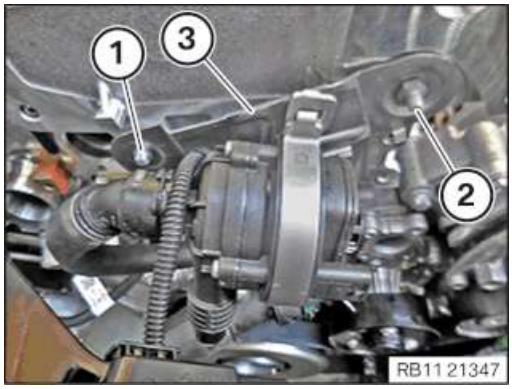
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

Holder for electrical auxiliary coolant pump on cylinder head

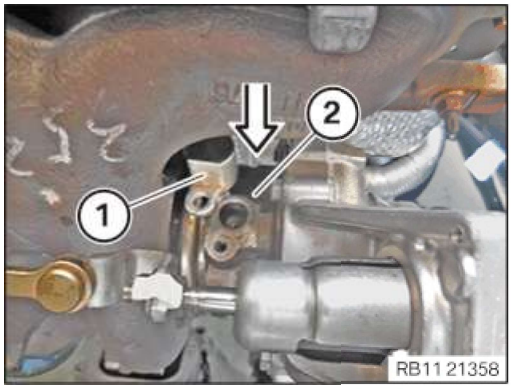
M6		Tightening torque	7 Nm



- Thread in ground cable (2) and install.
- Tighten nut (1).

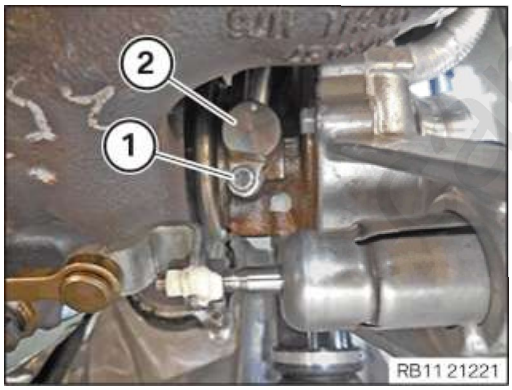
Standard screw connection M6

M6		8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

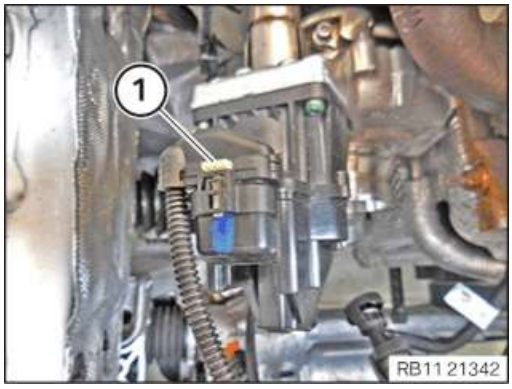
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm



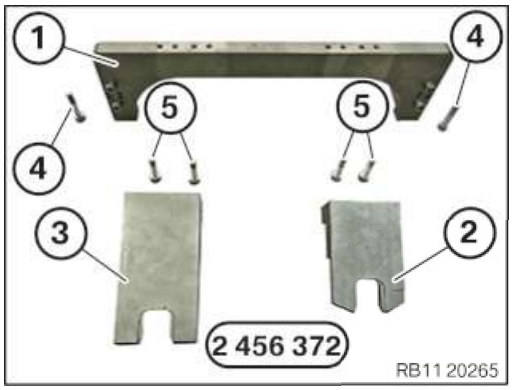
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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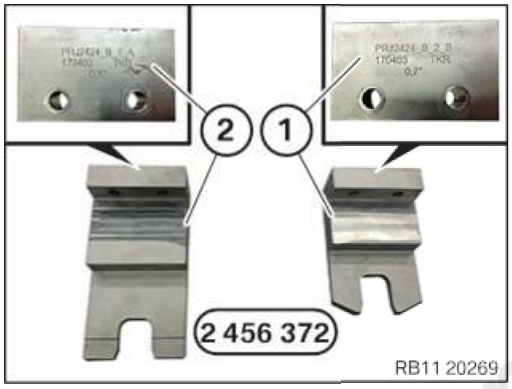
- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

48 – Adjust the camshafts with the special tool

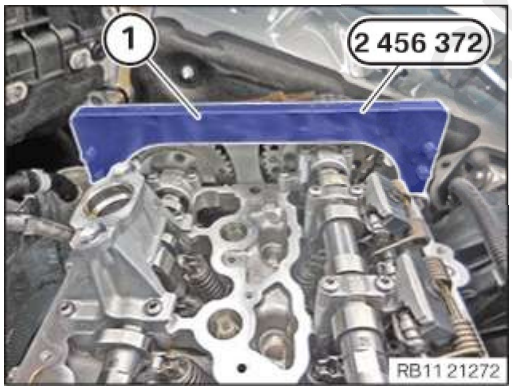


- Overview of the set of special tools 2 456 372:

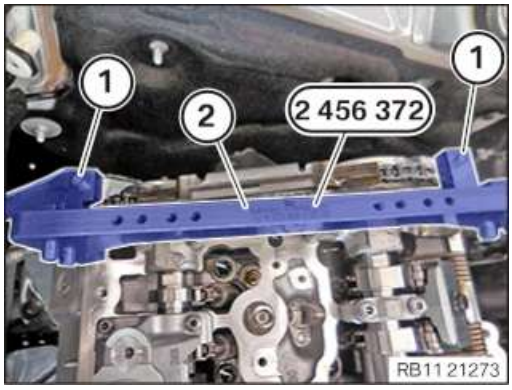
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



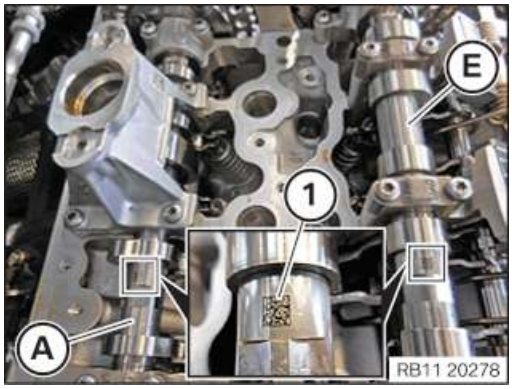
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



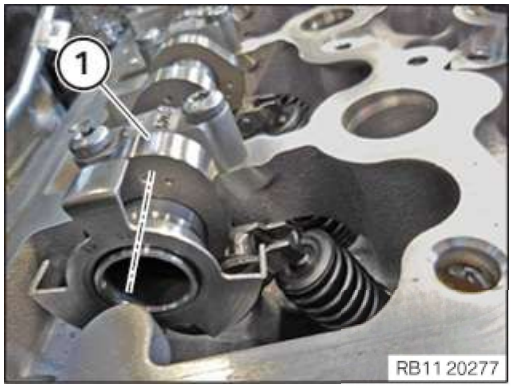
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

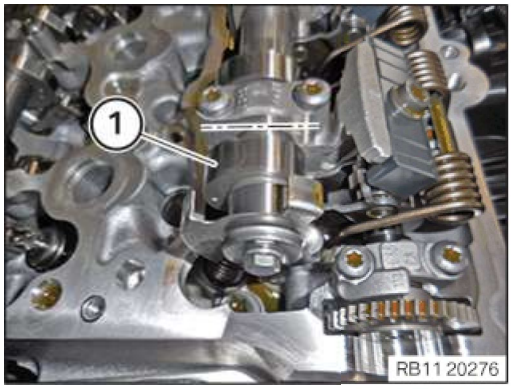
M6		Tightening torque	8 Nm



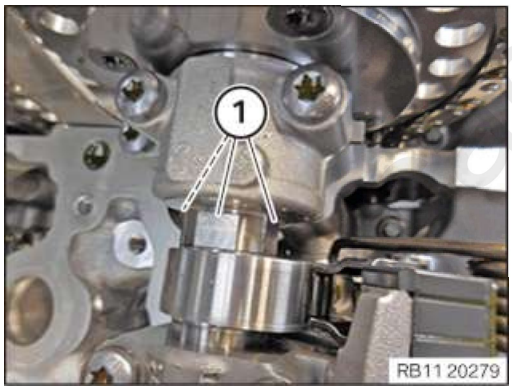
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



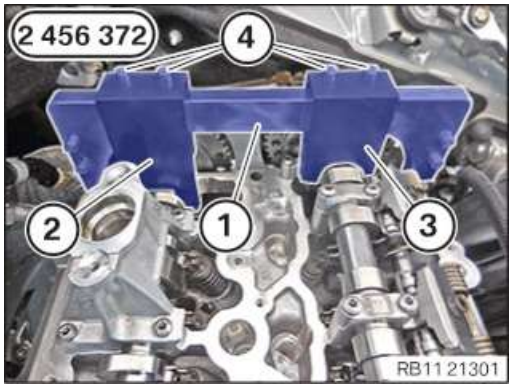
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

49 – Install exhaust camshaft adjuster

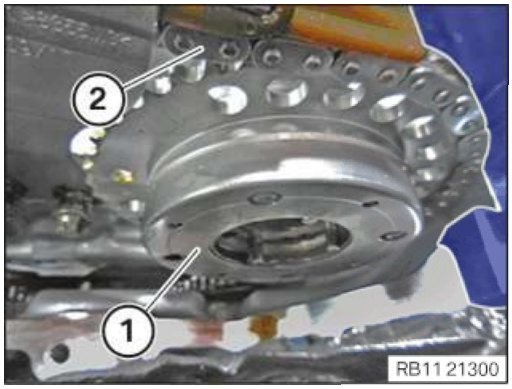
arodiagn.com

NOTICE

The figure shows the rear side of the engine.



- Keep exhaust camshaft adjuster (1) marked EX ready.



- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

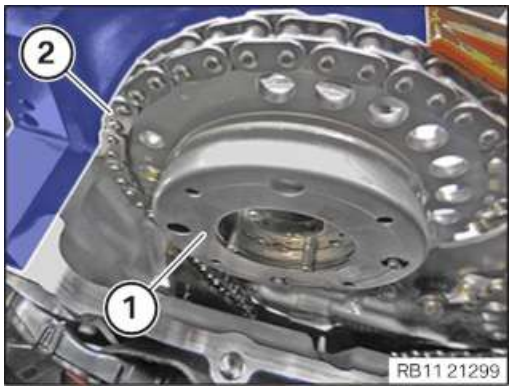
50 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.



- Keep intake adjuster (1) marked IN ready.

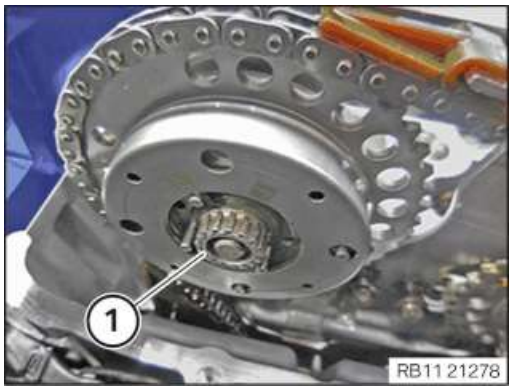


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

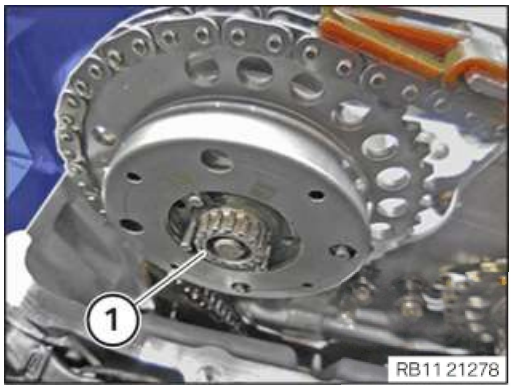
51 – Install the VANOS central valve of the intake adjuster

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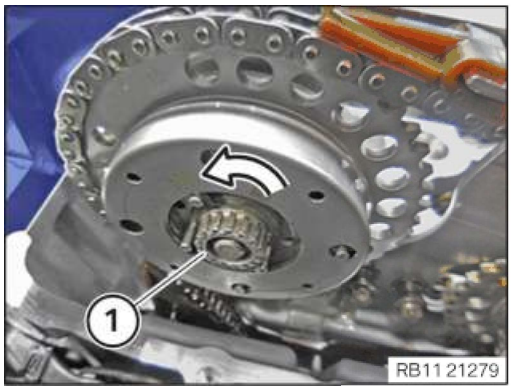
– Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.

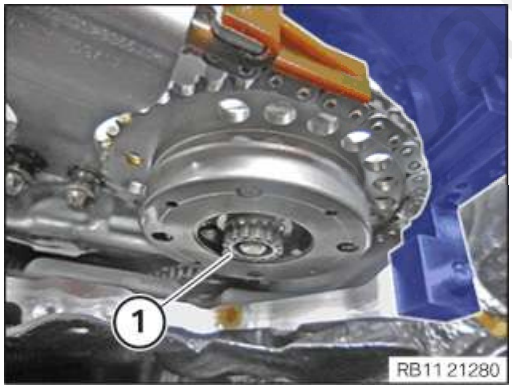


- Hand-tighten the VANOS central valve (1) of the intake adjuster.

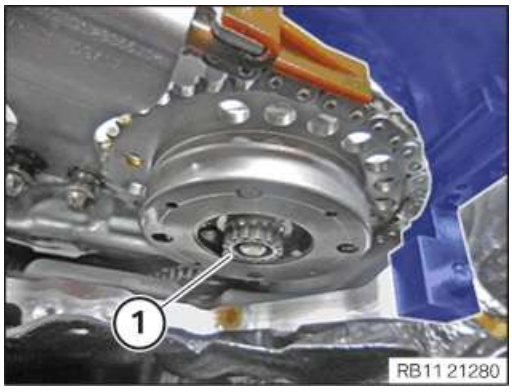


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

52 – Installing the VANOS central valve of the exhaust camshaft adjuster

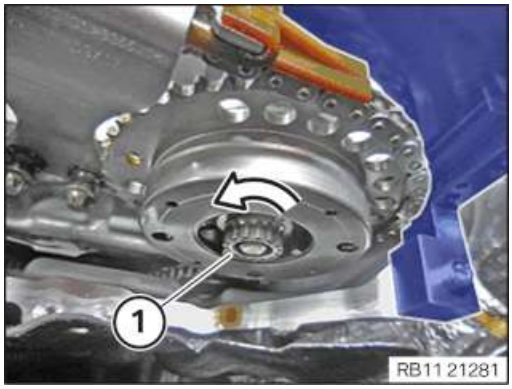


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



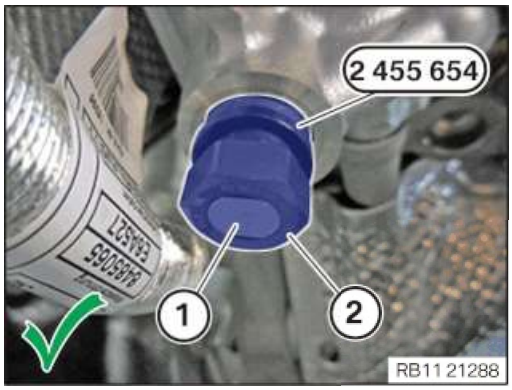
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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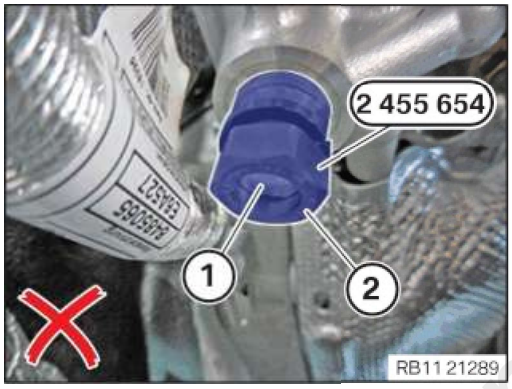
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

53 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

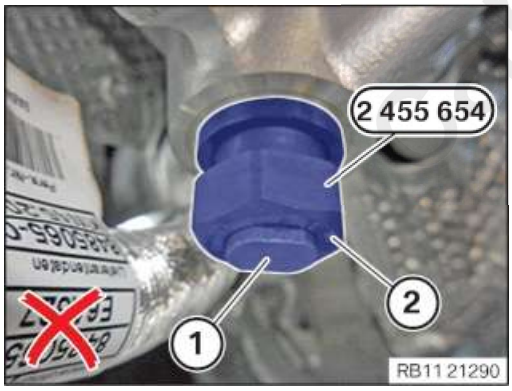
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

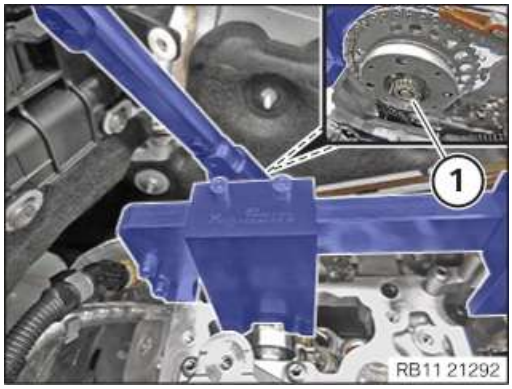
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

54 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

55 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

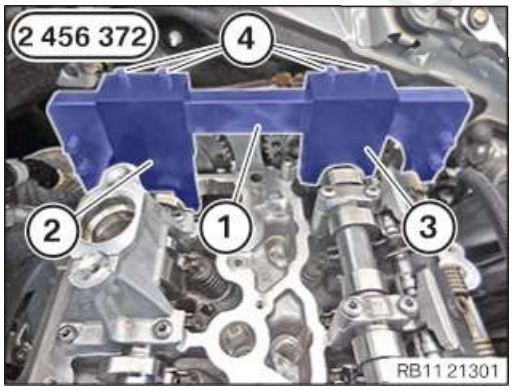


- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

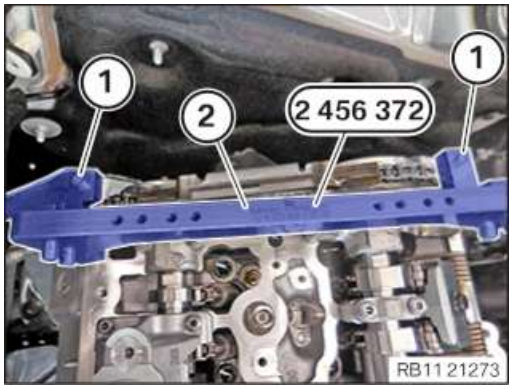
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

56 – Disassembling all special tools

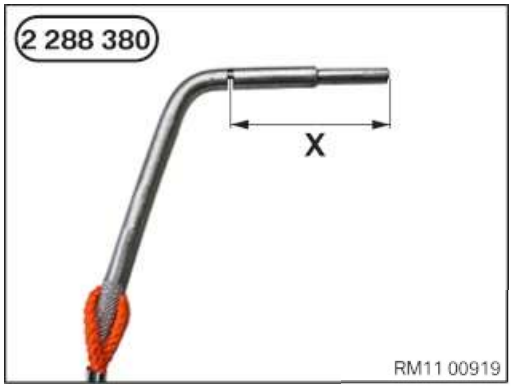


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

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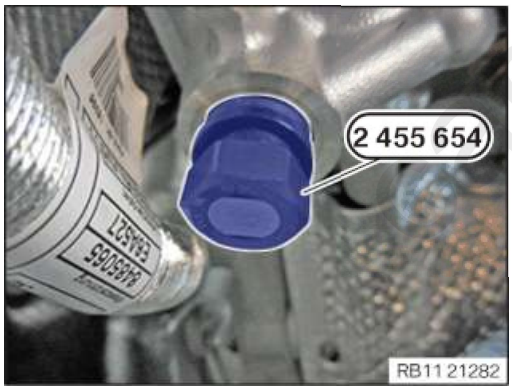
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

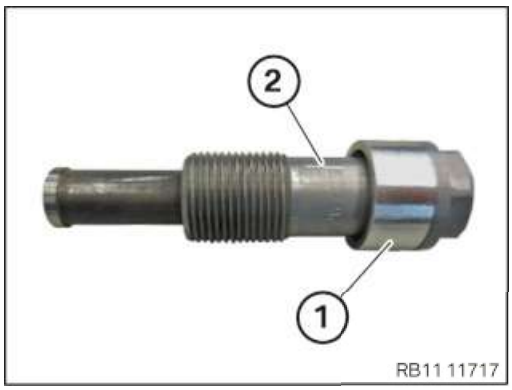
57 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

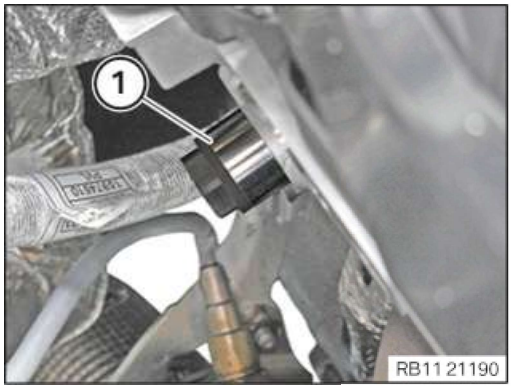


- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

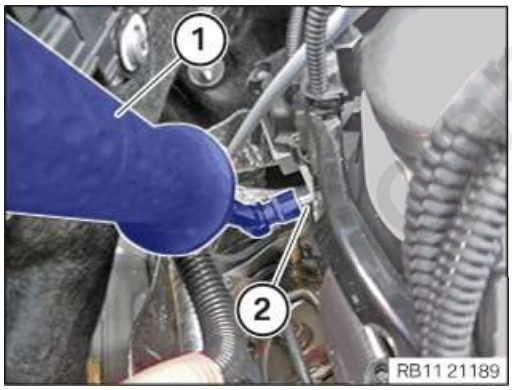


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

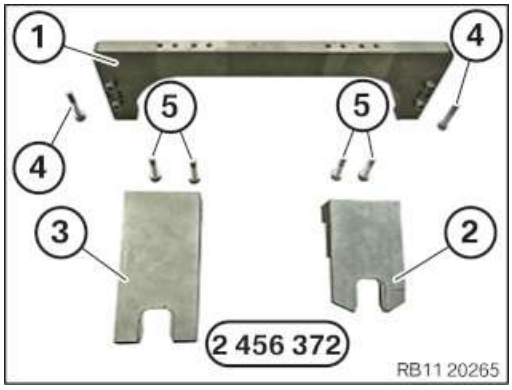


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

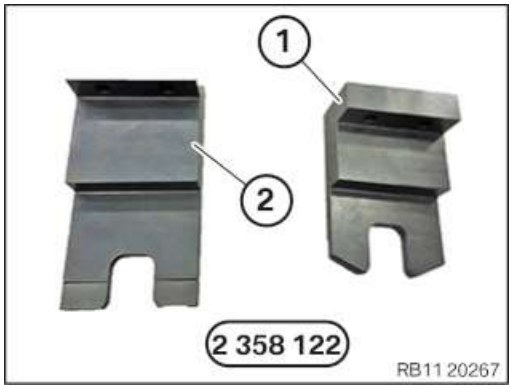
58 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



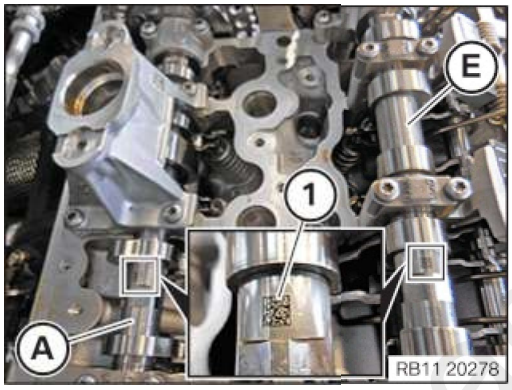
RISK OF DAMAGE

Damage to the engine.

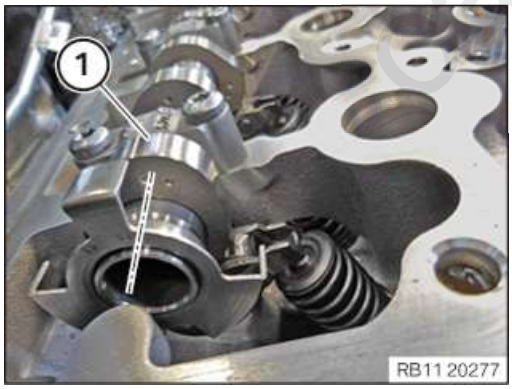
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

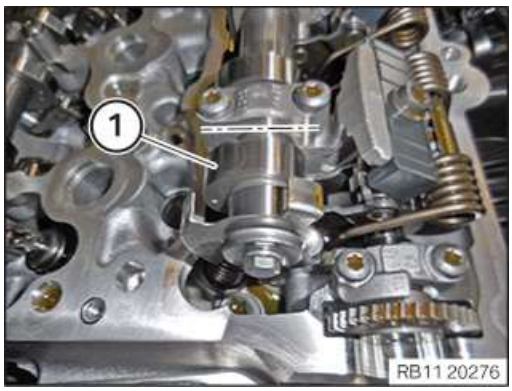
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



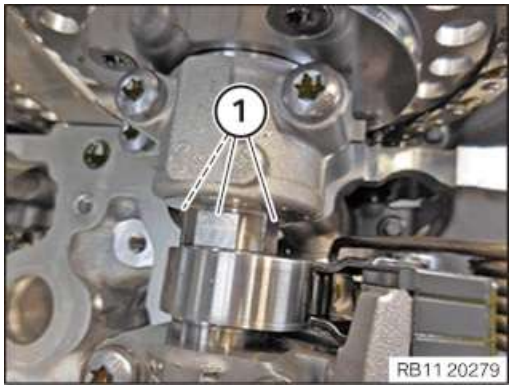
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



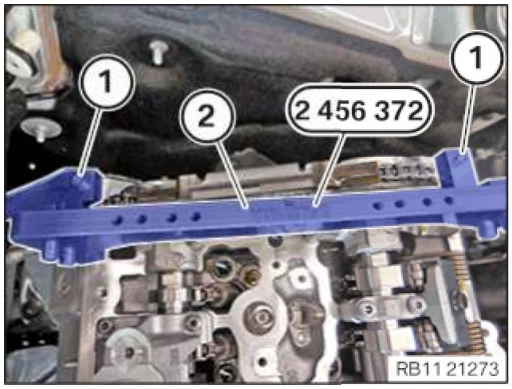
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



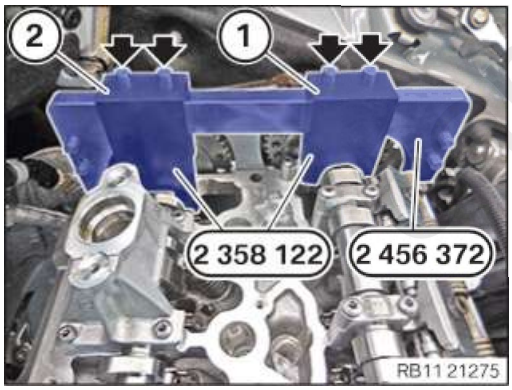
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

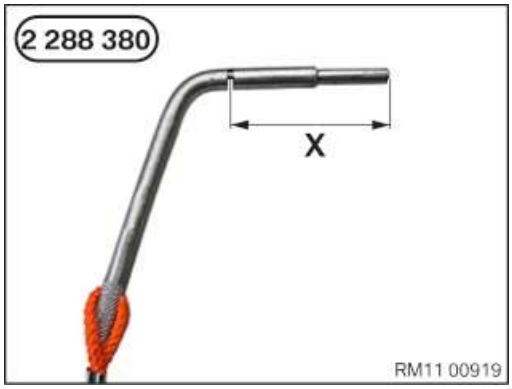
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

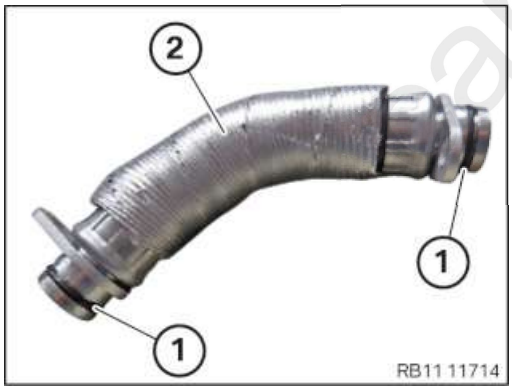


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

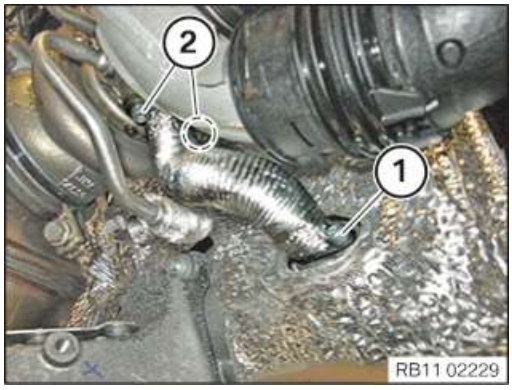
  The engine **is in the** TDC firing position of cylinder 1.

59 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

Oil return line to exhaust turbocharger/crankcase

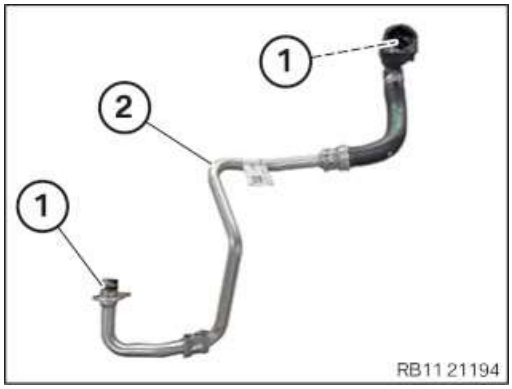
M6x14		Tightening torque	8 Nm

60 – Install the coolant return line for the exhaust turbocharger

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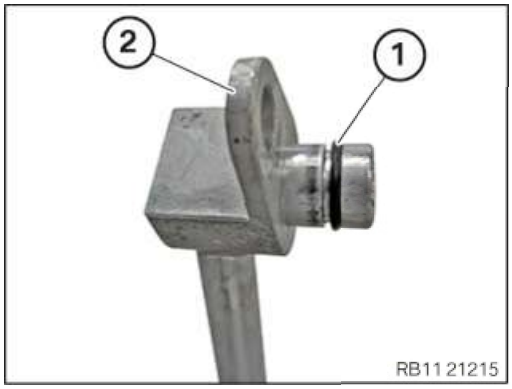
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



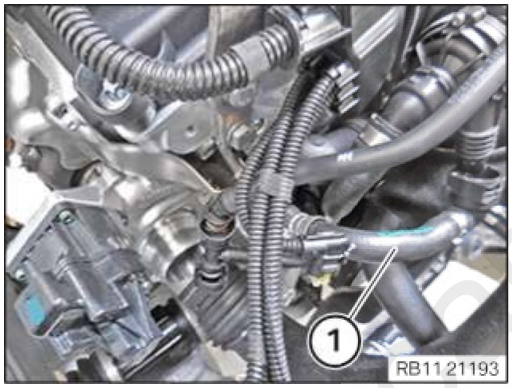
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-ring

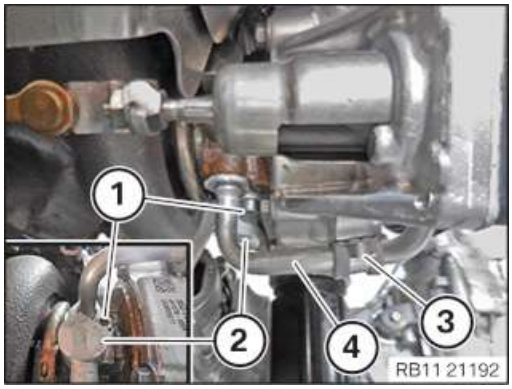


- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.

.com



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

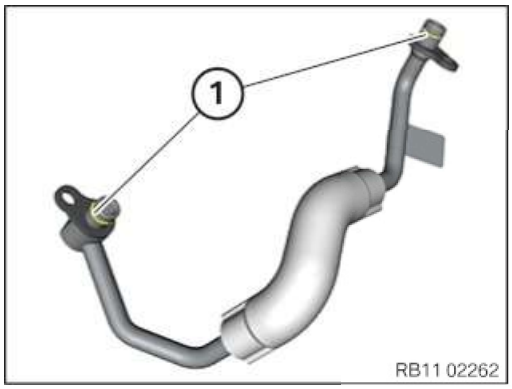
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

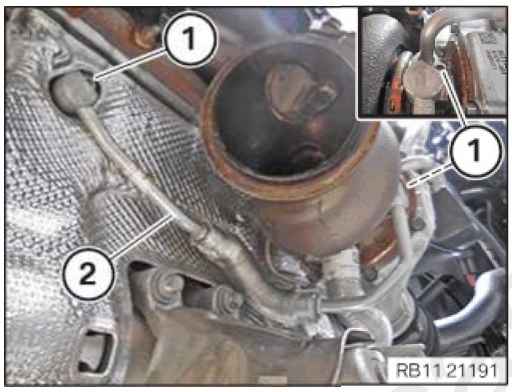
M6		Tightening torque	8 Nm

61 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

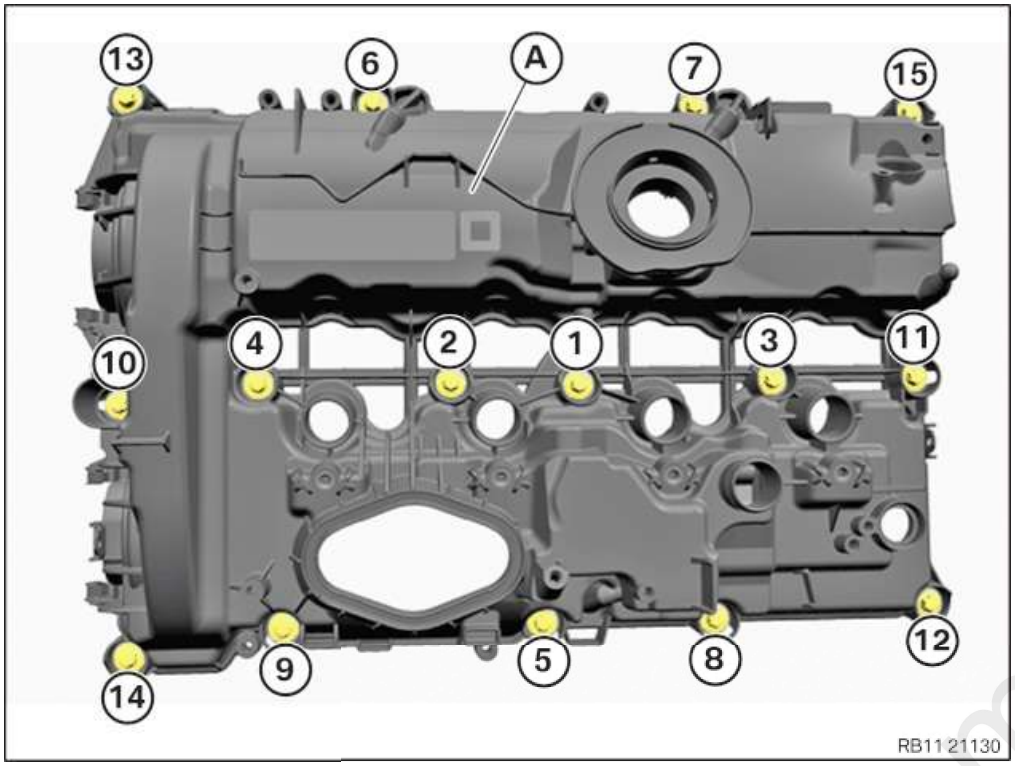
Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

62 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

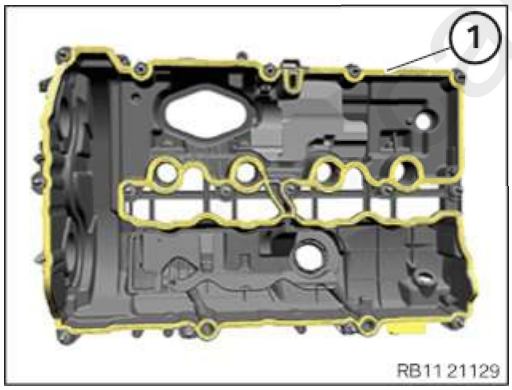
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

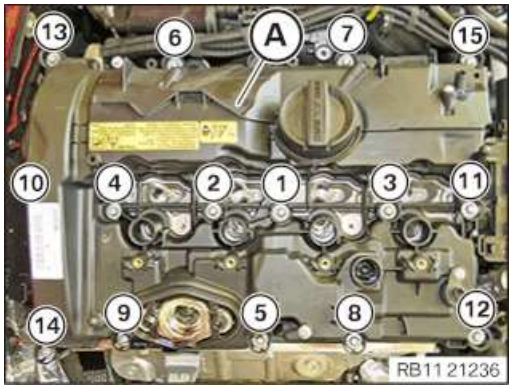
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).

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TECHNICAL INFORMATION

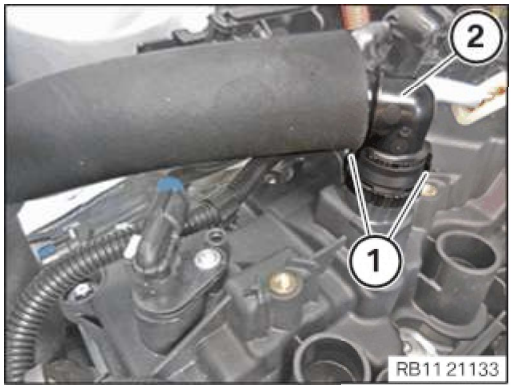
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

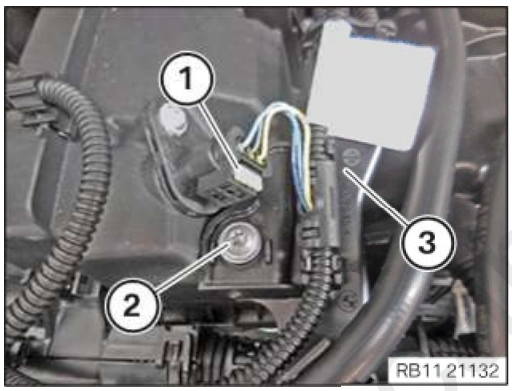
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

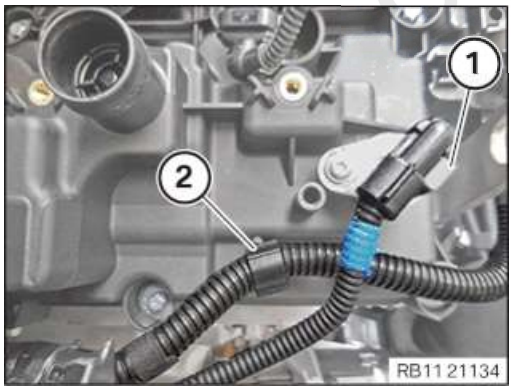


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

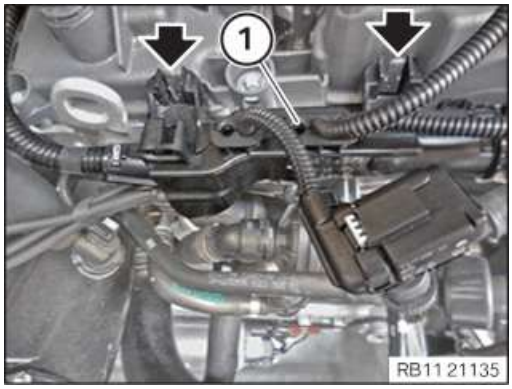
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

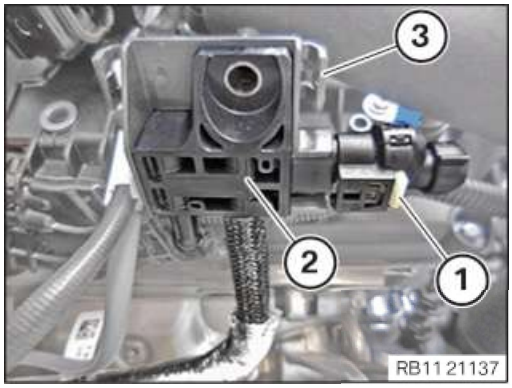


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

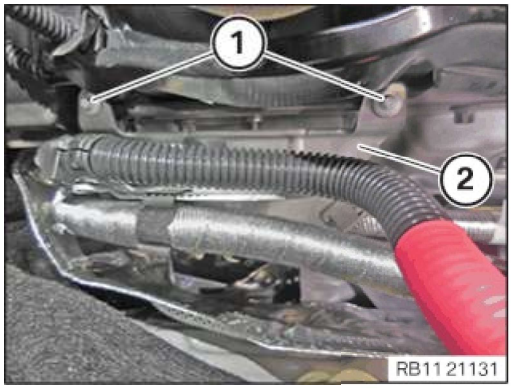
mdiagn.com



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

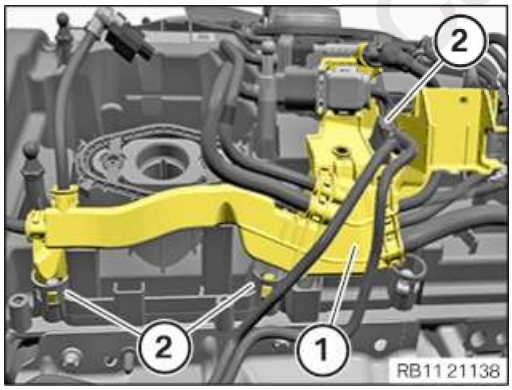
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

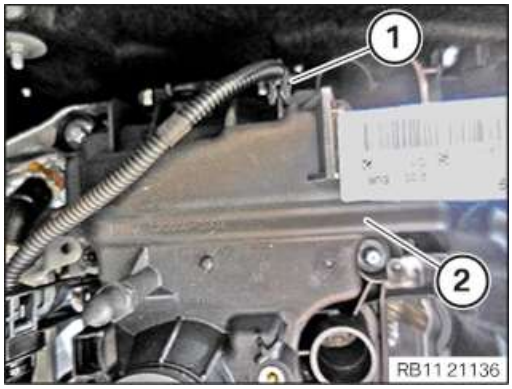
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

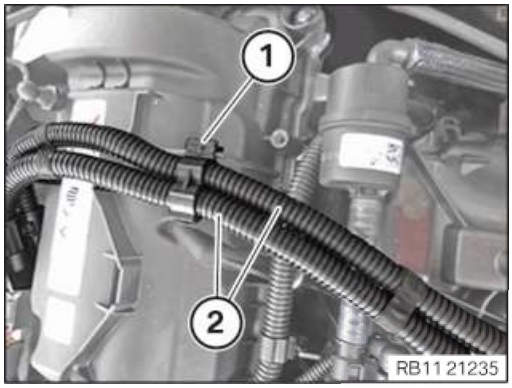


- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

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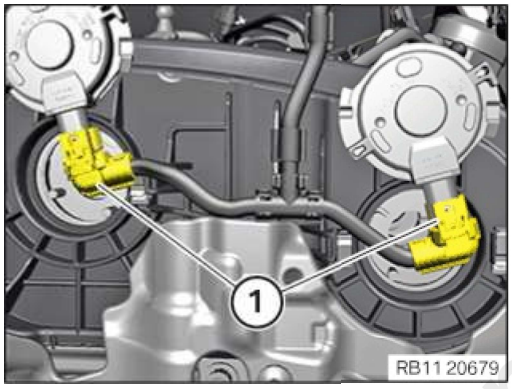


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

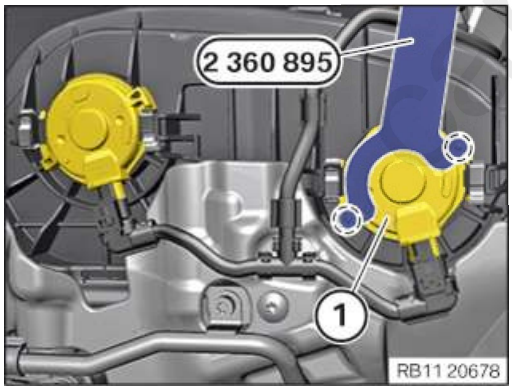
63 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

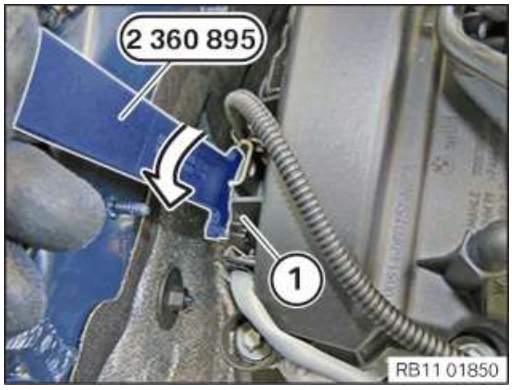
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



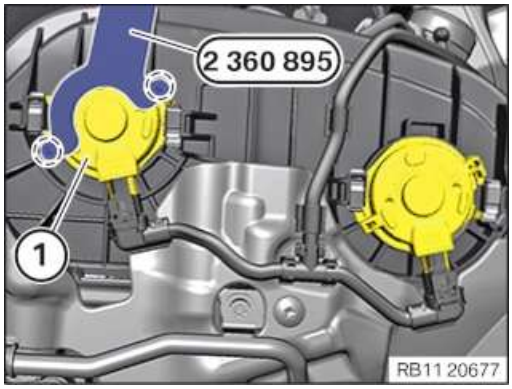
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



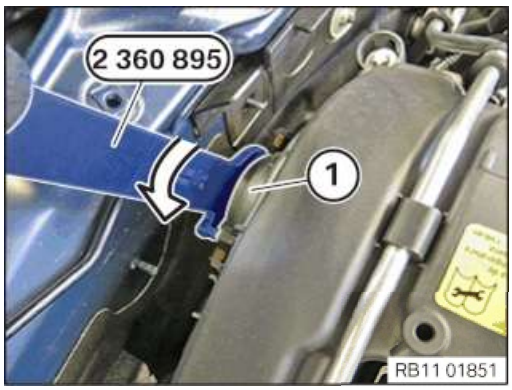
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

64 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

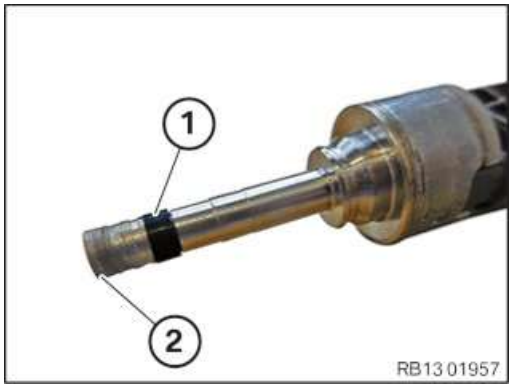
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.

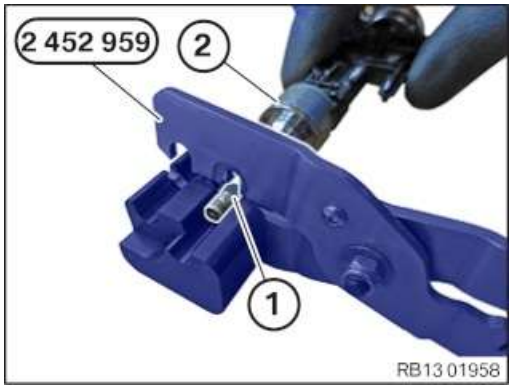


- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).

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- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

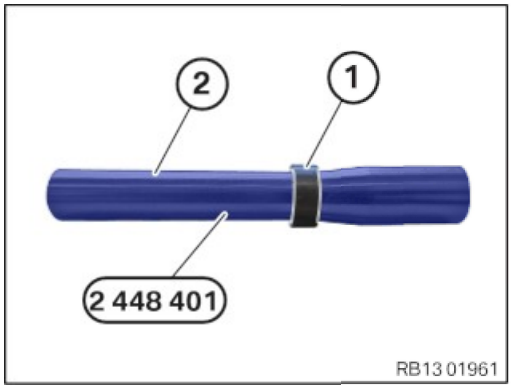


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

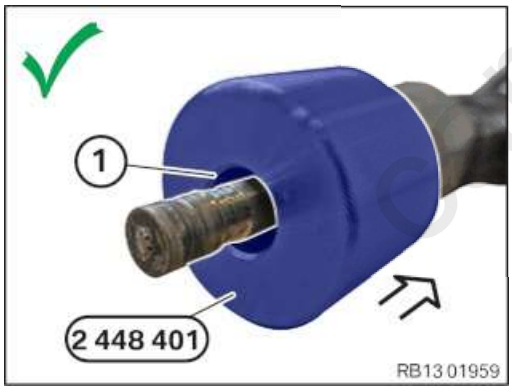
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

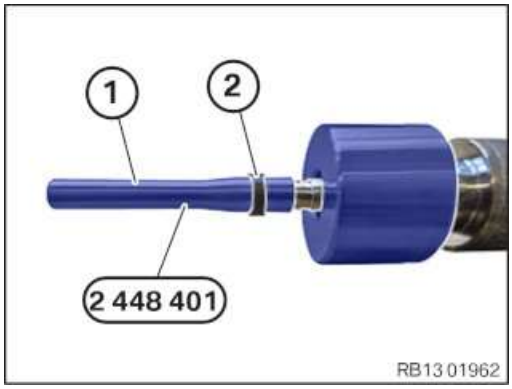
  The larger diameter of the assembly sleeve (1) must point to the injector tip.



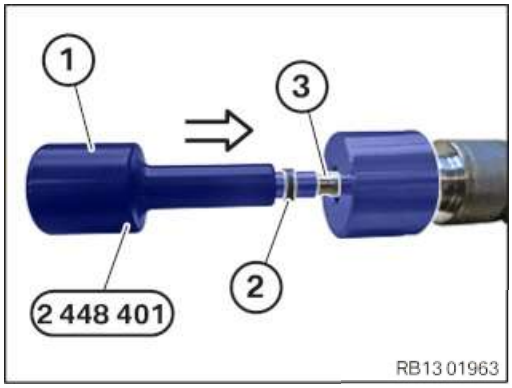
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

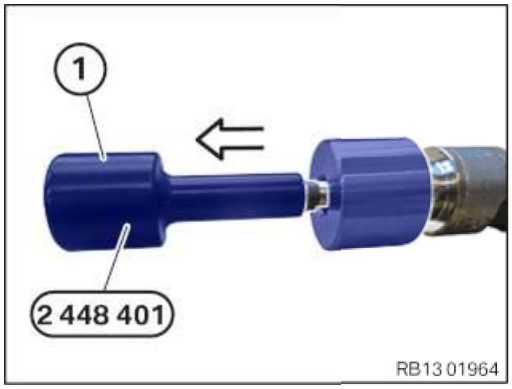
ardiagn.com



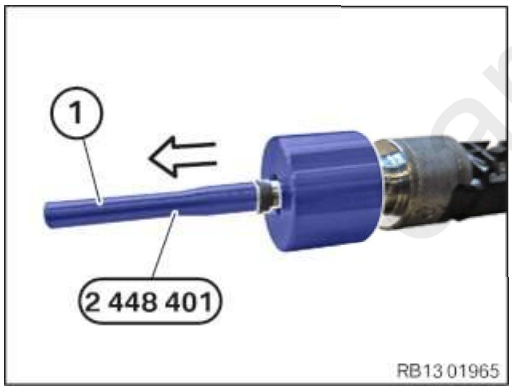
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



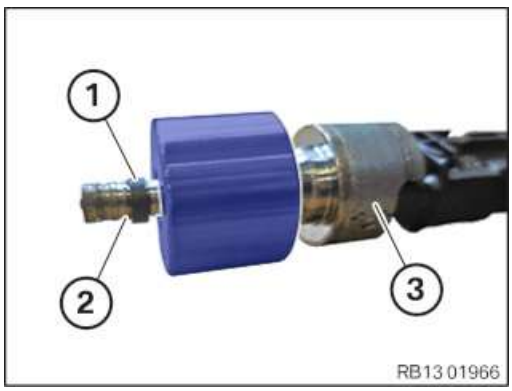
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

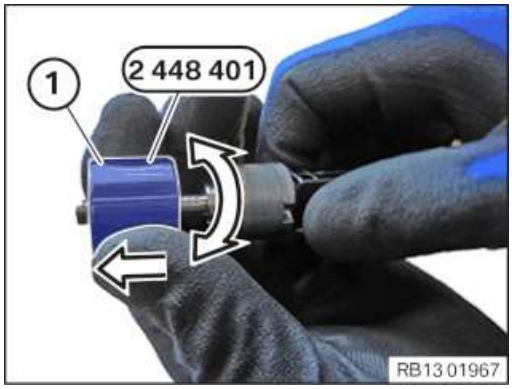


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



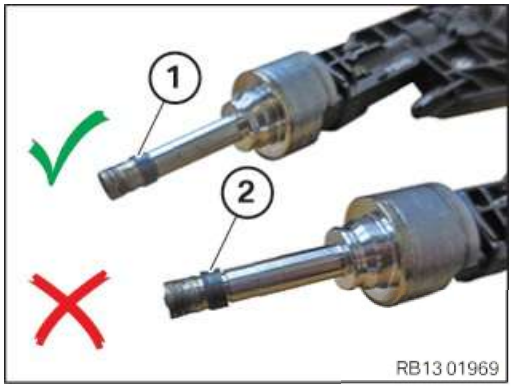
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

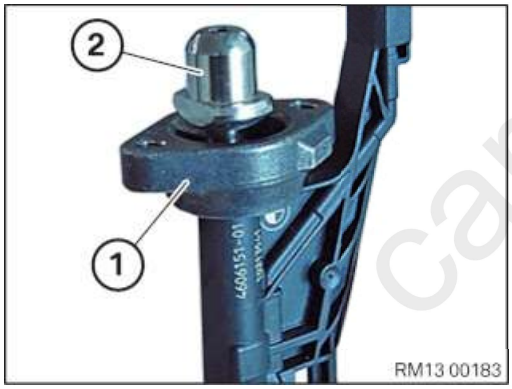


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

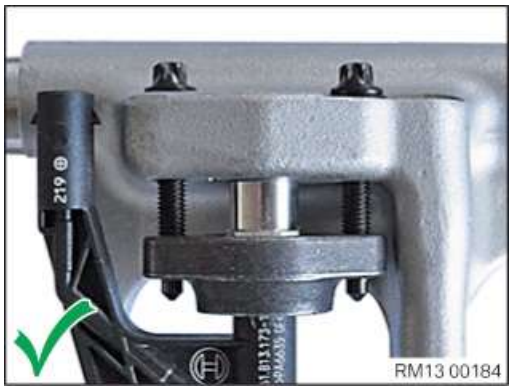
65 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



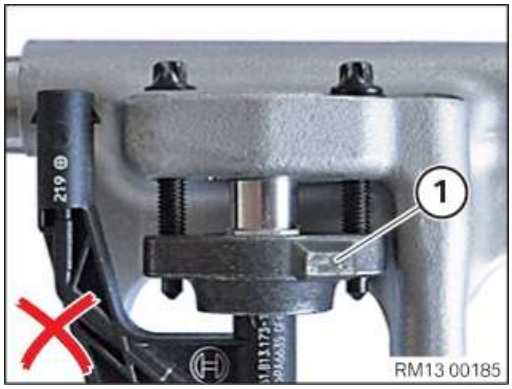
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

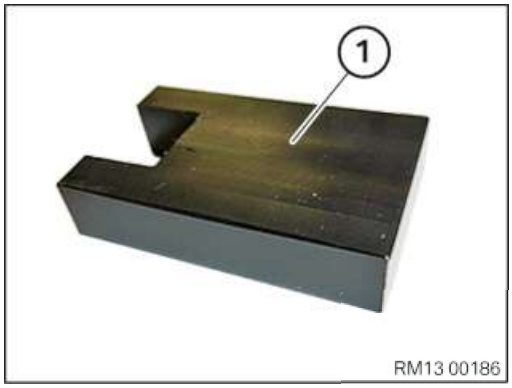
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



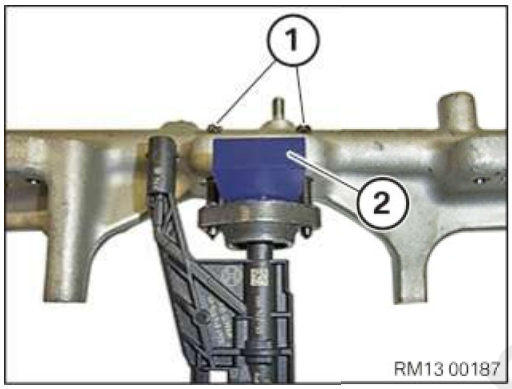
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



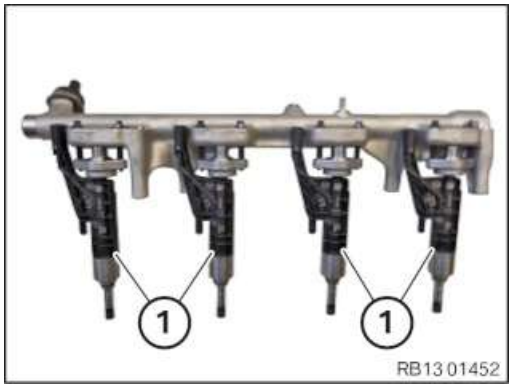
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

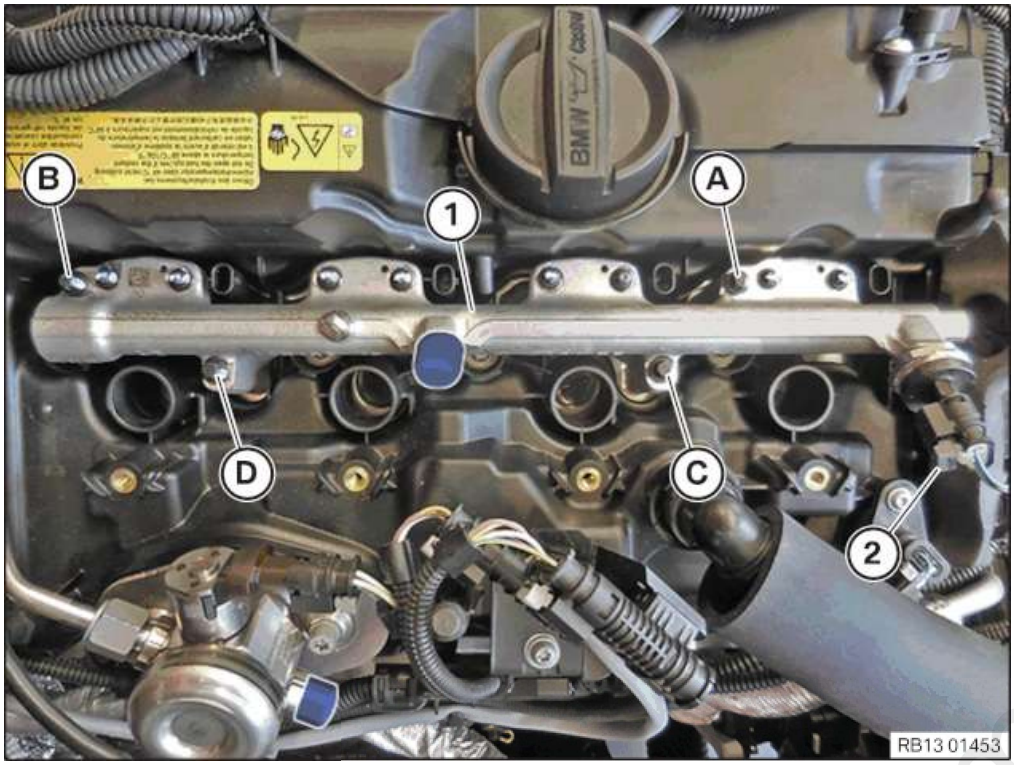


- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

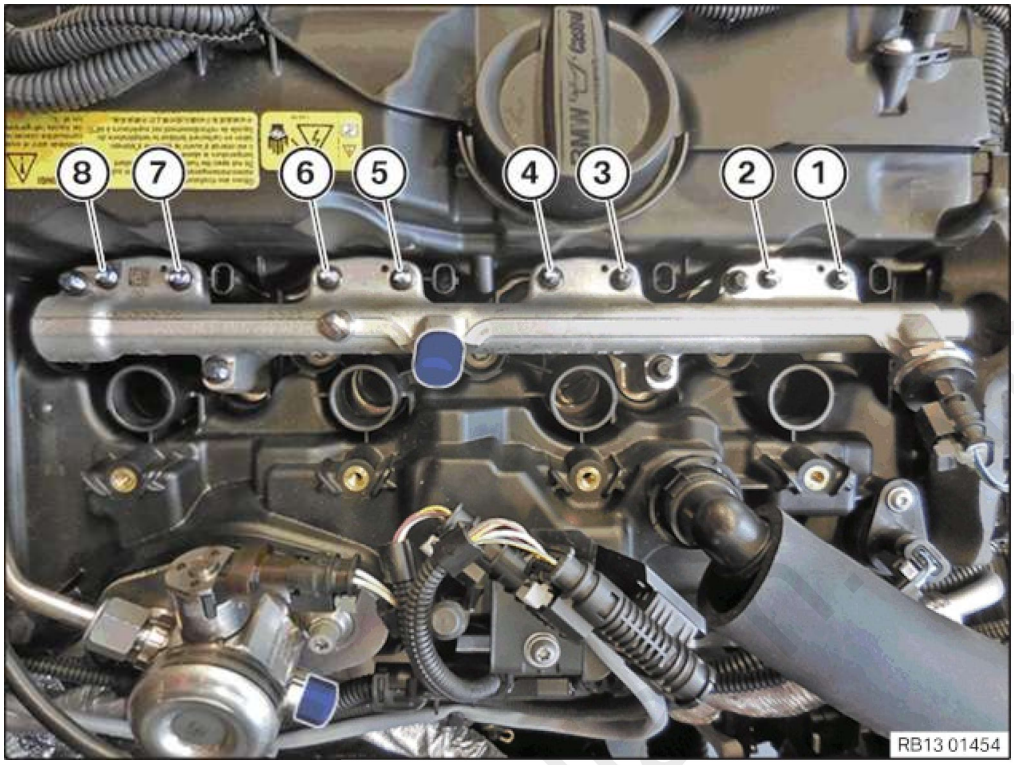
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.

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- Make sure that the rail (1) rests flat against the cylinder head.



- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

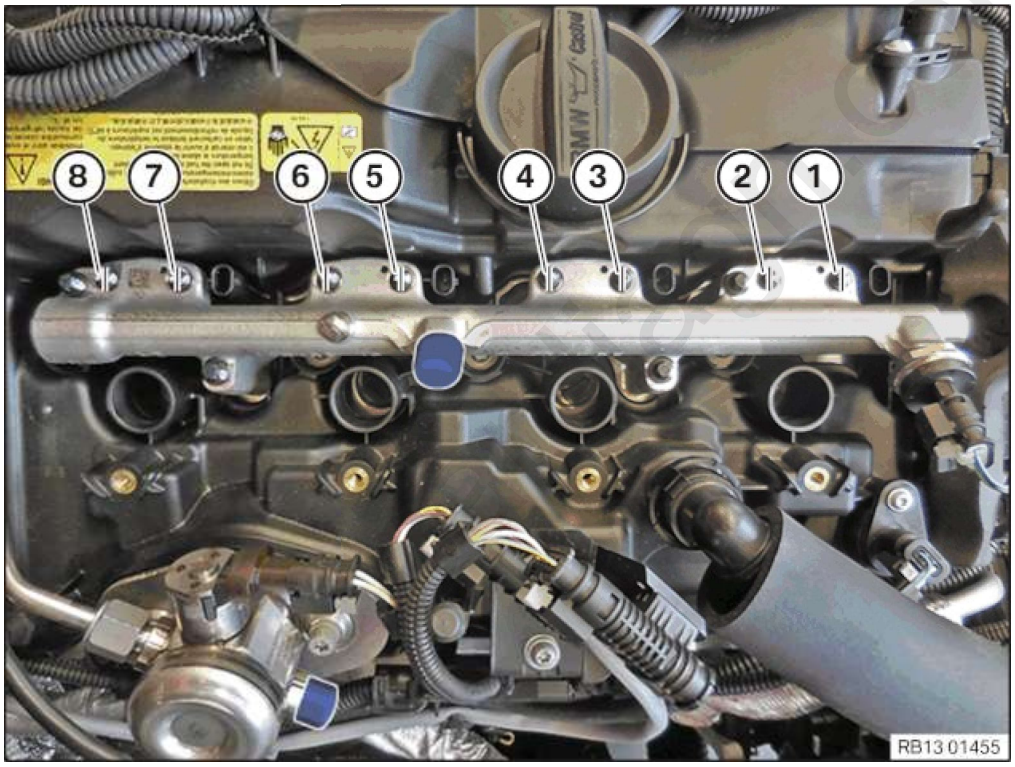
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

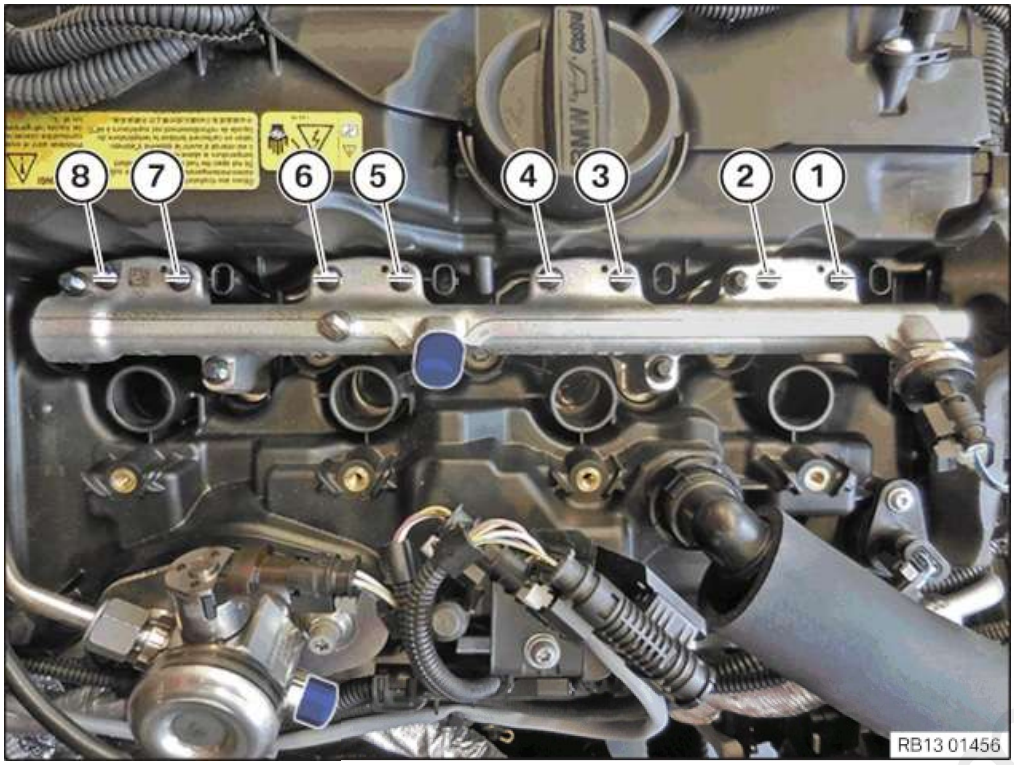
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.

- **Fuel injector 3:**
- Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
- **Fuel injector 4:**
- Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

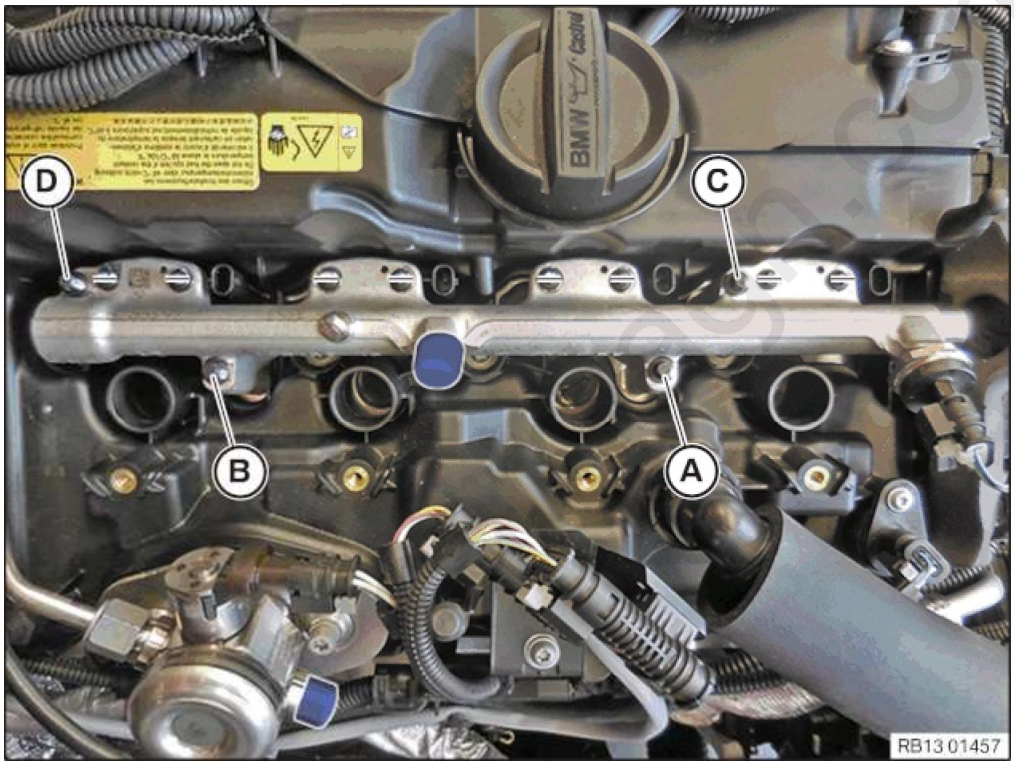


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

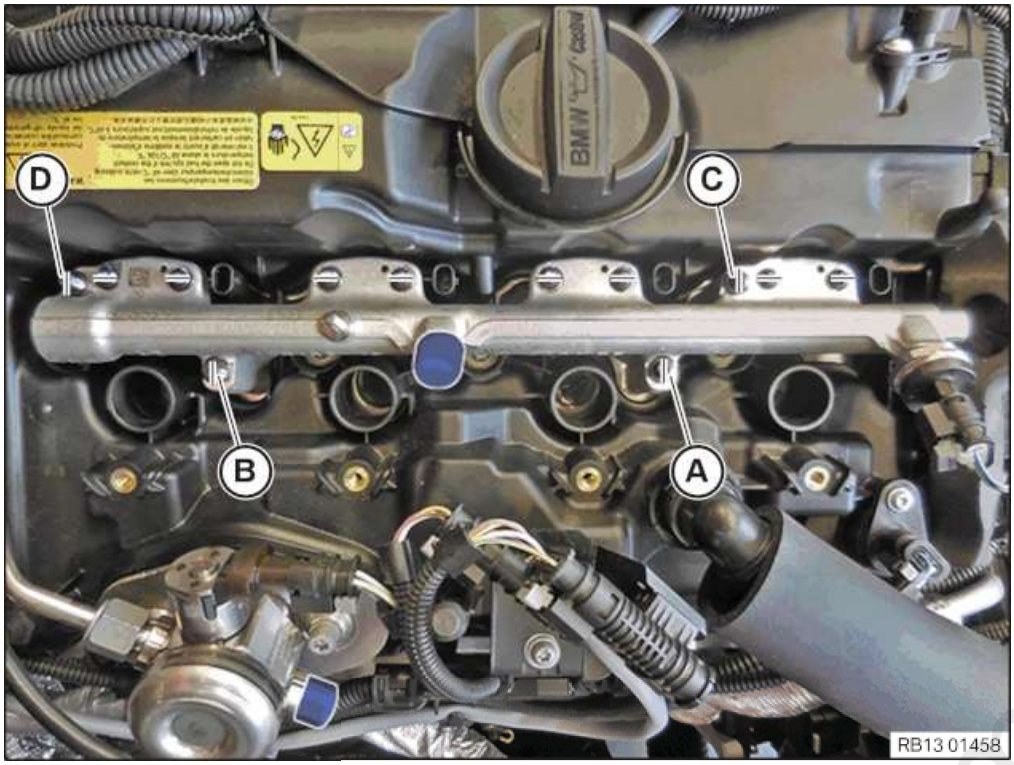
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

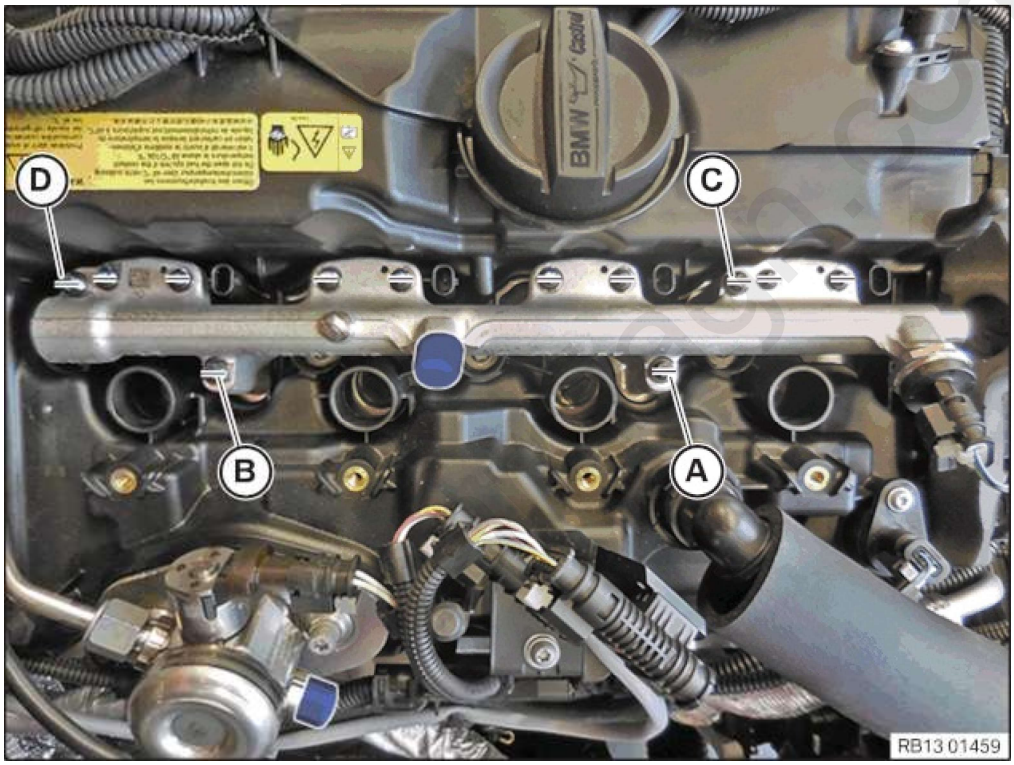
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

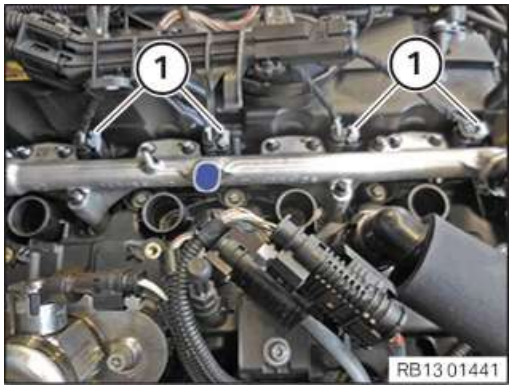


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



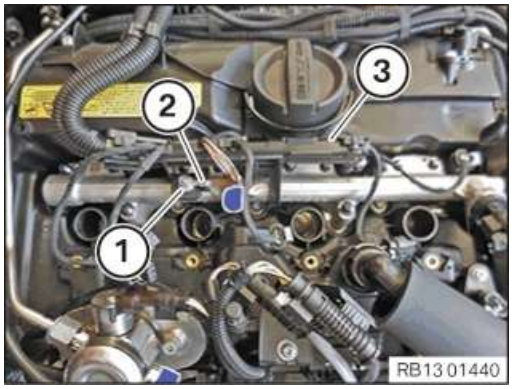
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

66 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

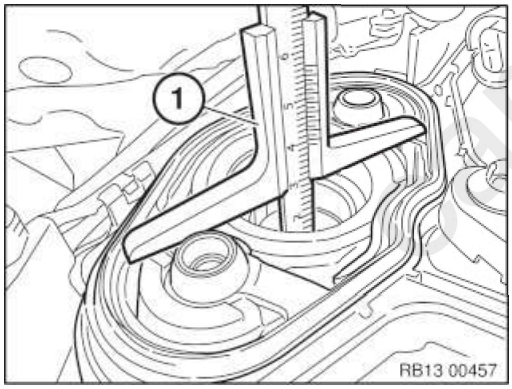
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

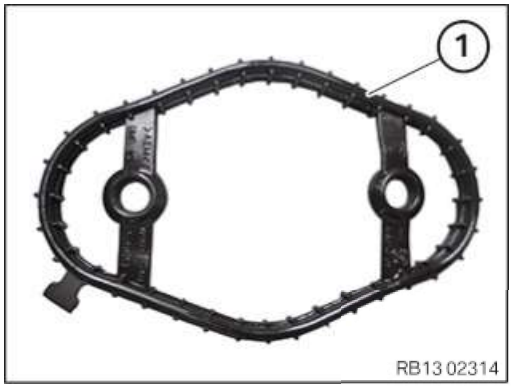
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



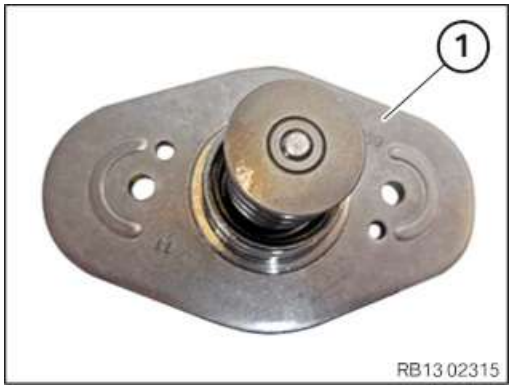
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

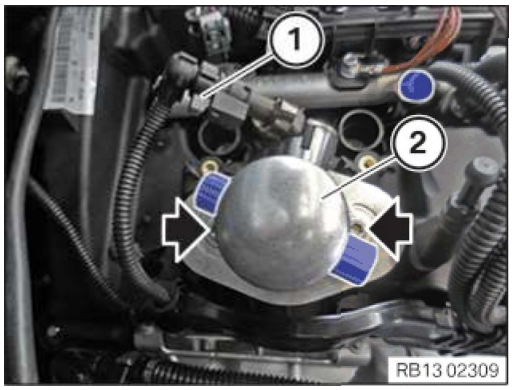
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

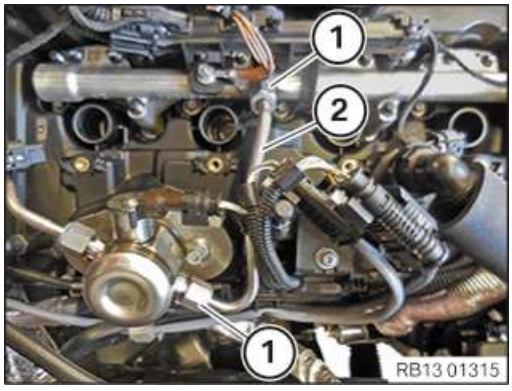
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

67 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

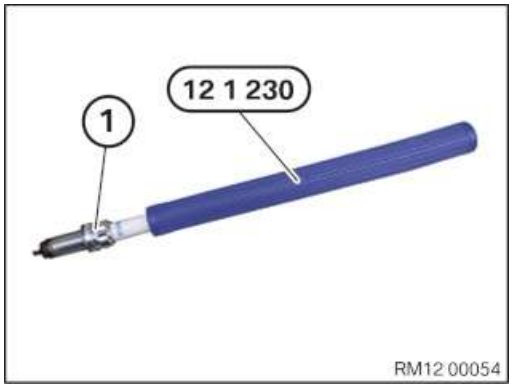
High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

68 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

M12x1.25		Tightening torque	23 Nm

69 – Installing the intake plenum

RISK OF DAMAGE

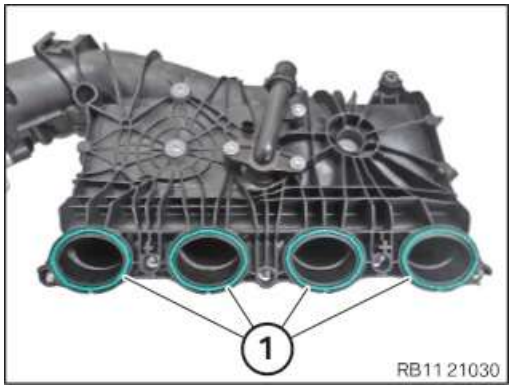
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

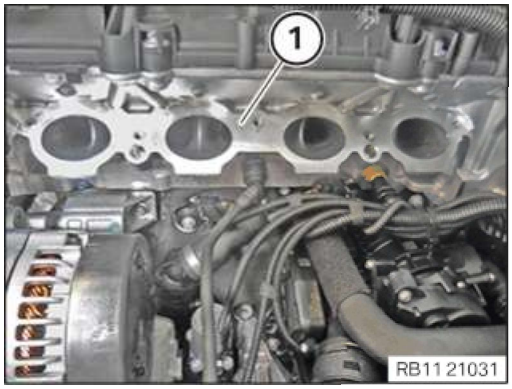
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

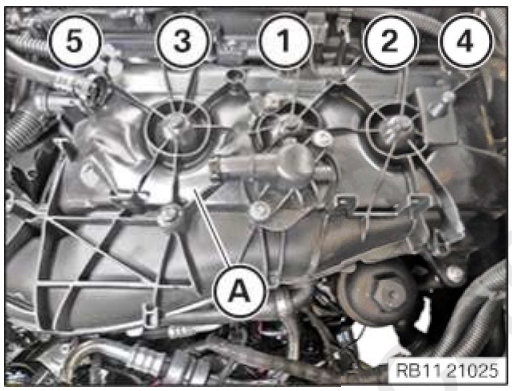


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

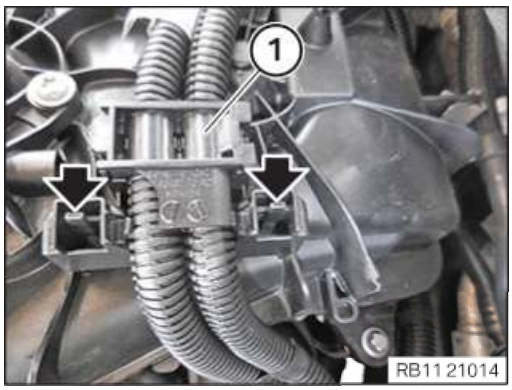
ertogen.com



- Tighten down screw (1).

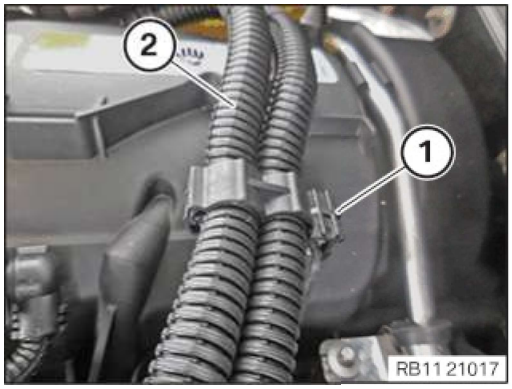
Intake plenum to support

M6X25		Tightening torque	8 Nm

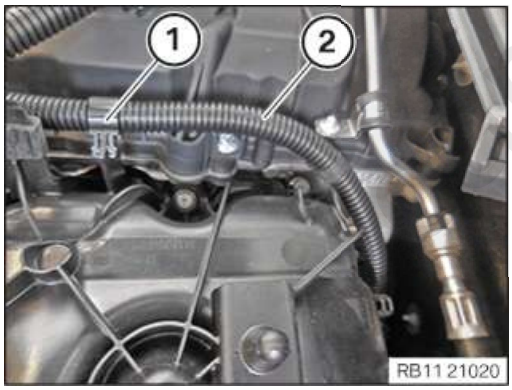


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

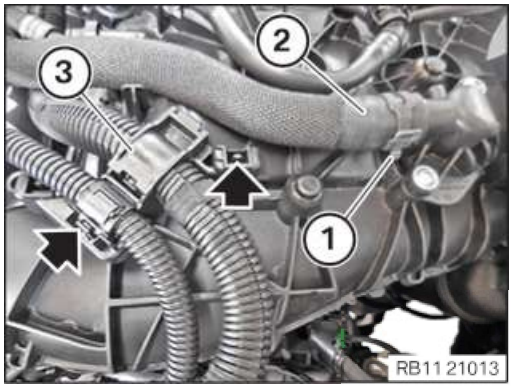
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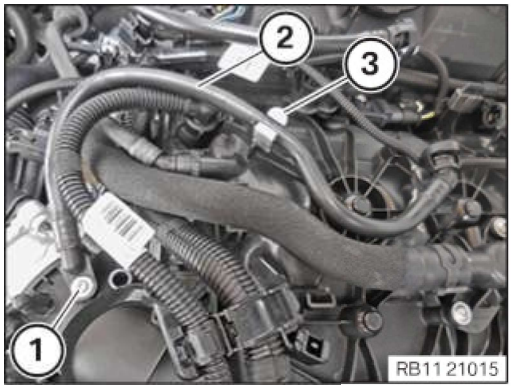
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



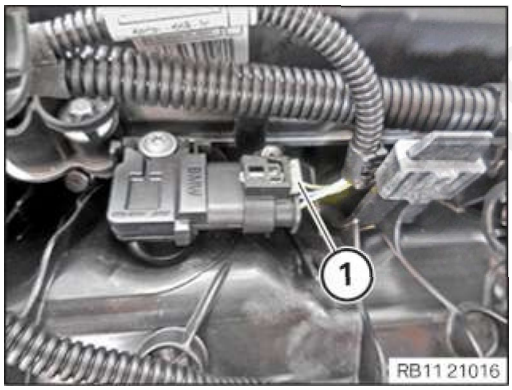
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

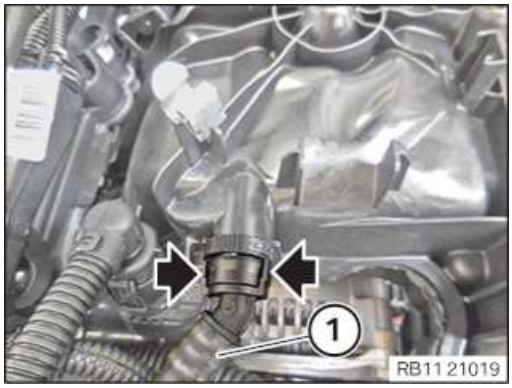
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

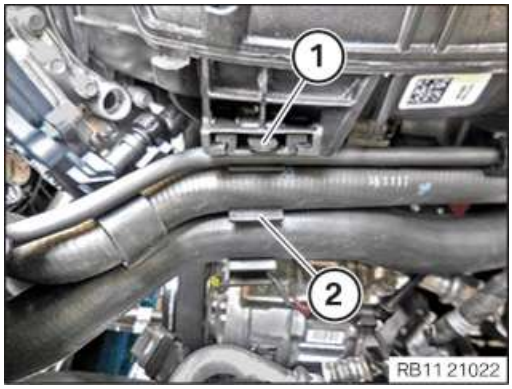
  The connector (1) must engage audibly.



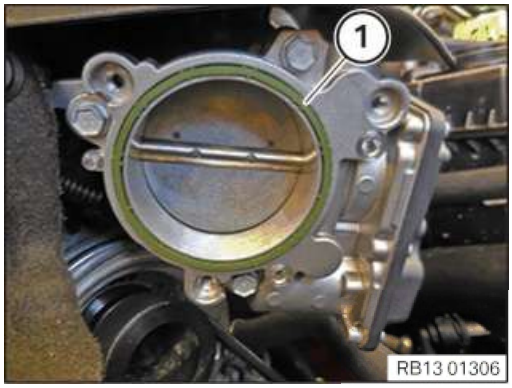
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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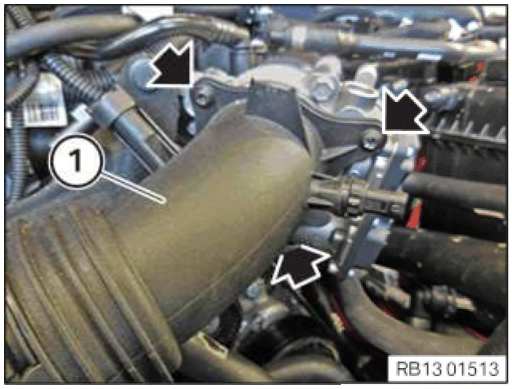


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

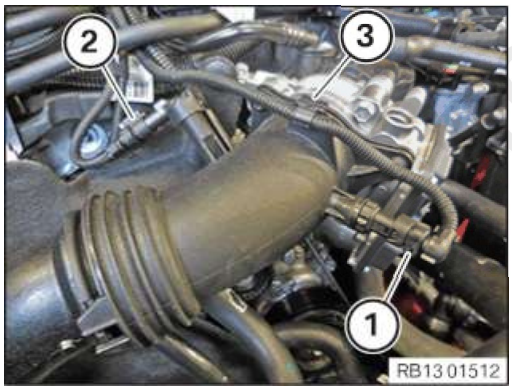
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

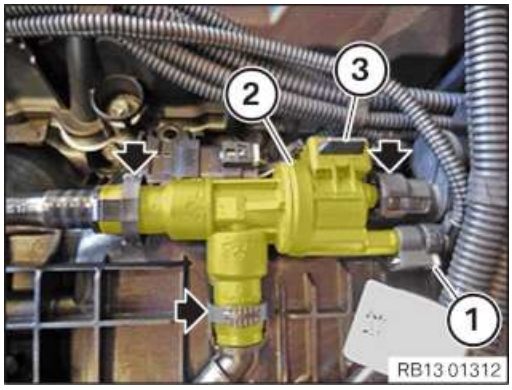
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

70 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

71 – Topping up the engine oil

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RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

TECHNICAL INFORMATION

- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

- Fill in engine oil at the oil filler neck.

Engine oil

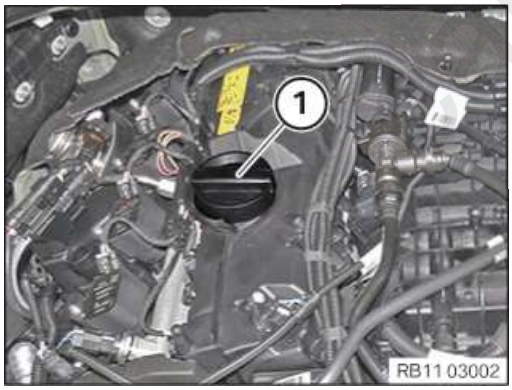
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

▸ **Installing the oil filler cap**

- Close oil filler cap (1).



72 – Remove the engine on an assembly stand

CAUTION

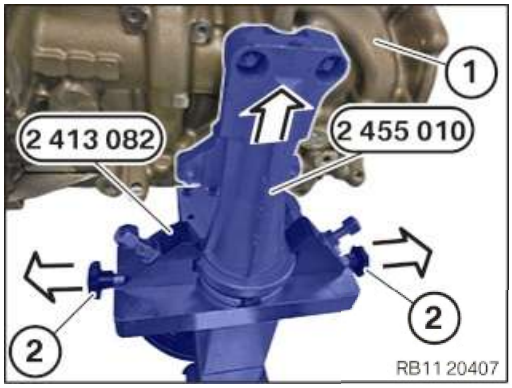
Heavy component.

Heavy components can lead to injury or damage.

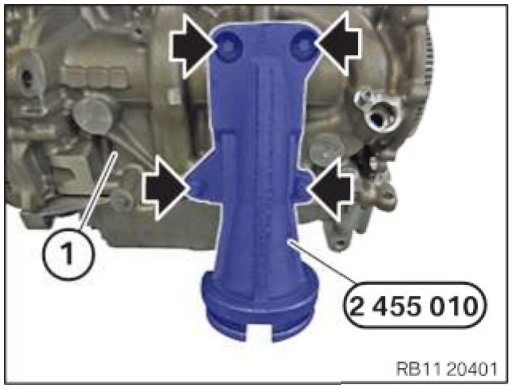
- Remove and install heavy components with the aid of another person/other persons.



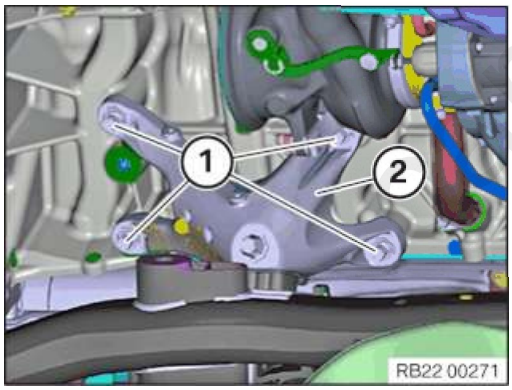
- Insert engine lifter with special tool and position engine (1).



- Unscrew the nuts on special tool .
- Detach the holder (2) in the direction of the arrow.
- Detach the engine (1) with special tool 2 455 010 out of the special tool in the direction of arrow.



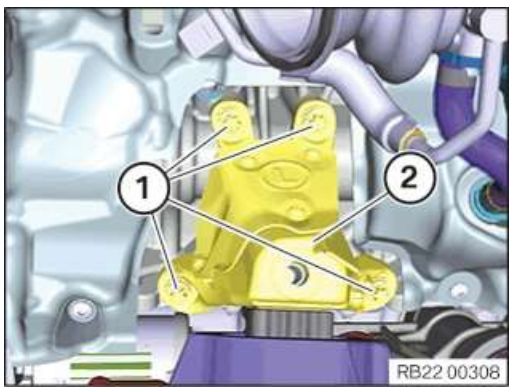
- Remove conventional screws (arrows).
- Feed out the special tool 2 455 010 on the engine (1) and remove.



- **Type: Rear-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm



- **Type: Four-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm

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- See additional information.

Additional Information

Overview of Tightening Torques

Special tool 2 455 010 to crankcase — Used in step 2

M10x30		Tightening torque	38 Nm

Special tool 11 8 930 to special tool 00 2 320 — Used in step 2

M14x35		Tightening torque	160 Nm

Oil drain plug — Used in step 4

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head — Used in step 174858

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 174858

M6		Tightening torque	8 Nm

Special tool to cylinder head — Used in step 26

M8		Tightening torque	21,5 Nm

Connecting rod bearing cap to connecting rod — Used in step 36

Renew screws.

Tighten screws crosswise.		Jointing torque	20 Nm
		1. Angle of rotation	70 °
		2. Angle of rotation	70 °

Oil deflector to crankcase — Used in step 37

M8 x 35		Renew screws.	15 Nm
			45 °

Camshaft sprocket to oil vacuum pump — Used in step 38

M8	Important - left-hand thread Renew screw.	1. Jointing torque	5 Nm
		2. Angle of rotation	90 °

Oil vacuum pump to crankcase — Used in step 39

M8	Renew screw.	1. Tightening torque	15 Nm
		2. Angle of rotation	45 °

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Oil sump to crankcase — Used in step 40

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 40

M8 x 50		Tightening torque	19 Nm

Flywheel to crankshaft — Used in step 41

M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

Battery positive lead to starter — Used in step 42

M8		Tightening torque	13,5 Nm

Cylinder head to crankcase — Used in step 47

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

Cylinder head bolt to timing case cover — Used in step 47

M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head — Used in step 47

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head — Used in step 47

M6x16			8 Nm

Cable routing to cylinder head, rear — Used in step 47

M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head — Used in step 47

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 47

M6x16		Tightening torque	8 Nm

Manifold support for intake air to cylinder head — Used in step 47

M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head — Used in step 47

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 47

M6			8 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 47

M6x12		Tightening torque	8 Nm

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VANOS central valve to camshaft — Used in step 5455

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 57

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Oil return line to exhaust turbocharger/crankcase — Used in step 59

M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger — Used in step 6061

M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger — Used in step 60

M6		Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 61

M6 x 12		Tightening torque	8 Nm

Cylinder head cover to cylinder head — Used in step 62

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 62

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 62

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 65

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 66

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 67

M14		Tightening torque	33 Nm

Spark plugs — Used in step 68

M12x1.25		Tightening torque	23 Nm

Intake plenum to cylinder head — Used in step 69

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 69

M6X25		Tightening torque	8 Nm

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Throttle body to holder			Used in step 69
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 69
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body			Used in step 69
M6		Tightening torque	8 Nm

Engine support arm to engine			Used in step 72
M10		Tightening torque	38 Nm

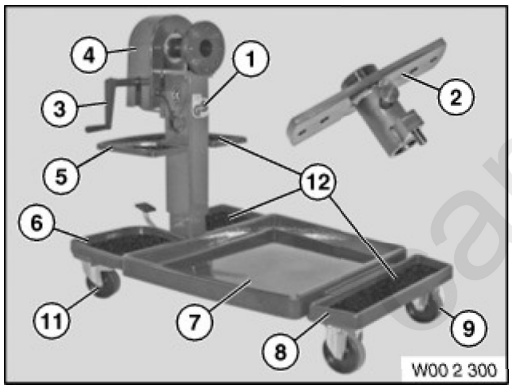
Overview of Special Tools

2 455 010 Engine support



Common	Used in step 272
Usage	For accommodating engine on assembly stand. Engine: B3x, B4x, N47.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 495 187 (00 2 300) Assembly stand



Common	Used in step 2
Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

Consisting of

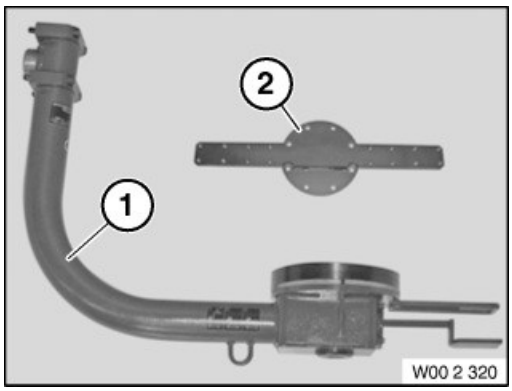
Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	

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2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.
3	0 495 200 (00 2 303)		**Crank**
4	0 495 201 (00 2 304)		**Cover** (Protective hood)
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)
7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.

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0 495 196 (00 2 320) Support arm



Common

Used in step 2

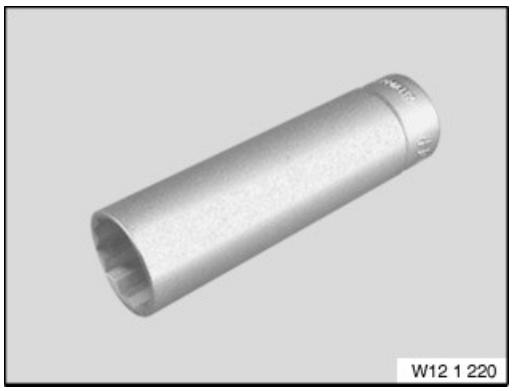
Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

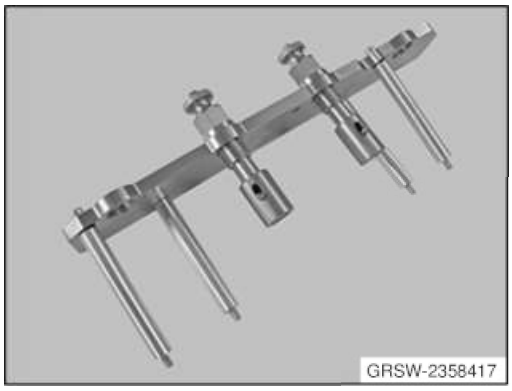
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0 495 560 (12 1 220) Socket



Common	Used in step 568
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

2 358 417 Device



Common	Used in step 8
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 8
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

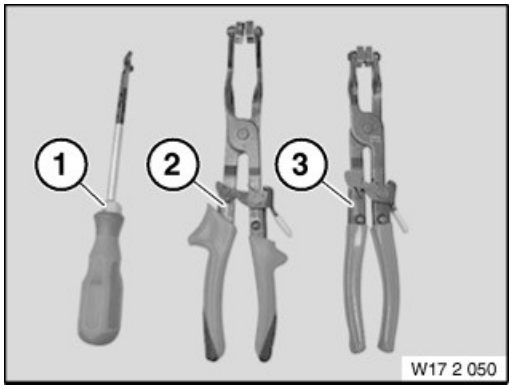
2 360 895 Pin wrench



Common	Used in step 963
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 794 (17 2 050) Pliers



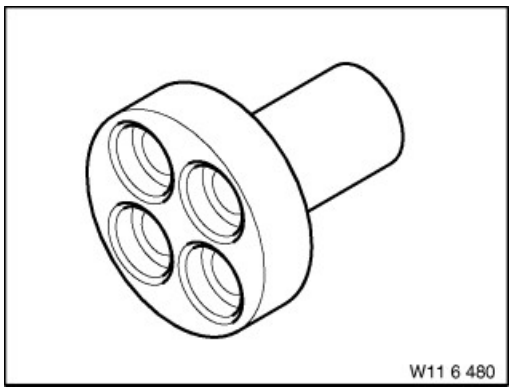
Common Used in step 1269

Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

0 493 380 (11 6 480) Connector



Common Used in step 1743565866

Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

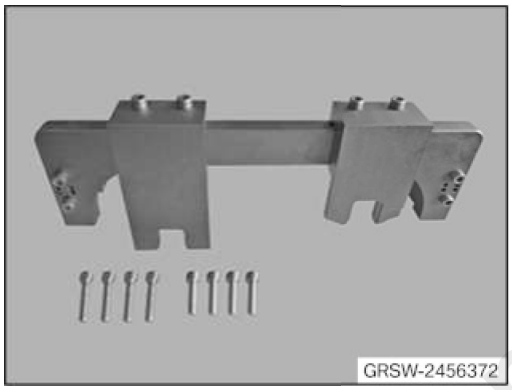
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2 288 380 Locating stud



Common	Used in step 17435658
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 1725485658
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 172558
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



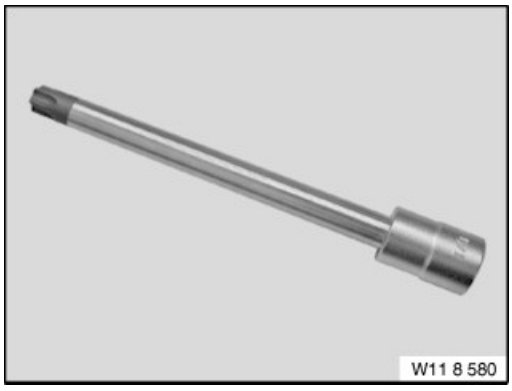
Common	Used in step 19205455
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 19205455
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

0 495 747 (11 8 580) Socket wrench



Common	Used in step 2647
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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2 220 718 Workshop crane



Common	Used in step 26
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

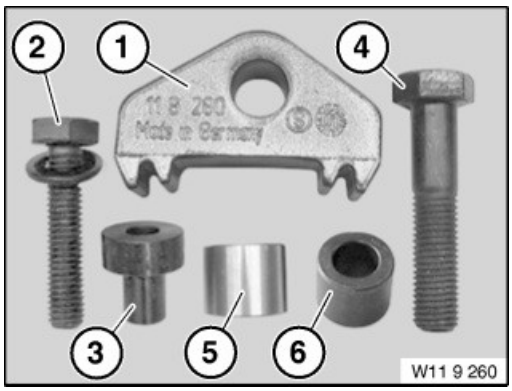
2 459 012 Holder



Common	Used in step 2647
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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0 493 938 (11 9 260) Holder



Common

Used in step 2841

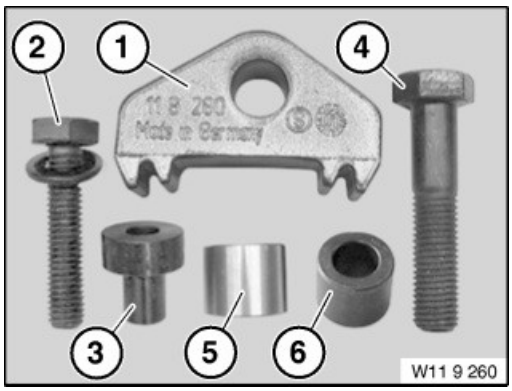
Usage	(Counter support with screw connection) For holding the flywheel when gearbox is removed
Included in the tool or work	
Storage location	A44
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 034 (11 9 261)		**Holder** (Individual counter support)	
2	0 494 035 (11 9 262)		**Screw** (Bolt (thread M10) with washer) For screwing counter support	
3	0 494 129 (11 9 263)		**Bush** (Bush for counter support) For counter support, for retaining flywheel when gearbox is removed Engine: N62, N73	
6	0 495 216 (11 9 266)		**Bush** For counter support, for retaining flywheel when gearbox is removed Engine: M57TU2	
4	0 494 130 (11 9 264)		**Screw** (Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed	
5	0 494 793 (11 9 265)		**Bush**	

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0 494 130 (11 9 264) Screw



Common Used in step 2841

Usage	(Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed
Included in the tool or work	0 493 938
Storage location	A44
Replaced by	
In connection with	
SI-Number	

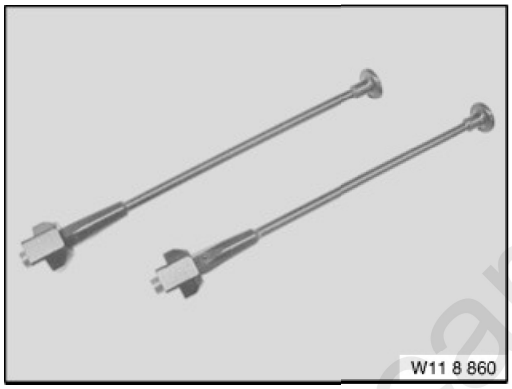
2 463 965 Socket wrench



Common Used in step 31

Usage	with T30, T40 and torx 45
Included in the tool or work	
Storage location	B6
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 496 144 (11 8 860) Assembly tool

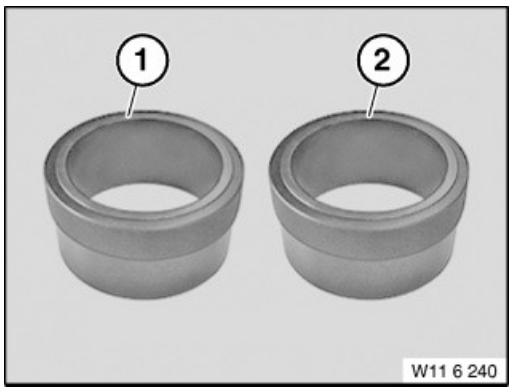


Common Used in step 3336

Usage	For installing piston with connecting rod in crankcase.
Included in the tool or work	
Storage location	A23
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

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0 495 373 (11 6 240) Bush



Common Used in step 36

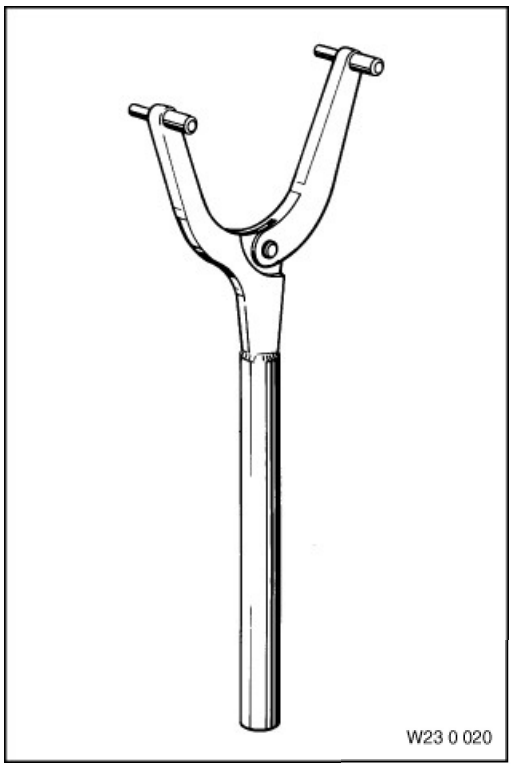
Usage	(Assembly bush set) For fitting pistons (diameter 82 mm) with connecting rod into the crankcase. Engine: N52B25
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 06 (244)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
2	0 495 527 (11 6 242)		**Bush** (assembly bush 82.25 mm)	
1	0 495 526 (11 6 241)		**Bush** (assembly bush 82.00 mm)	

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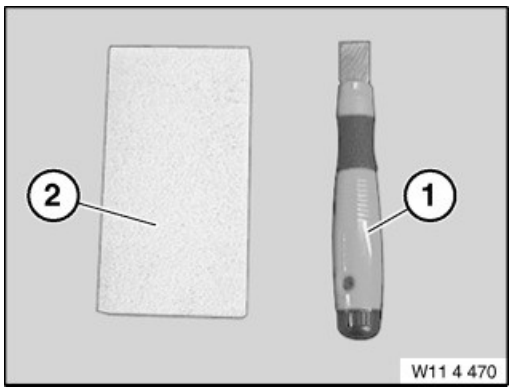
0 491 440 (23 0 020) Holder



Common	Used in step 38
Usage	(counter support) For all three- and four-hole flanges when releasing and tightening down
Included in the tool or work	
Storage location	B4
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool



Common Used in step 40

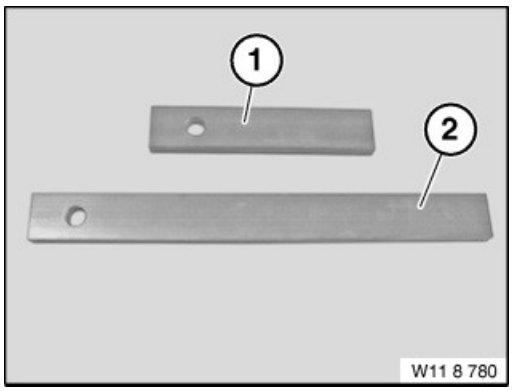
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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0 496 120 (11 8 780) Plate



Common Used in step 40

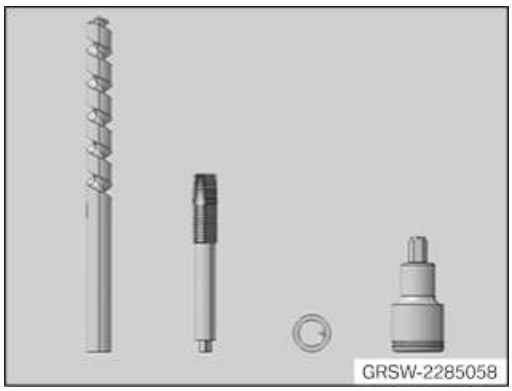
Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

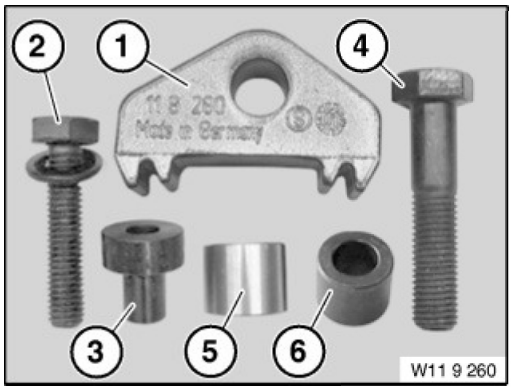
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2 285 058 Tool set



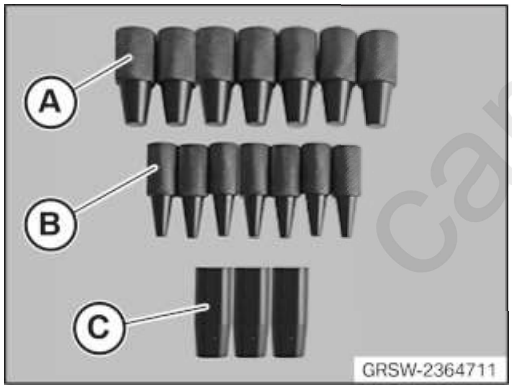
Common	Used in step 41
Usage	
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 14 (069)

0 494 034 (11 9 261) Holder



Common	Used in step 41
Usage	(Individual counter support)
Included in the tool or work	0 493 938
Storage location	
Replaced by	
In connection with	
SI-Number	

2 364 711 Plug



Common	Used in step 4445
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

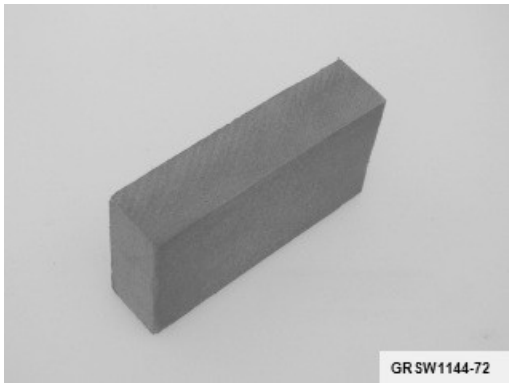
0 495 103 (11 4 471) Scraper



Common	Used in step 45
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

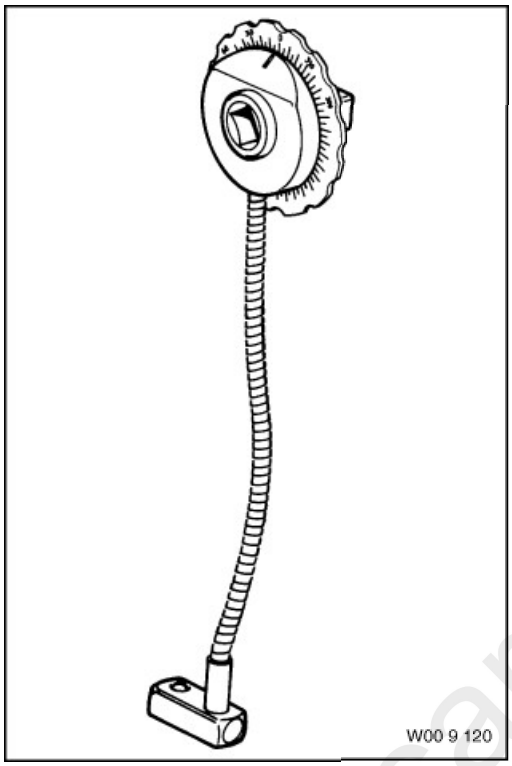
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0 495 104 (11 4 472) Extractor



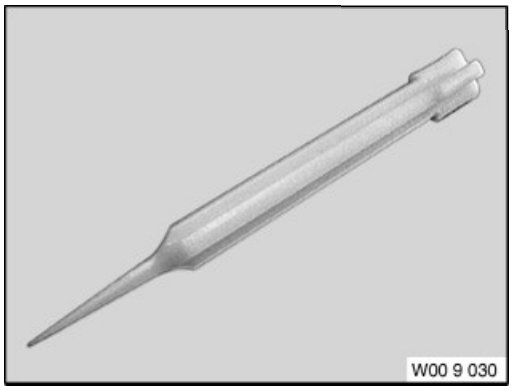
Common	Used in step 45
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

0 490 504 (00 9 120) Torque angle measuring dial



Common	Used in step 47
Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common	Used in step 476061
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

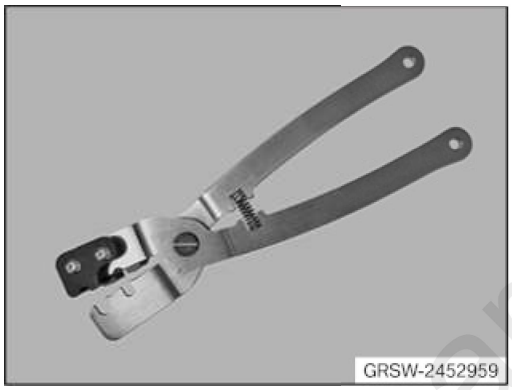
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2 455 654 Tensioning tool



Common	Used in step 5356
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 64
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 64
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

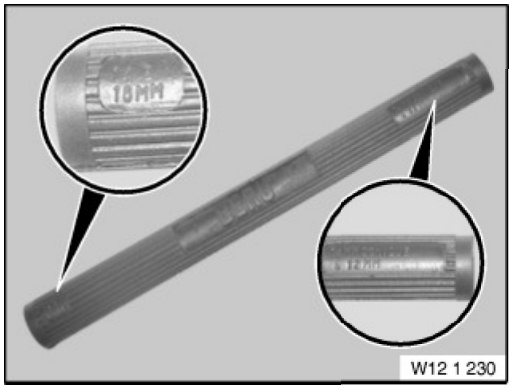
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2 358 022 Gauge



Common	Used in step 65
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

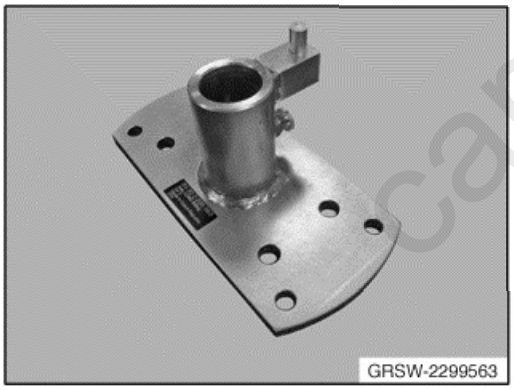
0 496 065 (12 1 230) Fitting aid



Common	Used in step 68
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

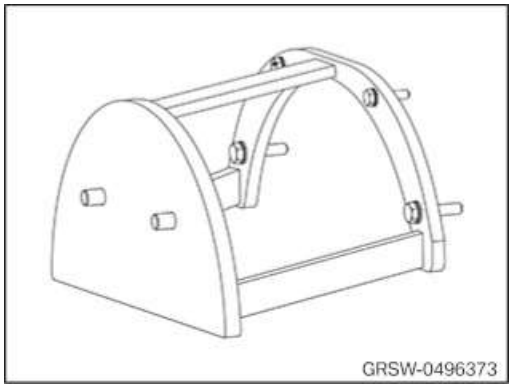
Replacement tools:

2 299 563 Adapter



Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

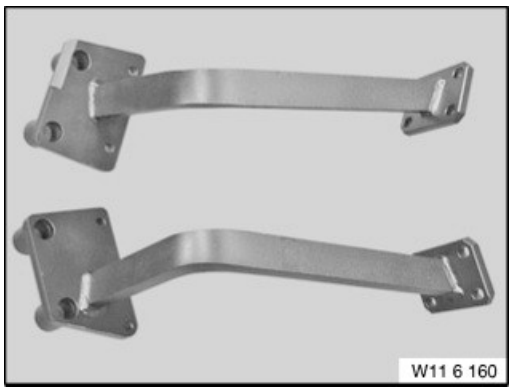
0 496 373 (11 5 420) Plate



Common	Used in step 2
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

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0 496 680 (11 6 160) Support



Common	Used in step 2
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

Overview Technical Data

Cylinder bore B38/B46/B48/B58	Used in step 35
Diameter of cylinder bore	82,000 mm ... 82,014 mm
Permitted irregularity of the cylinder bore	0,01 mm
Permitted conicity of the cylinder bore	0,01 mm
Permissible total wear tolerance between piston and cylinder bore (engine operated)	0,15 mm

Engine oil	Used in step 71
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil B48B20O1/B46B20O1	Used in step 71
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Screw-in depth of thread cutter	Used in step 41
Screw-in depth	18 mm

Links

Functional descriptions	Used in step
Petrol particulate filter	71

General repair instructions	Used in step
11 00 ... Overview of consumables (Electronic Parts Catalogue)	40

Repair instructions	Used in step
11 00 050 Removing and installing engine	173
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11 00 050 Removing and installing engine	173
11 00 050 Removing and installing engine	173
11 00 050 Remove and install engine	173
11 00 050 Remove and install engine (Automatic)	173
11 00 050 Remove and install engine (Automatic)	173
11 00 050 Remove and install engine	173
11 00 050 Remove and install engine	173
11 00 050 Remove and install engine (Automatic)	173
11 00 050 Remove and install engine (Automatic)	173
11 00 050 Remove and install engine	173
11 00 050 Remove and install engine	173
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11 00 050 Removing and installing the engine with a double-clutch transmission (DKG)	173
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13 53 ... Clean the cylinder head around the injectors due to grit / dust	8
61 13 ... Unlocking and disconnecting different plug connections	81062
61 35 ... Notes on ESD protection (Electro Static Discharge)	8911
61 35 ... Notes on ESD protection (Electro Static Discharge)	911

Operating materials	**Used in step**
3.0 Technically appropriate engine oils for BMW Group engines	71

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11 28 020 Replace tensioning device for drive belt of the alternator

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Removing the clean air pipe with the resonator

WARNING

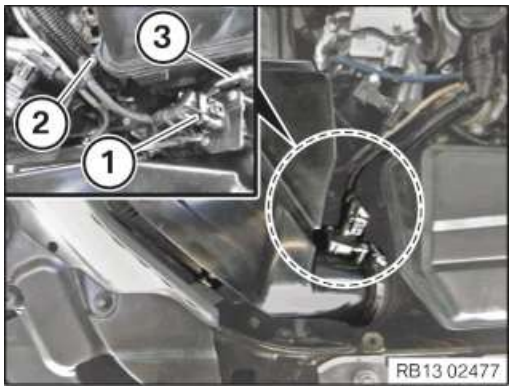
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

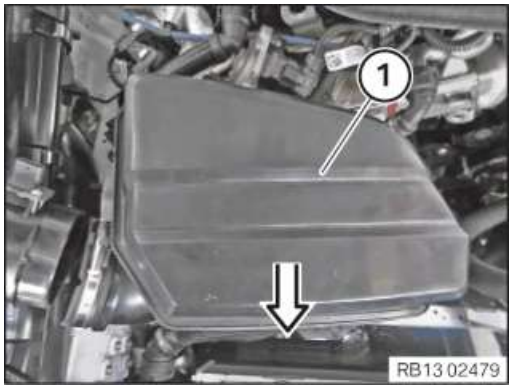


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

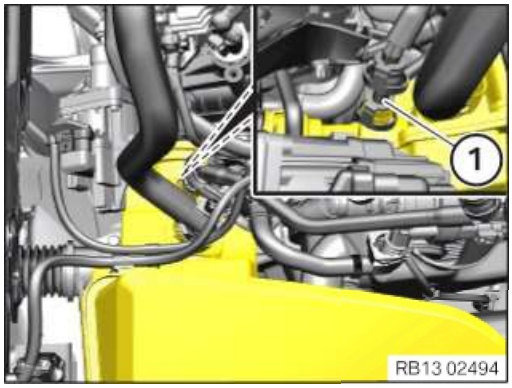


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

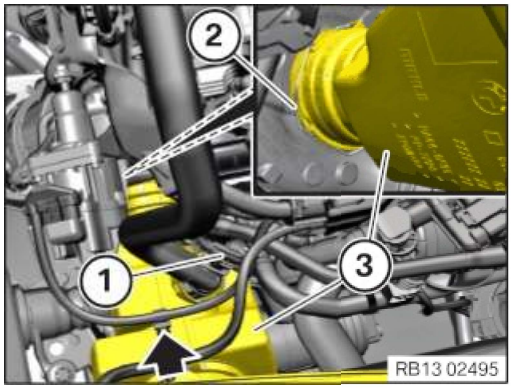
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- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

4 – Removing the throttle body

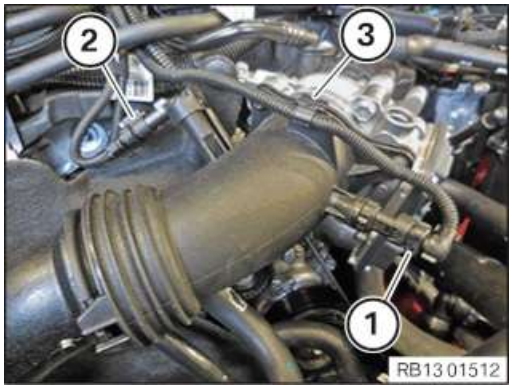
RISK OF DAMAGE

Electrostatic discharge.

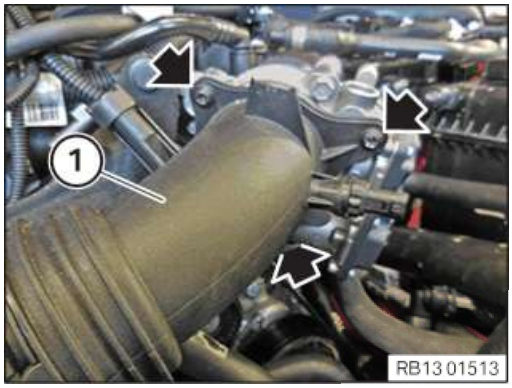
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

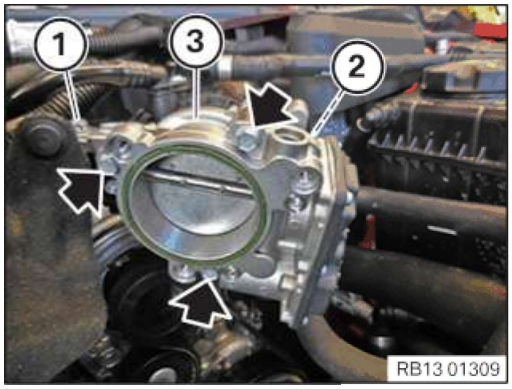
cardiagn.com



- Unlock and loosen connector (1).
- Unlock and loosen connector (2).
- Unlock and loosen clamp (3).

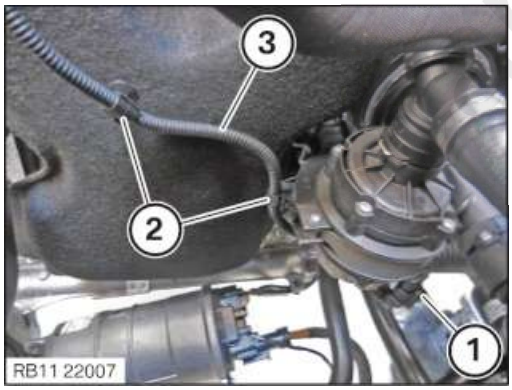


- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.

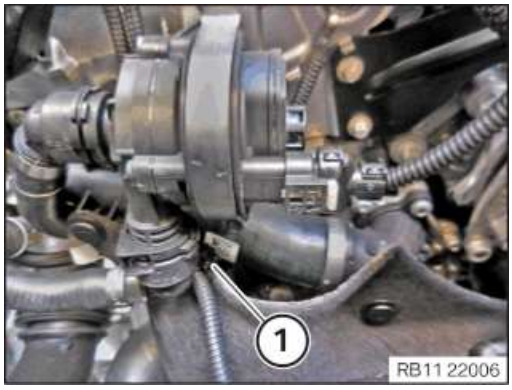


- Loosen screw (1).
- Remove screws (arrows).
- Unlock and loosen connector (2).
- Remove the throttle bodies (3).

5 – Removing the acoustic cover for the engine at the front

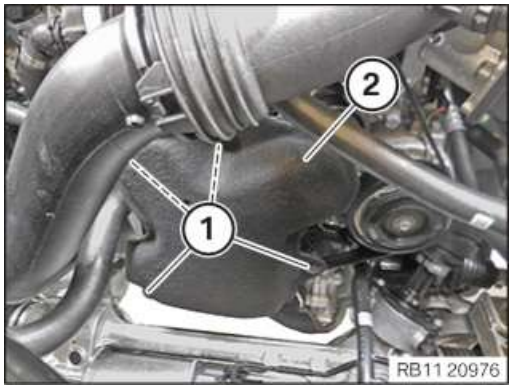


- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).

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- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

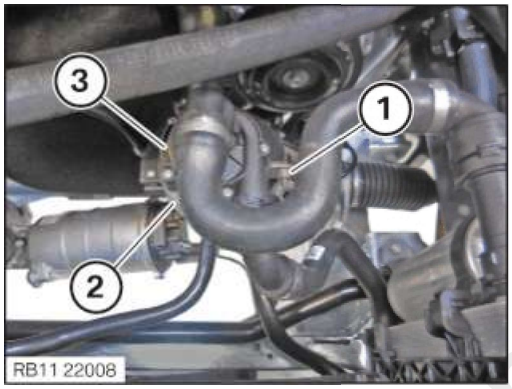
6 – Releasing the electrical auxiliary coolant pump for the charge air cooler or the air conditioning condenser

RISK OF DAMAGE

Non-visible damage to the coolant pump.

Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.



- Loosen nut (1).
- Thread out holder (2) and set aside.
- Guide out the electrical auxiliary coolant pump (3) and set it aside.

7 – Removing the drive belt for alternator

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

Component with preload.

Danger of injury!

- Reduce preload as far as possible before disassembly. Relieve component.

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TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.



- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Secure the belt tensioner with the special tool 0 496 268 (11 0 390).
- Guide out the drive belt for the alternator (2) and remove it.

8 – Removing the alternator

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

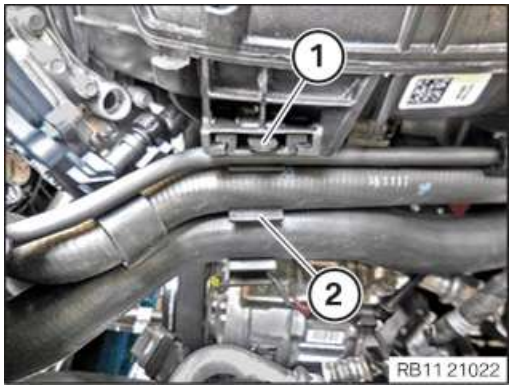
RISK OF DAMAGE

Electrostatic discharge.

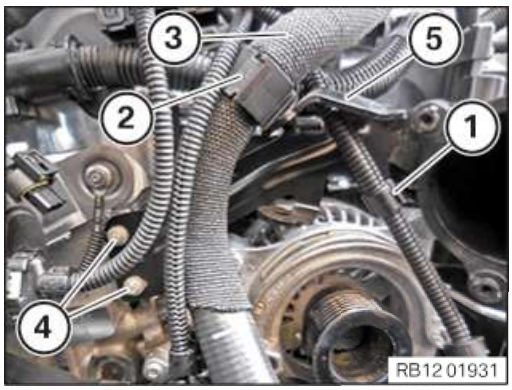
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

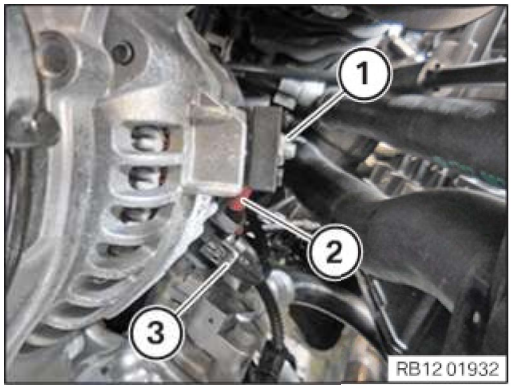
cardiagn.com



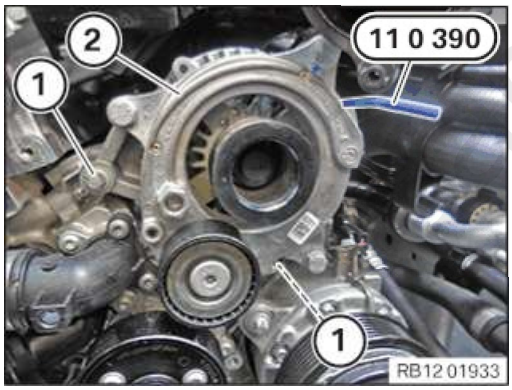
- Unlock the lock (1).
- Thread out holder (2) and set aside.



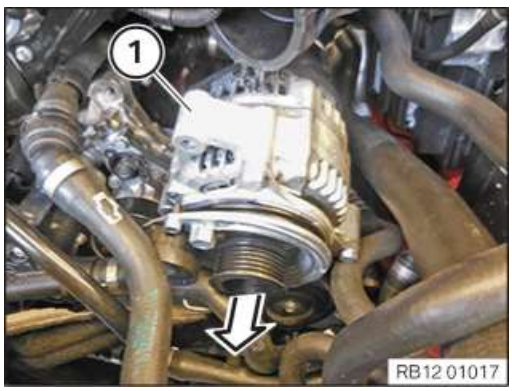
- Loosen clamp (1).
- Loosen clamp (2).
- Feed out coolant line (3) and place to one side.
- Loosen screws (4).
- Thread out holder (5) and set aside.



- Unfasten nut (1).
- Thread out positive battery cable (2) and set it aside.
- Unlock and loosen connector (3).



- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.
- Loosen screws (1).
- Disconnect the alternator (2).



- Feed the alternator (1) out toward the front in the direction of the arrow.

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MAIN WORK

9 – Removing the belt tensioner

CAUTION

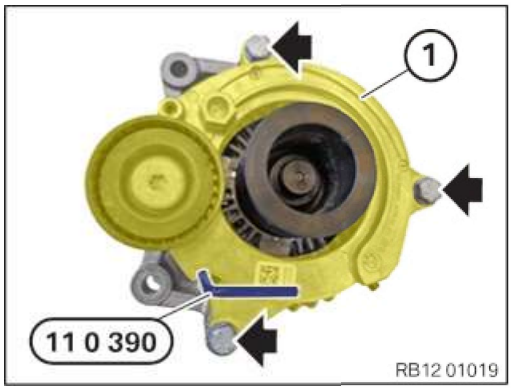
Component with preload.

Danger of injury!

- Reduce preload as far as possible before disassembly. Relieve component.

TECHNICAL INFORMATION

The belt tensioner must be installed to relieve the tension. The special tools or transportation retainers must be installed for disassembly.

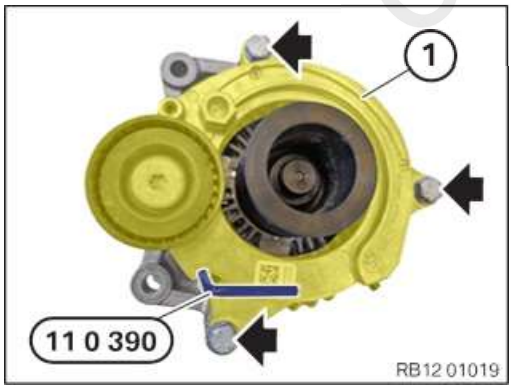


- Remove screws (arrows).
- Guide out the belt tensioner (1) at the alternator and remove.

10 – Installing the belt tensioner

TECHNICAL INFORMATION

The belt tensioner must be installed to relieve the tension. The special tools or transportation retainers must be installed for disassembly.



- Guide the belt tensioner (1) in at the alternator and install.
- Tighten screws (arrows).

Belt tensioner to alternator

M8X30		Tightening torque	28 Nm

POSTPROCESSES

11 – Installing the alternator

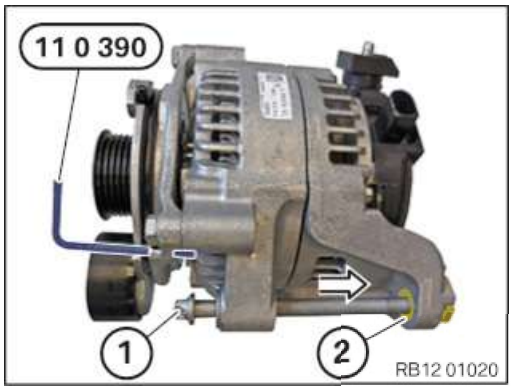
cardiagn.com

WARNING

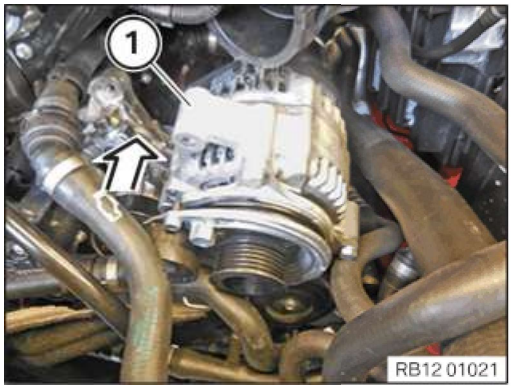
Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

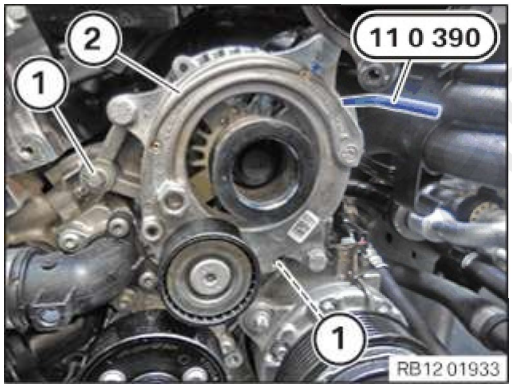
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.



- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.
- Slightly push back the threaded support sleeve (2) in the direction of the arrow to facilitate the installation of the alternator.
- Screw the screw (1) into the threaded support sleeve (2).
- Press back the threaded support sleeve (2) using the bolt (1).
- Once again unscrew the screw (1) from the threaded support sleeve (2).



- Guide in alternator (1) in the direction of the arrow and position it.

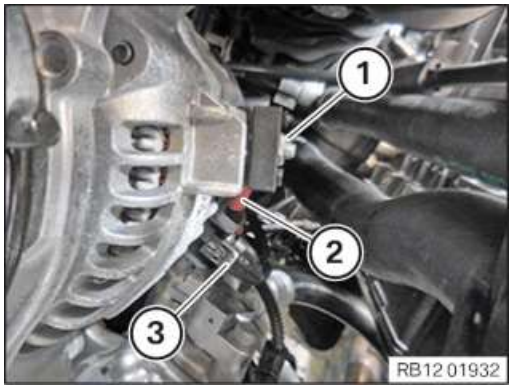


- Install the alternator (2).
- Tighten the screws (1).

Alternator to component carrier

M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm

- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.



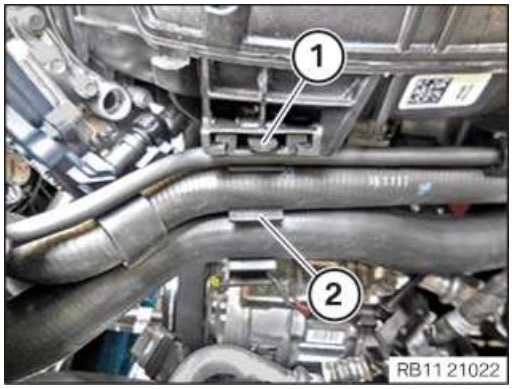
- Insert and install the positive battery cable (2).
- Tighten nut (1).

Positive battery cable to the alternator

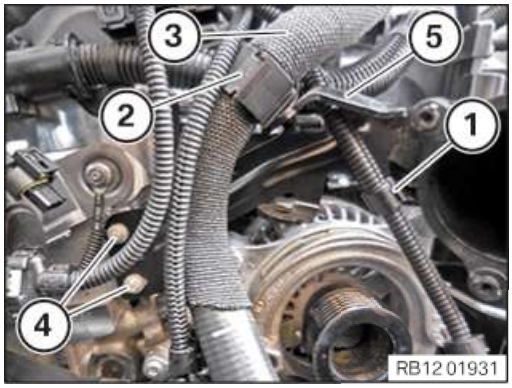
M8		Tightening torque	19 Nm

- Connect and lock the connector (3).
- The connector (3) must engage audibly.

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- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Insert and position the holders (5).
- Tighten down screws (4).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm

- Guide coolant line (3) into clamp (2) and install it.
- Secure clamps (2).
- Secure the clamp (1).

12 – Installing the drive belt for alternator

Overview of drive belt for alternator



1. Drive belt for alternator

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

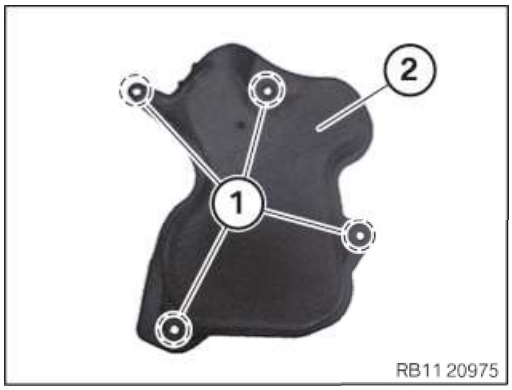
The drive belt must be replaced if contaminated with coolant- and oil residues.

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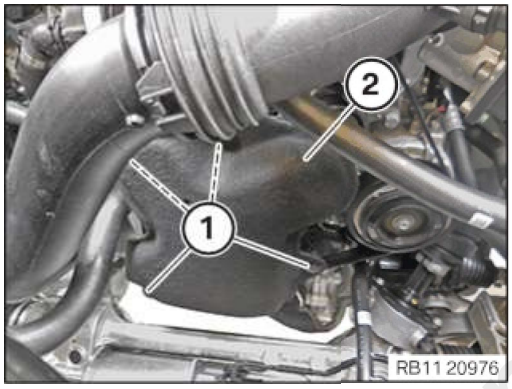
- Position the drive belt for alternator (2) on the ancillary components.
- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Feed the special tool 0 496 268 (11 0 390) out of the belt tensioner and remove it.

13 – Install the acoustic cover for the engine at the front

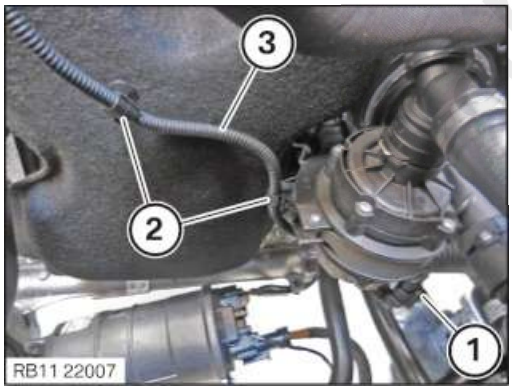


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

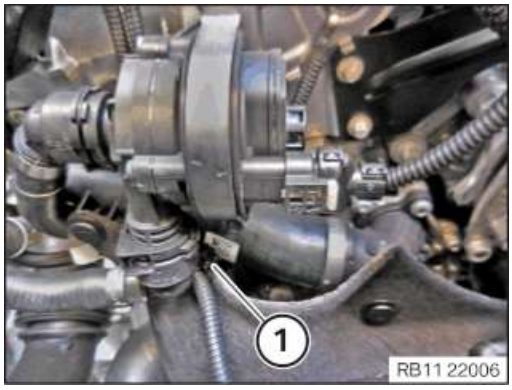


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



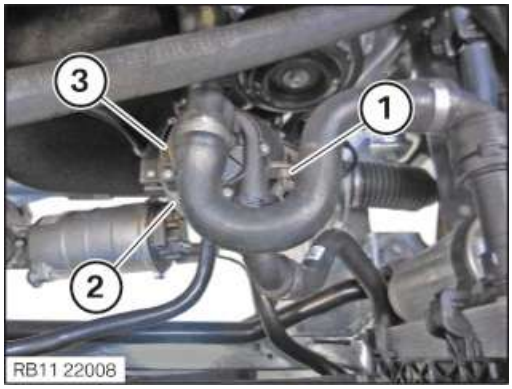
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

14 – Mounting the electrical auxiliary coolant pump for the charge air cooler/air conditioning condenser

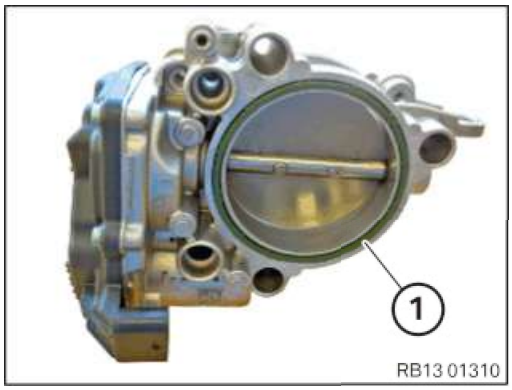


- Feed in and position the electrical auxiliary coolant pump (3).
- Insert and install the holder (2).
- Tighten nut (1).

Electric coolant pump to holder

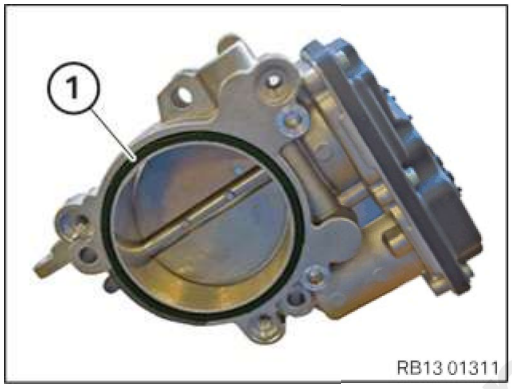
M6		Tightening torque	8 Nm

15 – Installing the throttle body



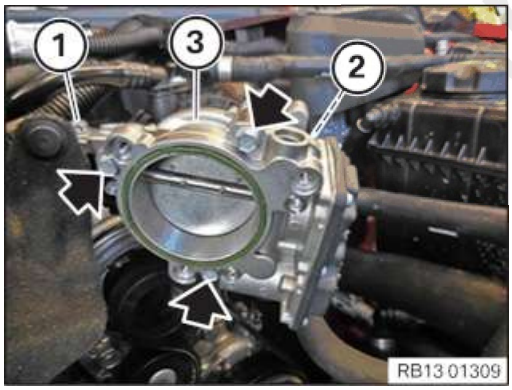
- Renew sealing ring (1).

  Parts: Sealing ring



- Renew sealing ring (1).

  Parts: Sealing ring



- Feed in and install the throttle body (3).
- Connect and lock the connector (2).
- Tighten screws (arrows).

Throttle body to intake plenum

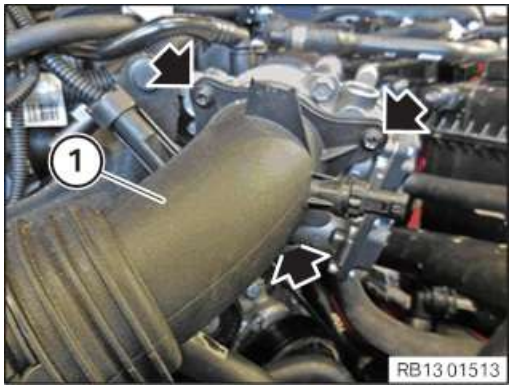
M6X50		Tightening torque	7 Nm

- Tighten down screw (1).

Throttle body to holder

M6X25		Tightening torque	8 Nm

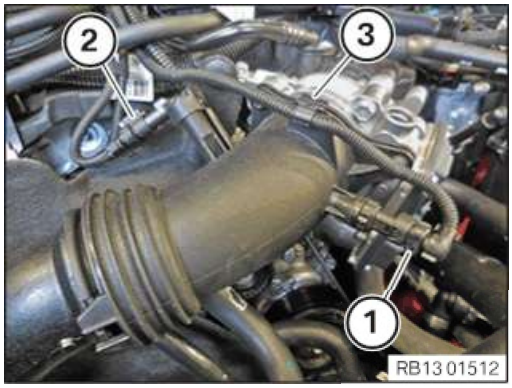
.diagn.com



- Insert and install charge air line (1).
- Tighten screws (arrows).

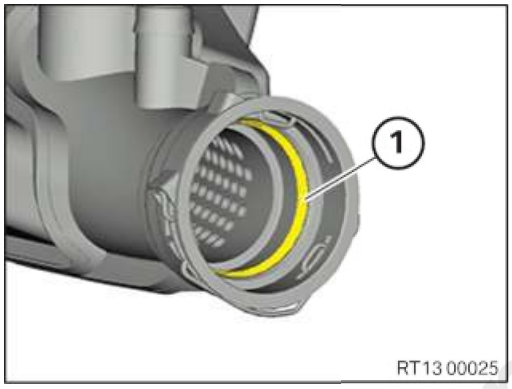
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect and lock the connector (1).
- Connect and lock the connector (2).
- Secure clamps (3).

16 – Installing the clean air pipe with resonator

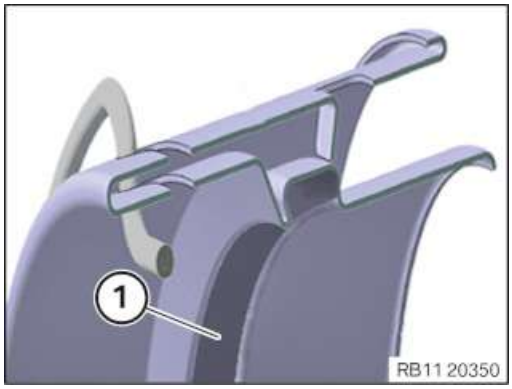


- Check the seal (1) for damages, replace if necessary.

▶ **Replace damaged gasket**

TECHNICAL INFORMATION

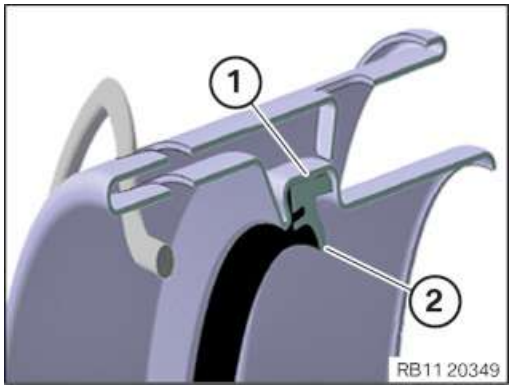
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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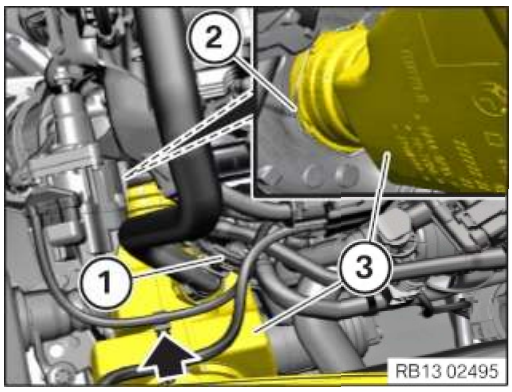
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

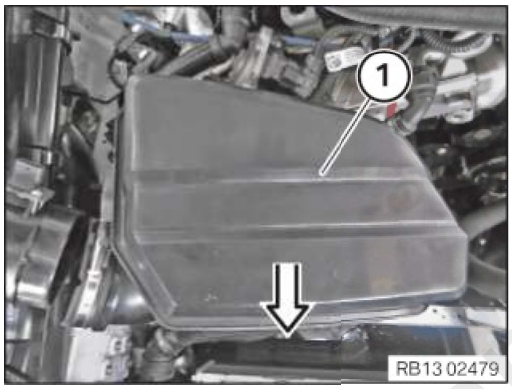
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



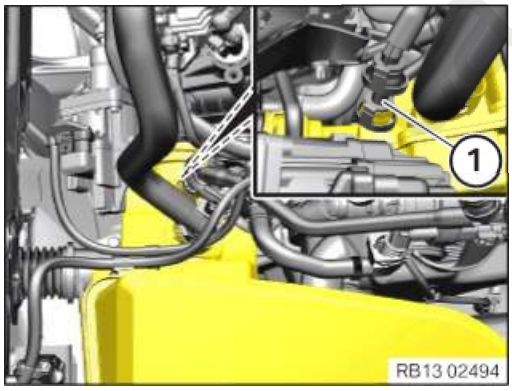
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

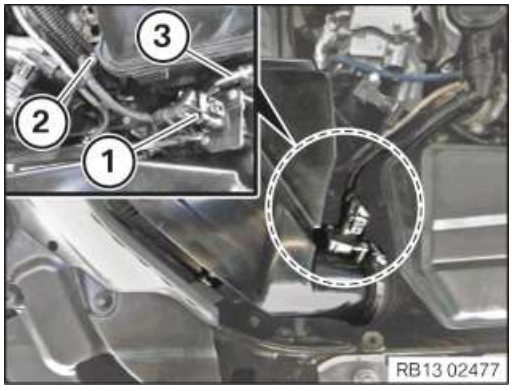
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

diag.com



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

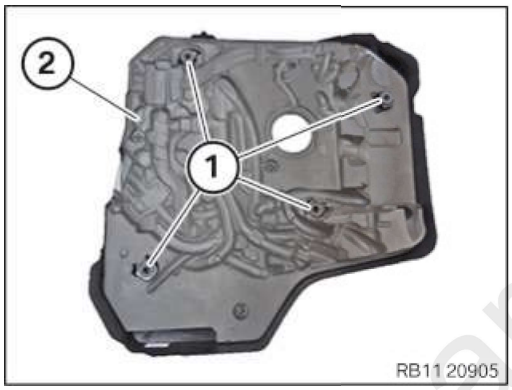
17 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

18 – Disconnecting all battery earth leads

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- See additional information.

Additional Information

Overview of Tightening Torques

Belt tensioner to alternator			Used in step 10
M8X30		Tightening torque	28 Nm

Alternator to component carrier			Used in step 11
M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm

Positive battery cable to the alternator			Used in step 11
M8		Tightening torque	19 Nm

Manifold support for intake air to cylinder head			Used in step 11
M6X16		Tightening torque	8 Nm

Electric coolant pump to holder			Used in step 14
M6		Tightening torque	8 Nm

Throttle body to intake plenum			Used in step 15
M6X50		Tightening torque	7 Nm

Throttle body to holder			Used in step 15
M6X25		Tightening torque	8 Nm

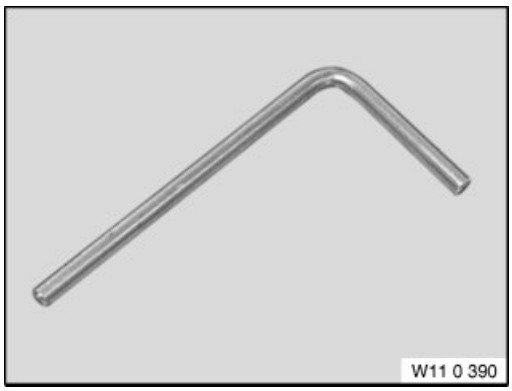
Charge air line to throttle body			Used in step 15
M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 16
Clamp		Tightening torque	3 Nm

Overview of Special Tools

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0 496 268 (11 0 390) Pin



Common	Used in step 781112
Usage	(roll pin) For securing new tensioning pulley (poly-V belt)
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 15 07 (390)

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Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	118
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	118
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
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61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 20 900 Disconnecting and connecting battery earth lead	118
61 35 ... Notes on ESD protection (Electro Static Discharge)	4
61 35 ... Notes on ESD protection (Electro Static Discharge)	468

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11 28 010 Replacing drive belt for alternator

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Removing the clean air pipe with the resonator

WARNING

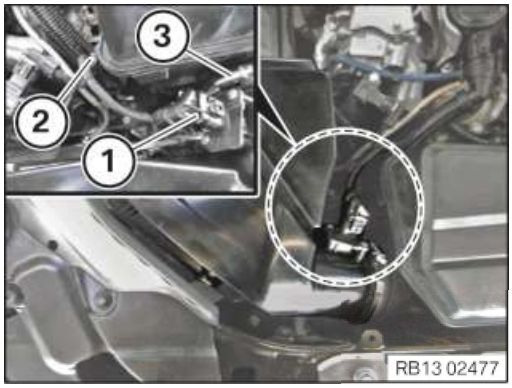
Hot surfaces.

Risk of burning!

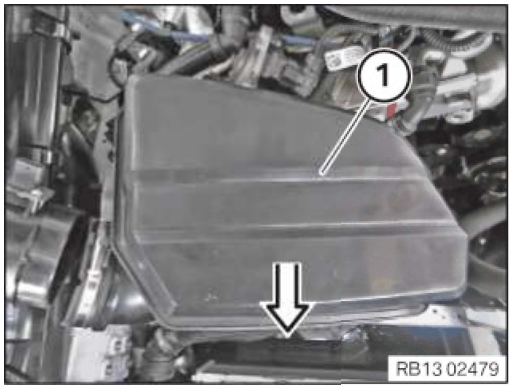
- Perform all work only on components that have cooled down.



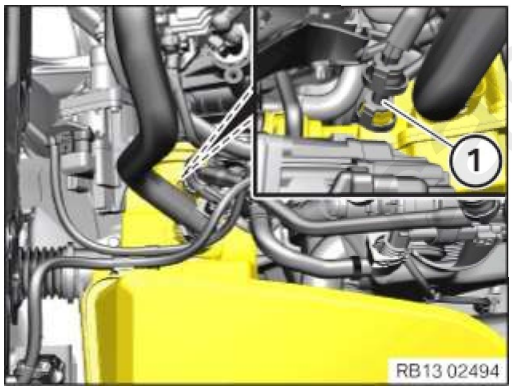
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



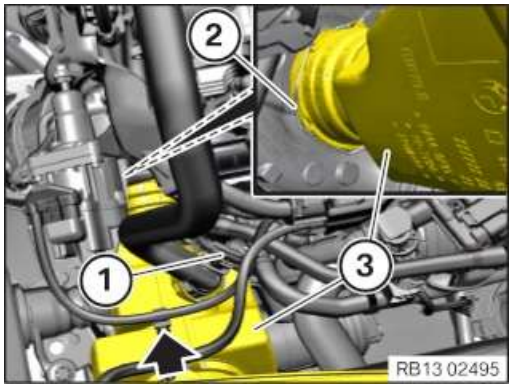
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



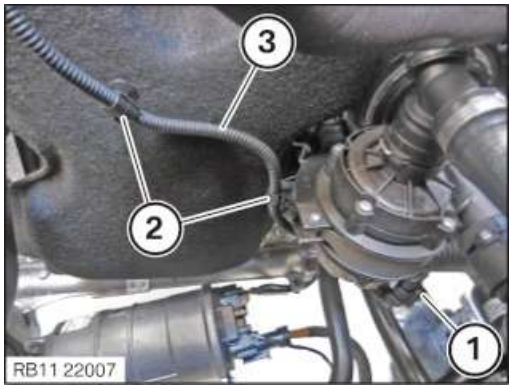
- Unlock and disconnect the tank ventilation line (1).



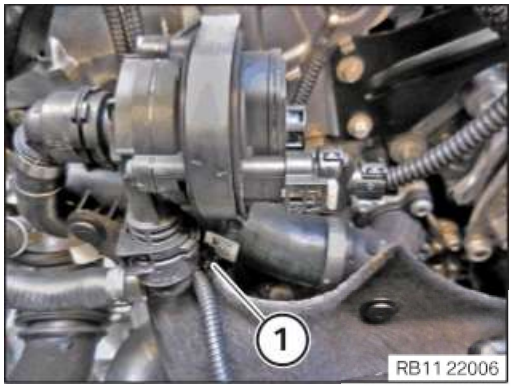
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

3 – Removing the acoustic cover for the engine at the front

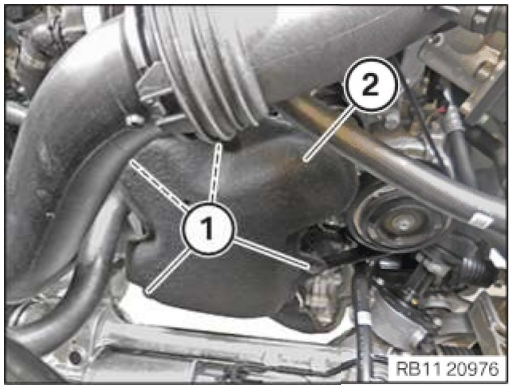
rdiagn.com



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

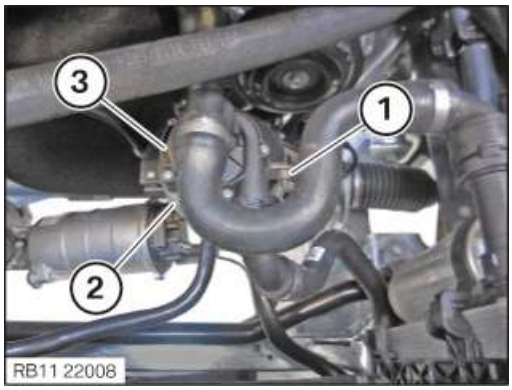
4 – Releasing the electrical auxiliary coolant pump for the charge air cooler or the air conditioning condenser

RISK OF DAMAGE

Non-visible damage to the coolant pump.

Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.



- Loosen nut (1).
- Thread out holder (2) and set aside.
- Guide out the electrical auxiliary coolant pump (3) and set it aside.

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5 – Removing the drive belt for alternator

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

Component with preload.

Danger of injury!

- Reduce preload as far as possible before disassembly. Relieve component.

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.



- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Secure the belt tensioner with the special tool 0 496 268 (11 0 390).
- Guide out the drive belt for the alternator (2) and remove it.

6 – Installing the drive belt for alternator

Overview of drive belt for alternator



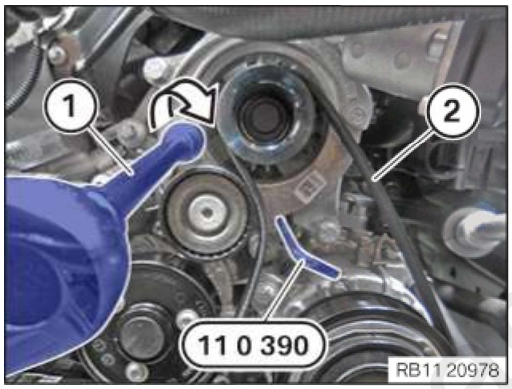
1. Drive belt for alternator

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

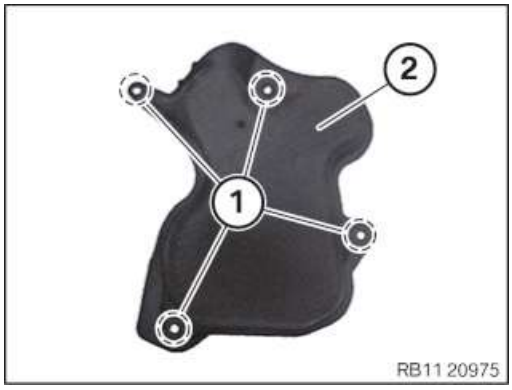
The drive belt must be replaced if contaminated with coolant- and oil residues.



- Position the drive belt for alternator (2) on the ancillary components.
- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Feed the special tool 0 496 268 (11 0 390) out of the belt tensioner and remove it.

POSTPROCESSES

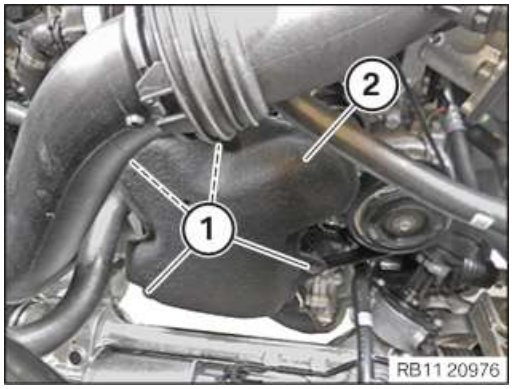
7 – Install the acoustic cover for the engine at the front



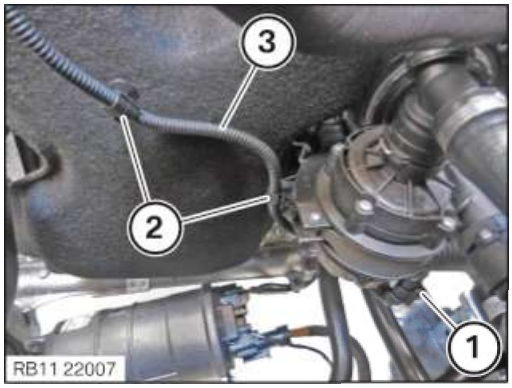
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

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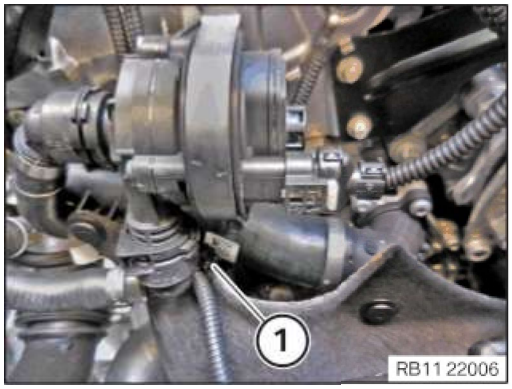


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



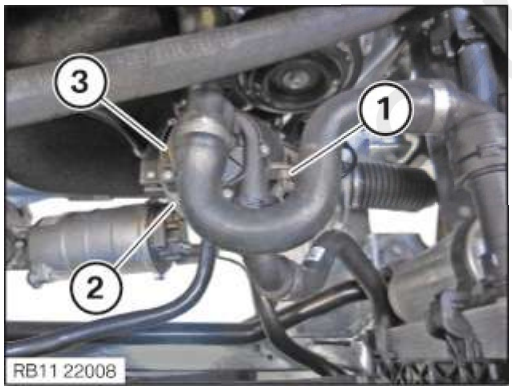
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

8 – Mounting the electrical auxiliary coolant pump for the charge air cooler/air conditioning condenser

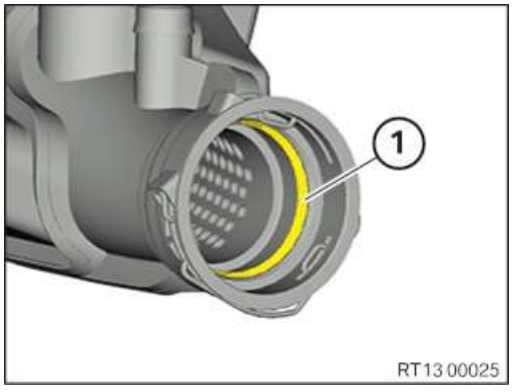


- Feed in and position the electrical auxiliary coolant pump (3).
- Insert and install the holder (2).
- Tighten nut (1).

Electric coolant pump to holder

M6		Tightening torque	8 Nm

9 – Installing the clean air pipe with resonator



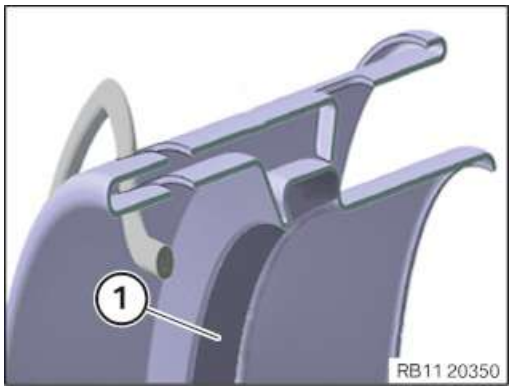
- Check the seal (1) for damages, replace if necessary.

mdiagn.com

▶ **Replace damaged gasket**

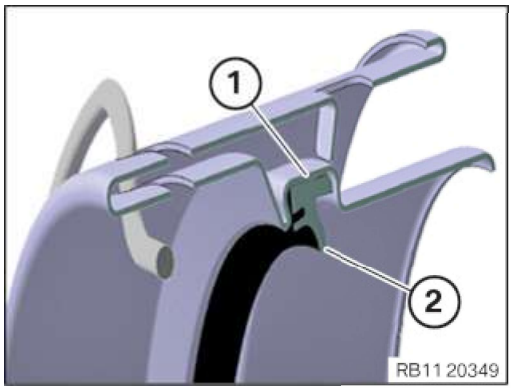
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



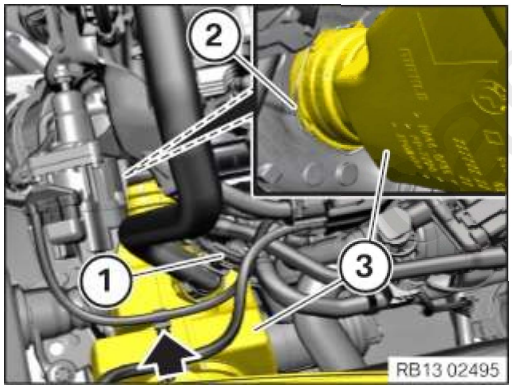
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

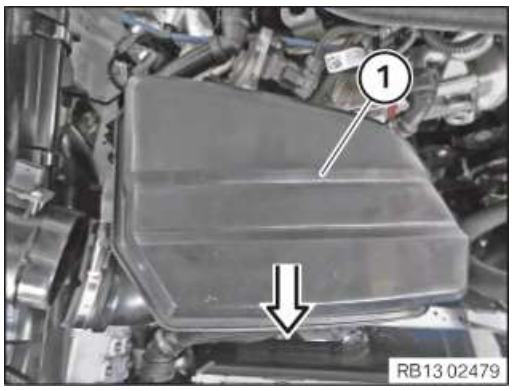
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



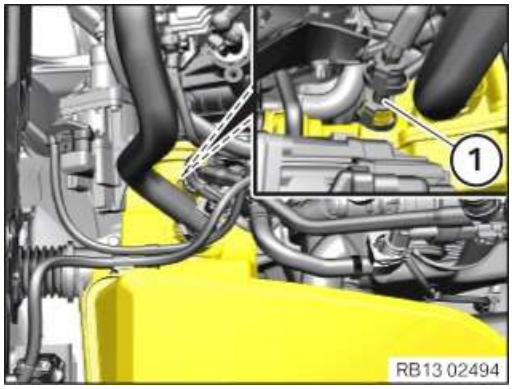
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

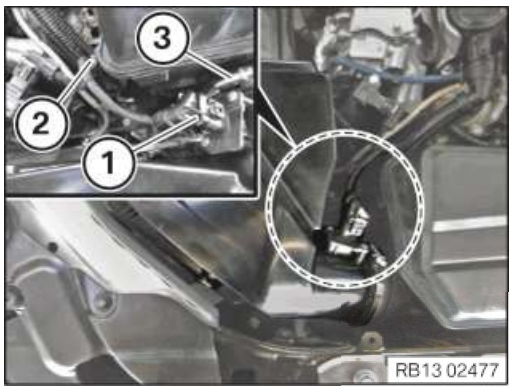
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

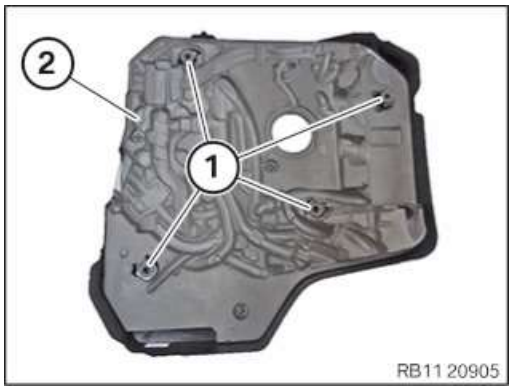
10 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

Additional Information

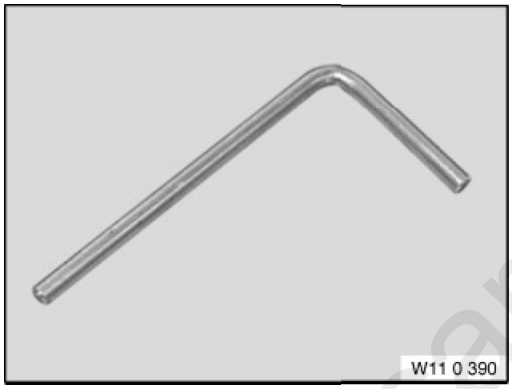
Overview of Tightening Torques

Electric coolant pump to holder			Used in step 8
M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 9
Clamp		Tightening torque	3 Nm

Overview of Special Tools

0 496 268 (11 0 390) Pin



Common	Used in step 56
Usage	(roll pin) For securing new tensioning pulley (poly-V belt)
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 15 07 (390)

Links

Repair instructions	**Used in step**
61 35 ... Notes on ESD protection (Electro Static Discharge)	4

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11 31 505 Adjusting the timing of the camshaft (s) (for work no. 11 31 005/508)

PRELIMINARY WORK

1 – Block the crankshaft in he TDC firing position of cylinder 1



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

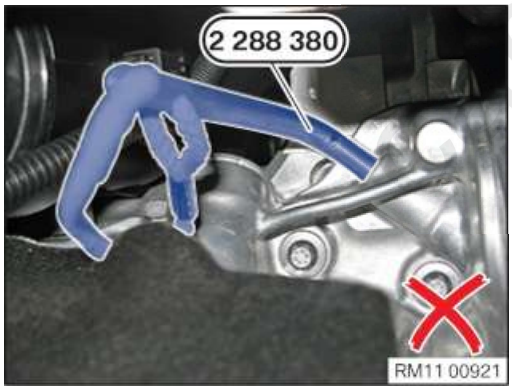
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

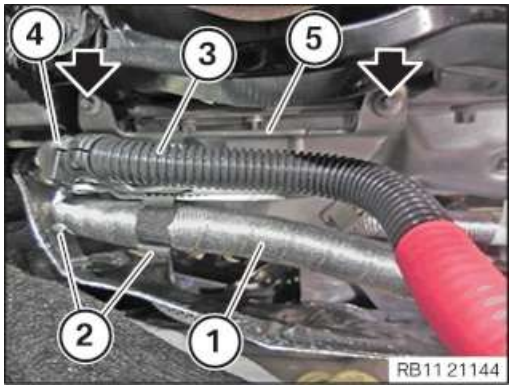


- **Vehicles with automatic transmission:**

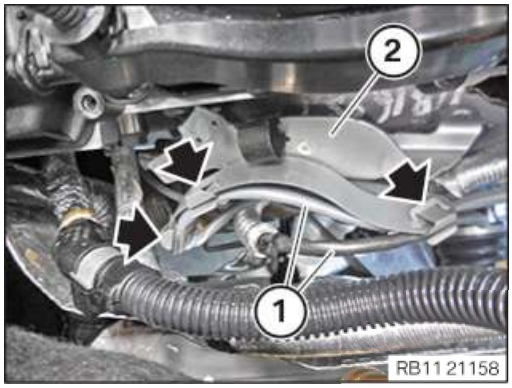
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

2 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

3 – Remove the heat shield on the cylinder head

WARNING

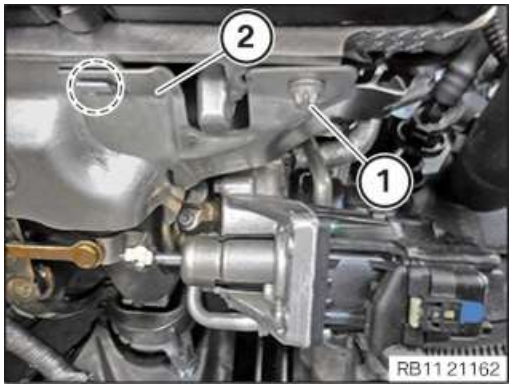
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

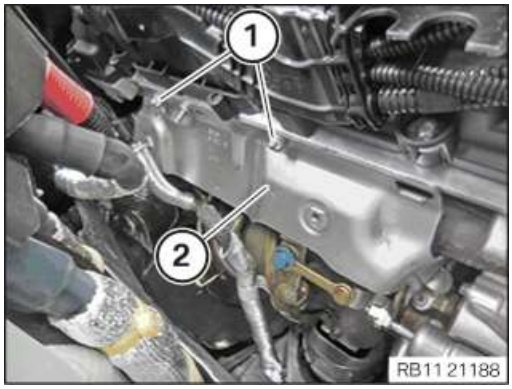


- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

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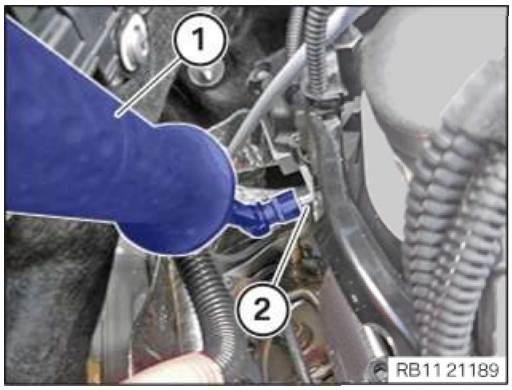


- Loosen screws (1).
- Feed out and remove the heat shield (2).

4 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



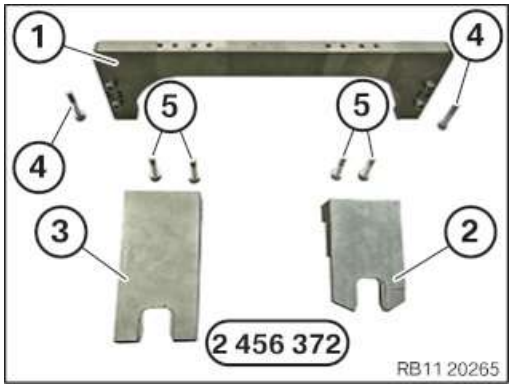
- Feed out and remove the chain tensioner (1).

MAIN WORK

5 – Adjust the timing of the camshaft

Prerequisite

Crankshaft is disconnected and blocked. Engine in TDC firing position at cylinder 1.



- Have the set of special tools 2 456 372 ready.

Number	Description
1	Basic carrier
2	0.7° setting gauge to adjust the intake camshaft
3	0.5° setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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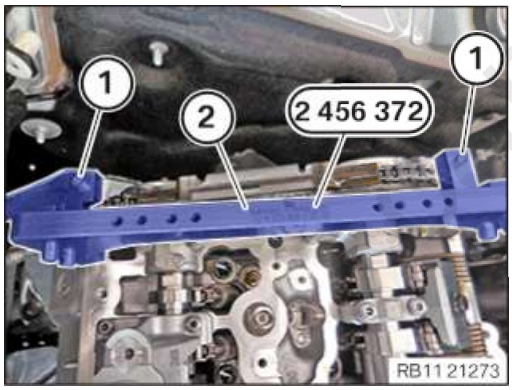
- Use setting gauge 0.7° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use setting gauge 0.5° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



- To release the VANOS central valve (1) use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



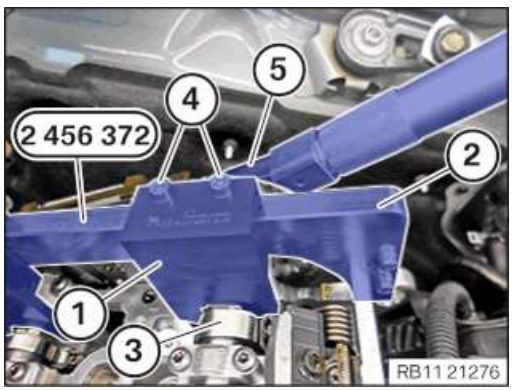
- Position basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



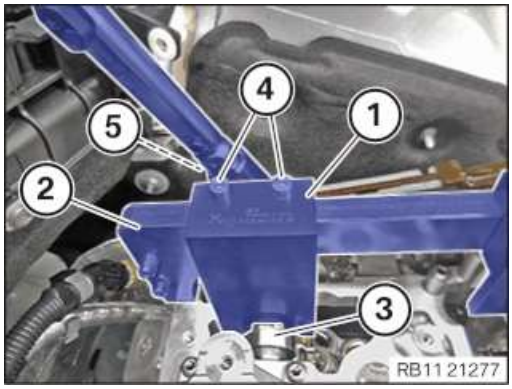
- Position setting gauge 0.7° (1) from the set of special tools 2 456 372 between basic carrier (2) from the set of special tools 2 456 372 and intake camshaft (3).
- If necessary, crank the engine at the crankshaft using special tool 0 493 380 (11 6 480).
- Tighten the screws (4) from the set of special tools 2 456 372.

Test gauge to basic carrier

M6		Tightening torque	8 Nm

- Release the VANOS central valve (5) of the intake adjuster.

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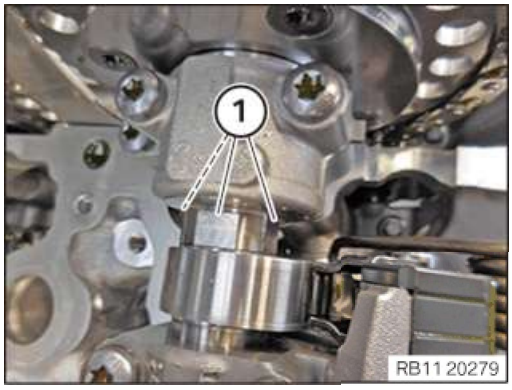


- Position setting gauge 0.5° (1) from the set of special tools 2 456 372 between basic carrier (2) from the set of special tools 2 456 372 and exhaust camshaft (3).
- If necessary, crank the engine at the crankshaft using special tool 0 493 380 (11 6 480).
- Tighten the screws (4) from the set of special tools 2 456 372.

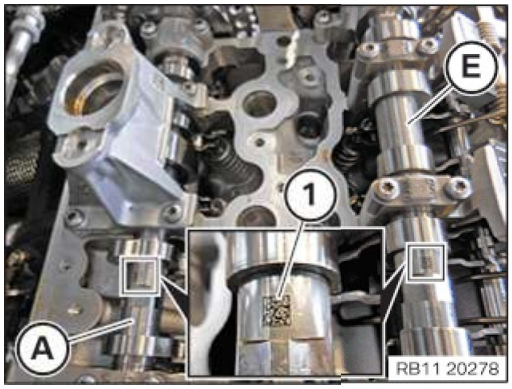
Test gauge to basic carrier

M6		Tightening torque	8 Nm

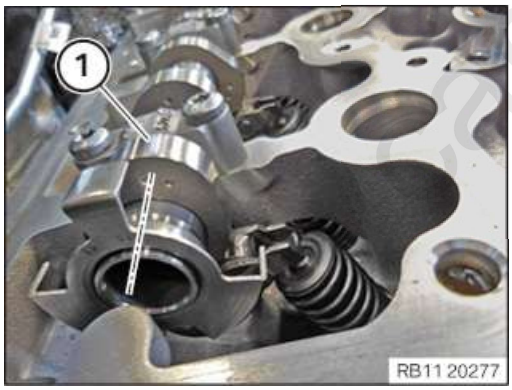
- Release the VANOS central valve (5) of the exhaust camshaft adjuster.



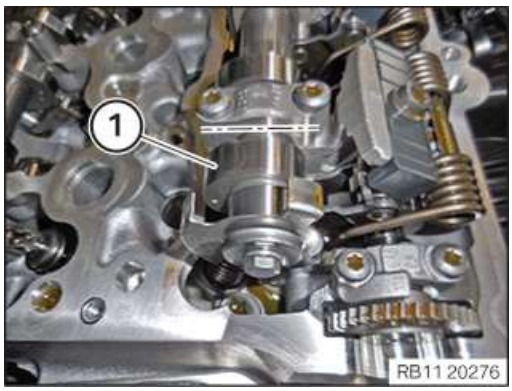
- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Turn intake camshaft (E) and exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



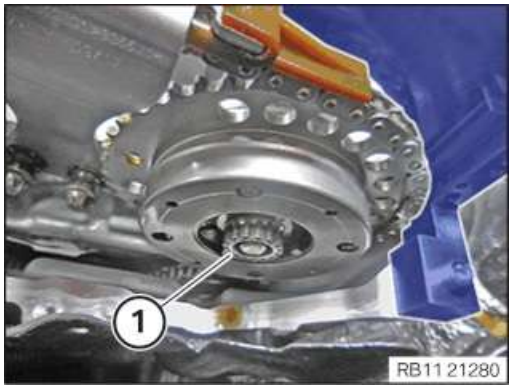
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



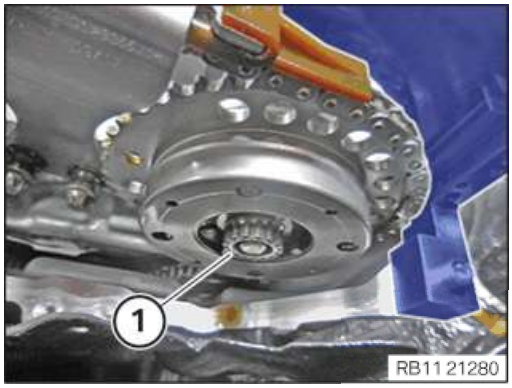
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

6 – Installing the VANOS central valve of the exhaust camshaft adjuster

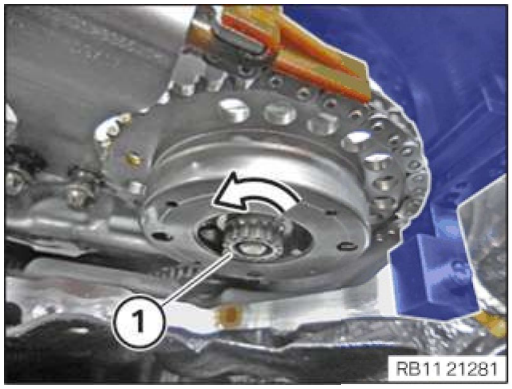
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- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.

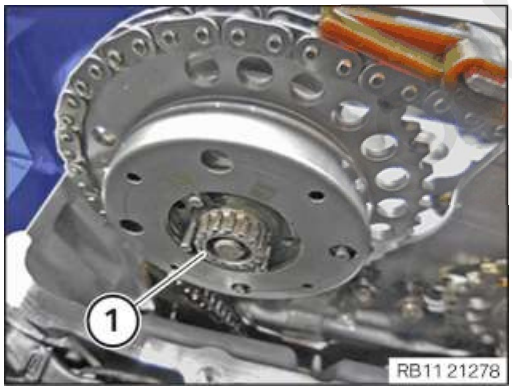


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

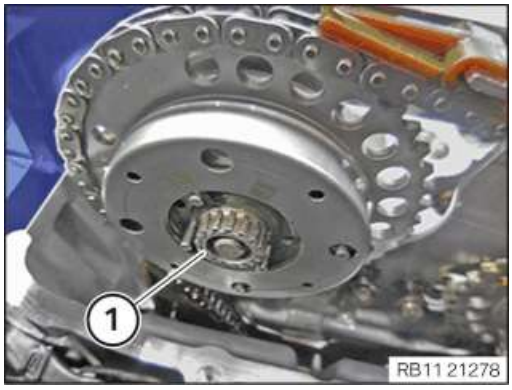


- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

7 – Install the VANOS central valve of the intake adjuster

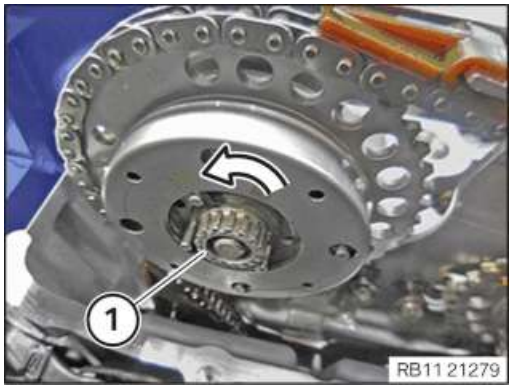


- Guide in the VANOS central valve (1) of the intake adjuster and install.



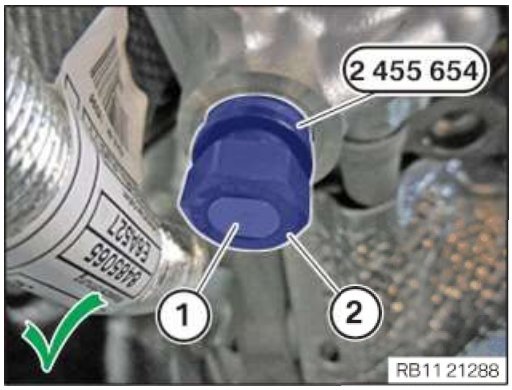
- Hand-tighten the VANOS central valve (1) of the intake adjuster.

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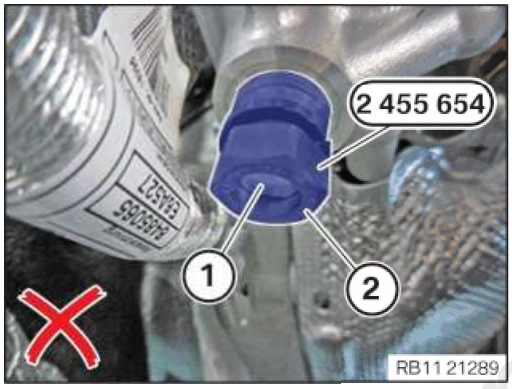
- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

8 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

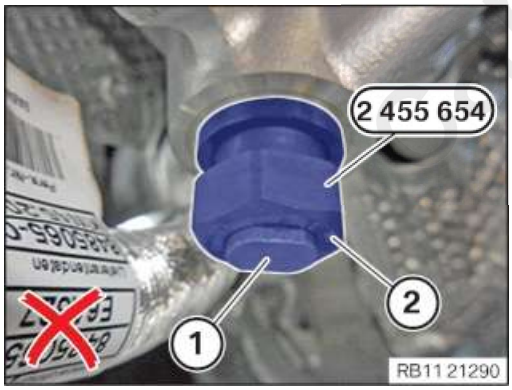
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

9 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the intake adjuster.

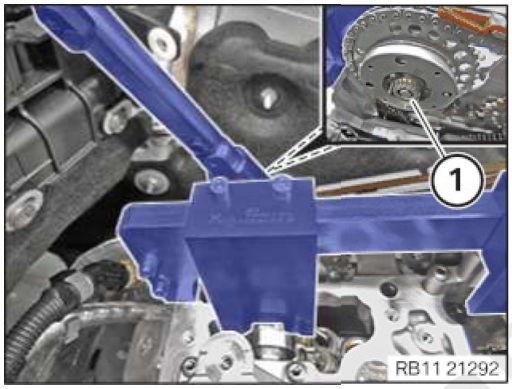
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

10 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



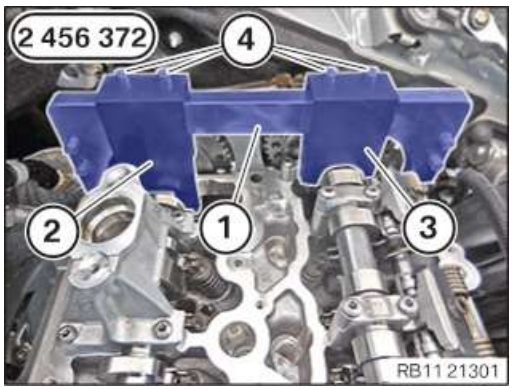
- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

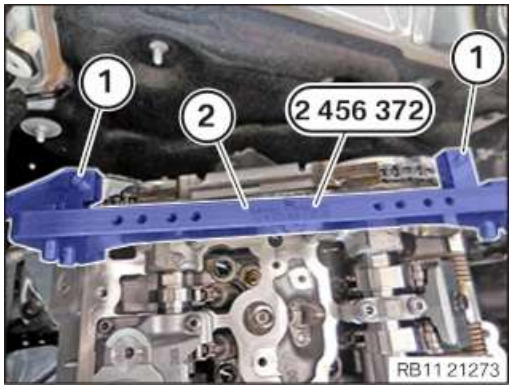
POSTPROCESSES

11 – Disassembling all special tools

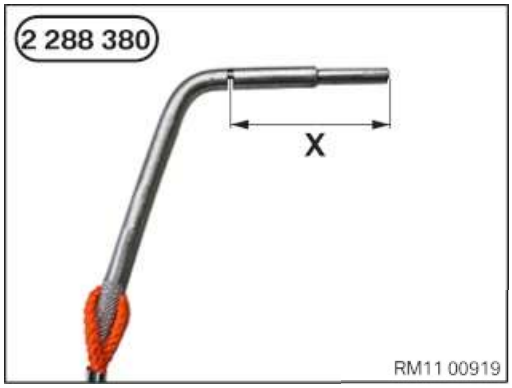


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

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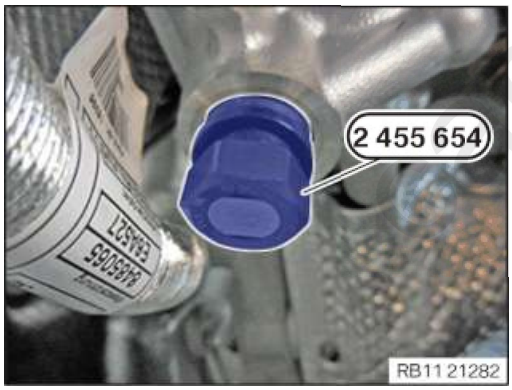
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

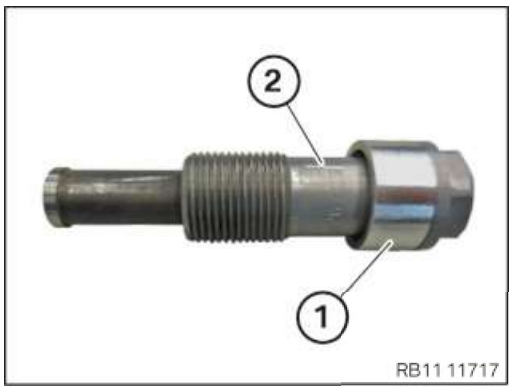
12 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

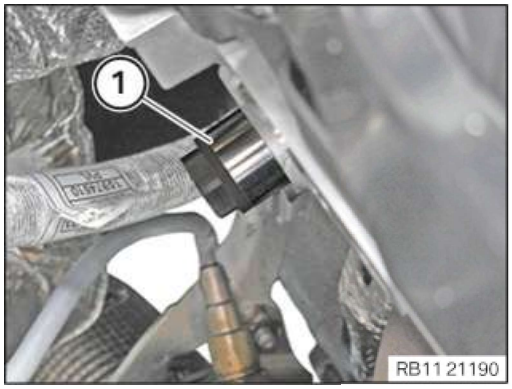


- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

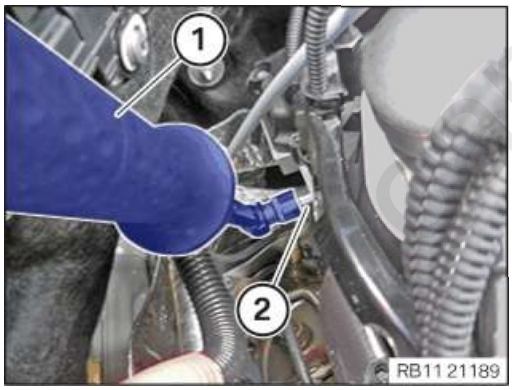


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

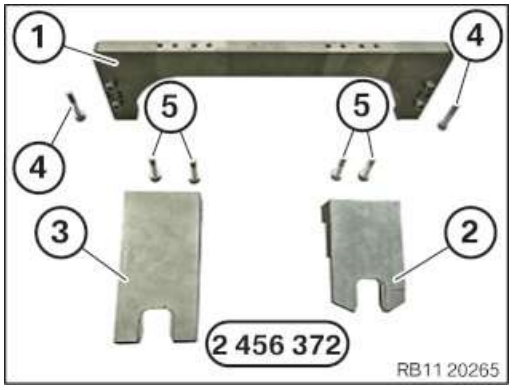


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

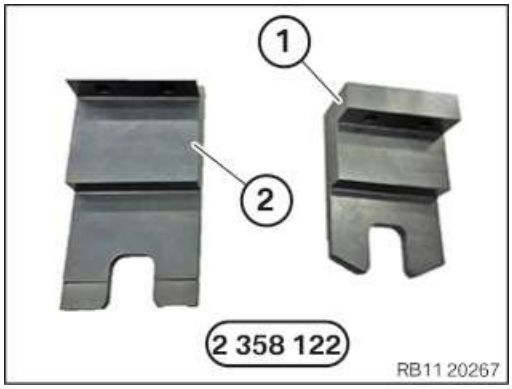
13 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

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- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



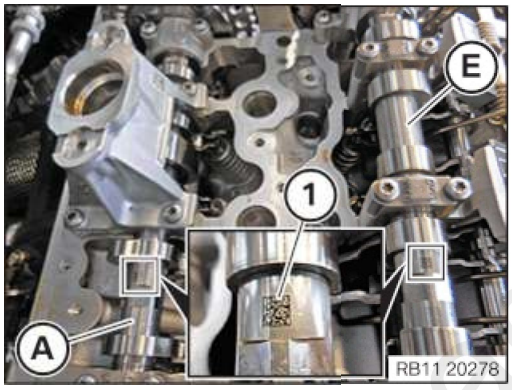
RISK OF DAMAGE

Damage to the engine.

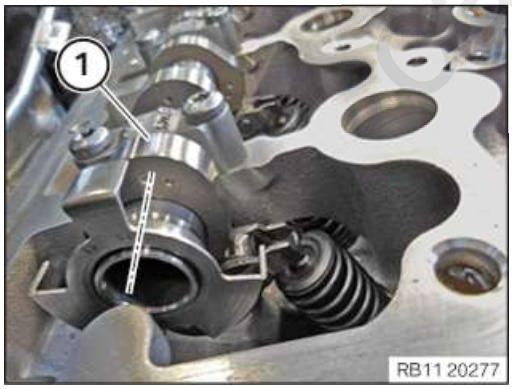
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

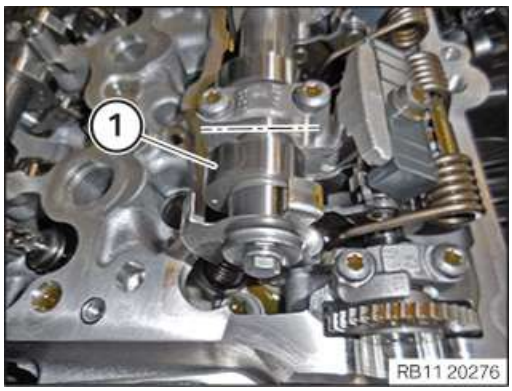
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



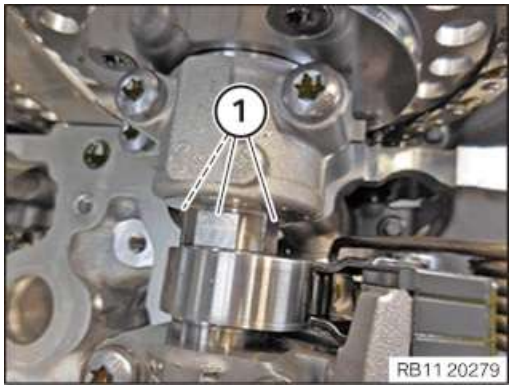
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



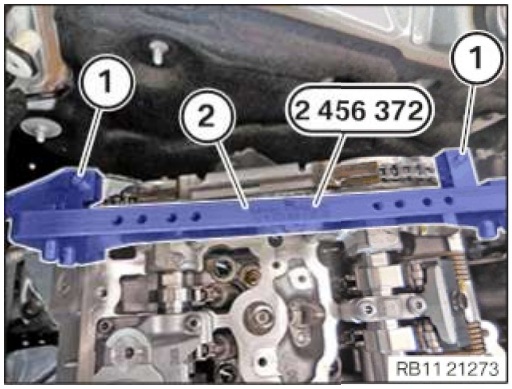
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



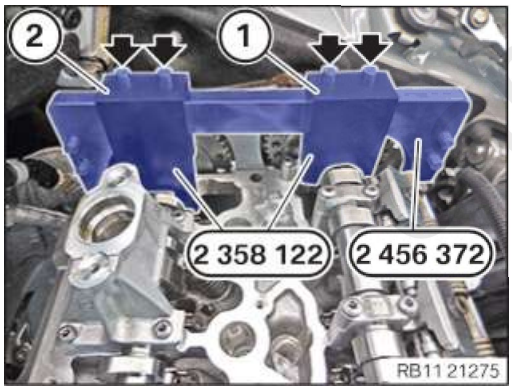
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

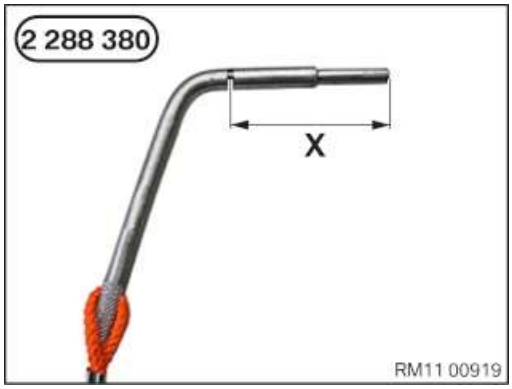
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

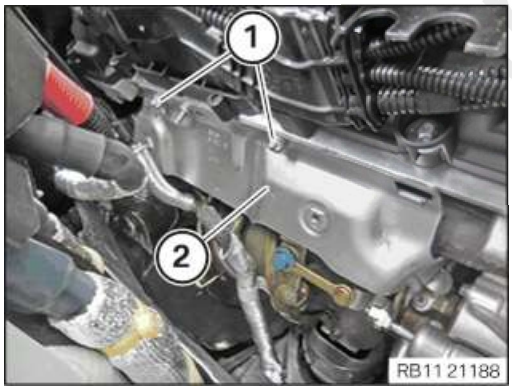


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

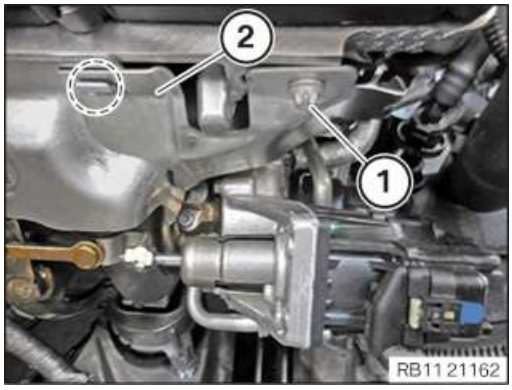
14 – Installing the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

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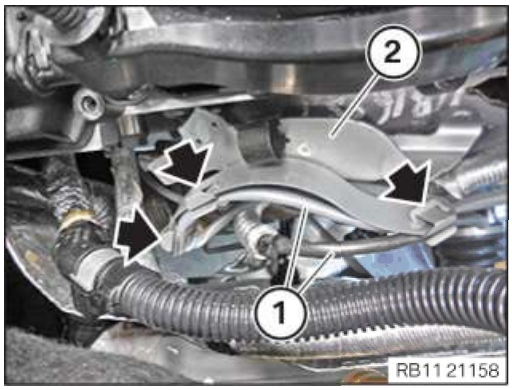


- Tighten down screw (1).

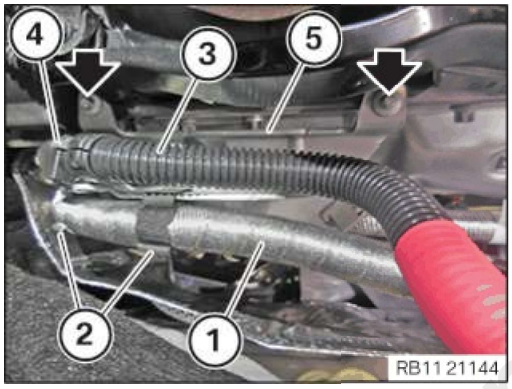
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

15 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head Used in step 513

M6		Tightening torque	8 Nm

Test gauge to basic carrier Used in step 513

M6		Tightening torque	8 Nm

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VANOS central valve to camshaft Used in step 910

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head Used in step 12

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Heat shield to cylinder head Used in step 14

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip Used in step 14

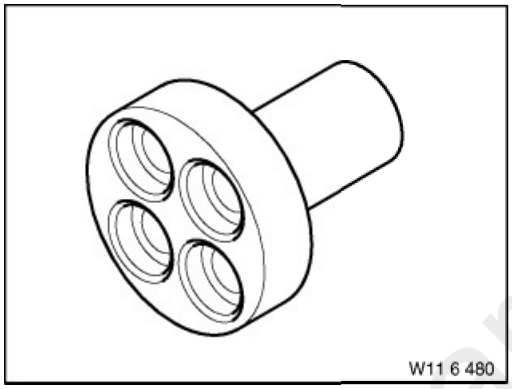
M6 x 12		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover Used in step 15

6X18		Tightening torque	6 Nm

Overview of Special Tools

0 493 380 (11 6 480) Connector



Common Used in step 151113

Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud

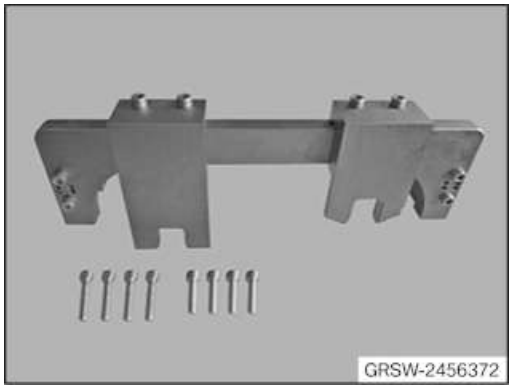


Common Used in step 11113

Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

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2 456 372 Gauge



Common	Used in step 51113
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 496 855 Ratchet handle



Common	Used in step 5910
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 5910
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

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2 455 654 Tensioning tool



Common	Used in step 811
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 13
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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11 31 005 Check the timing of the camshaft (s)

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Bring front compartment lid in the service position

Prerequisite

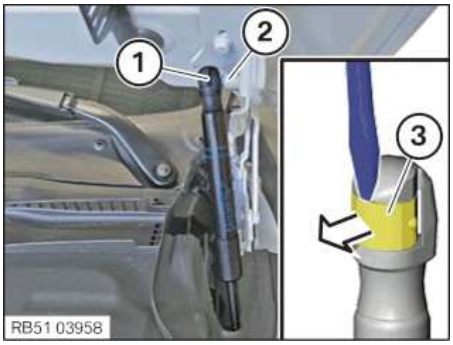
Engine compartment lid is open.

CAUTION

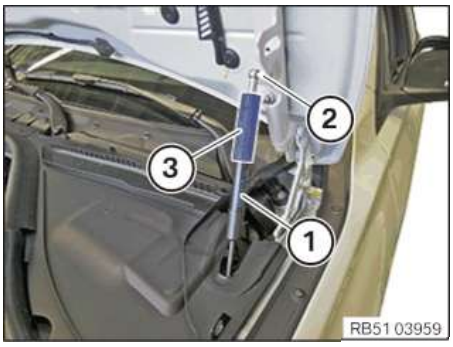
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

2 – Disconnecting all battery earth leads



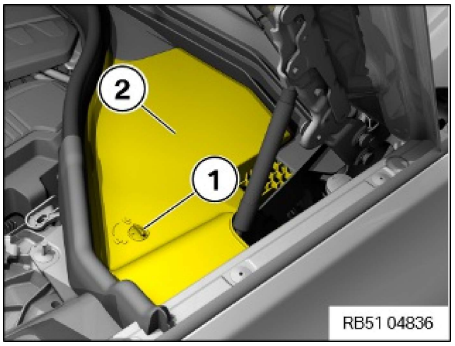
- See additional information.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

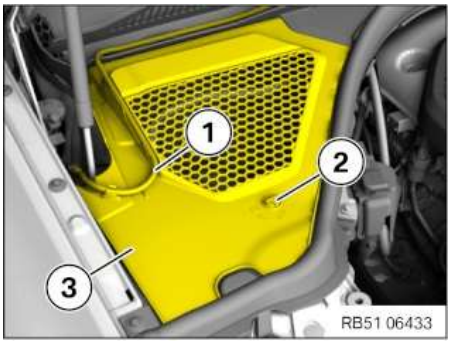
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

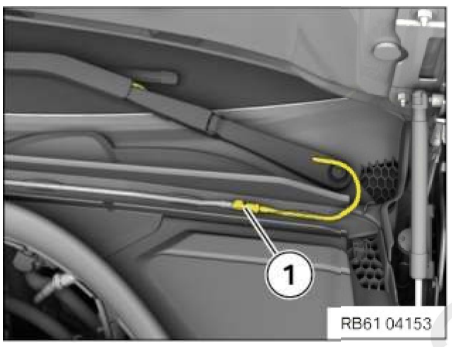
▶ **Remove the wiper arm**

RISK OF DAMAGE

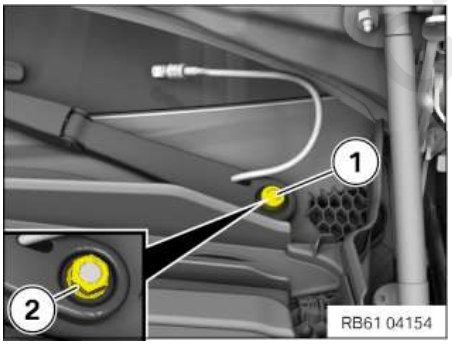
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

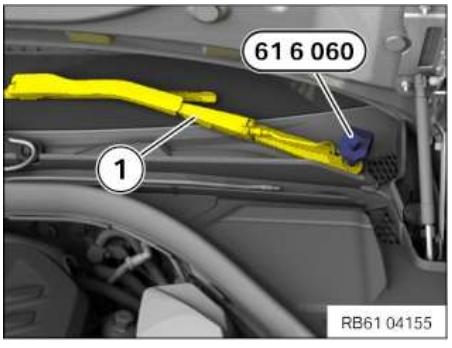
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



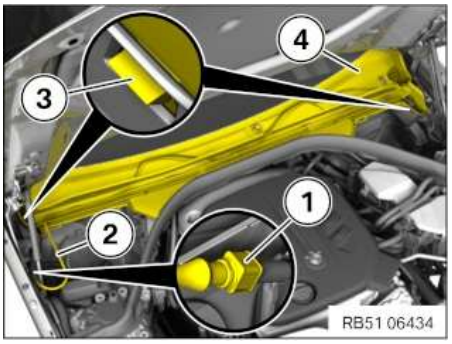
- Remove the protective cap (1).
- Loosen nut (2).



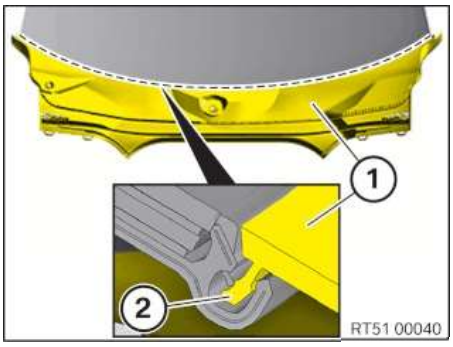
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

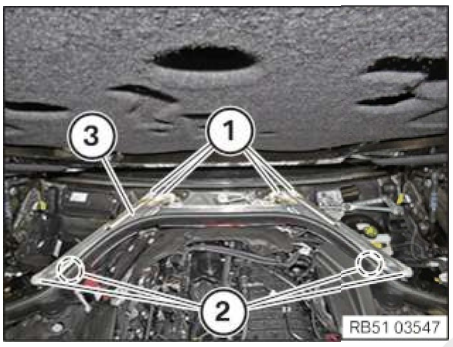


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

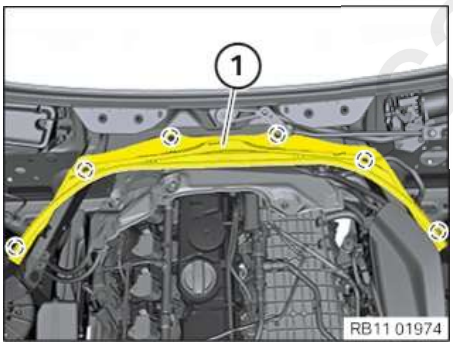
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

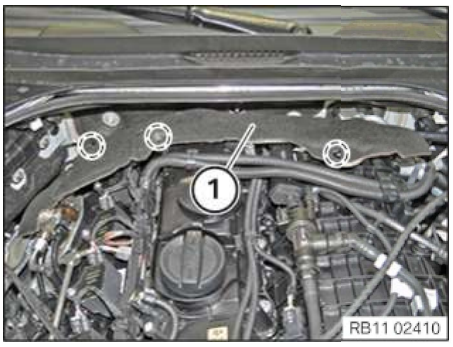
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



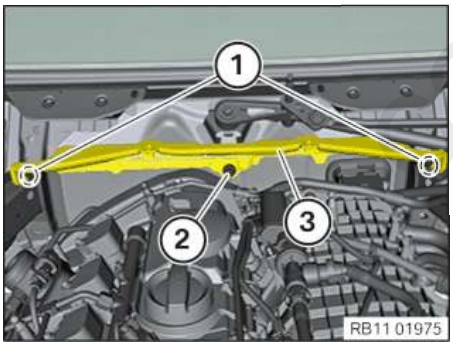
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

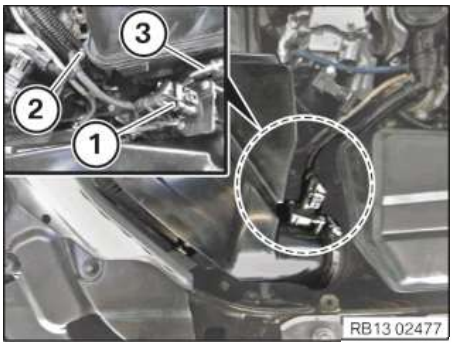
Risk of burning!

- Perform all work only on components that have cooled down.

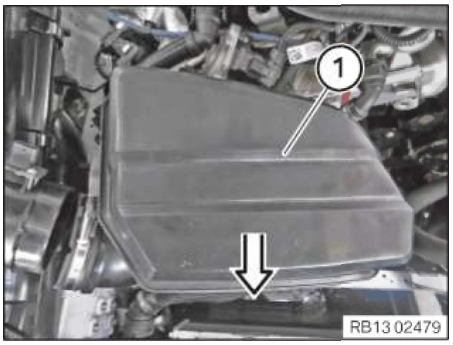
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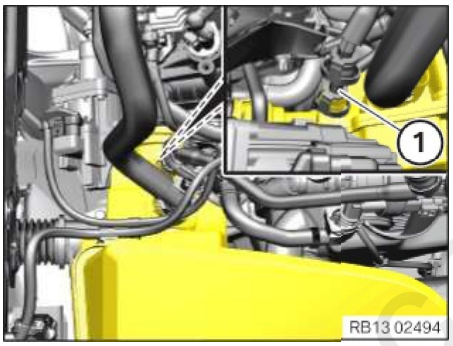
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



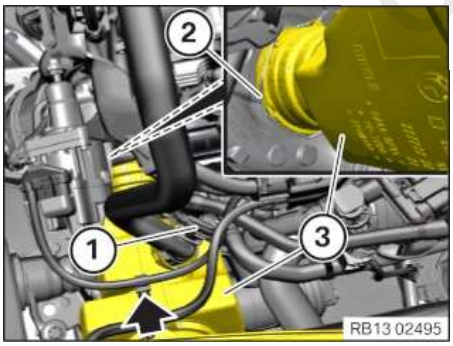
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



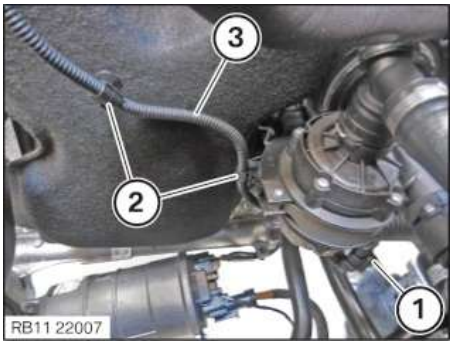
- Unlock and disconnect the tank ventilation line (1).



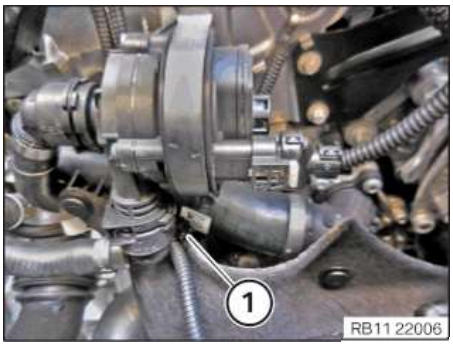
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

13 – Removing the acoustic cover for the engine at the front

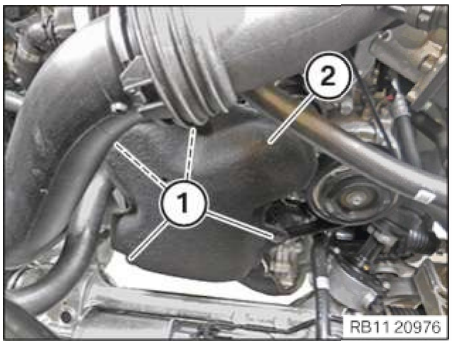
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

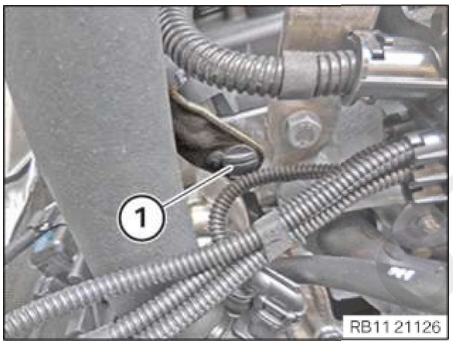


- Loosen clamp (1).

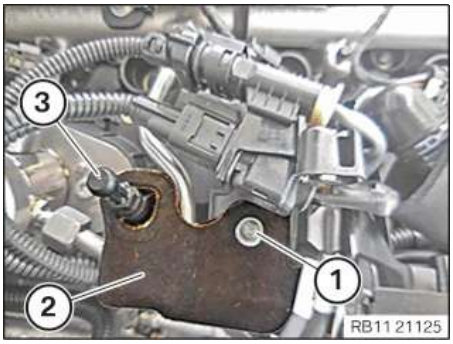


- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

14 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

RISK OF DAMAGE

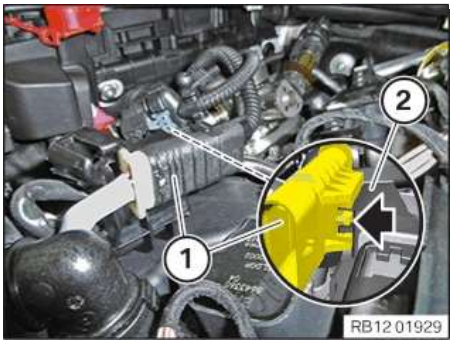
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

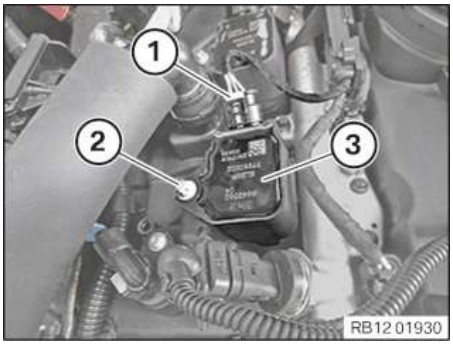


- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).

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- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

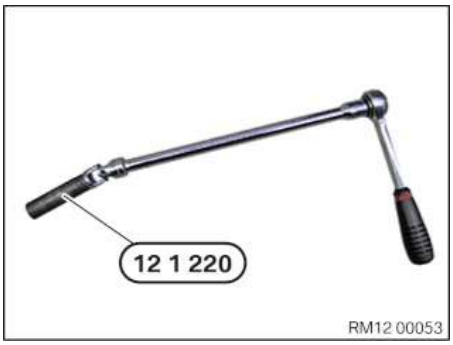
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

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- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

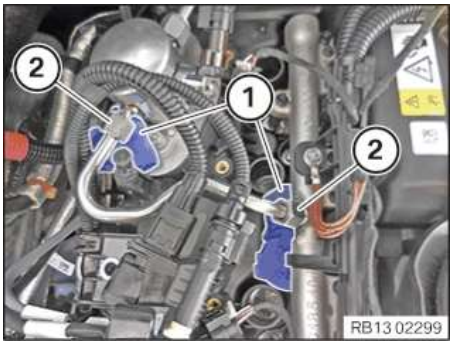
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

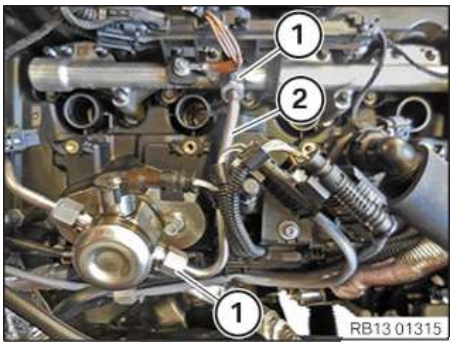


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

18 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

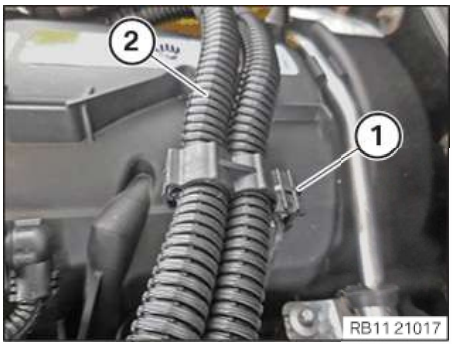
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

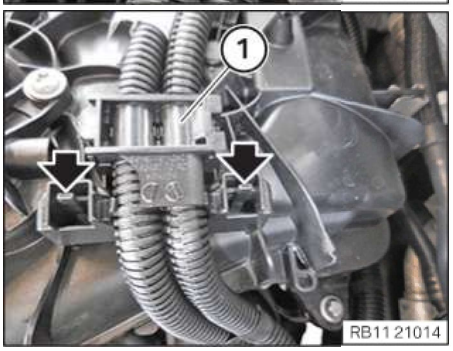
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

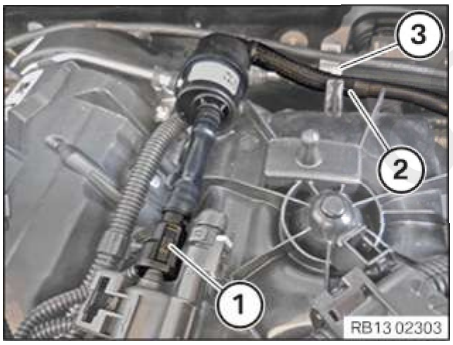
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



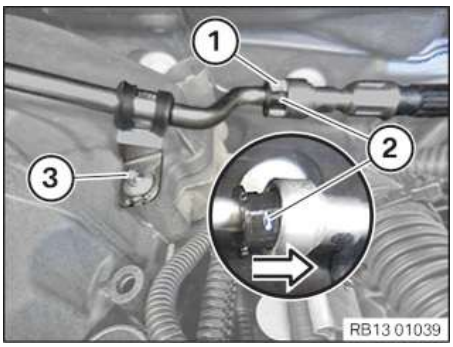
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

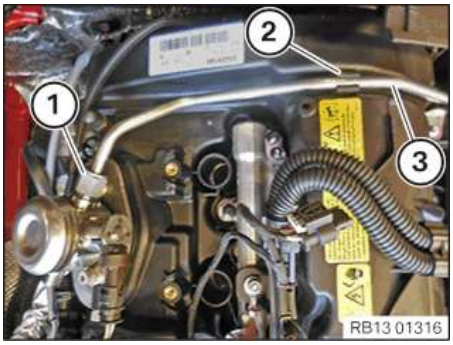


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

19 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

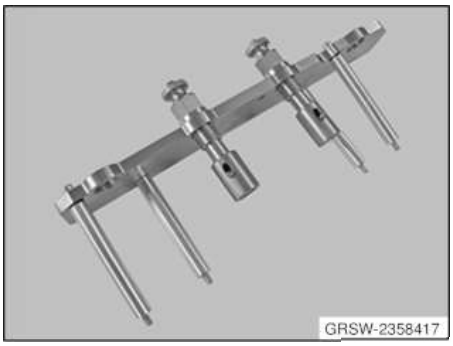
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



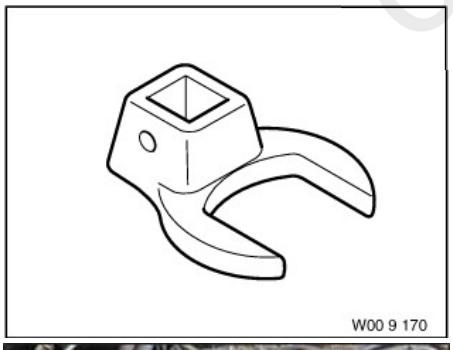
- Prepare special tool 2 358 417.



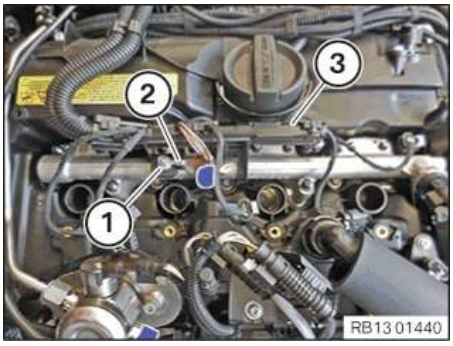
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

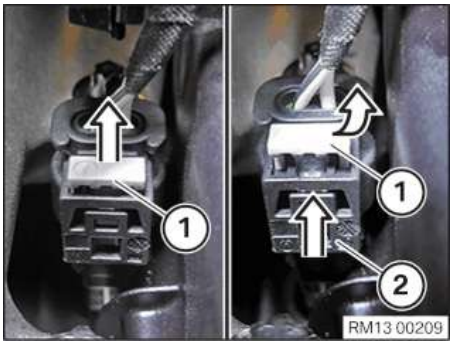


- Prepare special tool .

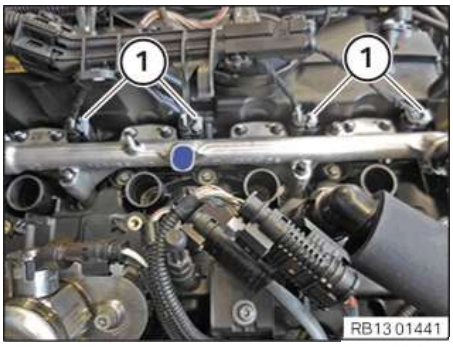


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



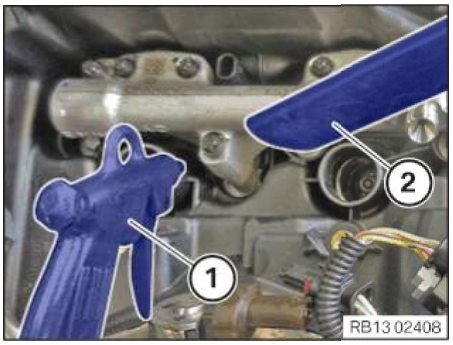
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

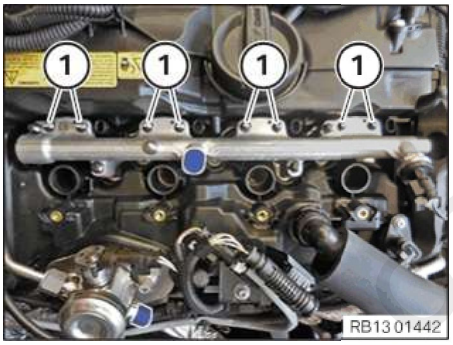


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

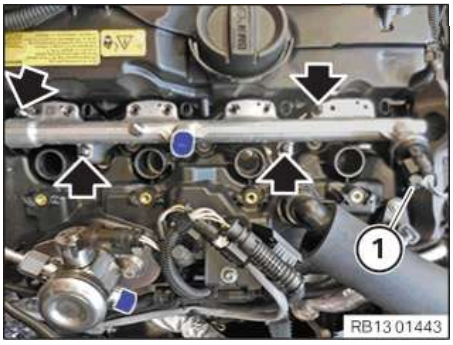
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



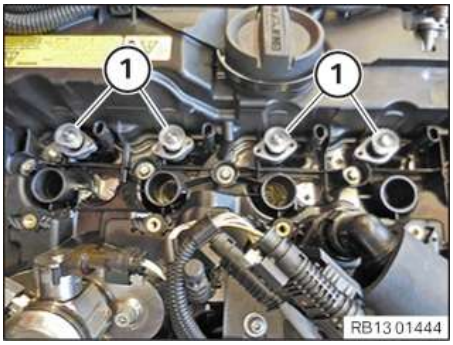
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

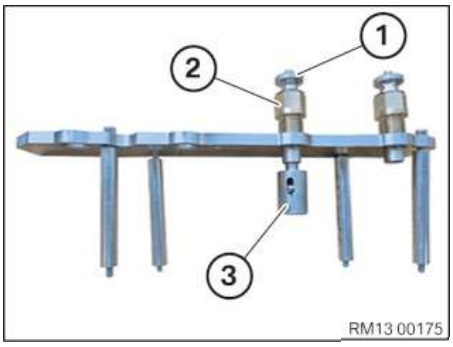
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

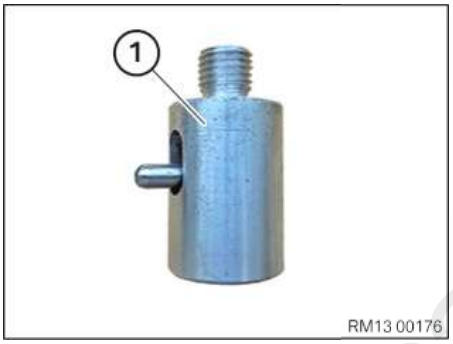
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

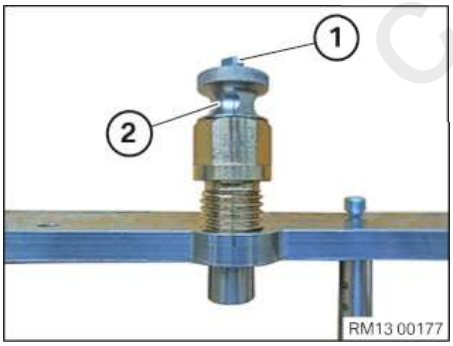
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

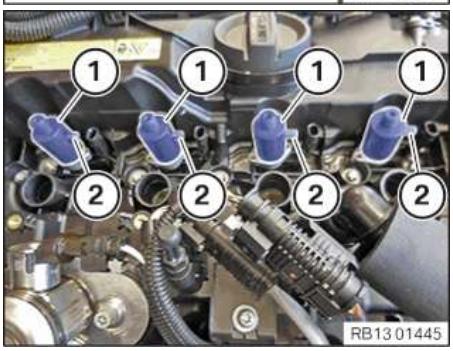
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



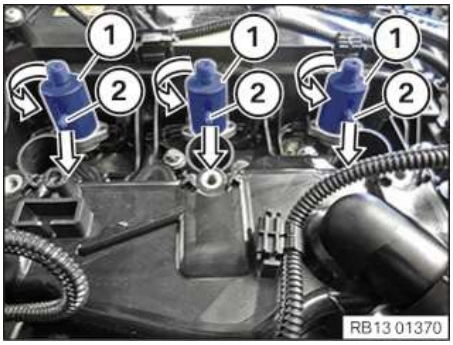
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



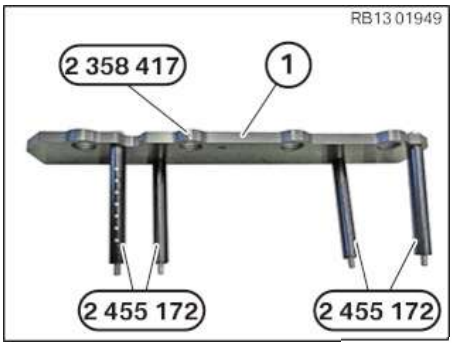
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

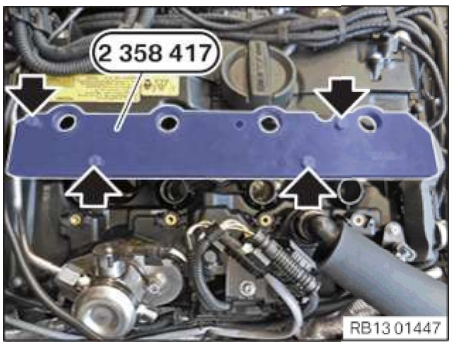
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



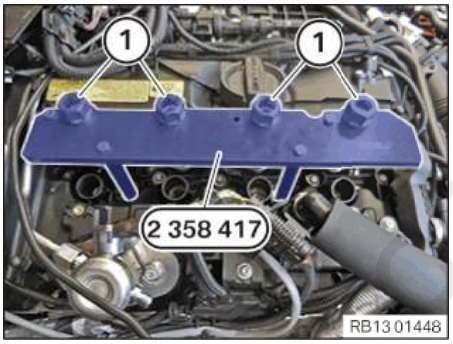
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

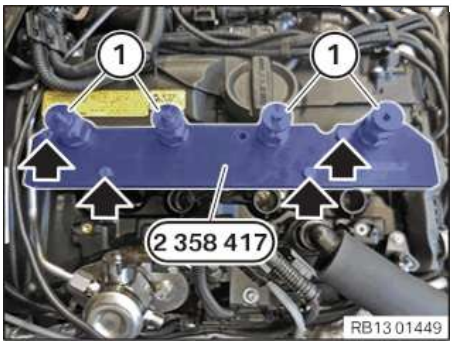
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

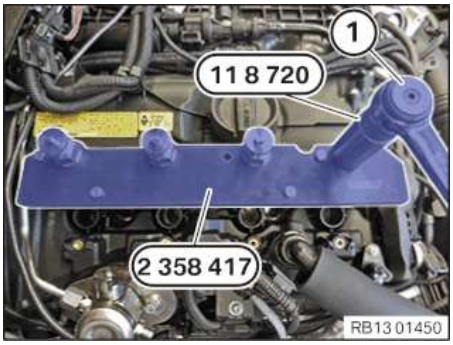
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

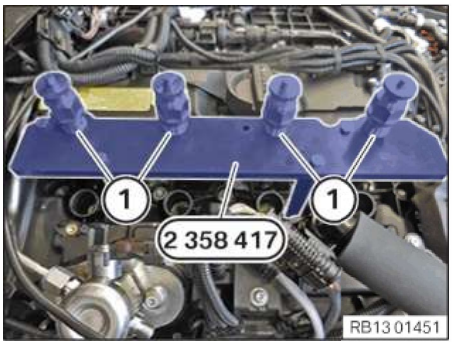


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

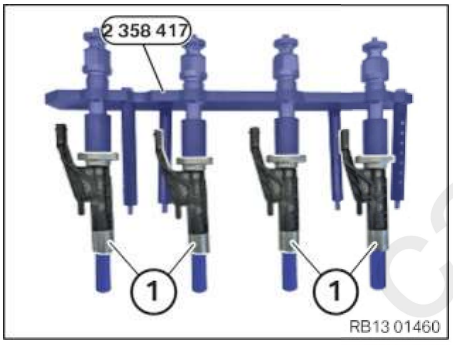
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

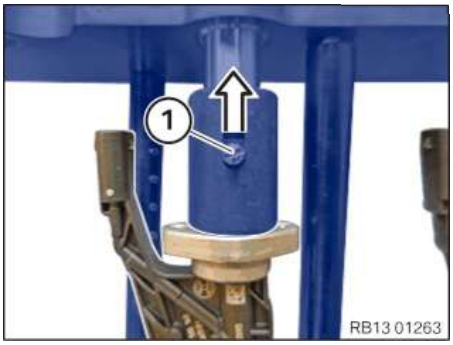


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

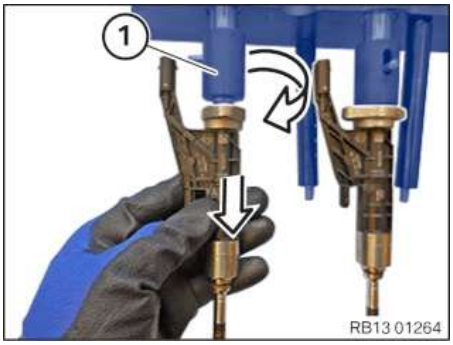


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

20 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

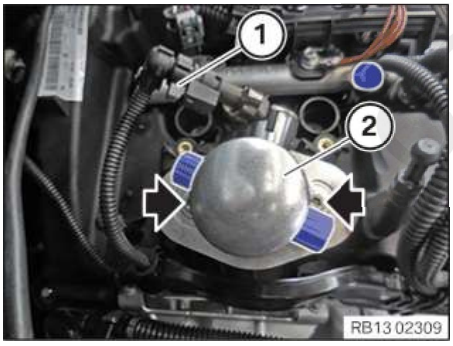
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

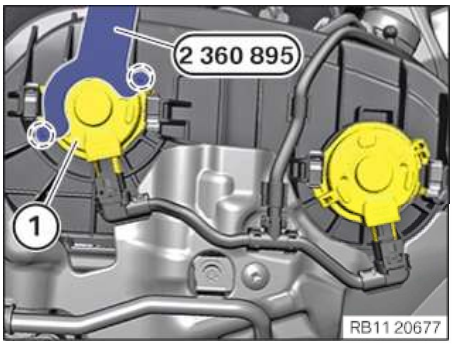
21 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

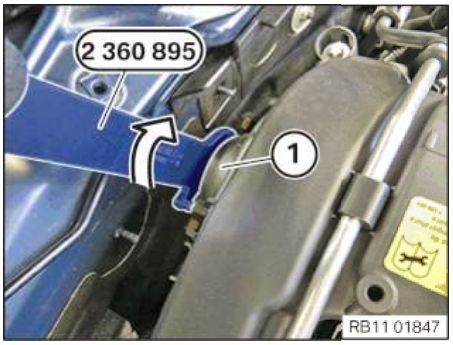
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



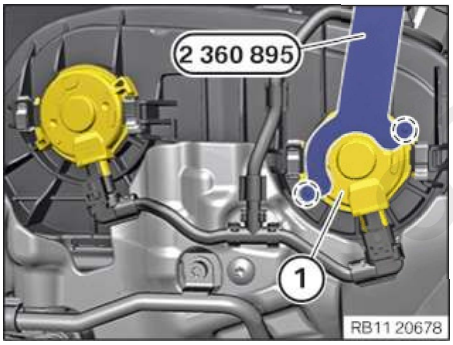
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



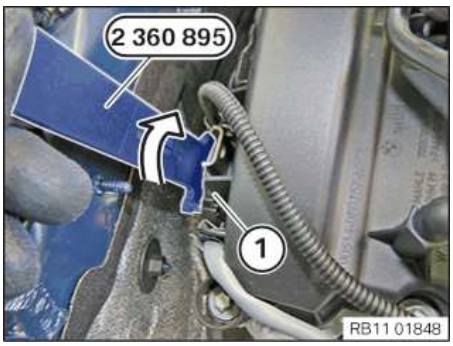
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

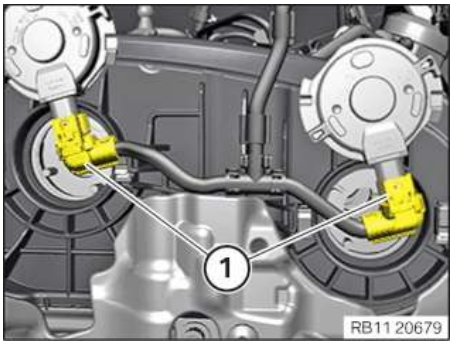
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.

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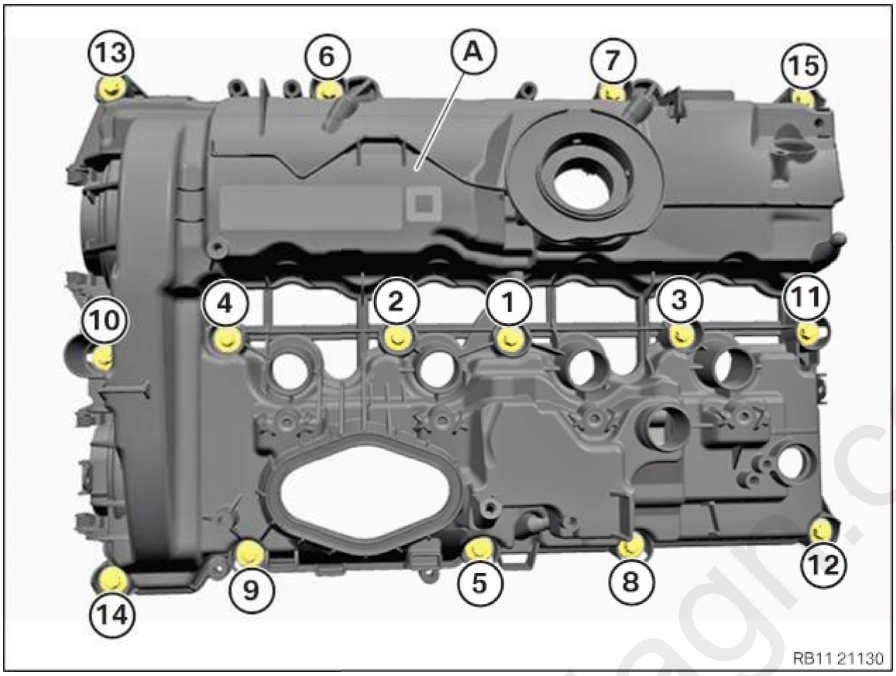
NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

22 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

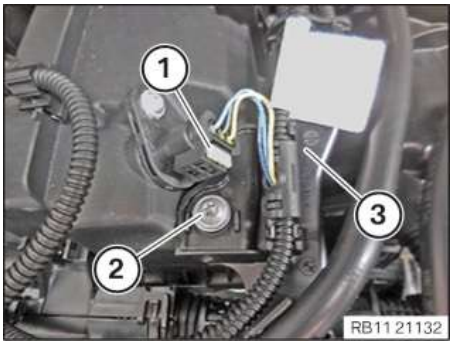
Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

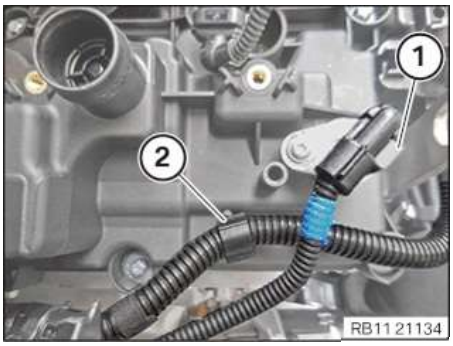


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

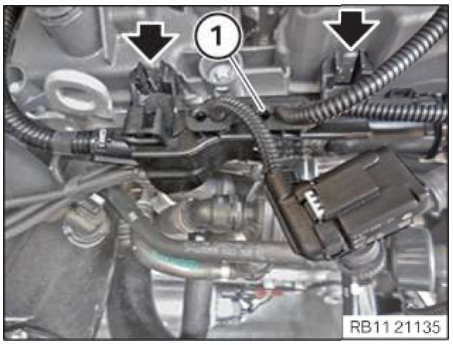
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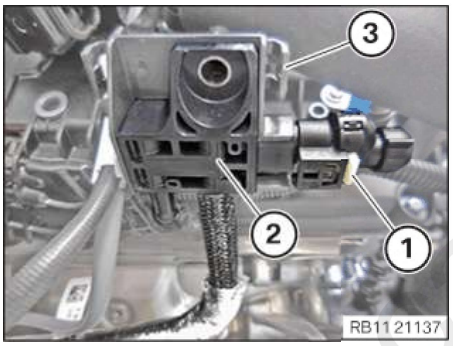
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



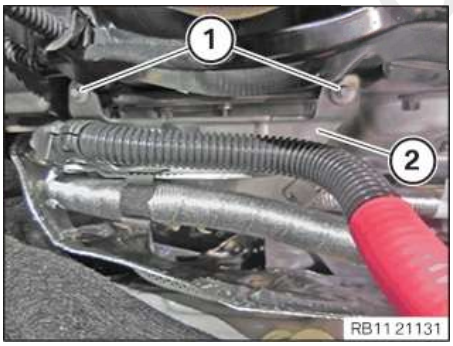
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



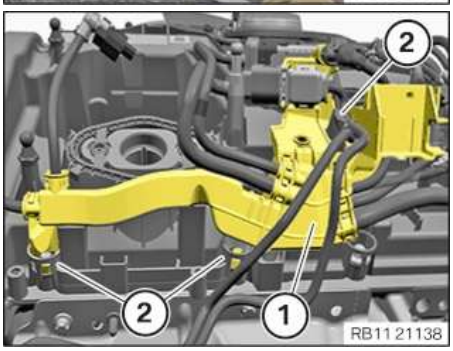
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.

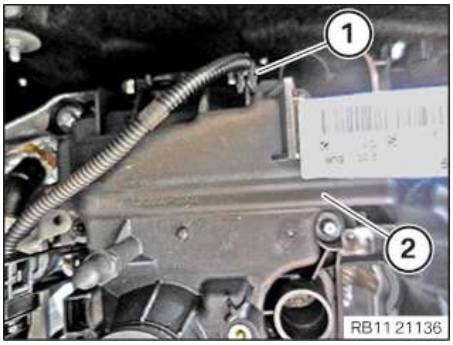


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

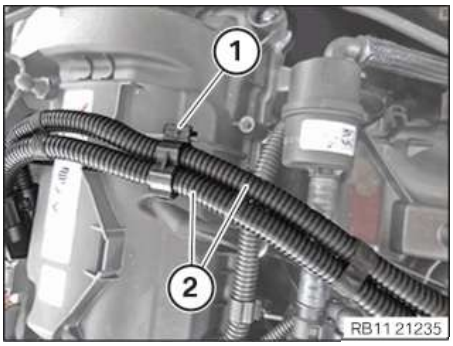


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

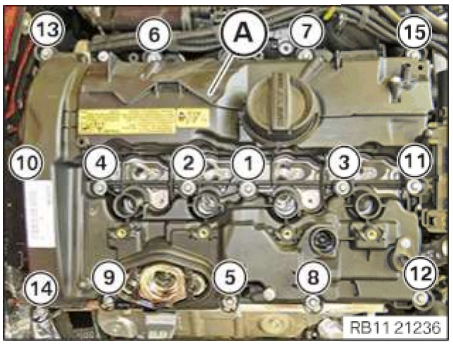
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- Loosen clamp (1).

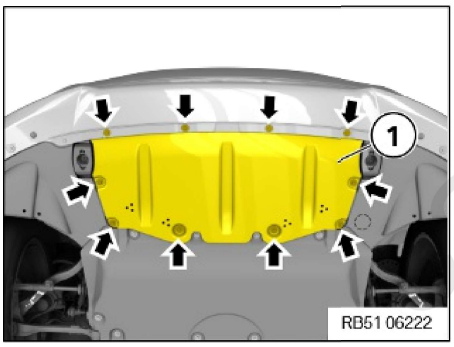


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

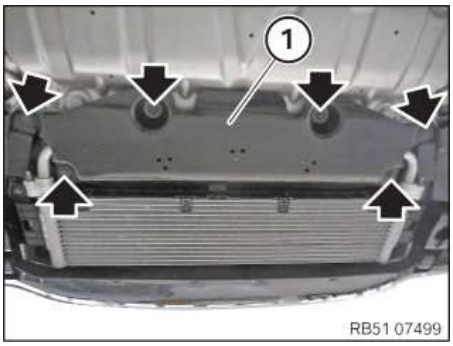
23 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed front underbody protection (1) backwards out of the bumper panel.

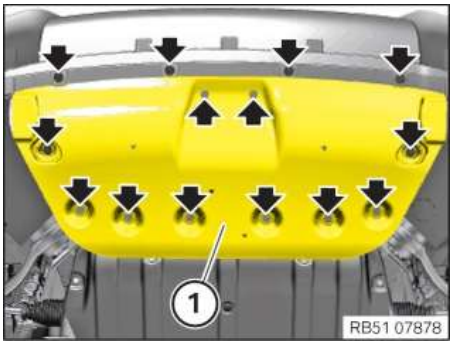


- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

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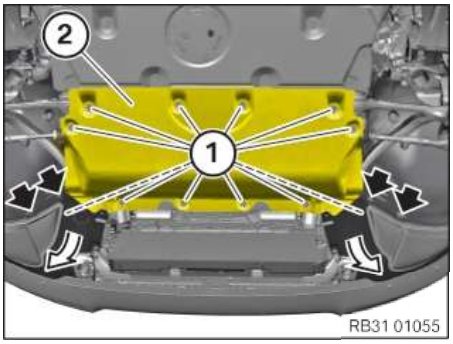


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

24 – Remove the underbody protection of the steering gear



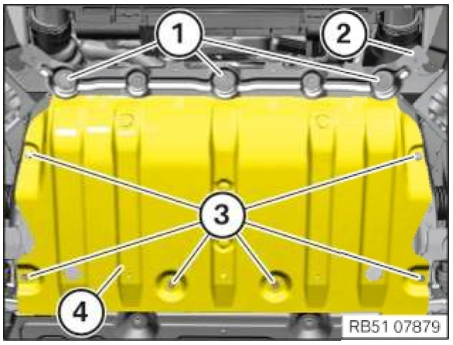
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

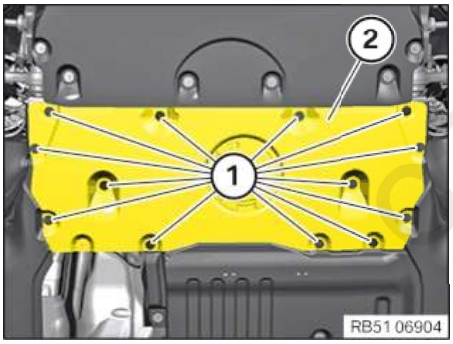
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

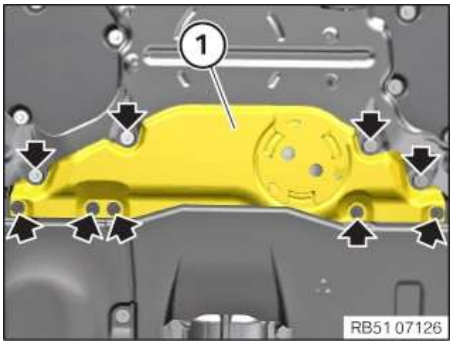
25 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



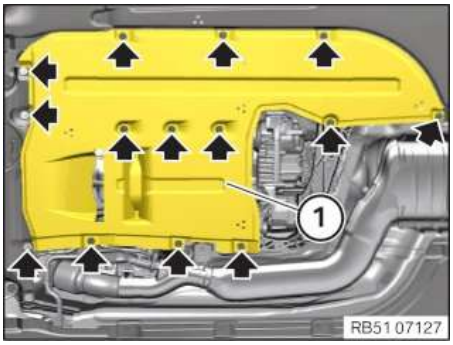
- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

26 – Remove rear underbody protection

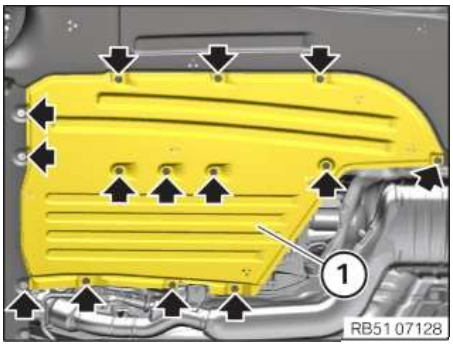
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- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



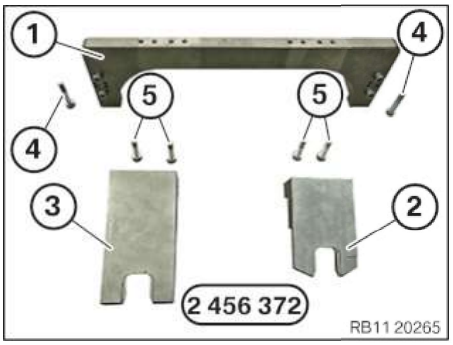
- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

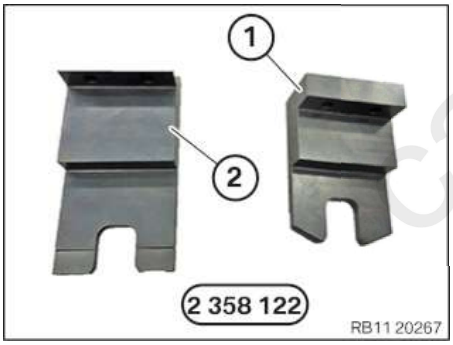
MAIN WORK

27 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



RISK OF DAMAGE

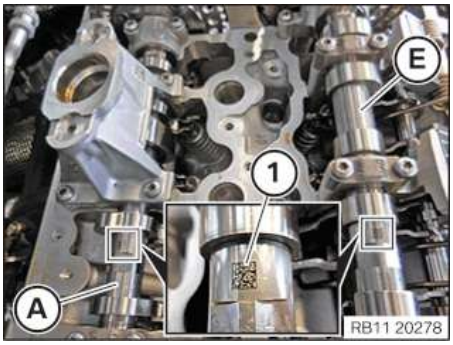
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

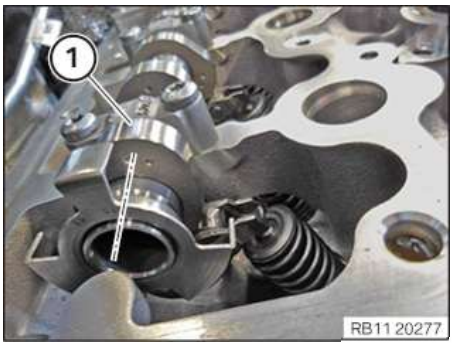
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

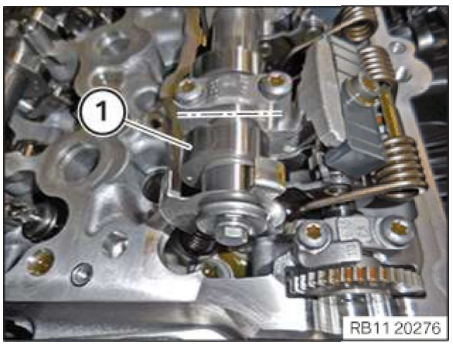
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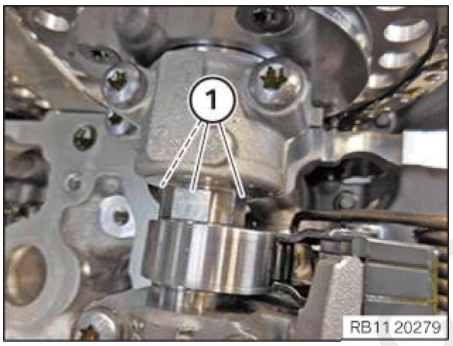
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



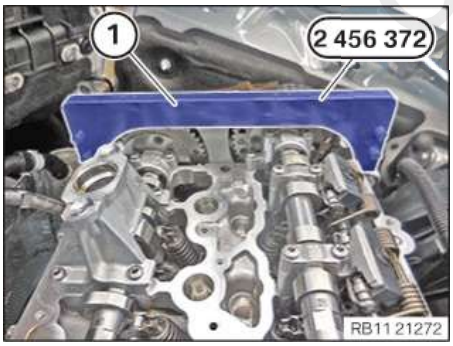
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



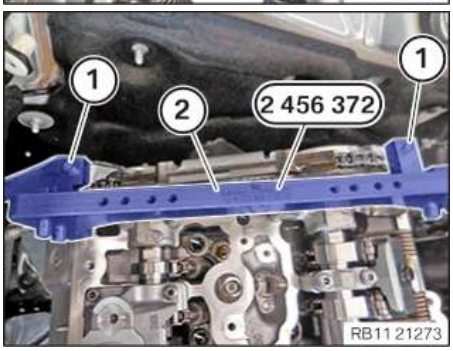
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

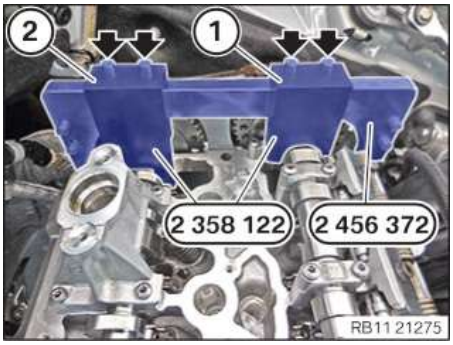


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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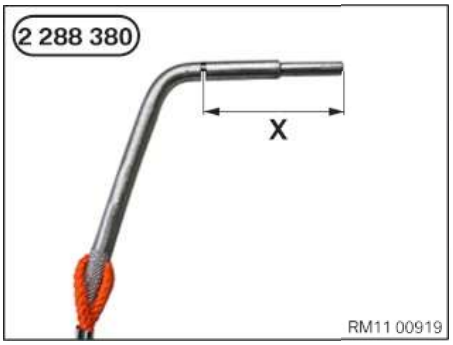
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

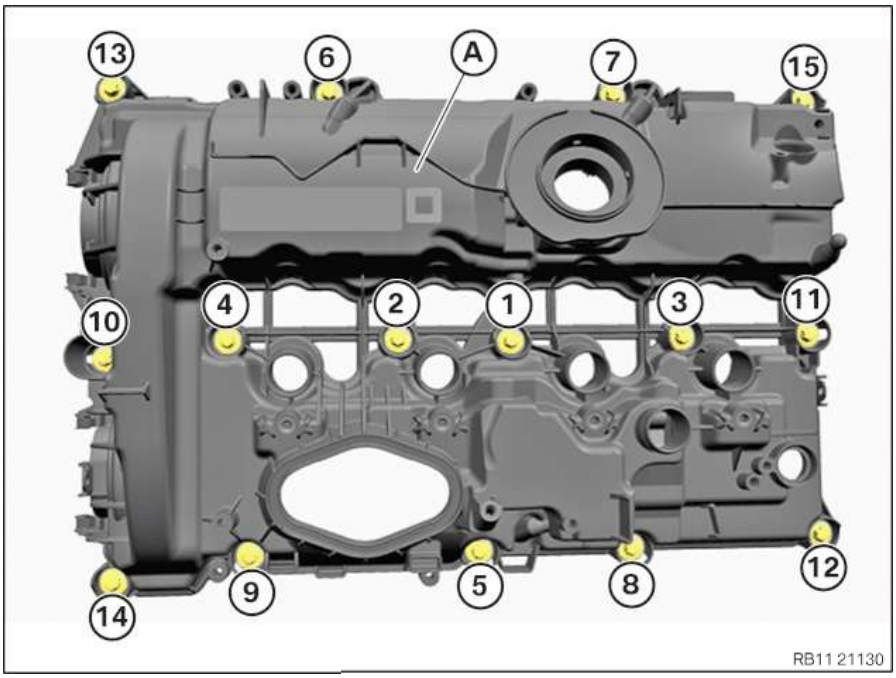
  The engine **is in the** TDC firing position of cylinder 1.

POSTPROCESSES

28 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

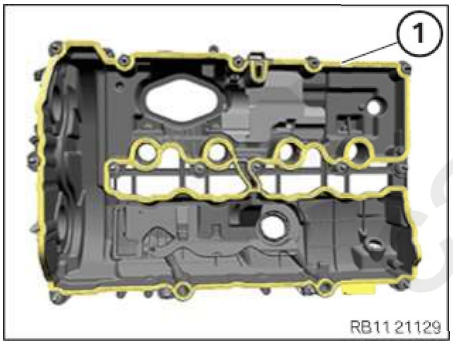
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

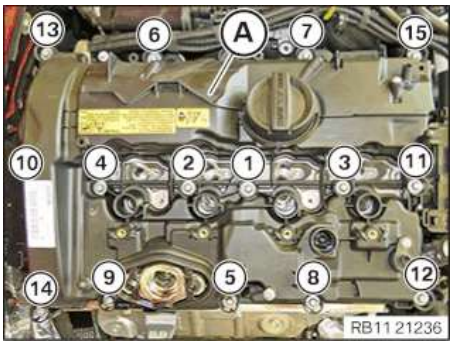
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

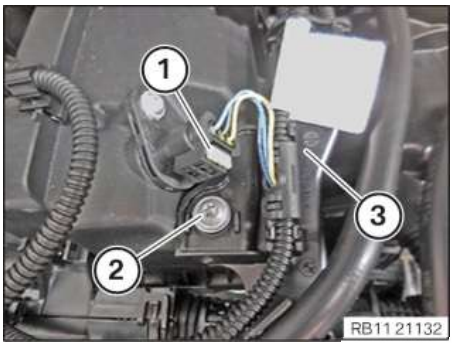
Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

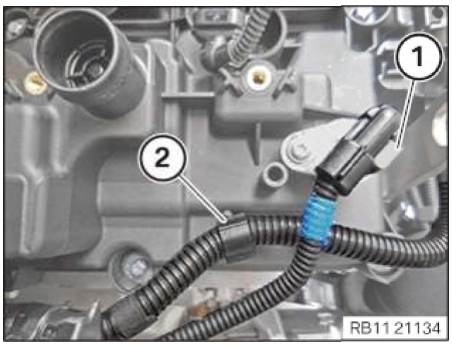


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

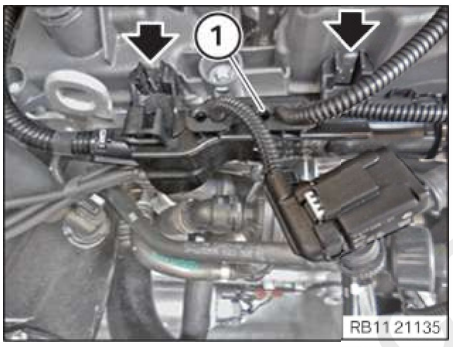
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

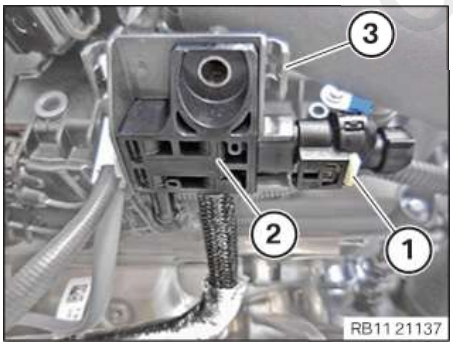
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

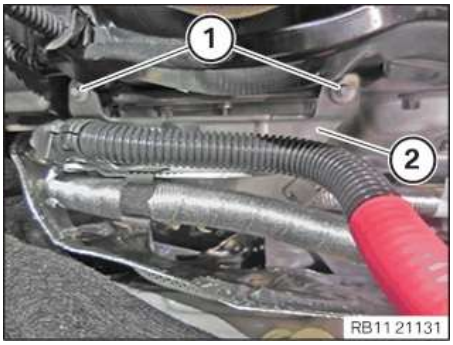


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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CAUTION

Improper routing of the positive battery cable.

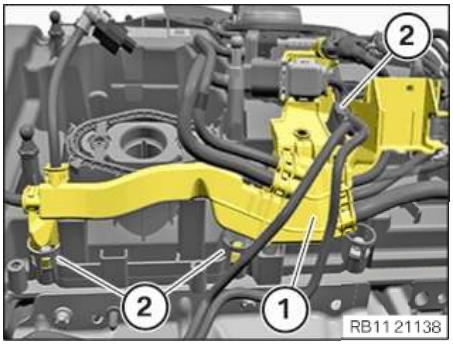
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

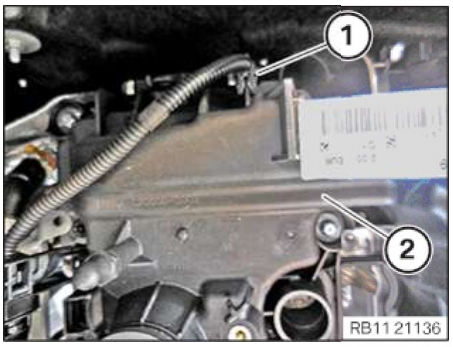
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

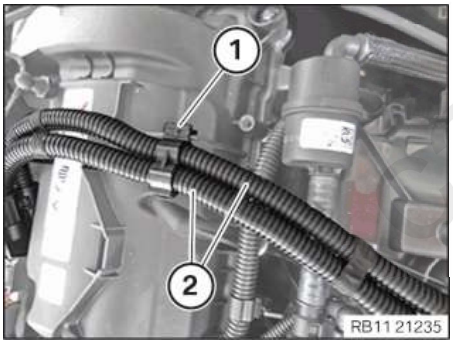
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

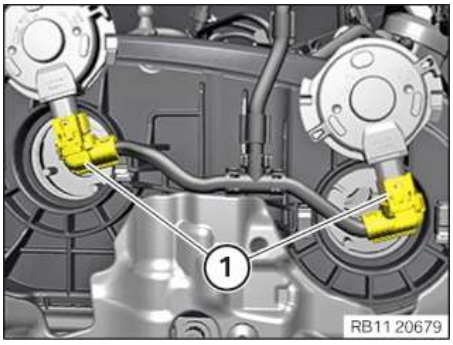


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

29 – Installing both actuators

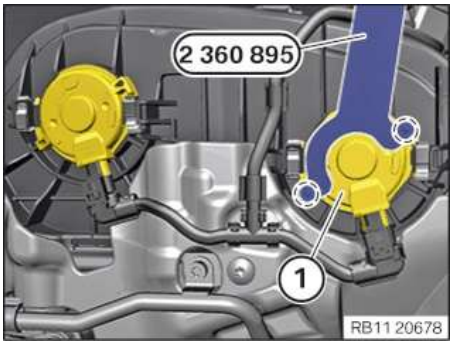


NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

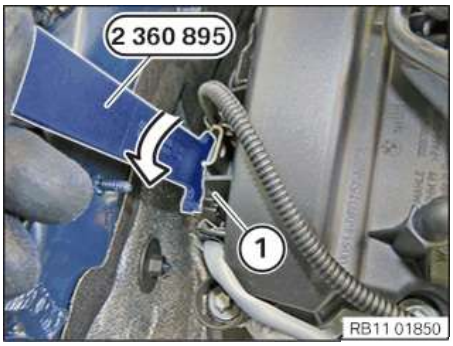
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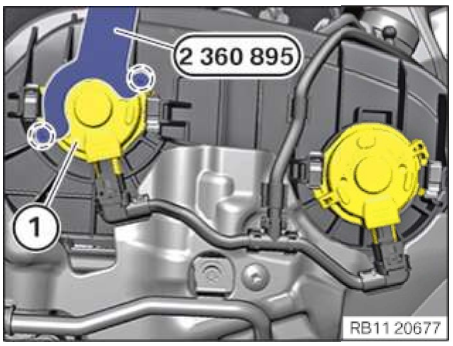
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



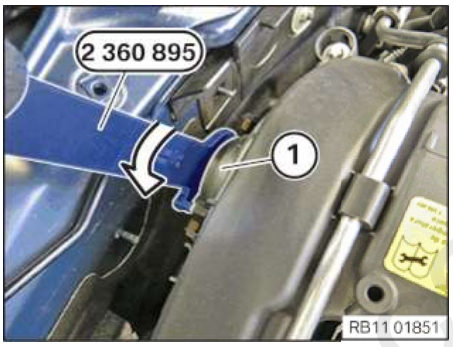
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

30 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

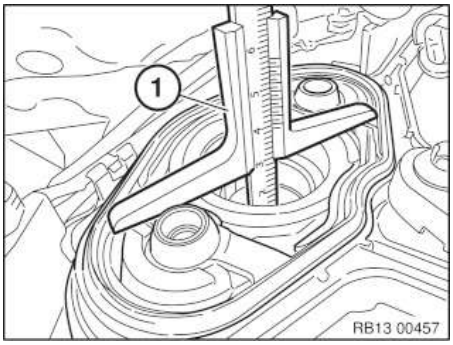
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

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- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

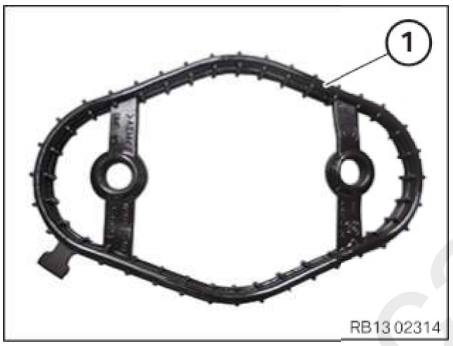
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

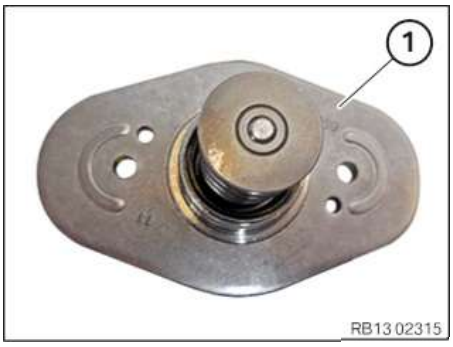
The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

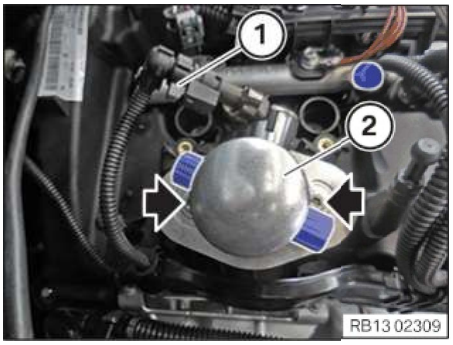
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

31 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

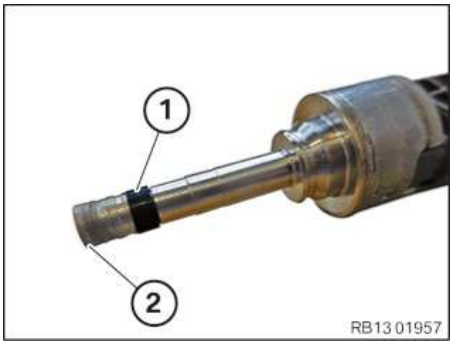
- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.

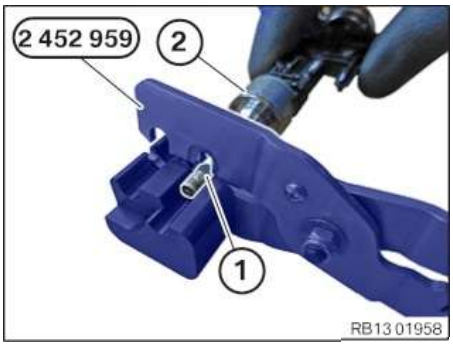
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- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

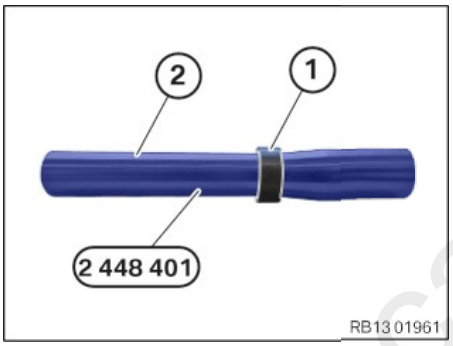


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

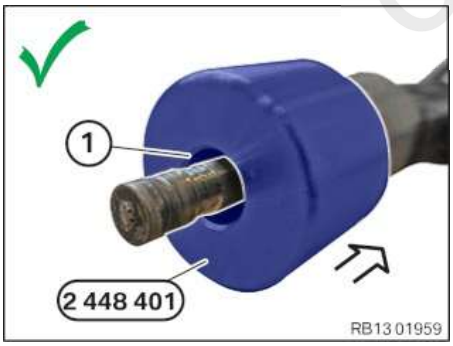
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

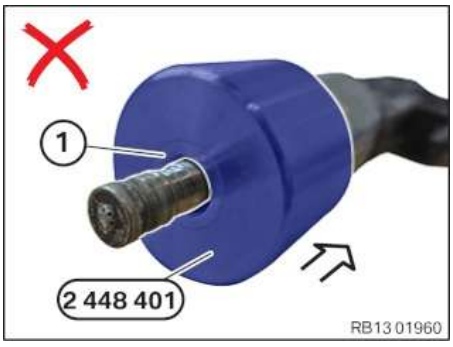


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

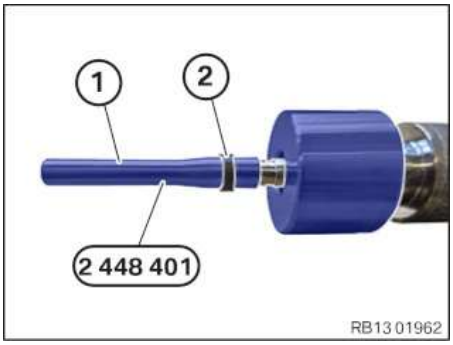
  The larger diameter of the assembly sleeve (1) must point to the injector tip.



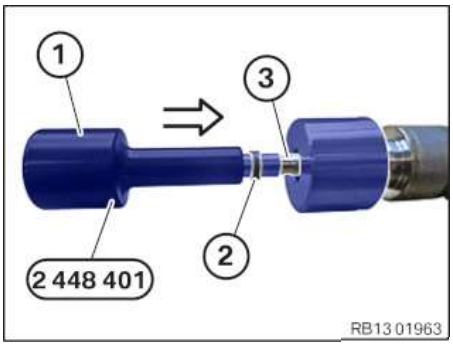
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

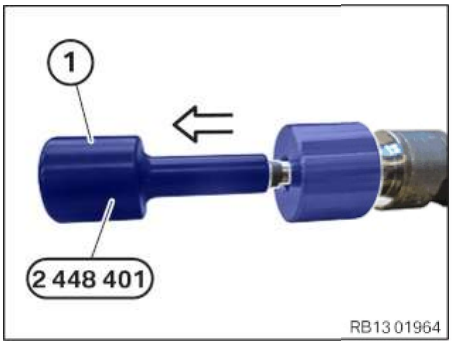
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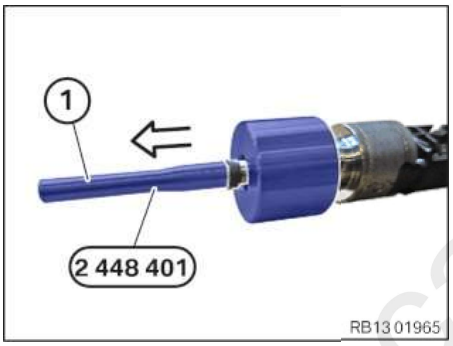
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



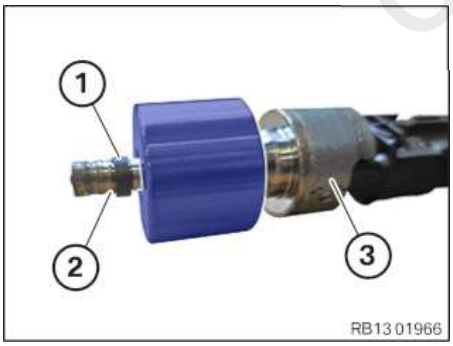
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



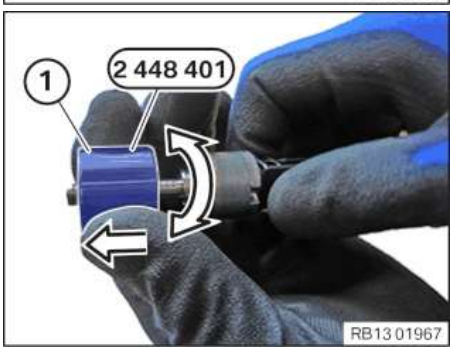
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



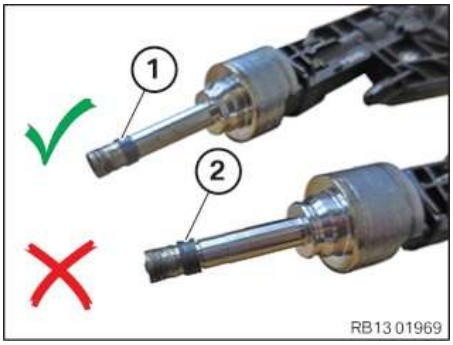
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

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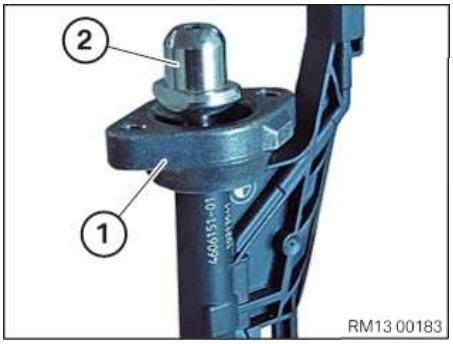


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

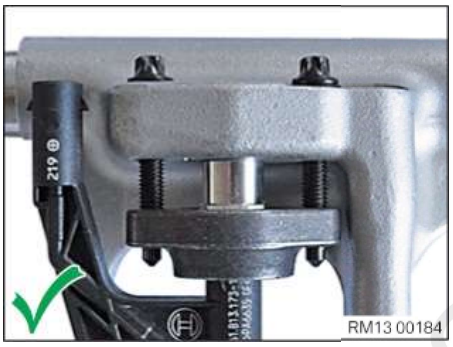
32 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

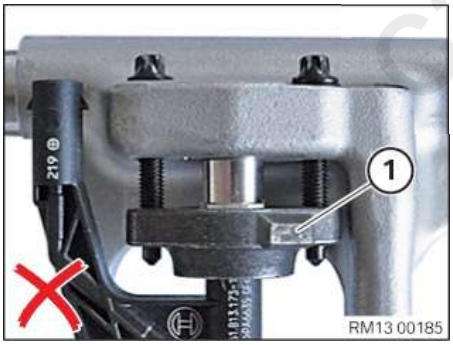


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



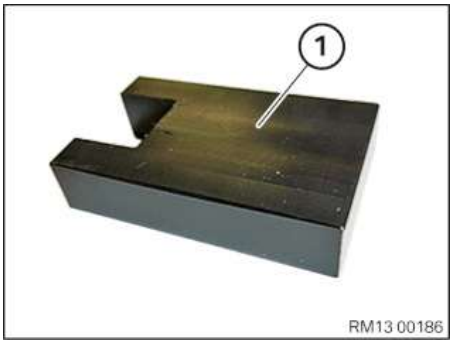
- If applicable, note the position of the cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



RISK OF DAMAGE

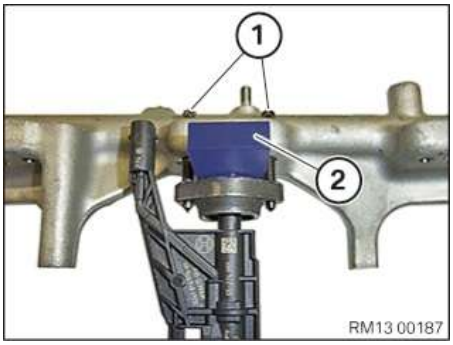
Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).

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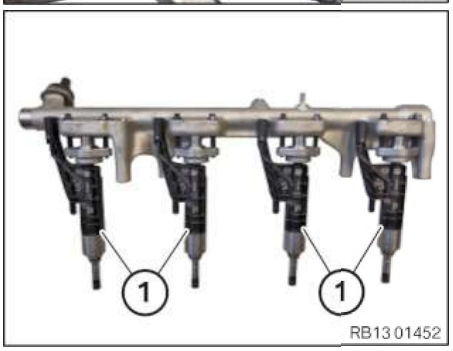
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



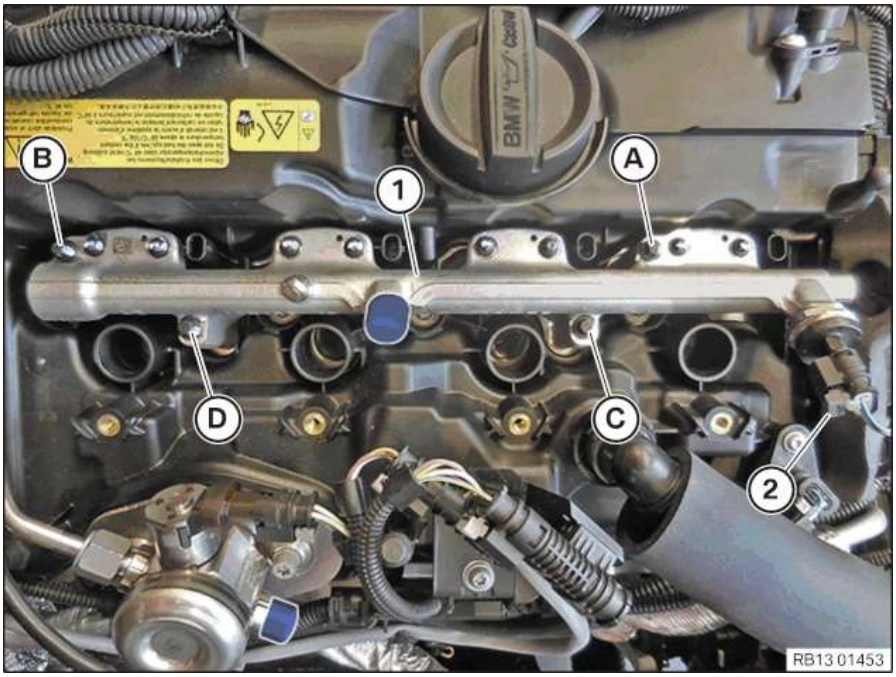
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

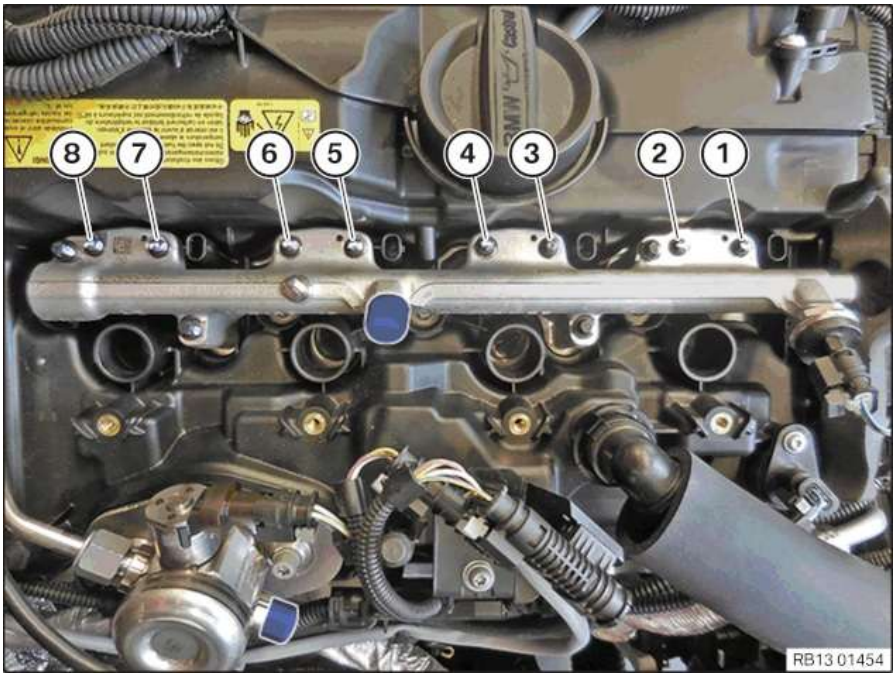
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

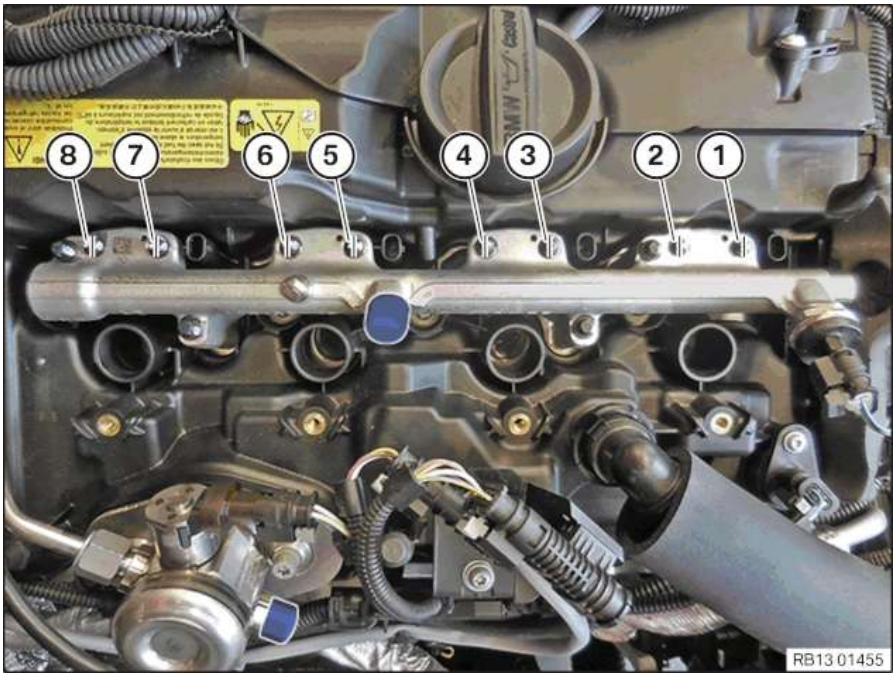
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

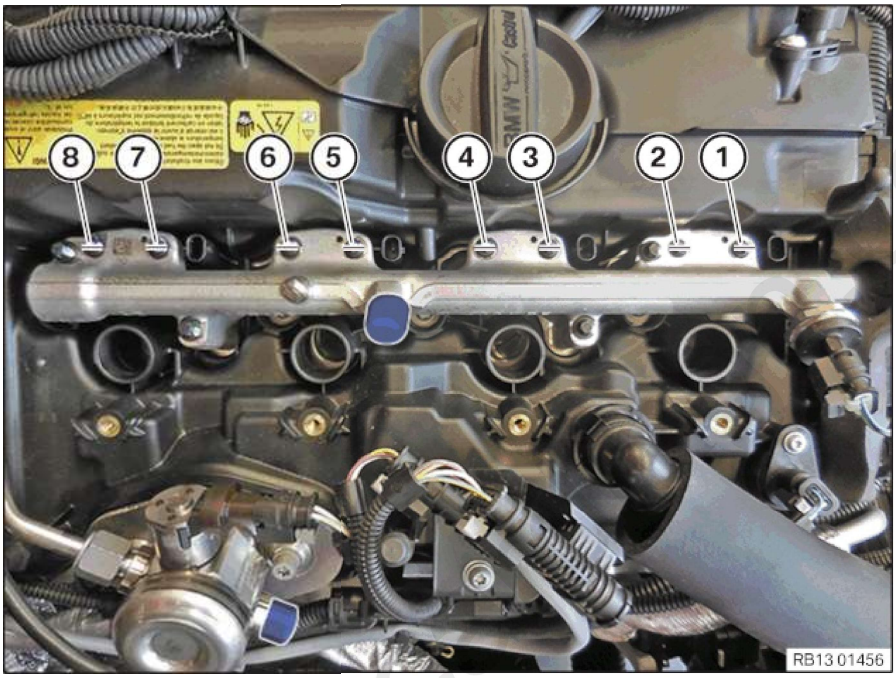
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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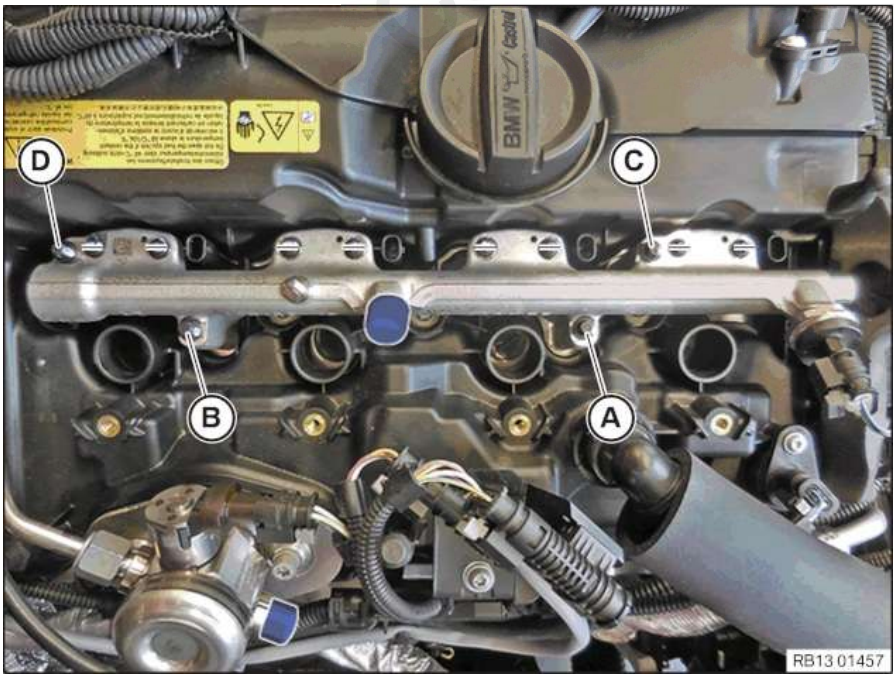


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

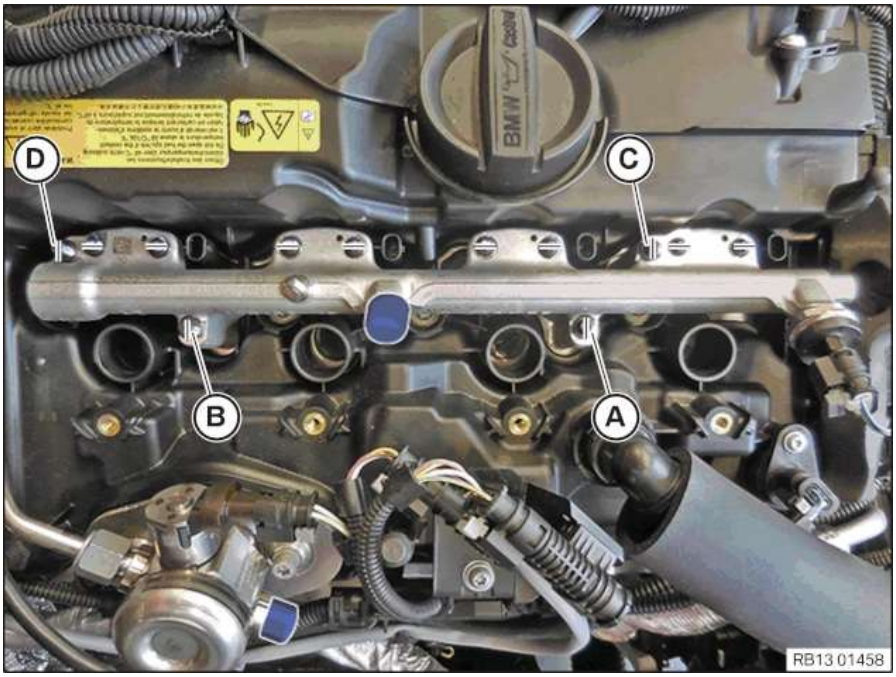
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

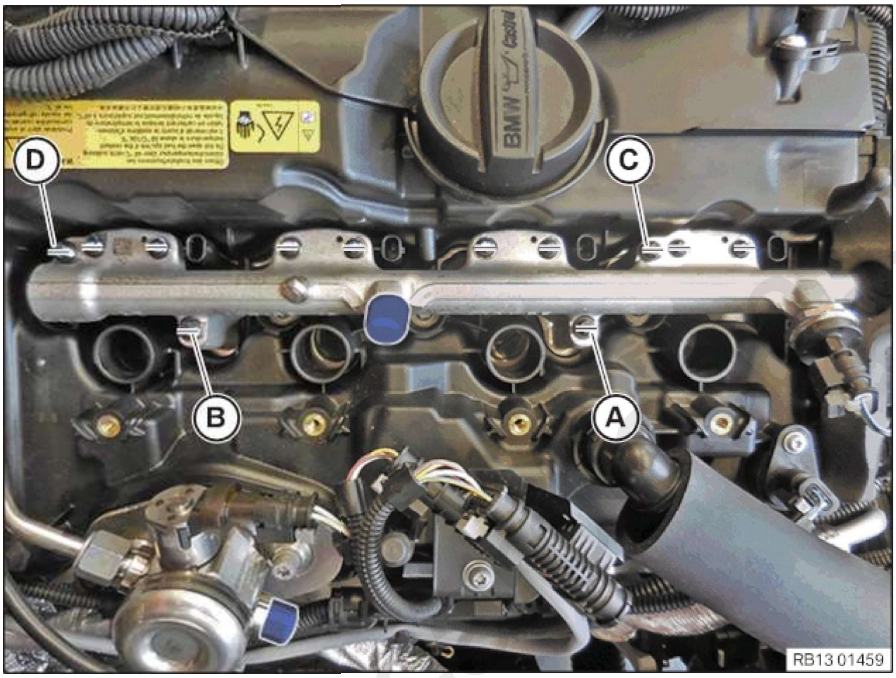
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

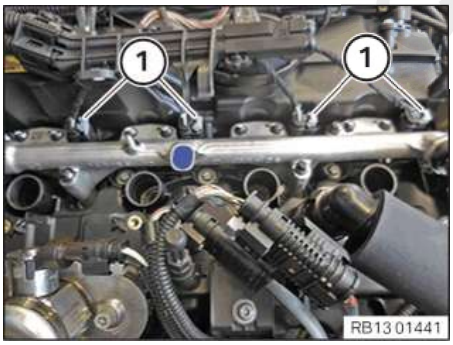


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



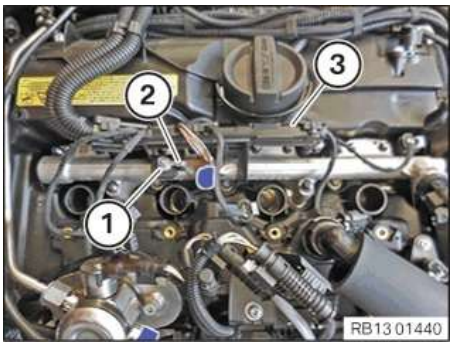
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

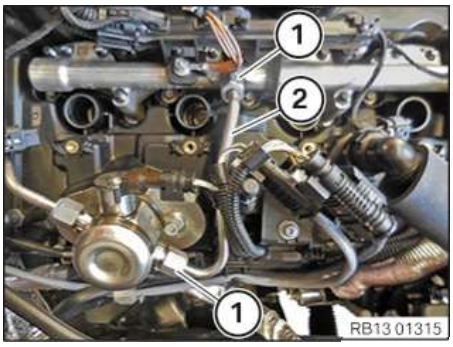
Ground cable to rail

M6		Tightening torque	5 Nm

33 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

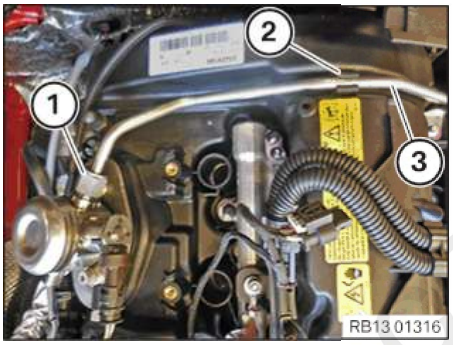
34 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

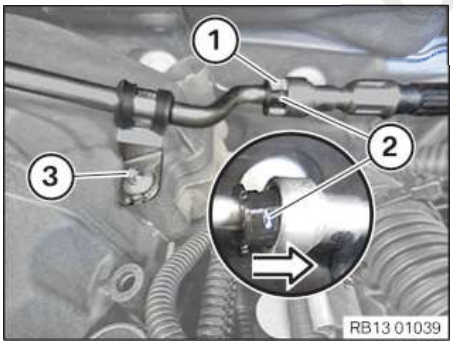
- Route all cables without abrasions, do not trap and crush.



- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

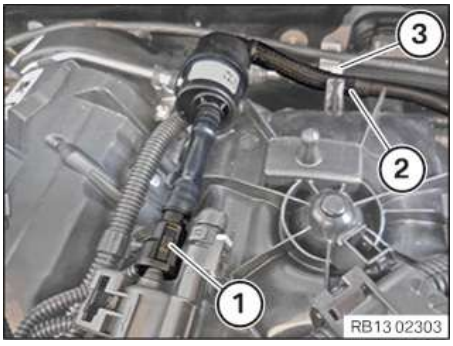
M14		Tightening torque	31 Nm



- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

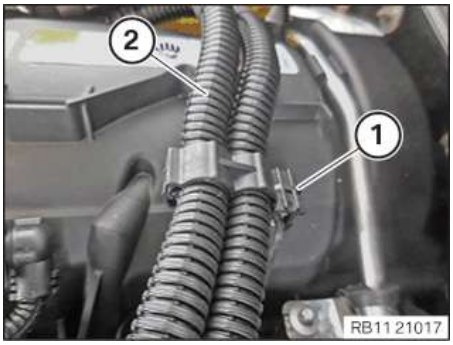
Fuel delivery line to cylinder head cover

M6 screw		Tightening torque	6,5 Nm

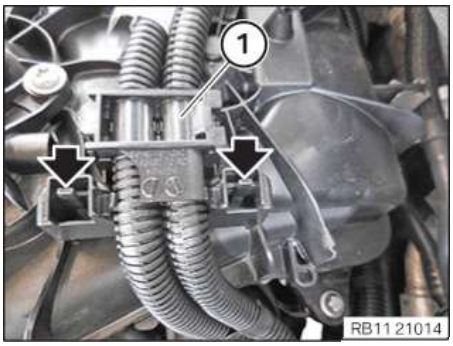


- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).

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- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

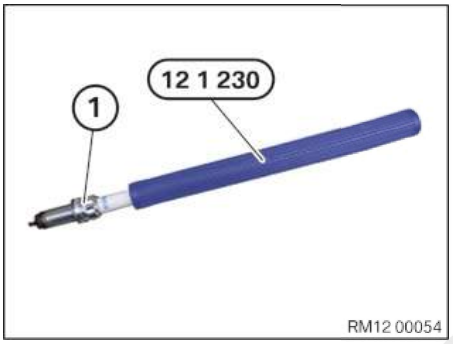


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

35 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

M12x1.25		Tightening torque	23 Nm

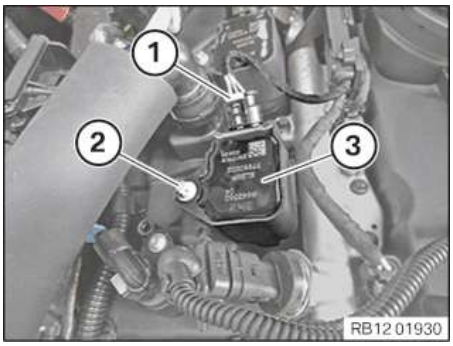
36 – Install all ignition coils

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NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



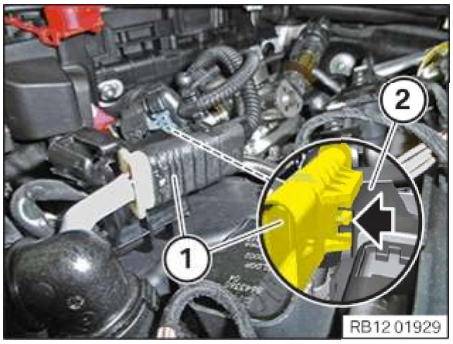
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

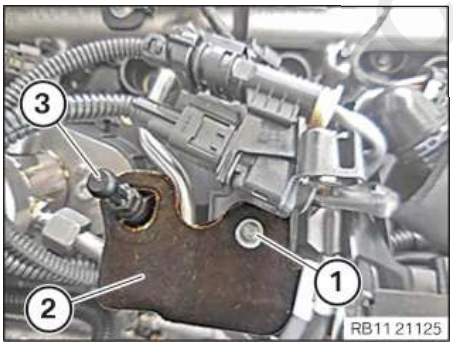
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

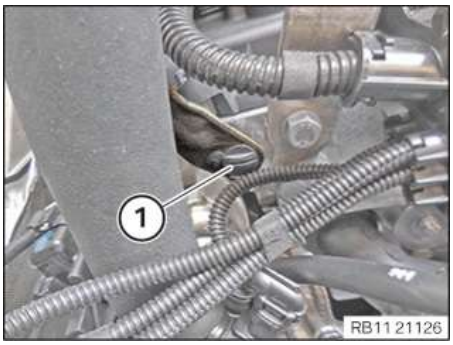
37 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

Acoustic cover (side) to cylinder head cover

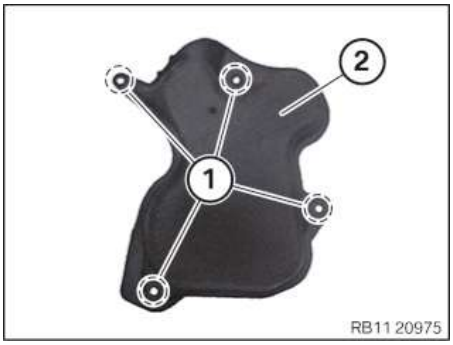
TS6 x 20		8 Nm



- Secure the clip (1).

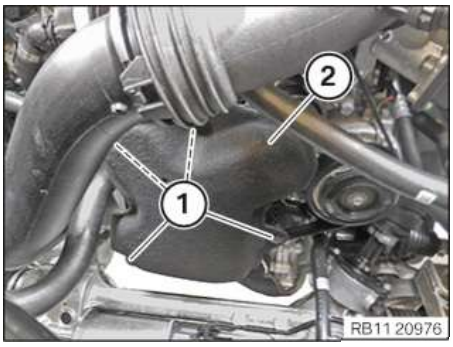
38 – Install the acoustic cover for the engine at the front

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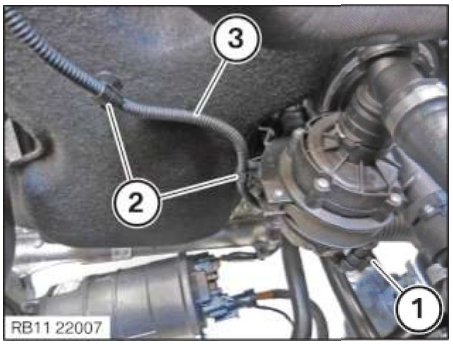


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

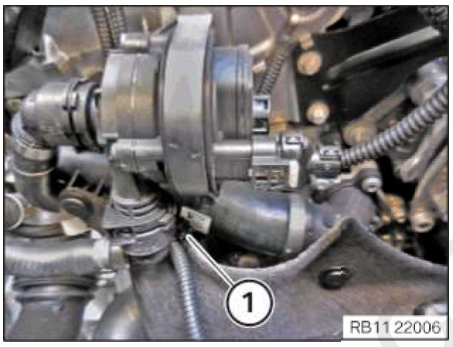


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



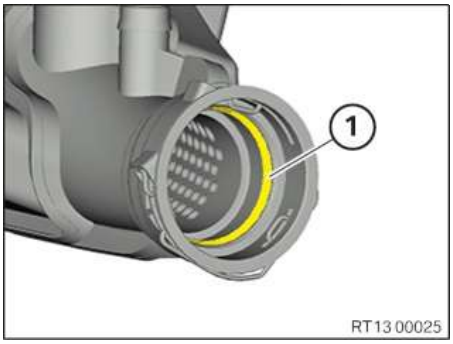
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

39 – Installing the clean air pipe with resonator



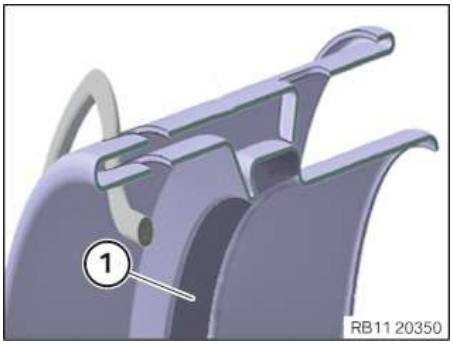
- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

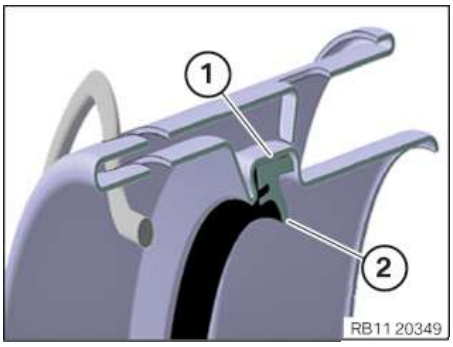
Do not use pointed or sharp-edged tools for the installation and/or removal.

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- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



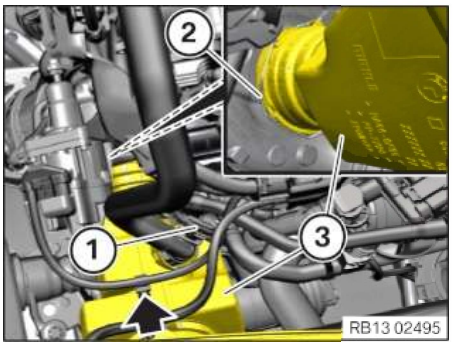
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

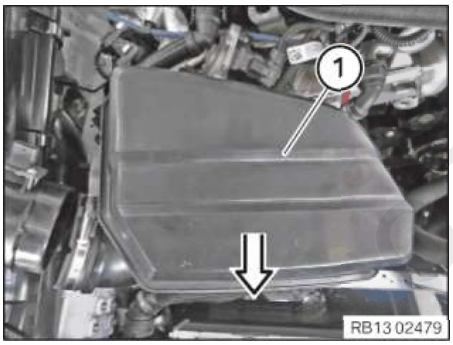
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



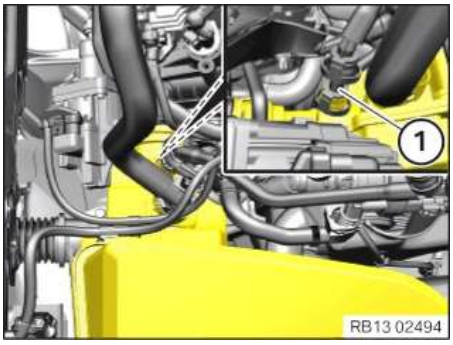
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Secure clamp (arrow).

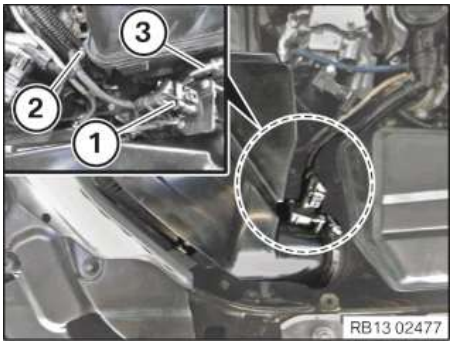


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).

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- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



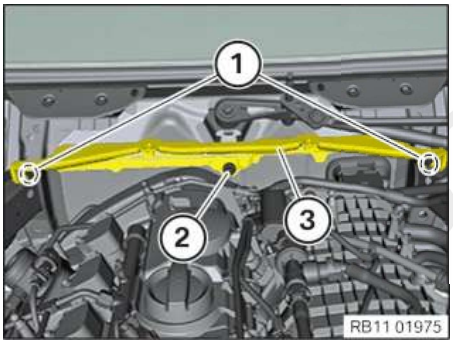
- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

40 – Disconnecting all battery earth leads



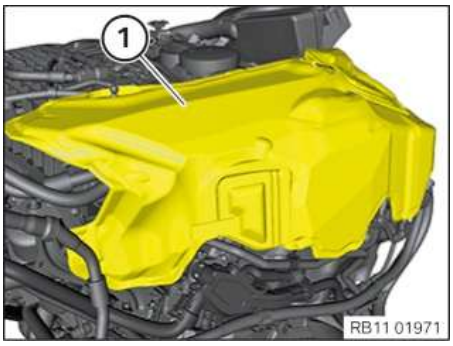
- See additional information.

41 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

42 – Installing acoustic cover at rear



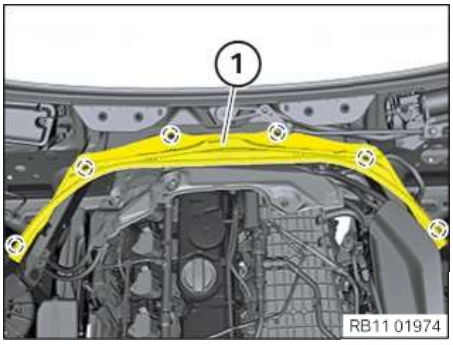
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.

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- Install the acoustic cover (1) from the top and clip it in into the marked areas.

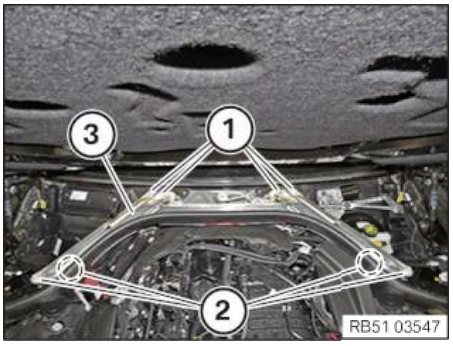
43 – Installing the centre bulkhead upper part



- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).
  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

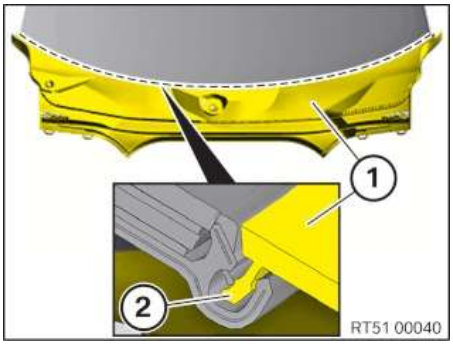
44 – Installing cowl panel cover

RISK OF DAMAGE

Damage caused by water ingress into the vehicle.

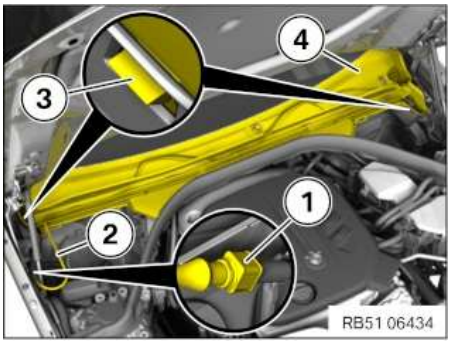
Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.

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- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

45 – Installing both wiper arms

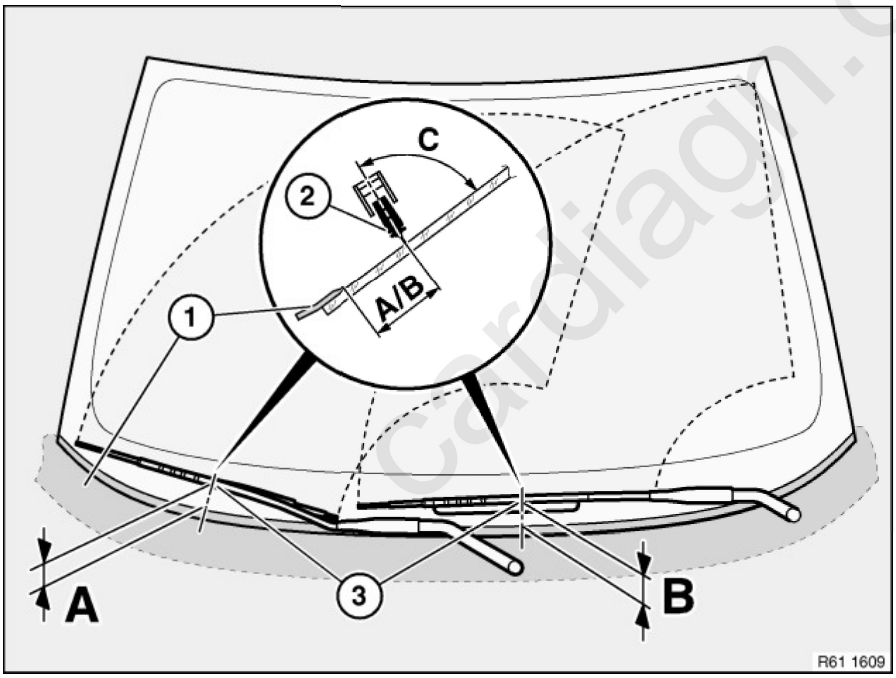
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

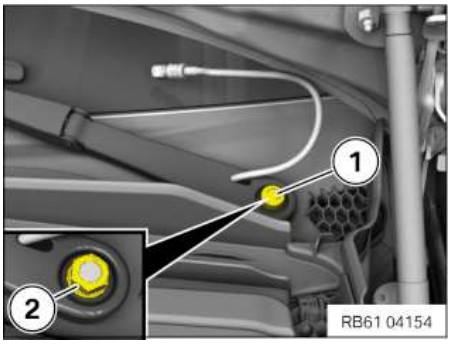
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm



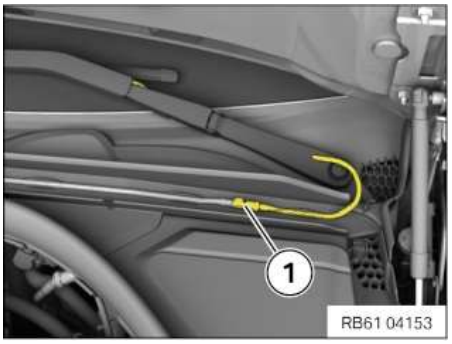
- Tighten nut (2).

Windscreen wiper arm

Combination hexagon nut		Tightening torque	35 Nm

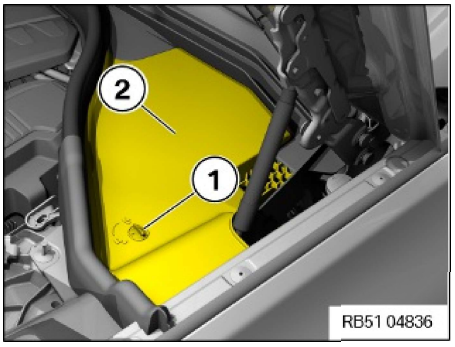
- Connect the protective cap (1).

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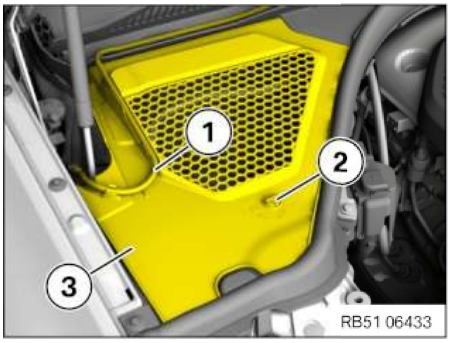
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

46 – Install the cover of the engine compartment on the rear left



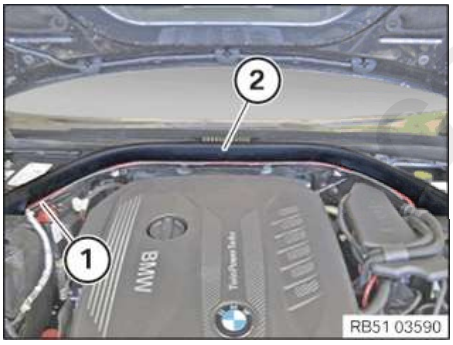
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

47 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

48 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

49 – Install acoustic cover

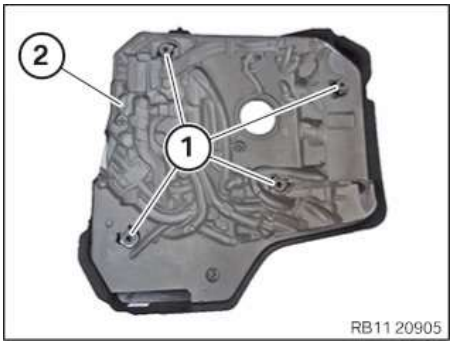
RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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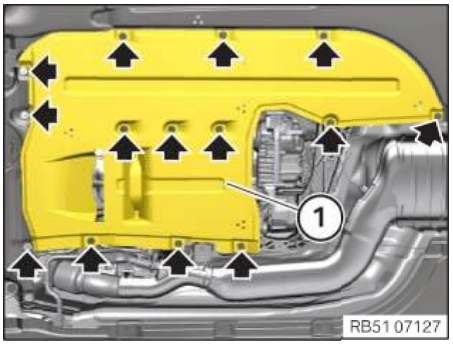
- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

50 – Installing underbody protection at rear



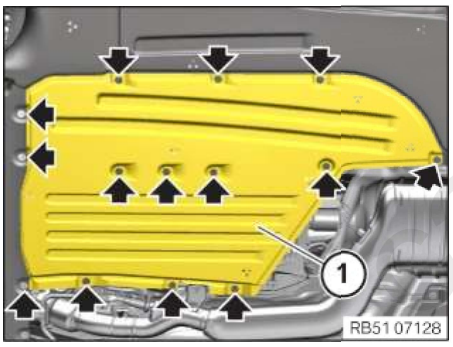
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

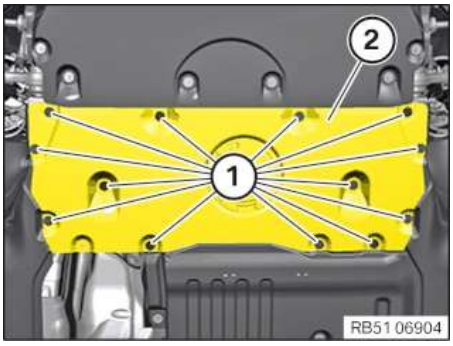
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

51 – Installing the centre underbody protection



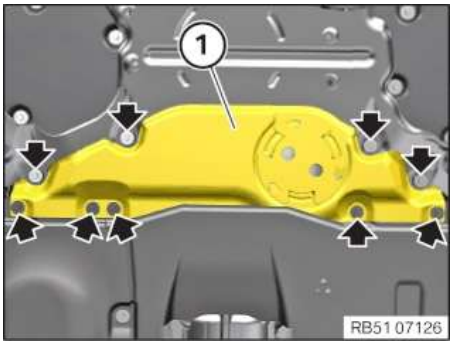
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

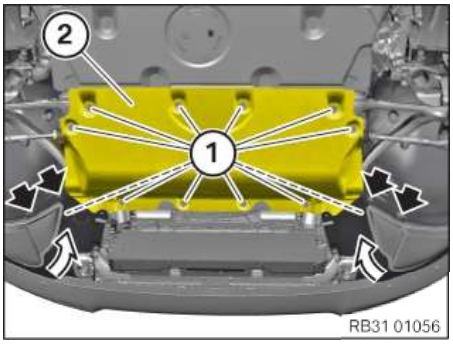
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

52 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

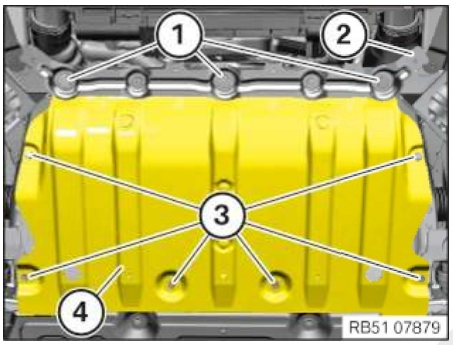
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

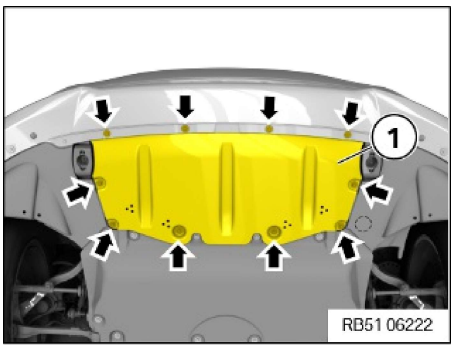
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

53 – Installing the front underbody protection



- **Version 1:**

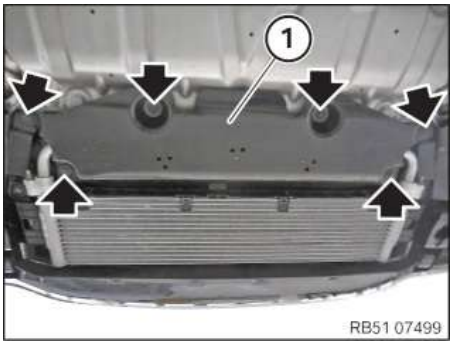
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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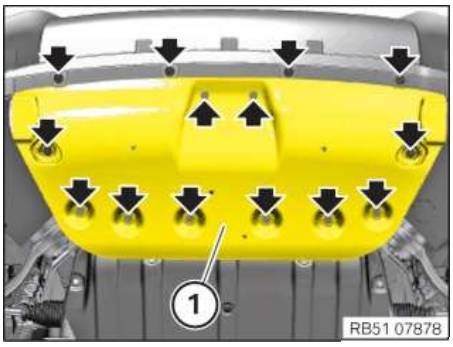
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

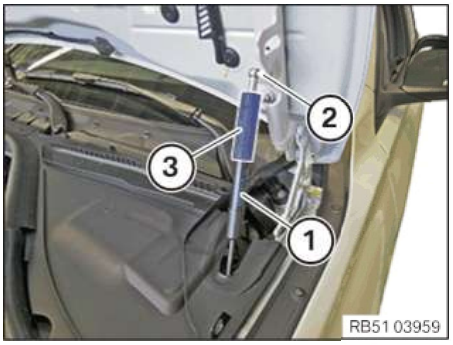
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

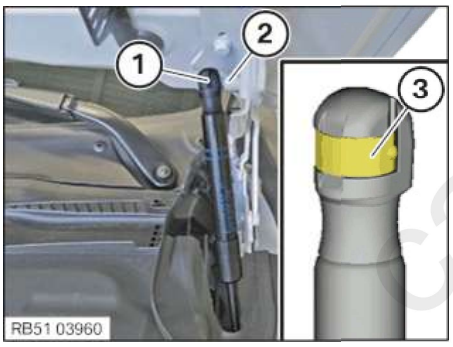
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

54 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head — Used in step 27

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 27

M6		Tightening torque	8 Nm

Cylinder head cover to cylinder head — Used in step 28

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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Wiring harness section of engine to cylinder head cover			Used in step 28
M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover			Used in step 28
6X18		Tightening torque	6 Nm

High pressure pump to high pressure pump flange			Used in step 30
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

Ground cable to rail			Used in step 32
M6		Tightening torque	5 Nm

High pressure line between high pressure pump and high pressure rail			Used in step 33
M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump			Used in step 34
M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover			Used in step 34
M6 screw		Tightening torque	6,5 Nm

Spark plugs			Used in step 35
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 36
Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover			Used in step 37
TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 39
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 43
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 43
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 43
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 45
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection			Used in step 5051
Hexagon screw		Tightening torque	3 Nm

Underbody protection of the steering gear			Used in step 52
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 52
Thermoplastic hexagon screw		Tightening torque	3 Nm

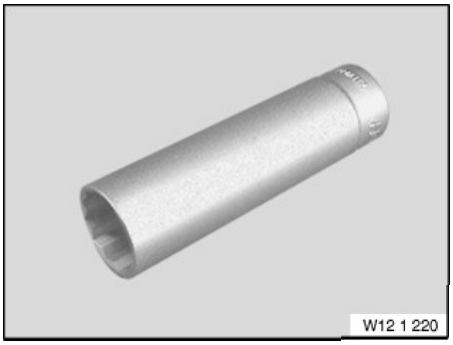
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Holder underride guard to front axle support			Used in step 52
M10		Tightening torque	56 Nm

Underbody protection front			Used in step 53
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

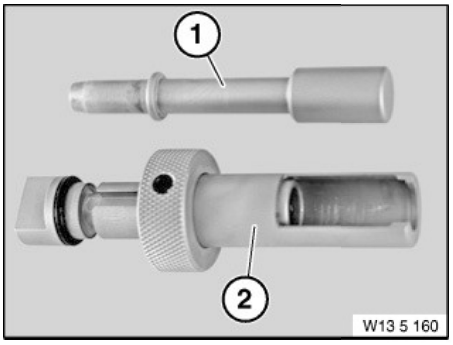
Overview of Special Tools

0 495 560 (12 1 220) Socket



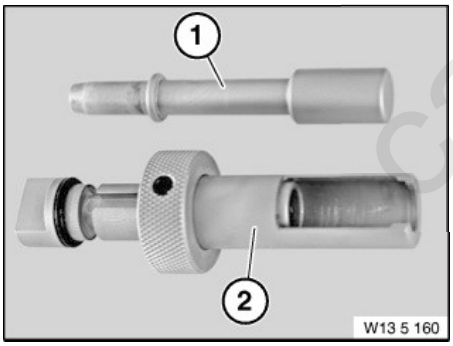
Common	Used in step 1635
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 496 567 (13 5 161) Fastener



Common	Used in step 18
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

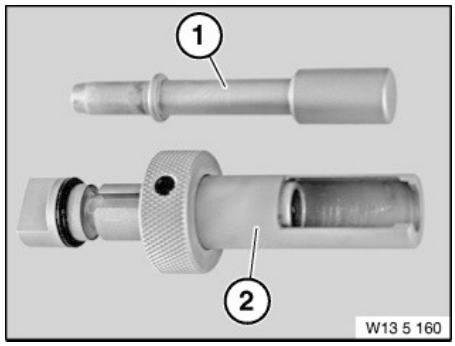
0 496 568 (13 5 162) Fastener



Common	Used in step 18
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 565 (13 5 160) Fastener



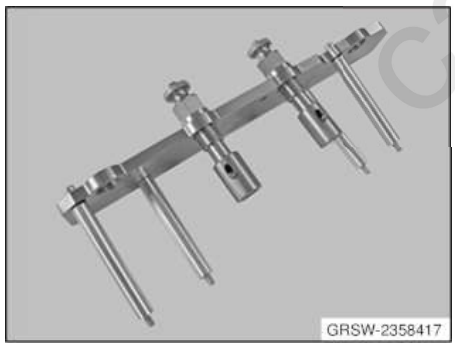
Common Used in step 18

Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

2 358 417 Device

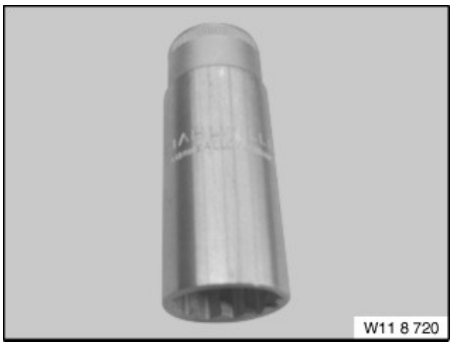


Common Used in step 19

Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 106 (11 8 720) Socket WAF 46



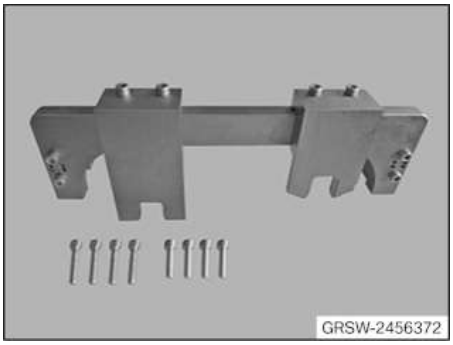
Common	Used in step 19
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

2 360 895 Pin wrench



Common	Used in step 2129
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

2 456 372 Gauge



Common	Used in step 27
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

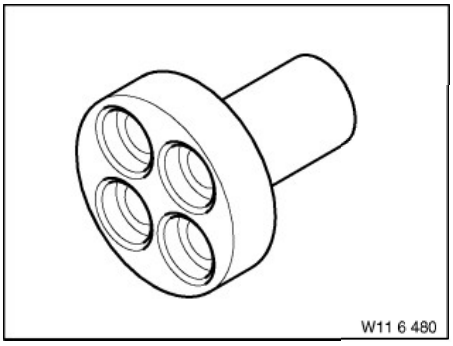
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2 358 122 Gauge



Common	Used in step 27
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 493 380 (11 6 480) Connector



Common	Used in step 2730
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 27
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 452 959 Pliers



Common	Used in step 31
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 448 401 Fitting aid



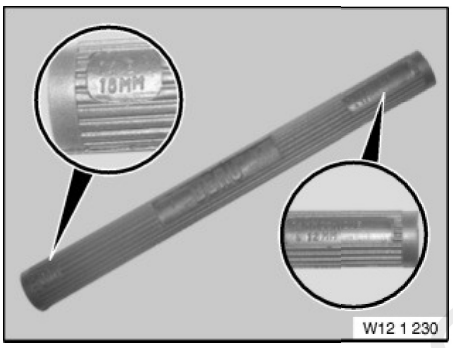
Common	Used in step 31
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 32
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



Common	Used in step 35
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 45
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	240
61 20 900 Disconnecting and connecting battery earth lead	240
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61 20 900 Disconnecting and connecting battery earth lead	240
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	240
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	240
61 20 900 Disconnecting and connecting battery earth lead	240

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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	240
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	240
61 20 900 Disconnecting and connecting battery earth lead	240
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61 20 900 Disconnecting and connecting battery earth lead	240
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	240
61 20 900 Disconnecting and connecting battery earth lead	240
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61 20 900 Disconnecting and connecting battery earth lead	240
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61 20 900 Disconnecting and connecting battery earth lead	240
61 35 ... Notes on ESD protection (Electro Static Discharge)	151921
13 53 ... Clean the cylinder head around the injectors due to grit / dust	19
61 13 ... Unlocking and disconnecting different plug connections	192228
61 35 ... Notes on ESD protection (Electro Static Discharge)	21

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11 31 ... Notes on checking and adjusting the timing (B36, B37, B38, B46, B47, B48)

Special tools required:

- 2 288 380

Attention!

Risk of damage to engine.

The notes for checking and adjusting the timing must be strictly observed!

If the crankshaft is fixed properly, it is not possible to turn the engine forwards or backwards on the vibration damper.



Vehicles with manual transmission:

Dimension (x) = 56 mm.

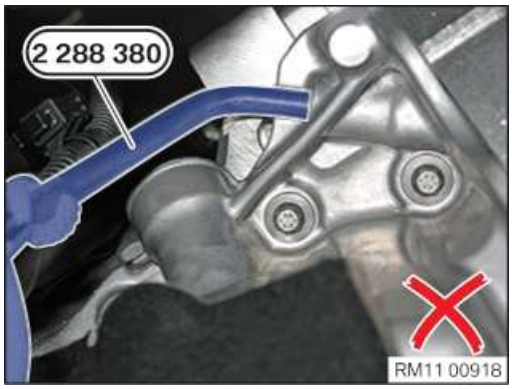
Insert the special tool 2 288 380 up to dimension (X) into the dowel hole.



Vehicles with manual transmission:

Special tool 2 288 380 correctly positioned.

The engine is located at the first cylinder at top dead centre.



Vehicles with manual transmission:

Special tool 2 288 380 incorrectly positioned.

The TDC setting of the first cylinder has not been acheived.



Vehicles with automatic transmission:

Dimension (Y) = 66 mm.

Insert the special tool 2 288 380 up to dimension (Y) into the dowel hole.



Vehicles with automatic transmission:

Special tool 2 288 380 correctly positioned.

The engine is located at the first cylinder at top dead centre.



Vehicles with automatic transmission:

Special tool 2 288 380 incorrectly positioned.

The TDC setting of the first cylinder has not been acheived.

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11 31 090 Remove and install/replace chain tensioner piston

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

PRELIMINARY WORK

1 – Bring front compartment lid in the service position

Prerequisite

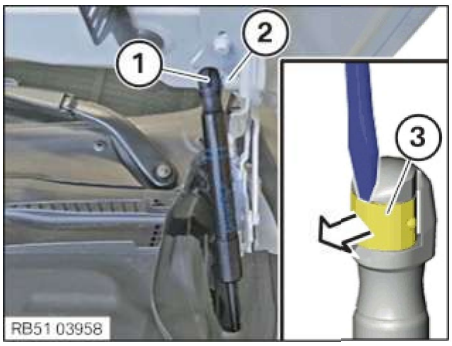
Engine compartment lid is open.

CAUTION

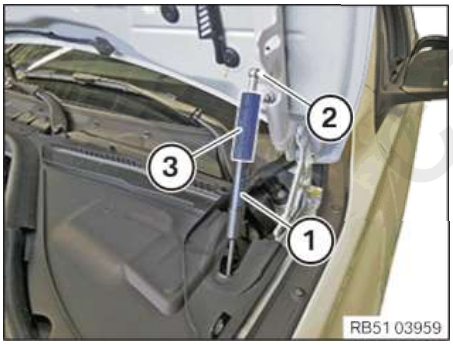
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

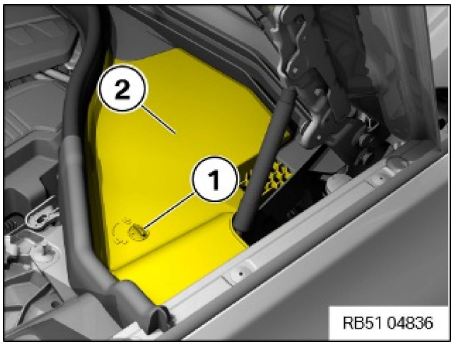
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

2 – Remove the seal for the rear bonnet



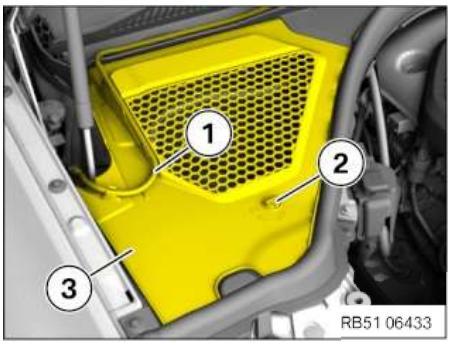
- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

3 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

4 – Remove the cover of the rear right engine compartment



- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

5 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

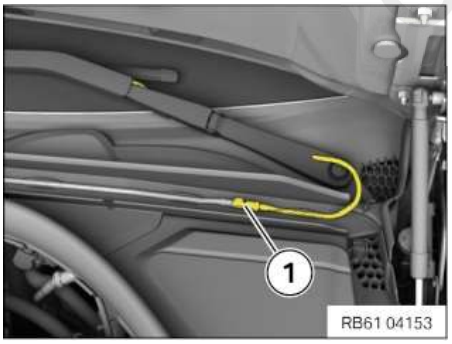
▸ **Remove the wiper arm**

RISK OF DAMAGE

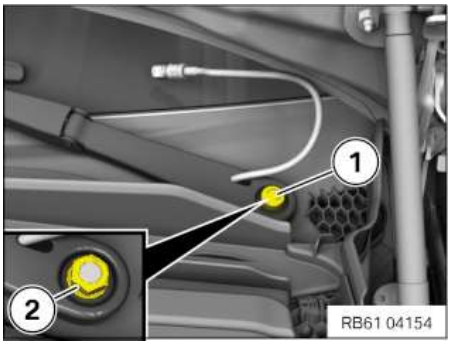
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.

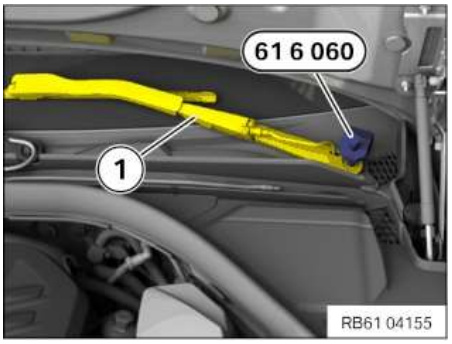


- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



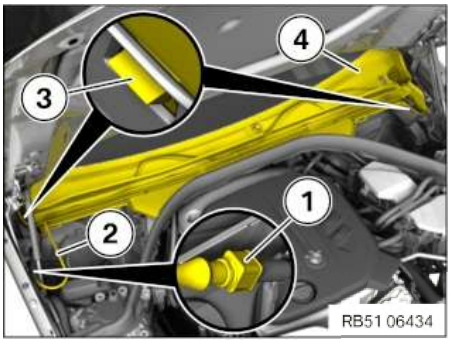
- Remove the protective cap (1).
- Loosen nut (2).

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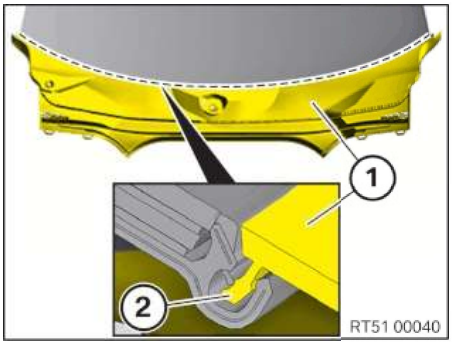


- Pull off the wiper arm (1) using special tool .

6 – Remove cowl panel cover



- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).



- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

7 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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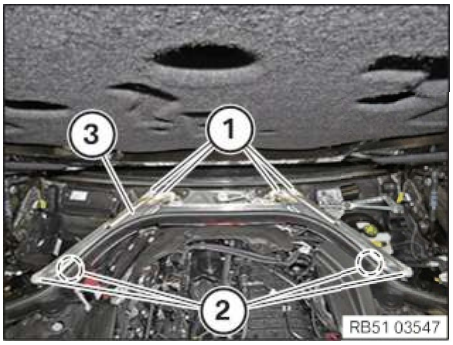


- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

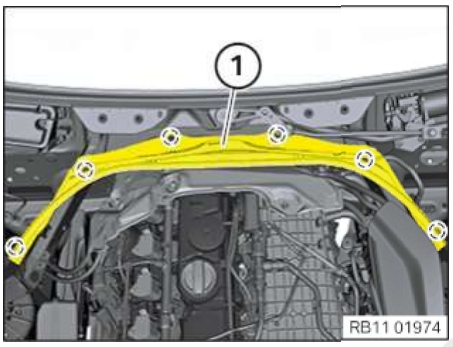
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

10 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

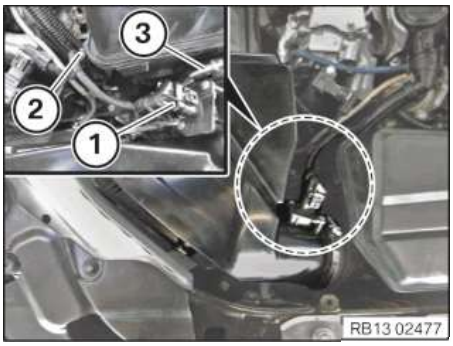
Risk of burning!

- Perform all work only on components that have cooled down.

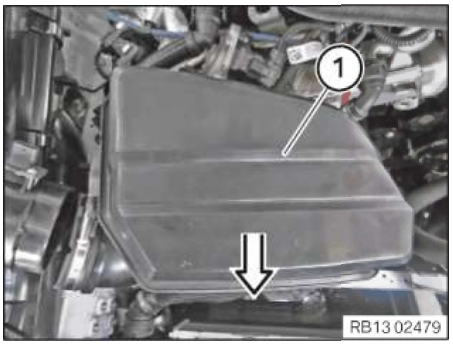
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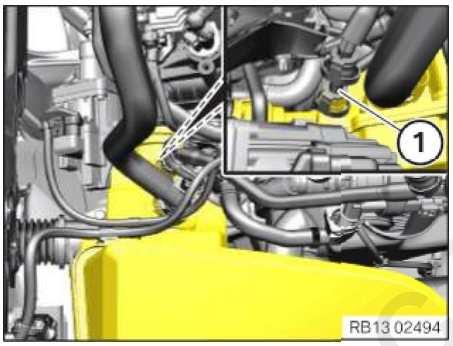
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



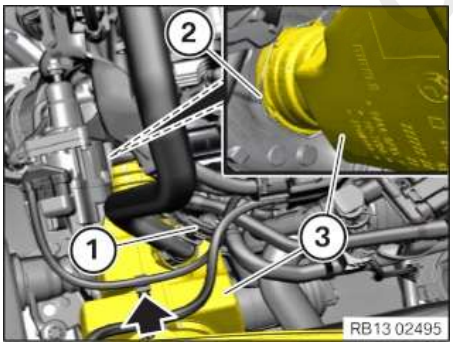
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

11 – Remove differential pressure sensor

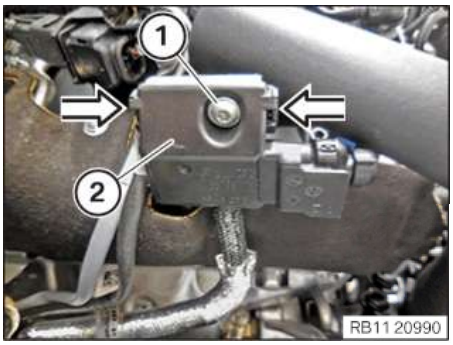
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RISK OF DAMAGE

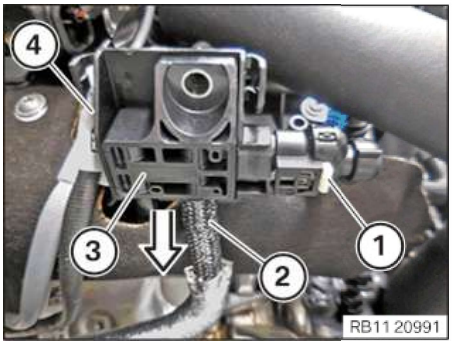
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

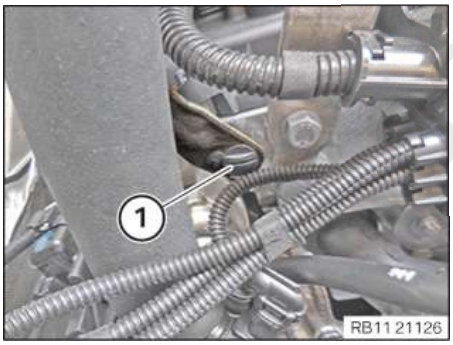


- Loosen screw (1).
- Release the locks (arrows).
- Guide out and remove the cover (2).

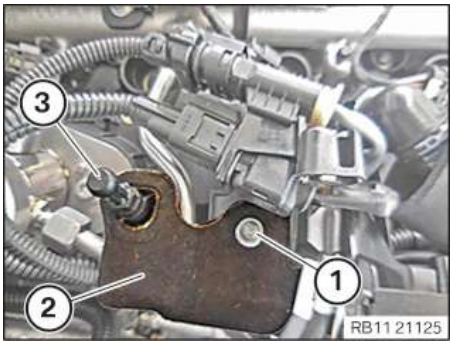


- Unlock plug connection (1) and disconnect.
- Pull off the pressure hose (2) from the differential pressure sensor (3) in the direction of arrow and place it to one side.
- Guide the differential pressure sensor (3) out of the holder (4) and remove.

12 – Removing the cylinder head cover acoustic cover



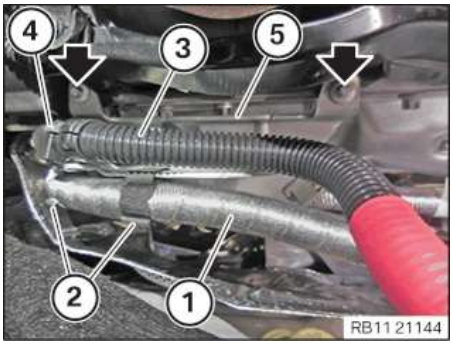
- Loosen clip (1).



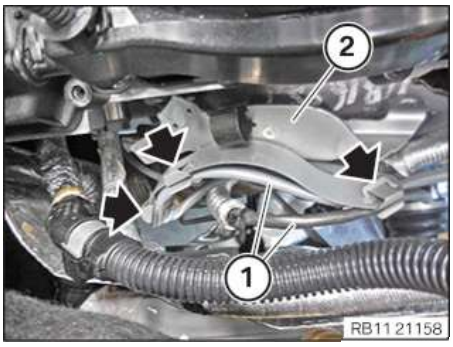
- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

13 – Remove the holder of the positive battery cable

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- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

14 – Remove the heat shield on the cylinder head

WARNING

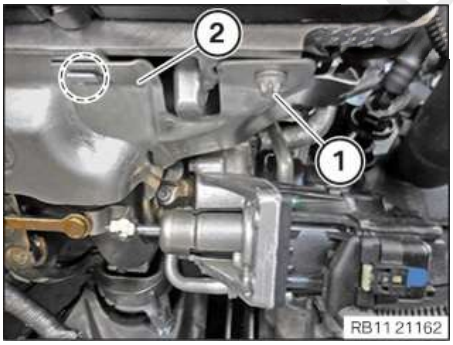
Hot surfaces.

Risk of burning!

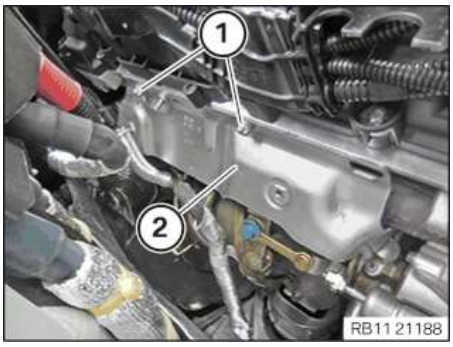
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.



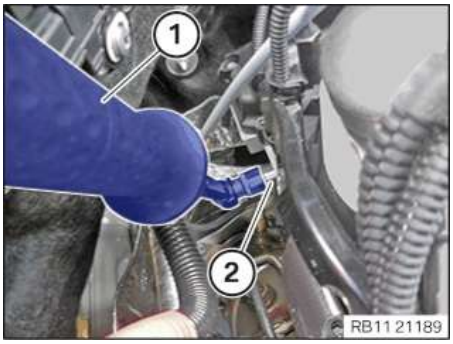
- Loosen screws (1).
- Feed out and remove the heat shield (2).

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15 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

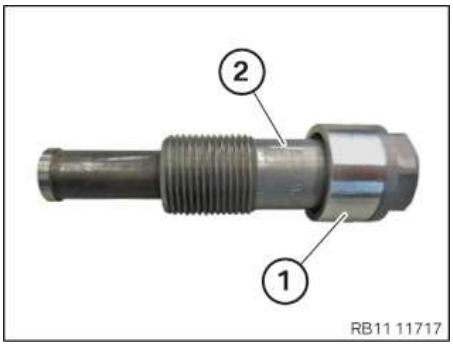
16 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



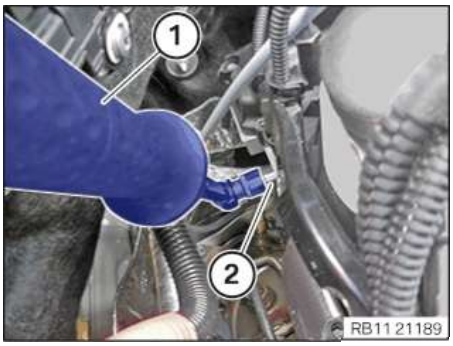
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.

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- Insert and install the chain tensioner (1).



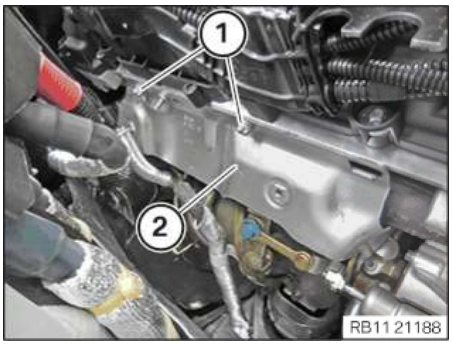
- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

POSTPROCESSES

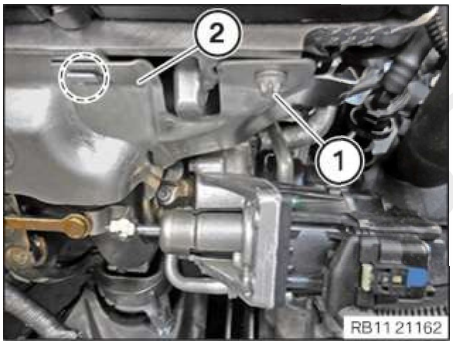
17 – Installing the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



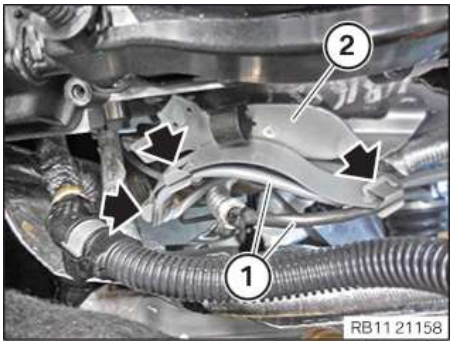
- Tighten down screw (1).

Heat shield to clamping strip

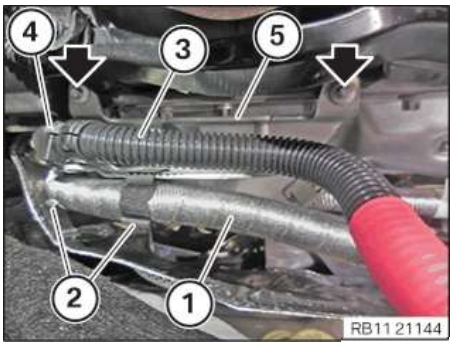
M6 x 12		Tightening torque	8 Nm

18 – Install the holder of the positive battery cable

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- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

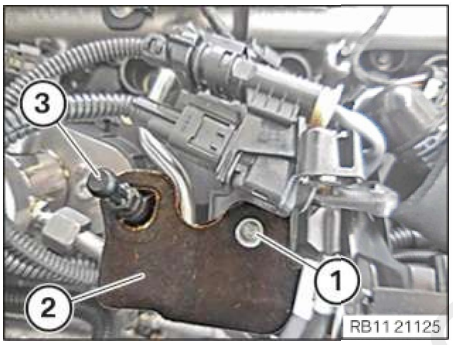
- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

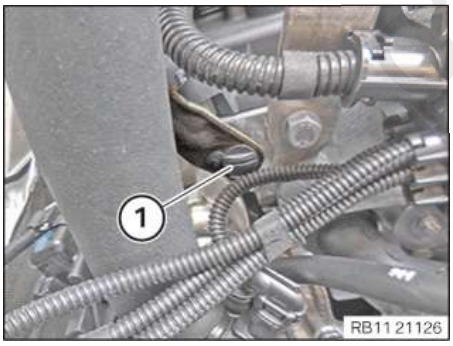
19 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

Acoustic cover (side) to cylinder head cover

TS6 x 20	8 Nm



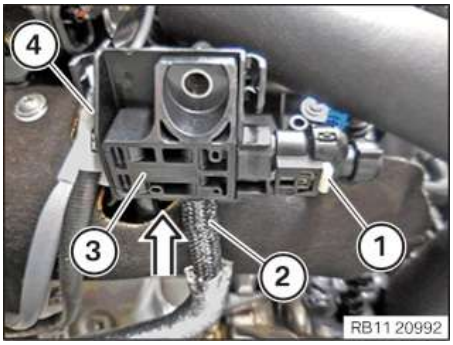
- Secure the clip (1).

20 – Install differential pressure sensor

TECHNICAL INFORMATION

Check the pressure hose on the pressure sensor and/or the differential pressure sensor. Replace hardened pressure hose. Check connection on pressure pipe and pressure sensor for leaks.

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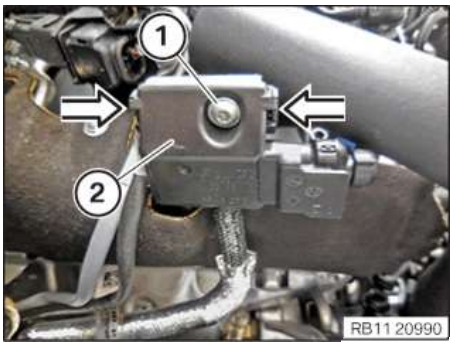


- Thread in differential pressure sensor (3) on the holder (4) and install.

  Differential pressure sensor (3) must engage audibly.
- Renew pressure hose (2).

  Parts: Pressure hose
- Connect the pressure hose (2) to the differential pressure sensor (3) in the direction of arrow until the limit position.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



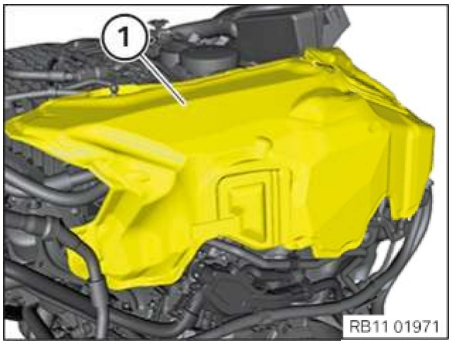
- Guide in and install cover (2).

  Cover (2) must engage audibly in the locks (arrows).
- Tighten down screw (1).

Differential pressure sensor to holder

TS6X20		Tightening torque	4 Nm

21 – Installing acoustic cover at rear

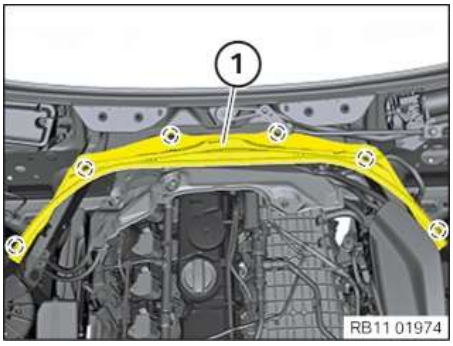


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

22 – Installing the centre bulkhead upper part

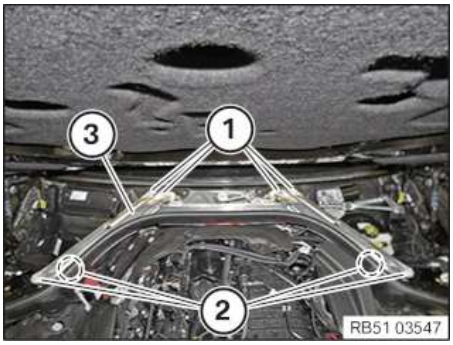


- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm

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- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

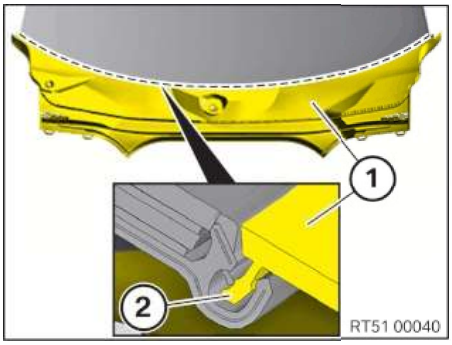
23 – Installing cowl panel cover

RISK OF DAMAGE

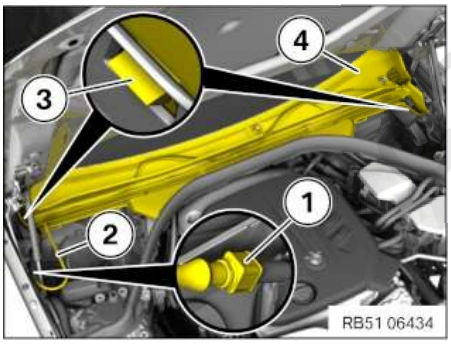
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

24 – Installing both wiper arms

NOTICE

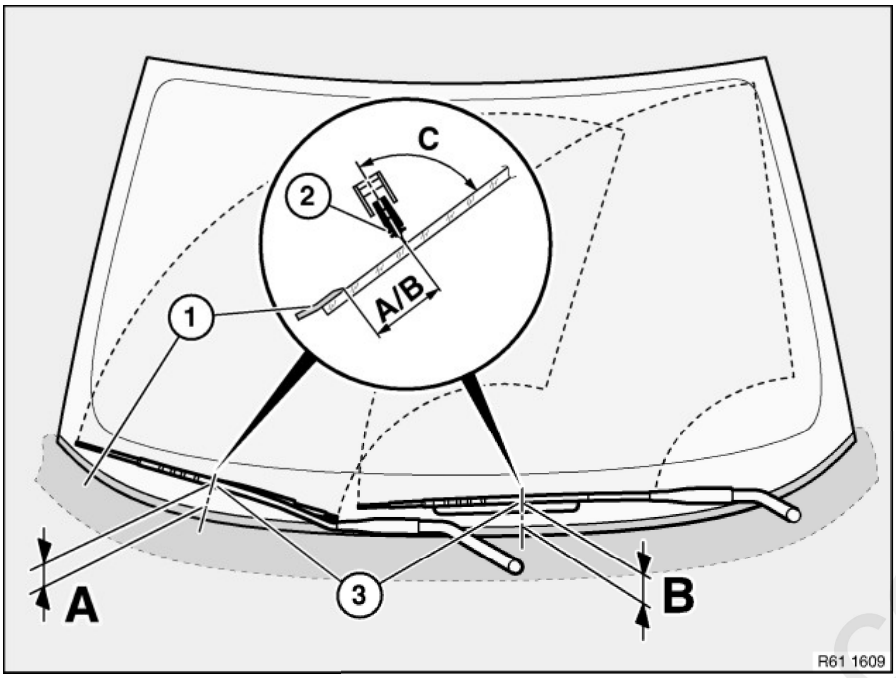
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

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TECHNICAL INFORMATION

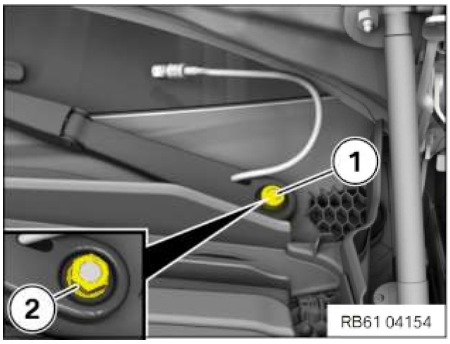
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

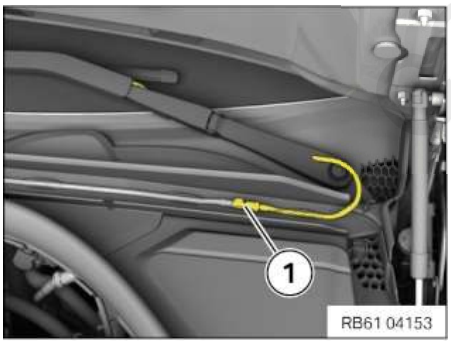


- Tighten nut (2).

Windscreen wiper arm

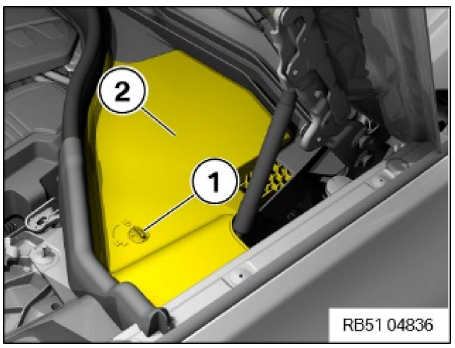
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

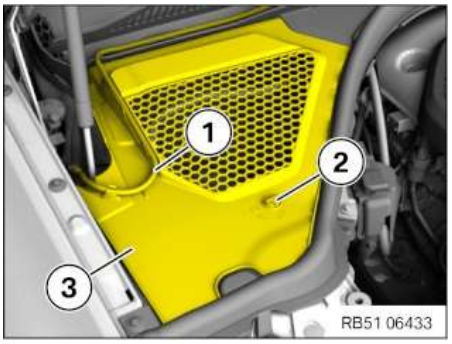
25 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

26 – Install the rear right engine compartment cover

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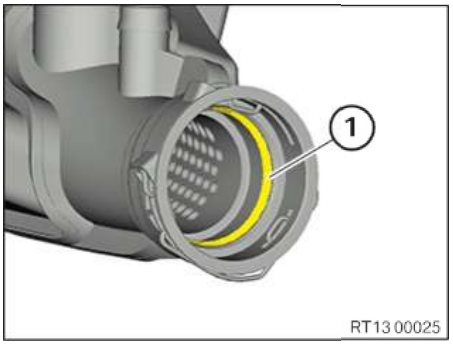
- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

27 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

28 – Installing the clean air pipe with resonator

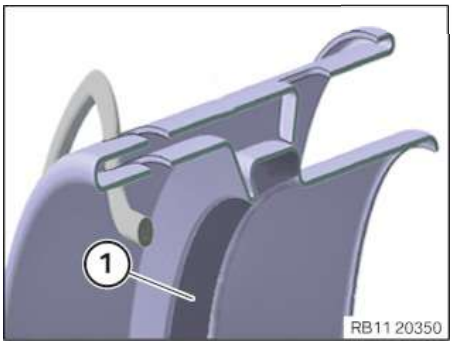


- Check the seal (1) for damages, replace if necessary.

▶ **Replace damaged gasket**

TECHNICAL INFORMATION

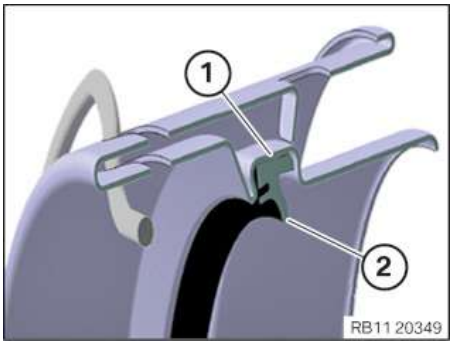
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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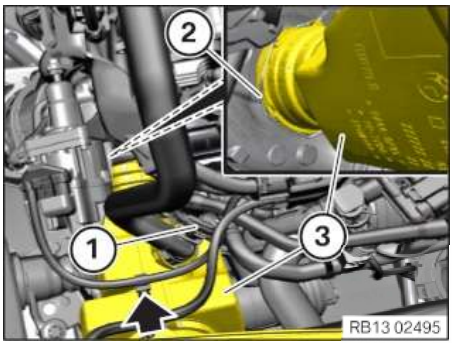
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

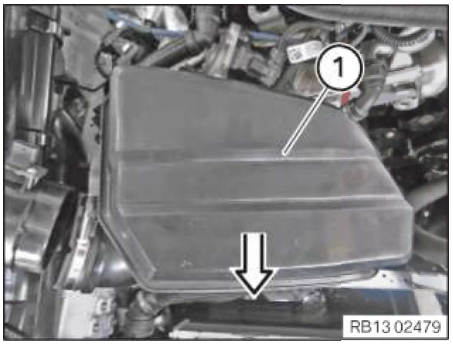
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



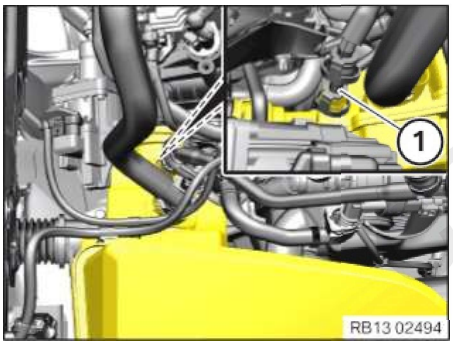
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

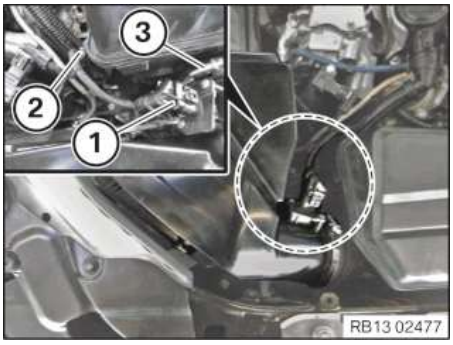
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

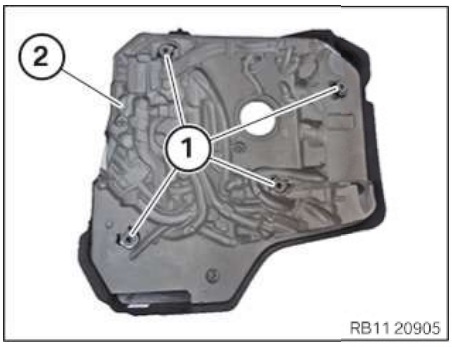
29 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



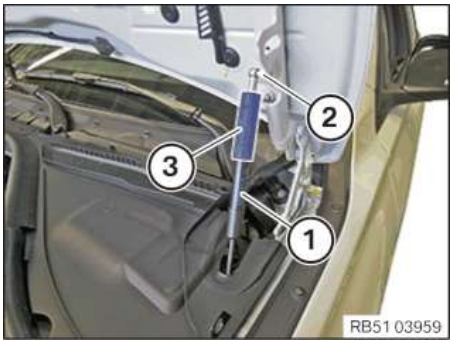
- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

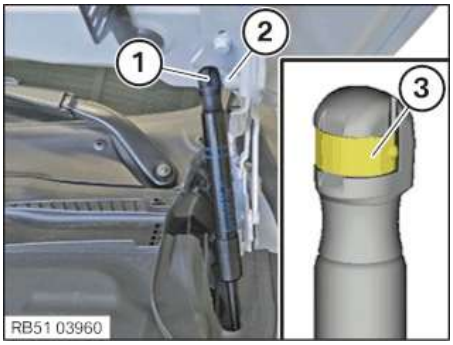
  The acoustic cover (1) must audibly engage into place.

30 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Chain tensioner to cylinder head — Used in step 16

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Heat shield to cylinder head — Used in step 17

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 17

M6 x 12		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 18

6X18		Tightening torque	6 Nm

Acoustic cover (side) to cylinder head cover — Used in step 19

TS6 x 20			8 Nm

Differential pressure sensor to holder — Used in step 20

TS6X20		Tightening torque	4 Nm

Bulkhead upper part to bottom bulkhead — Used in step 22

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 22

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 22

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 24

Combination hexagon nut		Tightening torque	35 Nm

Clean air pipe to upper section of intake filter housing — Used in step 28

Clamp		Tightening torque	3 Nm

Overview of Special Tools

Overview Technical Data

Distance from window pane edge to wiper blade — Used in step 24

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Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	11

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11 31 028 Removing and installing / replacing exhaust camshaft

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

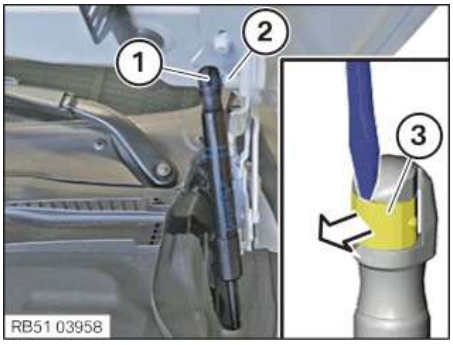
Engine compartment lid is open.

CAUTION

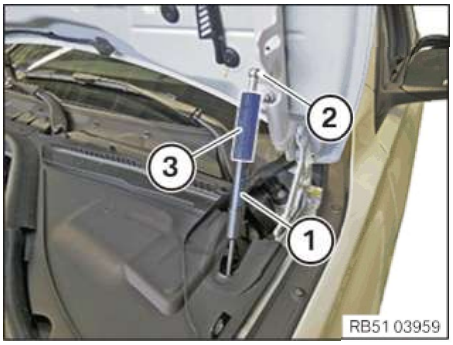
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

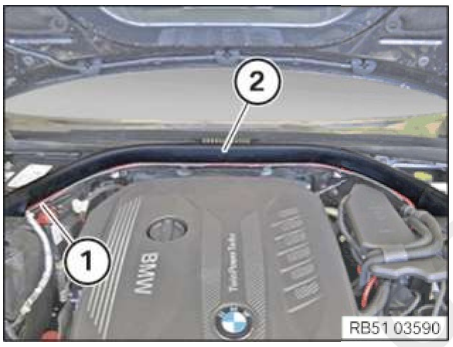


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

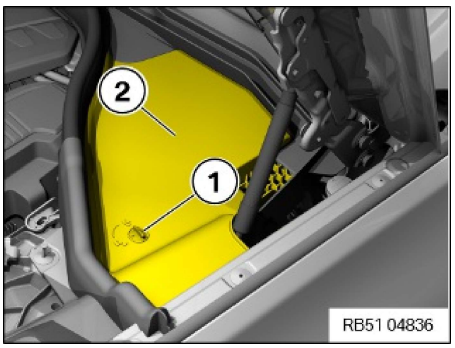
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

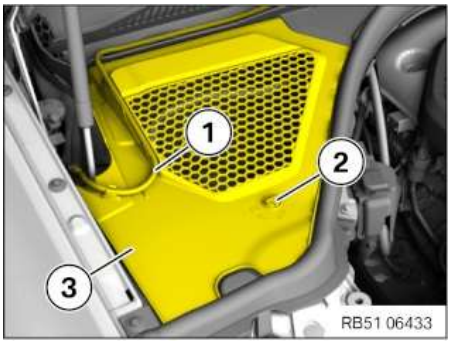
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

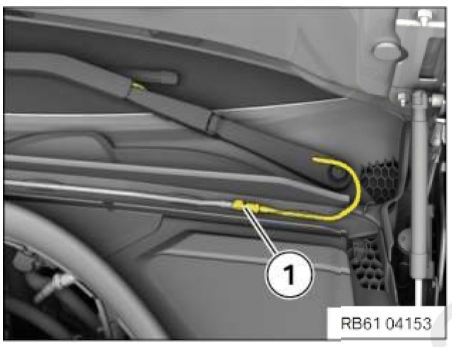
▶ **Remove the wiper arm**

RISK OF DAMAGE

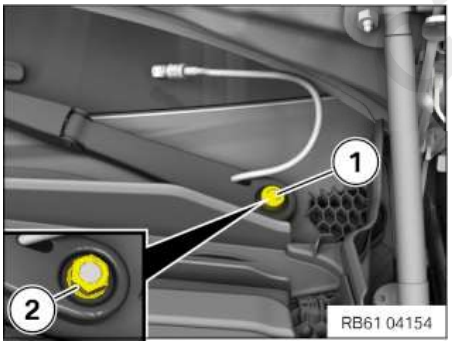
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

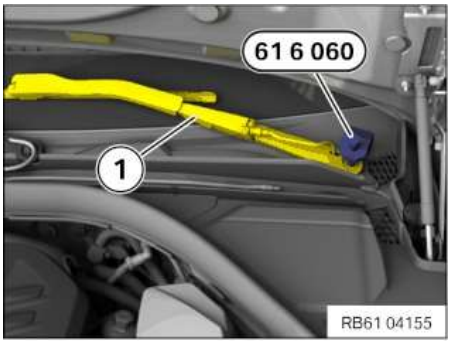
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



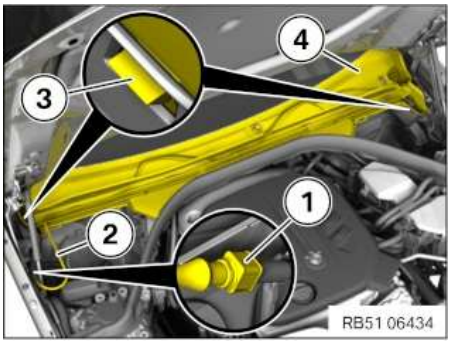
- Remove the protective cap (1).
- Loosen nut (2).



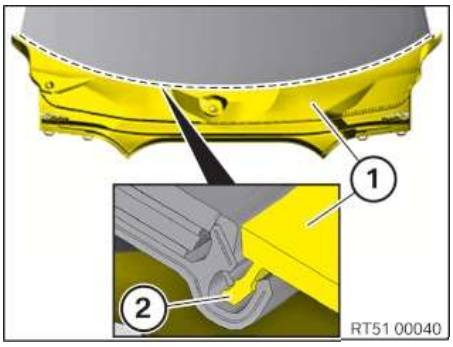
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

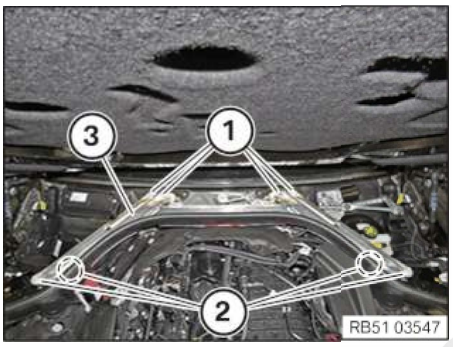


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

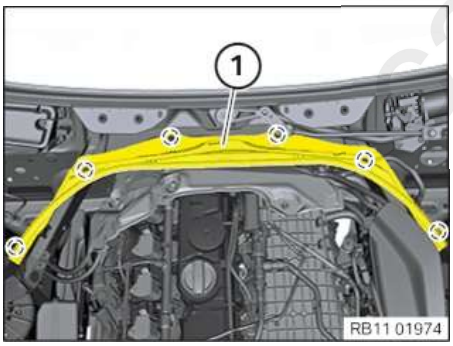
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

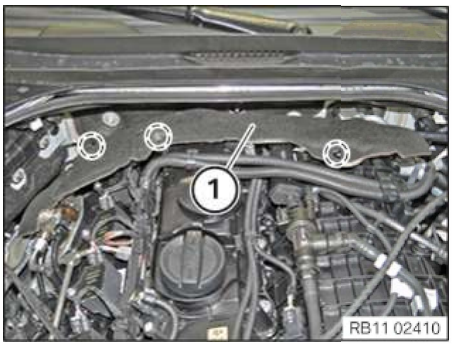
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



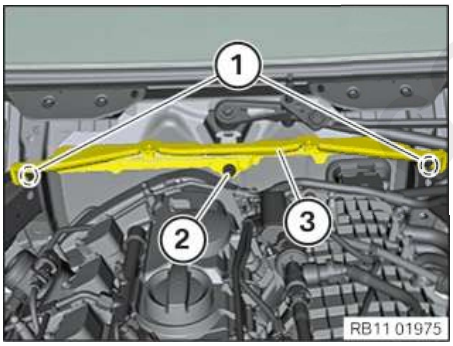
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

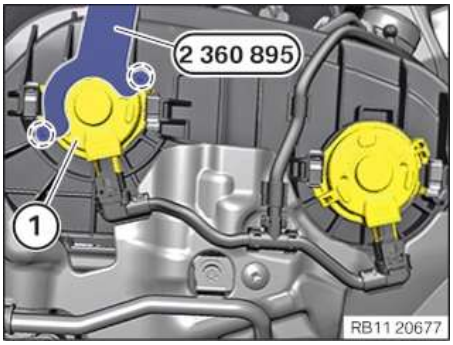
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

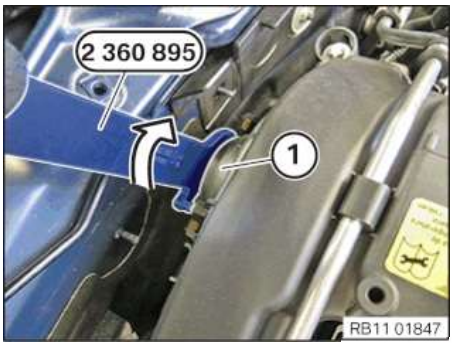
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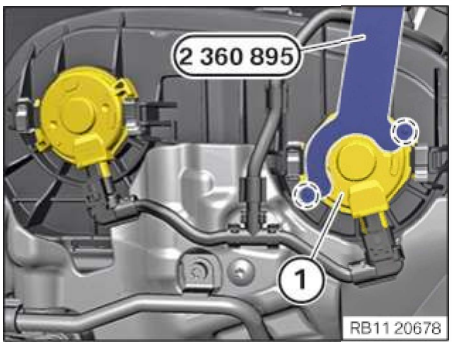
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



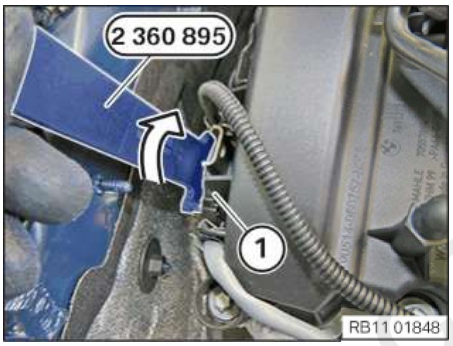
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



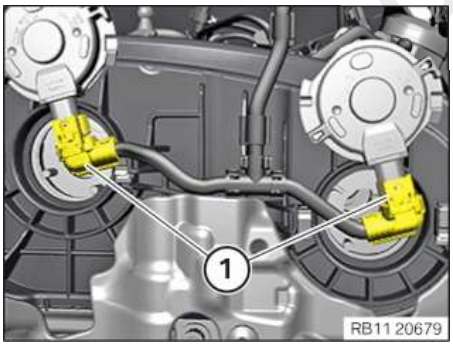
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

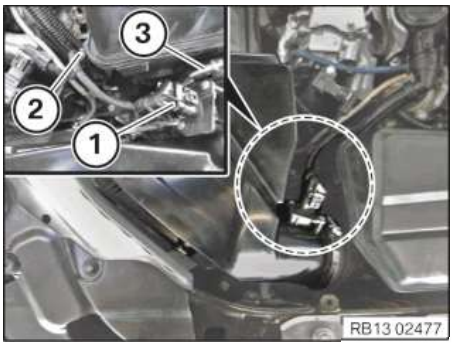
Risk of burning!

- Perform all work only on components that have cooled down.

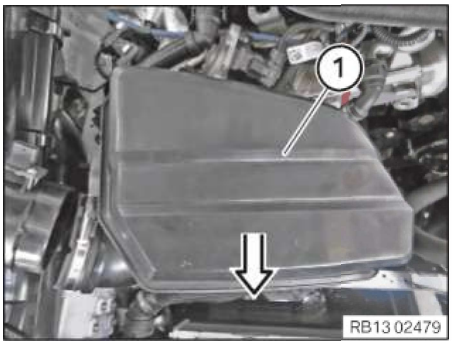
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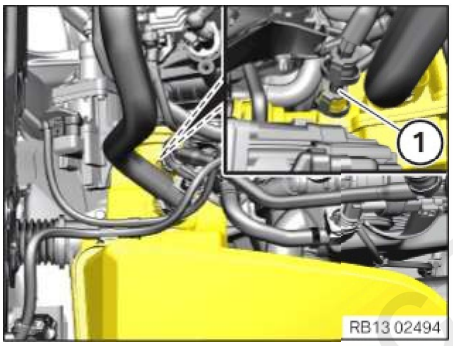
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



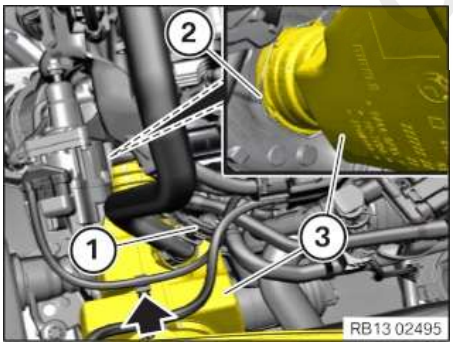
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



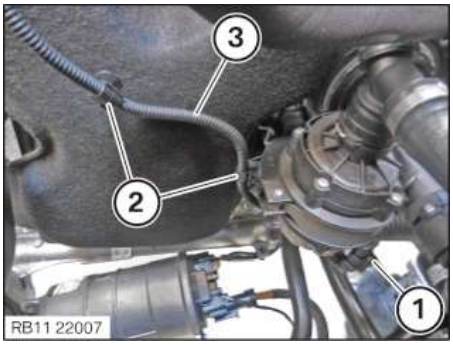
- Unlock and disconnect the tank ventilation line (1).



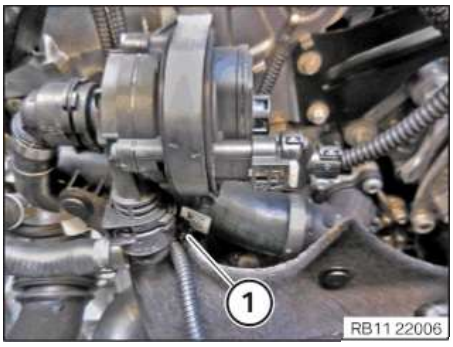
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

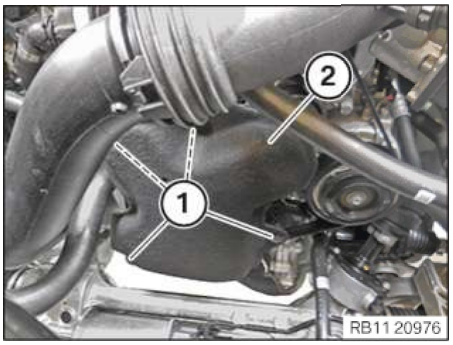
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

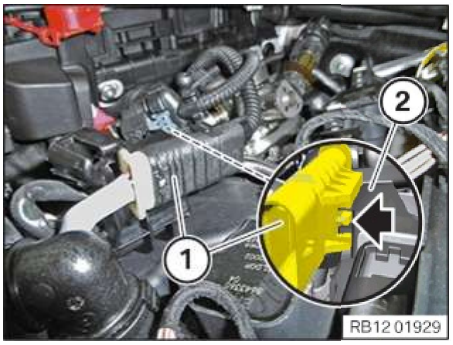
Electrostatic discharge.

Damage to or destruction of electrical components.

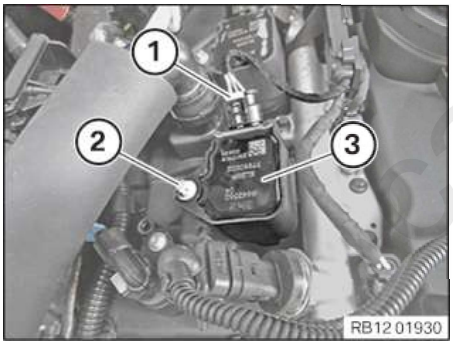
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

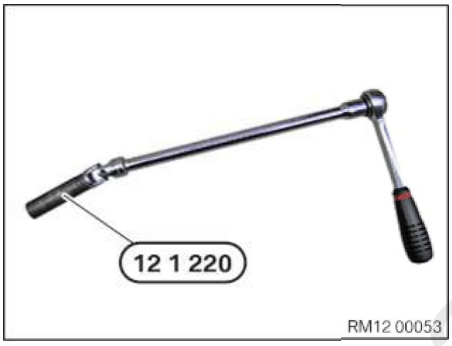
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

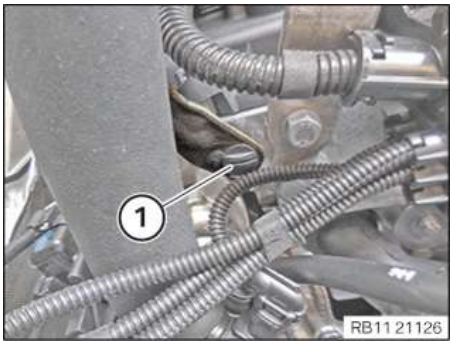
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

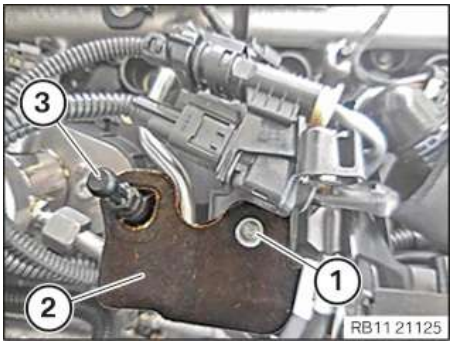


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

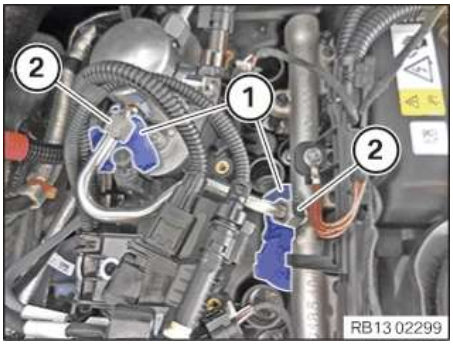
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

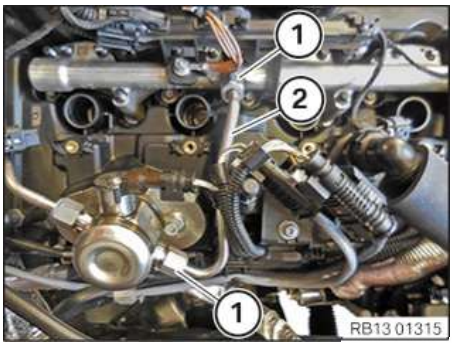


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

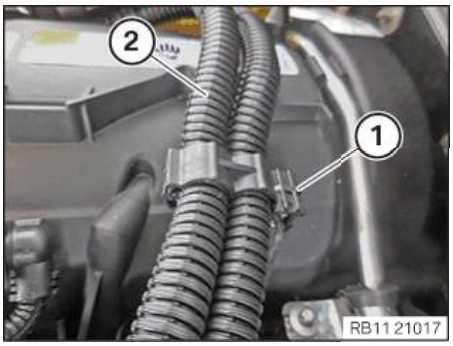
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

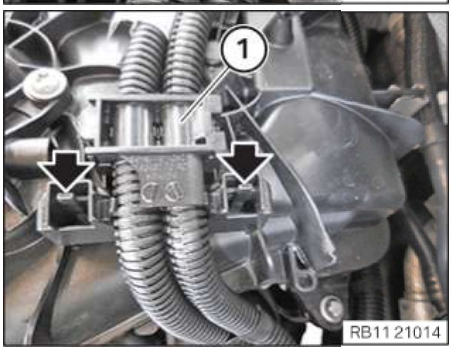
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

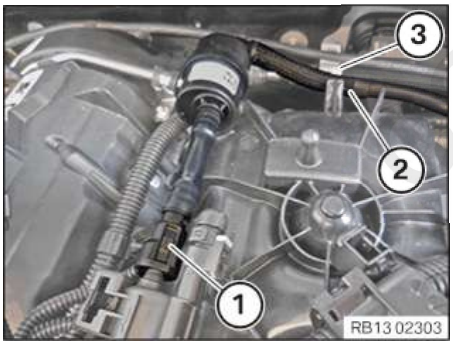
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



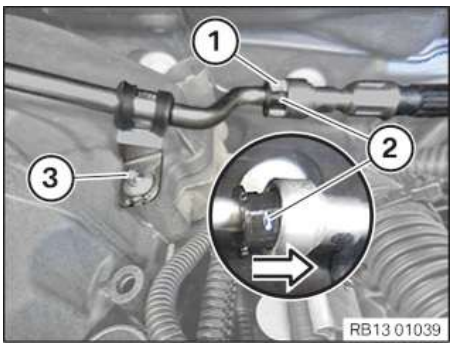
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

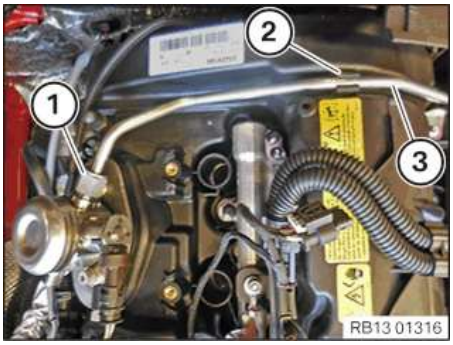


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

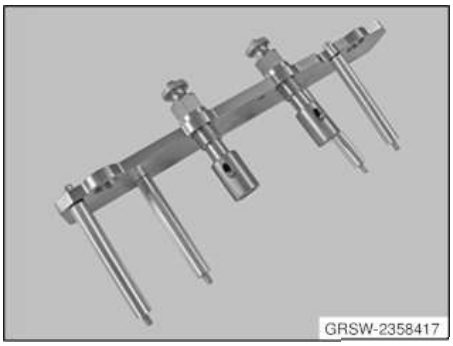
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



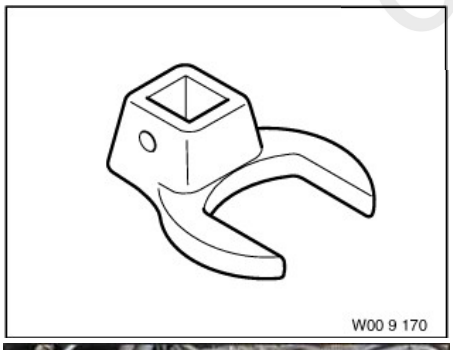
- Prepare special tool 2 358 417.



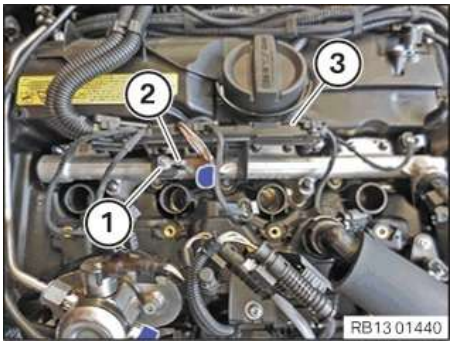
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

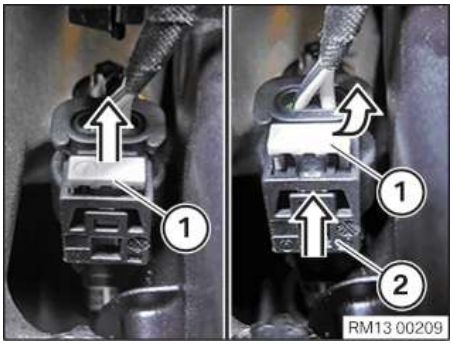


- Prepare special tool .

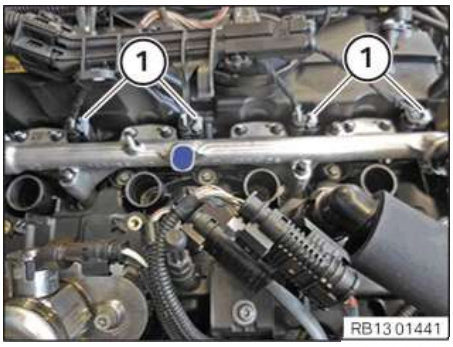


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



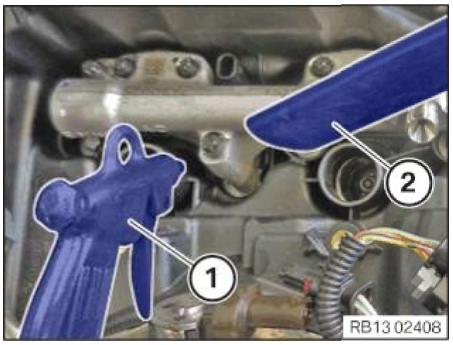
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

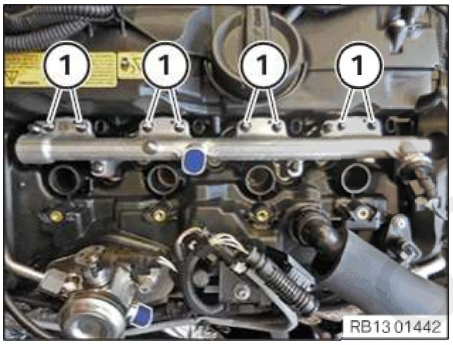


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

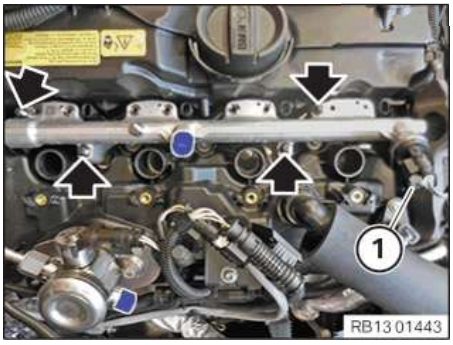
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



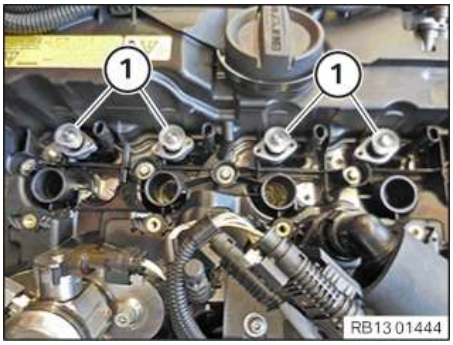
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

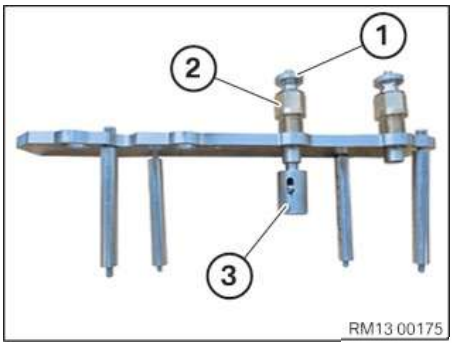
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

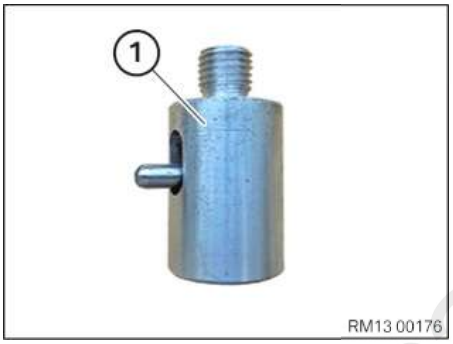
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

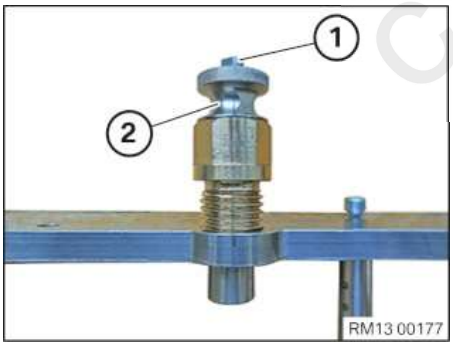
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

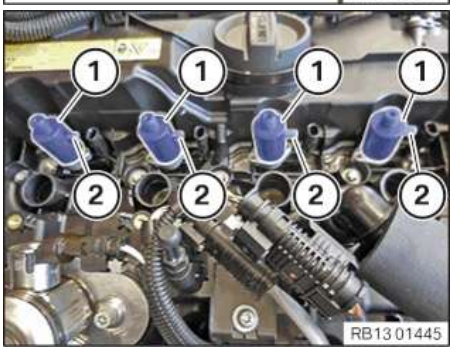
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



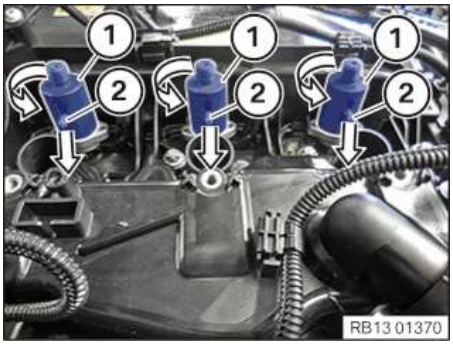
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



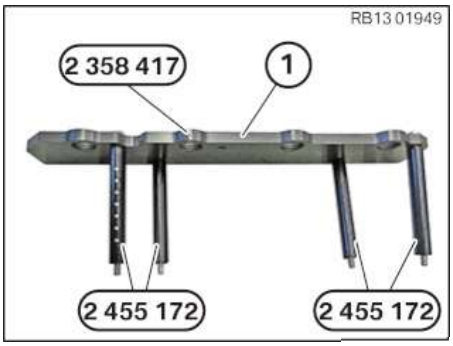
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

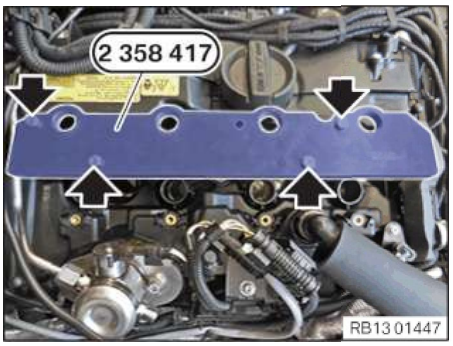
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



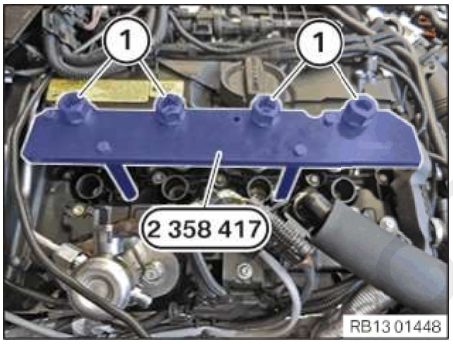
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

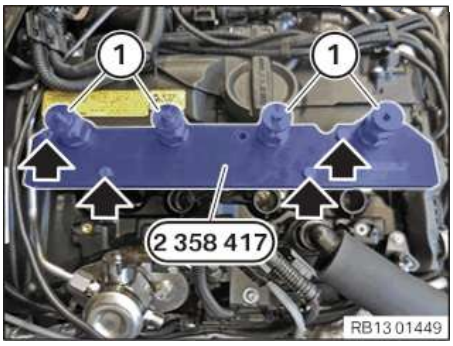
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

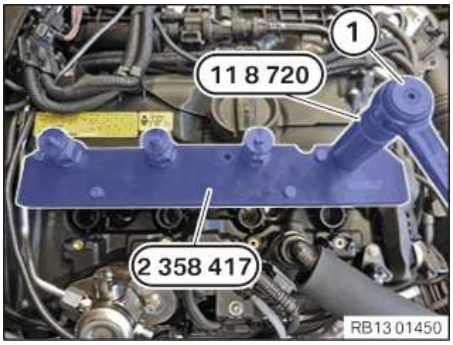
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

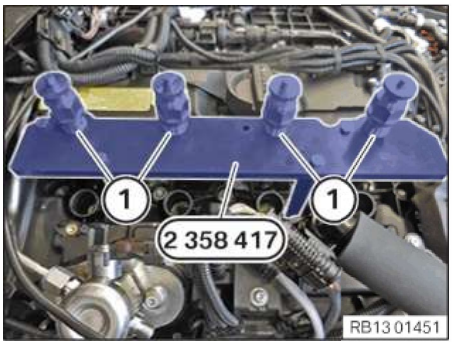


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

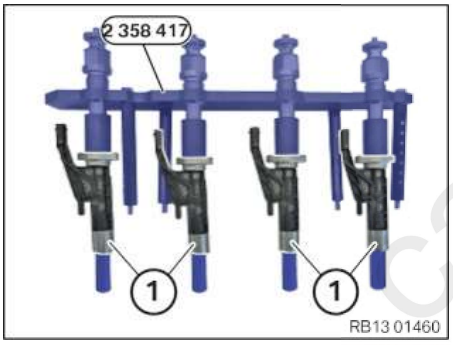
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

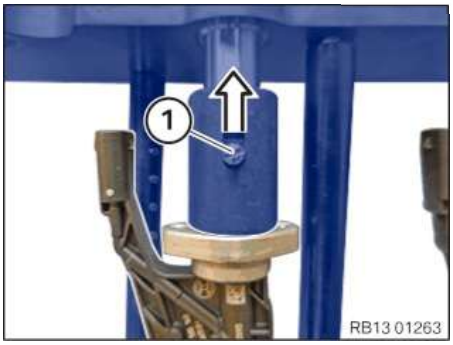


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

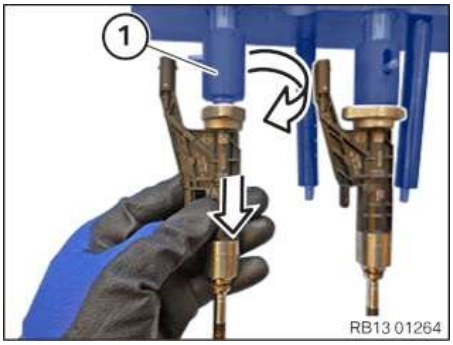


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

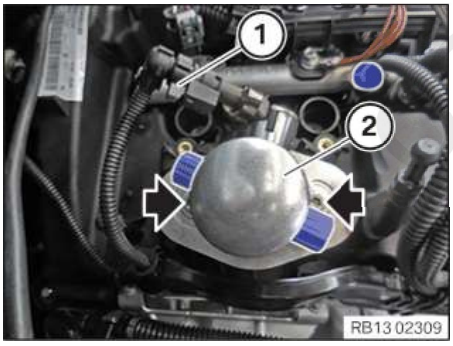
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

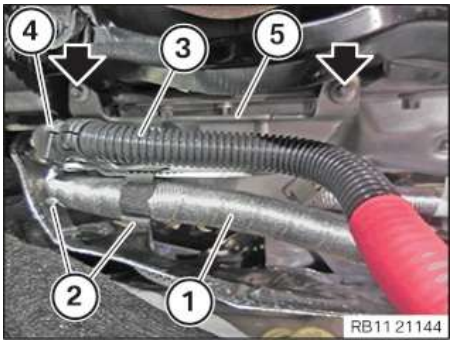
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

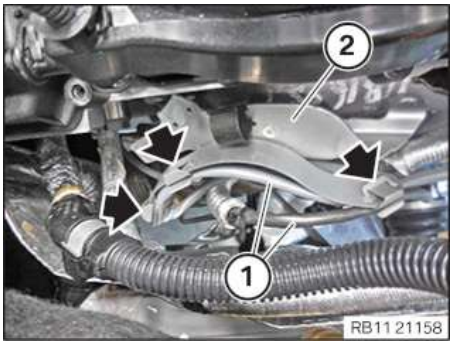


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

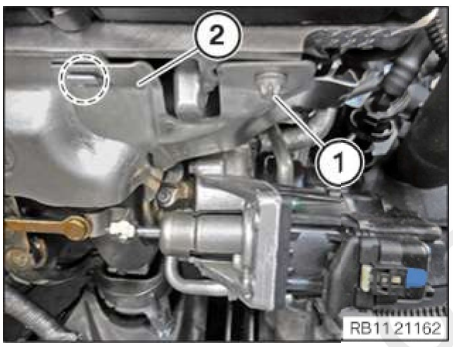
Hot surfaces.

Risk of burning!

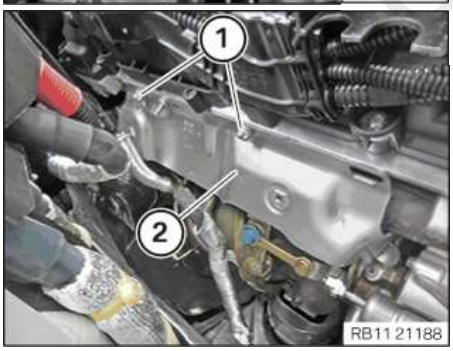
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

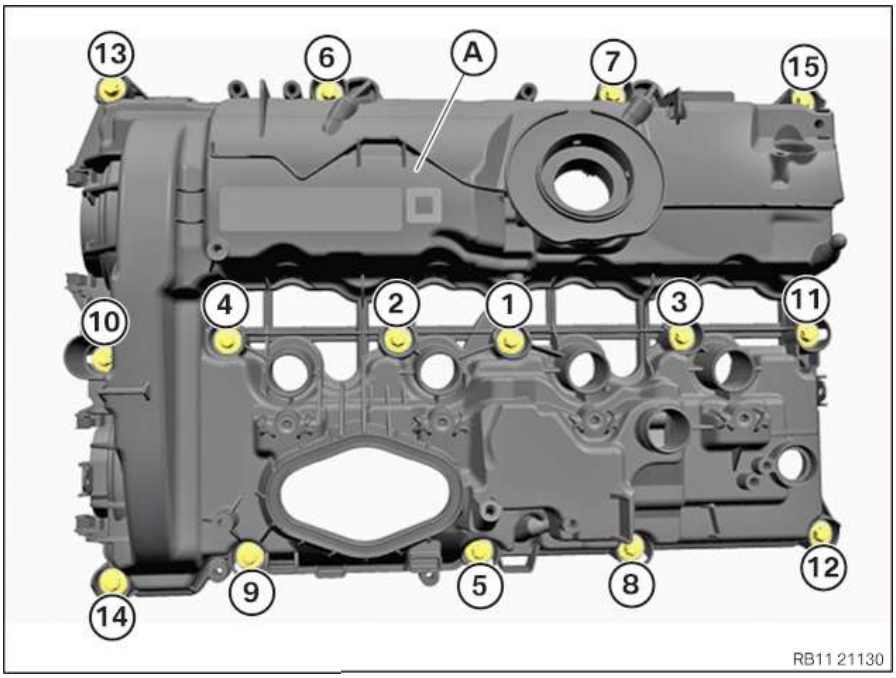


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

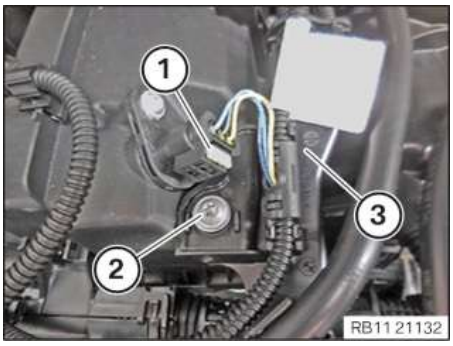
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

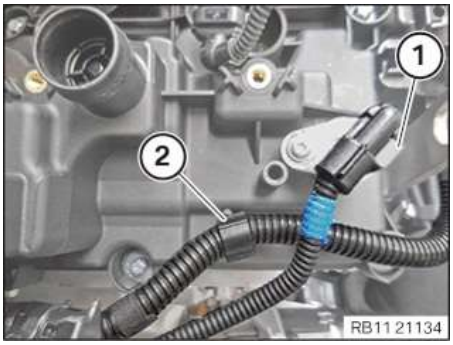
- Do not pull on the wires when disconnecting connectors and plug connections.



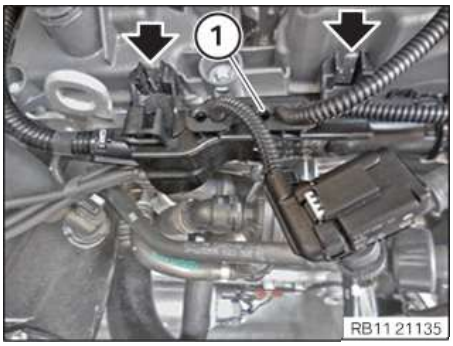
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



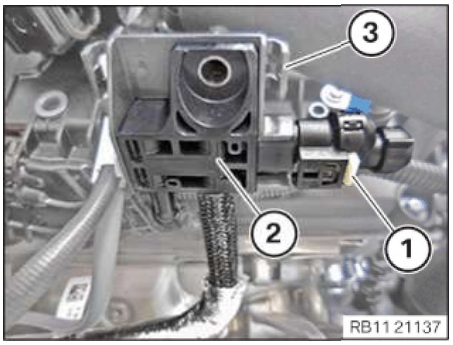
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



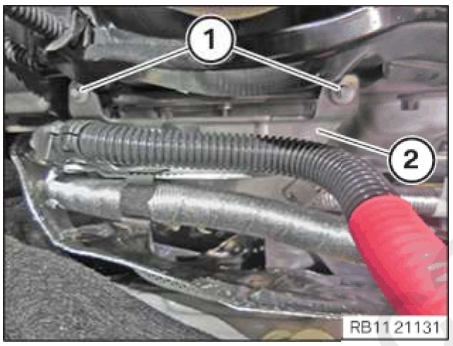
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



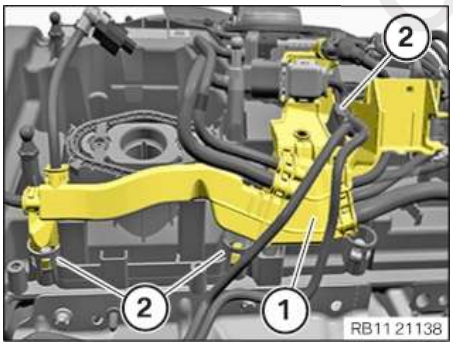
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



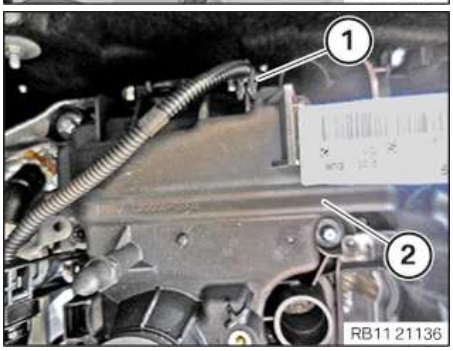
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

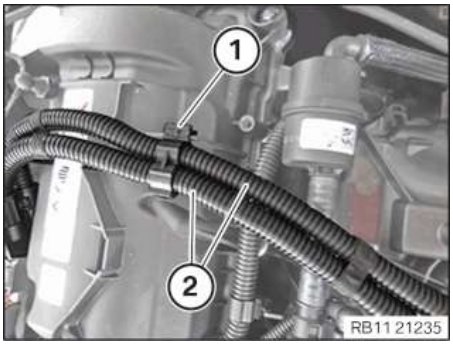


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

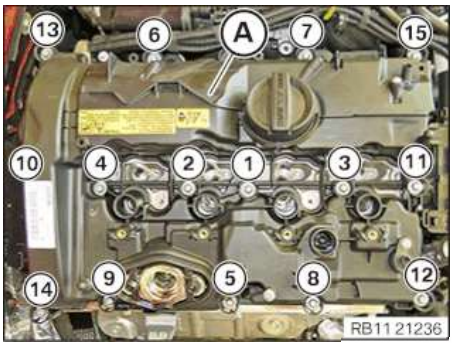


- Loosen clamp (1).

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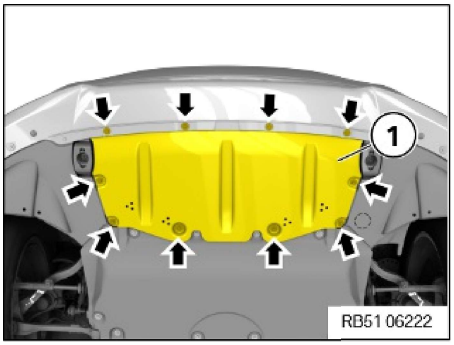


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

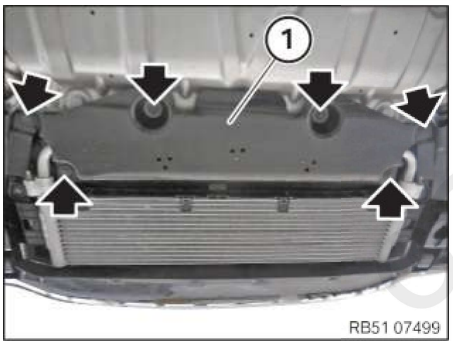
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

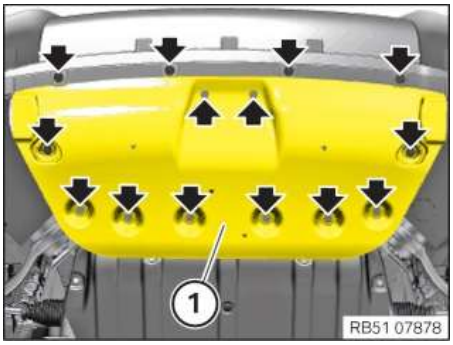
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

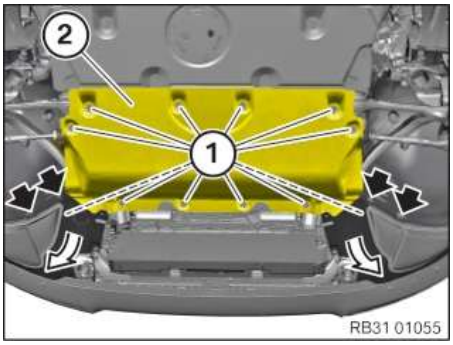


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



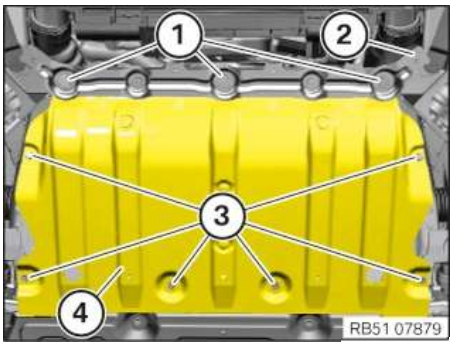
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

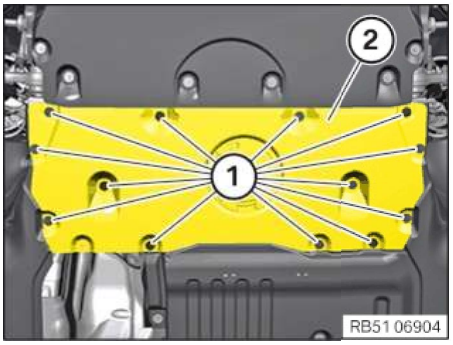
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

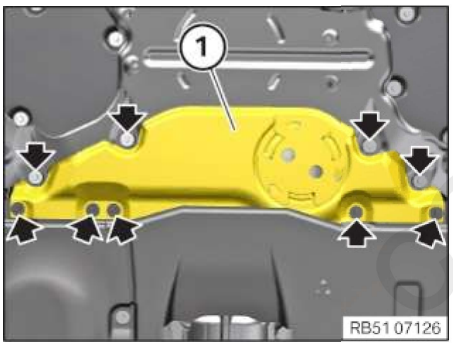
27 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

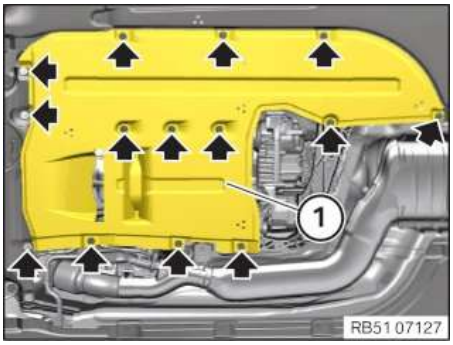


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

28 – Remove rear underbody protection

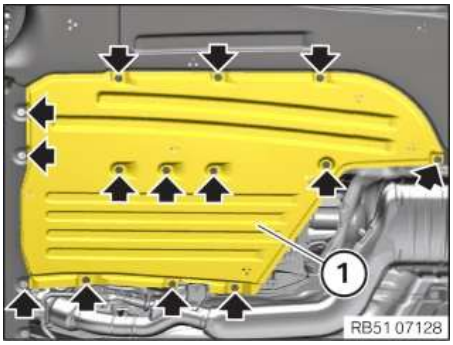


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

29 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



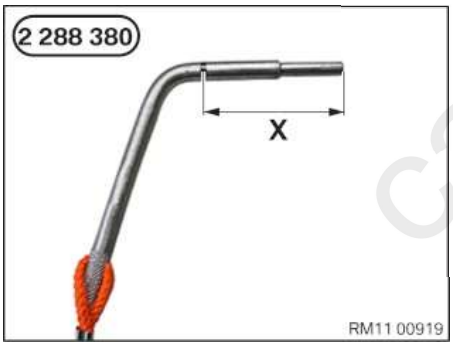
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

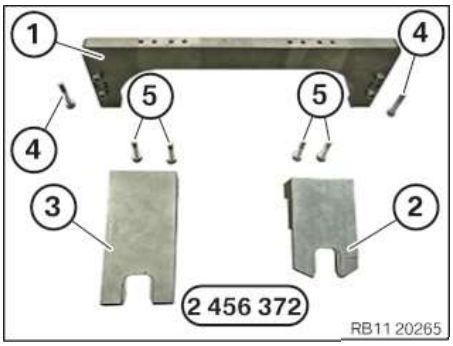
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- **Vehicles with automatic transmission:**

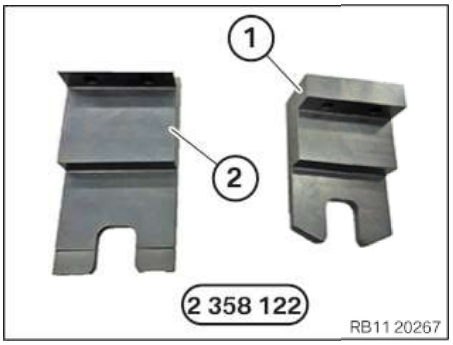
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



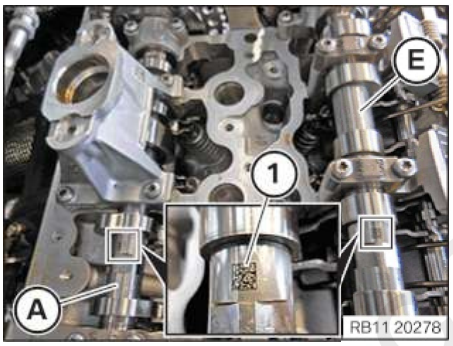
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

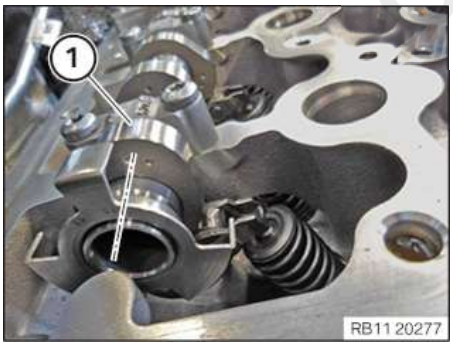


- Overview of the test gauges from the set of special tools 2 358 122:

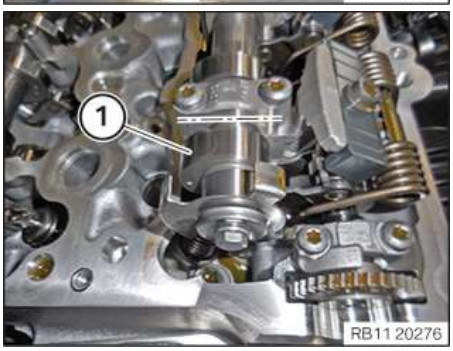
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

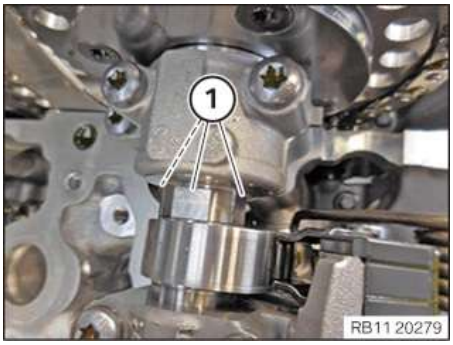


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

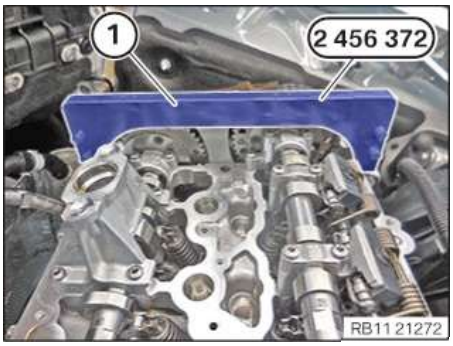


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

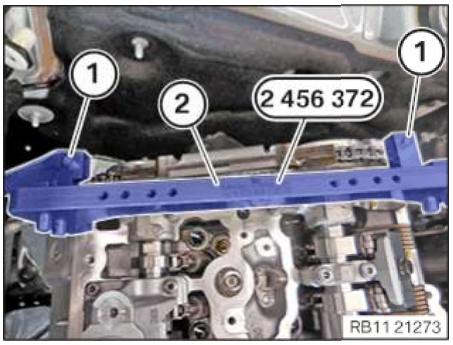
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- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



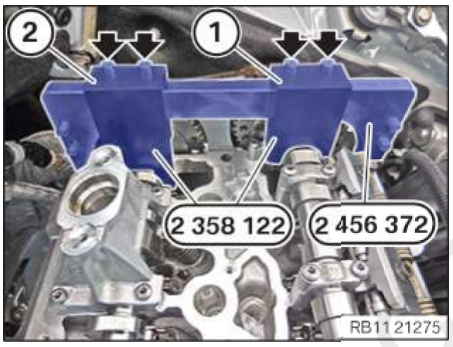
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

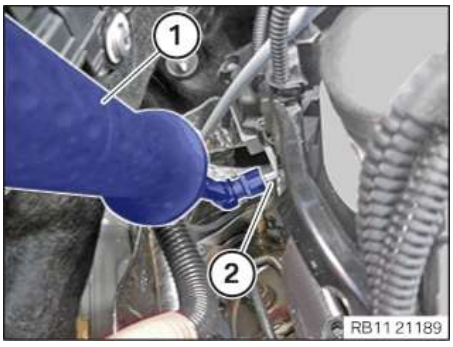
Test gauge to basic carrier

M6		Tightening torque	8 Nm

30 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

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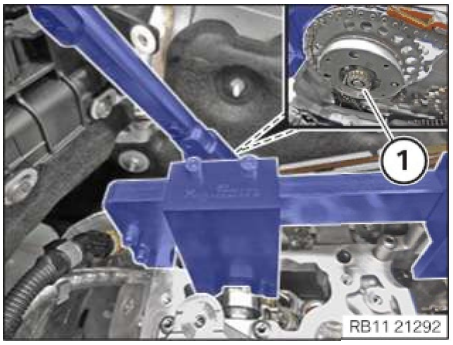


- Feed out and remove the chain tensioner (1).

31 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

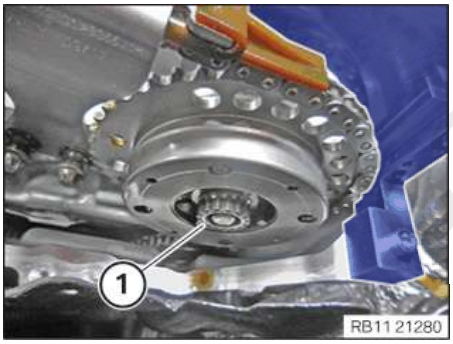


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

32 – Remove the VANOS central valve of the exhaust camshaft adjuster

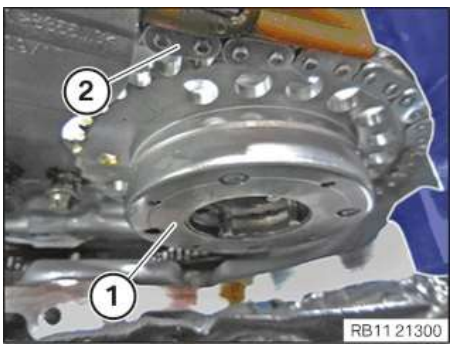


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

33 – Remove exhaust camshaft adjuster

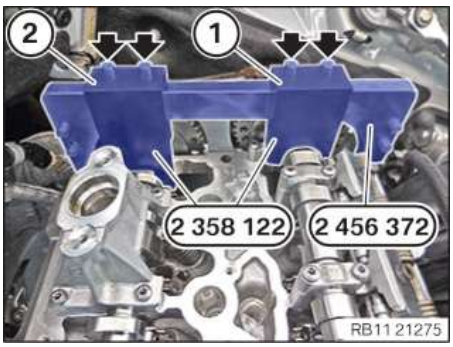
NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

34 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

MAIN WORK

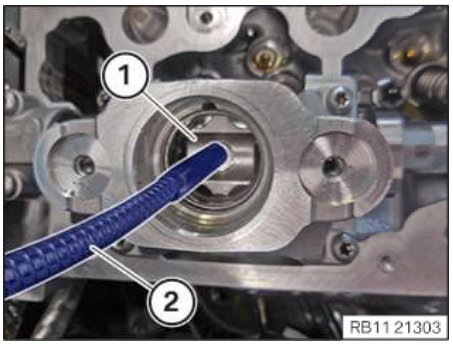
35 – Remove exhaust camshaft.

RISK OF DAMAGE

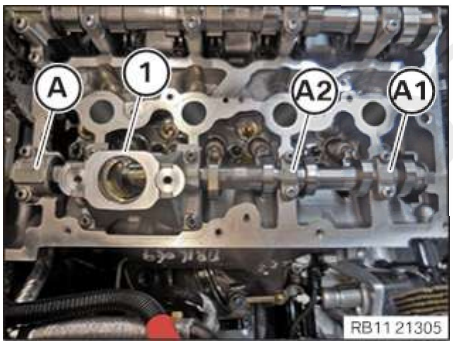
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Feed out and remove roller tappet (1) with commonly available tools (2).

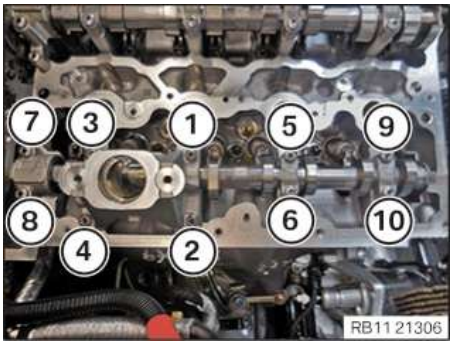


- Ensure that the exhaust camshaft bearing caps (A1) (A2) and (A) are placed in the right position 0 495 105 (11 4 480) in the special tool.

Note: The exhaust camshaft bearing caps can be read from the intake side and are identified by **A1**, **A2** and **A**.

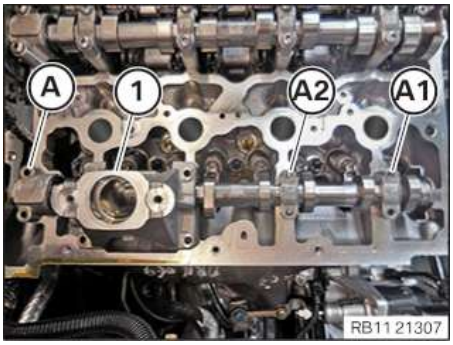
Note: Exhaust camshaft bearing cap **A** is a thrust bearing.

Note: Bearing cap **1** is the high pressure pump bracket.

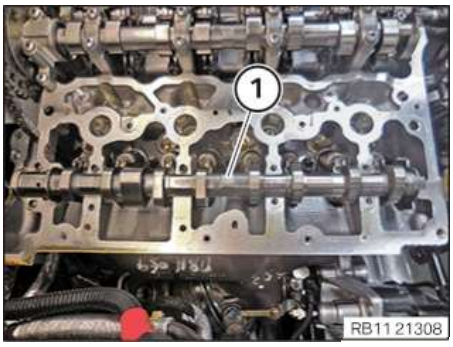


- Loosen all screws on the exhaust camshaft bearing cap in **sequence** from (10) to (1) in **half** turn.

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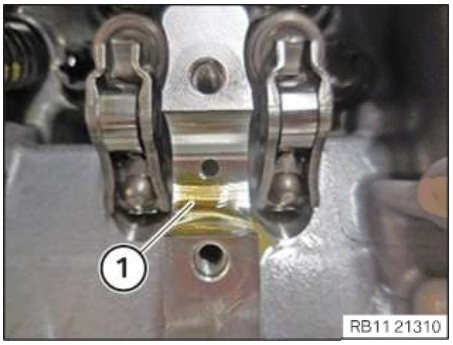


- Remove the exhaust camshaft bearing cap (A1) (A2) and (A) and store it properly in the special tool 0 495 105 (11 4 480).
- Remove high pressure pump bracket (1) and place in order in special tool 0 495 105 (11 4 480).

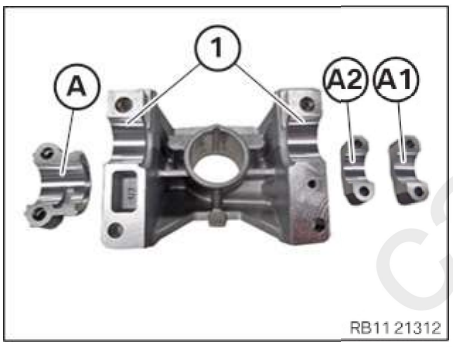


- Feed out and remove exhaust camshaft (1).

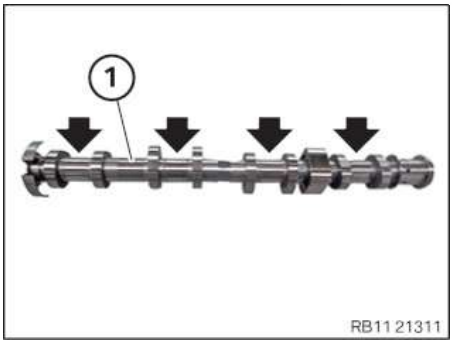
36 – Install exhaust camshaft



- Coat all bearing positions (1) with **fresh** engine oil.

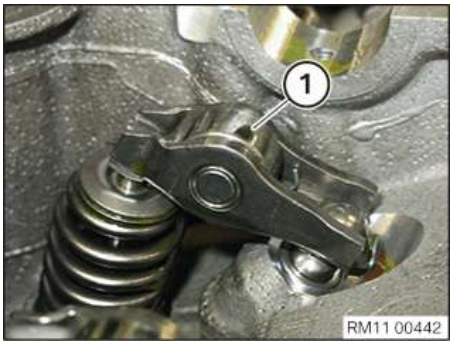


- Clean all the bearing positions of exhaust camshaft bearing caps (A1), (A2) and (A) and coat them with engine oil.
- Clean bearing positions (1) of the high pressure pump bracket and coat with engine oil.

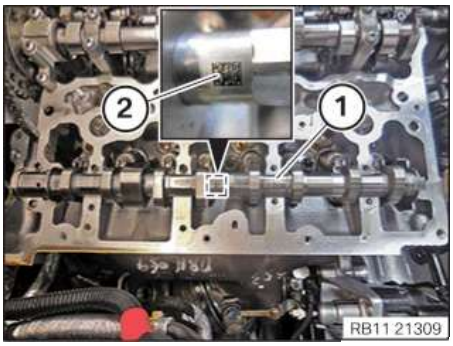


- Clean all the bearing positions (arrows) of exhaust camshaft (1) and coat with engine oil.

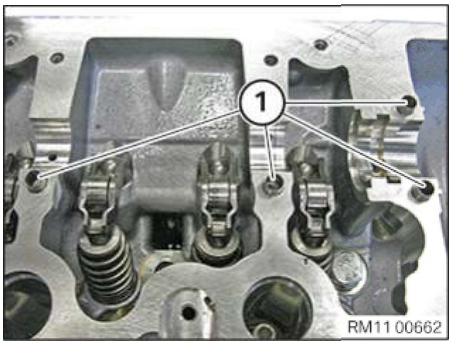
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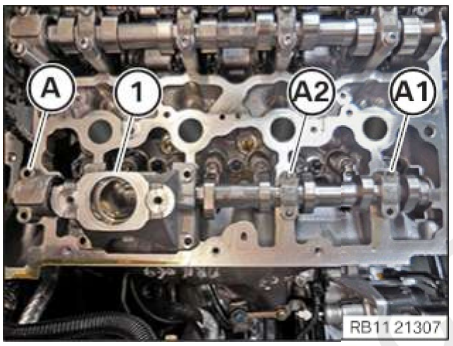
- Ensure the **correct** fit of the roller cam followers (1) before mounting the exhaust camshaft.
- Coat roller cam follower (1) with **new** engine oil.



- Insert exhaust camshaft (1) in the cylinder head, such that the mark (2) points **upwards**.



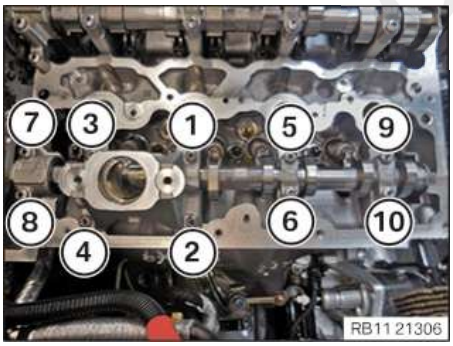
- Check the fitting sleeves (1) for **correct** fit and damage and replace where required.



- Position all exhaust camshaft bearing caps (A1) (A2) (A) and high pressure pump bracket (1) on the cylinder head and press down.

Note: The exhaust camshaft bearing caps can be read from the intake side and are identified by **A1**, **A2** and **A**.

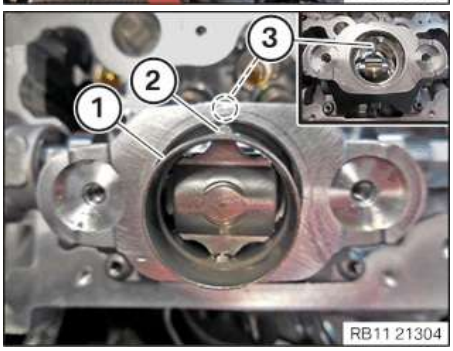
Note: Exhaust camshaft bearing cap **A** is a thrust bearing.



- Join all the screws in the **sequence** (1) to (10) **in half turns**.
- **Adhere to** the **jointing torque**.
- **Tighten** all bolts in sequence (1) to (10).

Exhaust camshaft to cylinder head

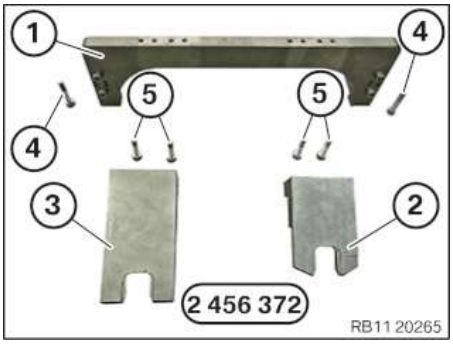
M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm



- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

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37 – Adjust the camshafts with the special tool

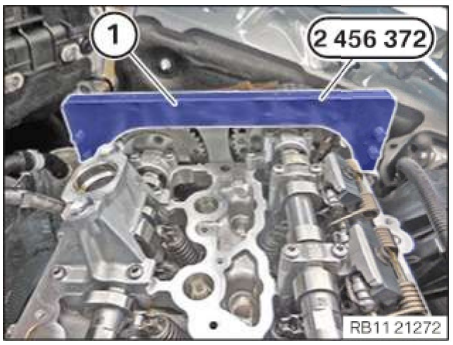


- Overview of the set of special tools 2 456 372:

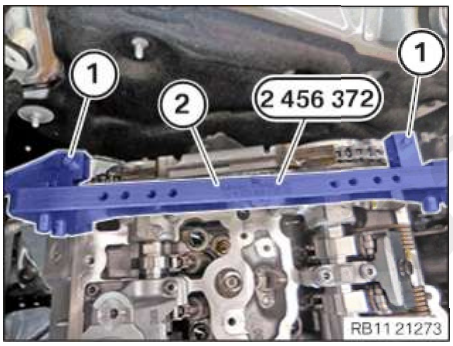
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



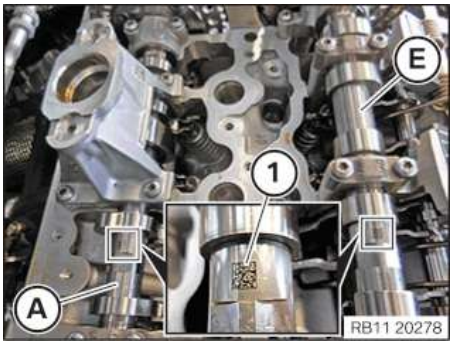
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

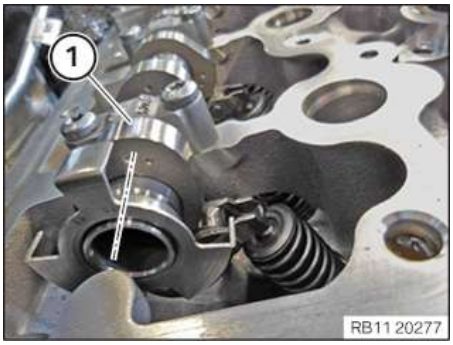
Basic carrier to cylinder head

M6		Tightening torque	8 Nm

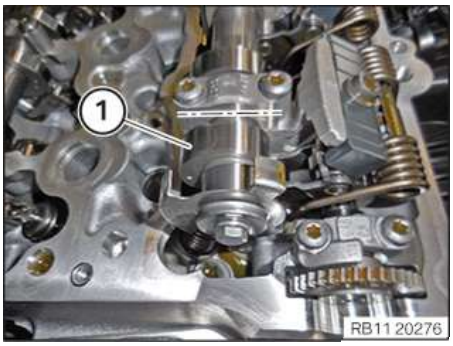


- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.

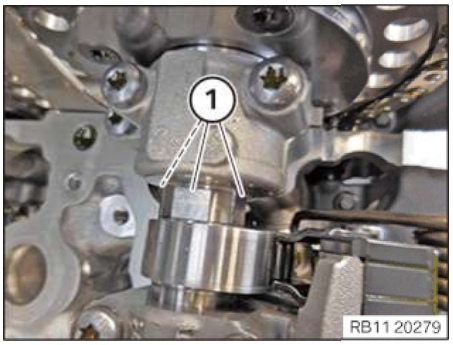
boardiagn.com



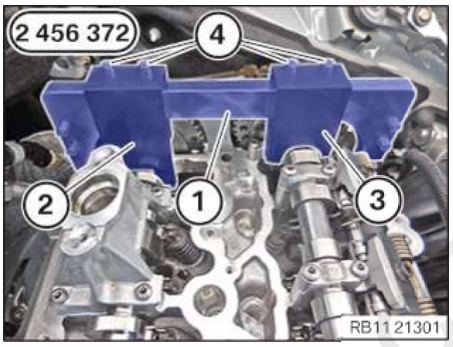
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

38 – Install exhaust camshaft adjuster

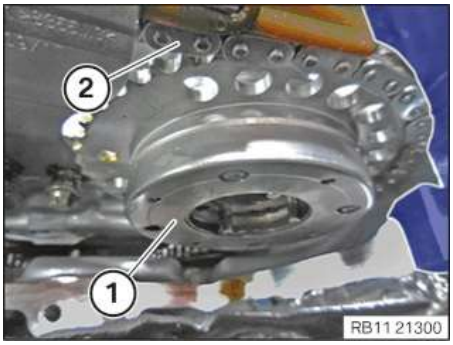
NOTICE

The figure shows the rear side of the engine.



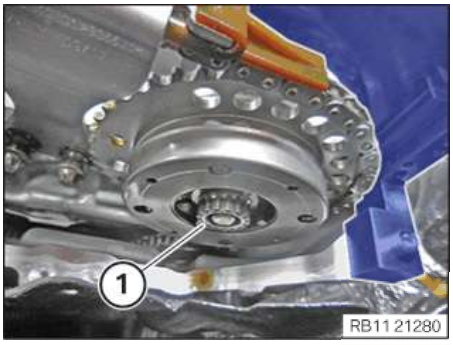
- Keep exhaust camshaft adjuster (1) marked EX ready.

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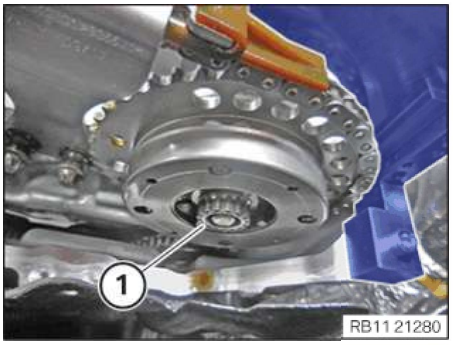


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

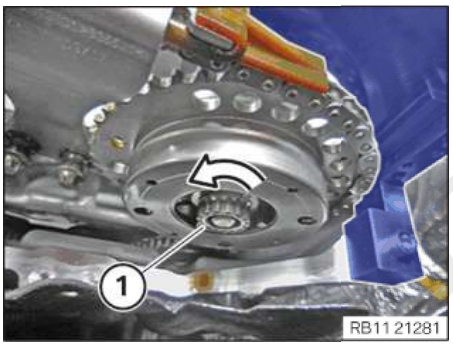
39 – Installing the VANOS central valve of the exhaust camshaft adjuster



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

40 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

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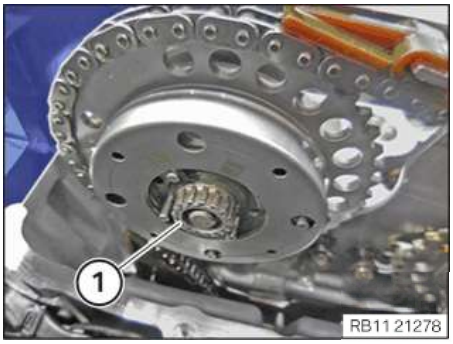


NOTICE

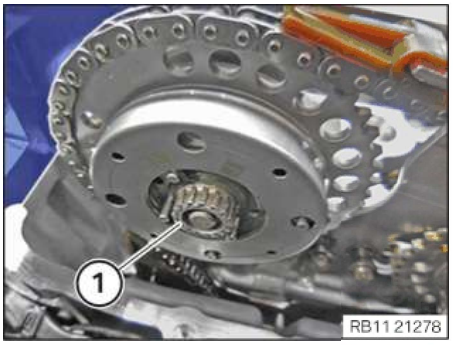
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

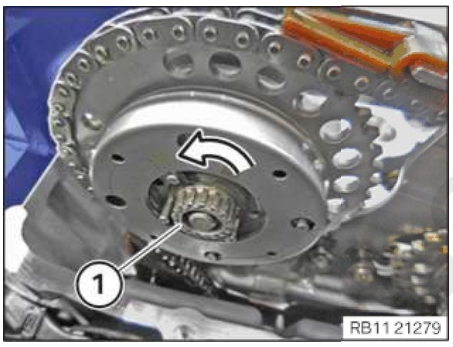
41 – Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.

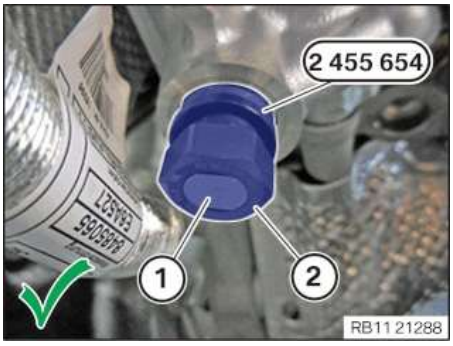


- Hand-tighten the VANOS central valve (1) of the intake adjuster.



- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

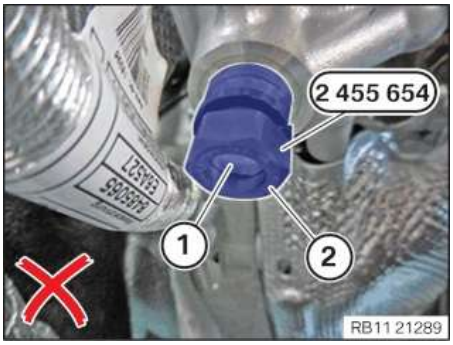
42 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

  The pin (1) must align **precisely** with housing (2).

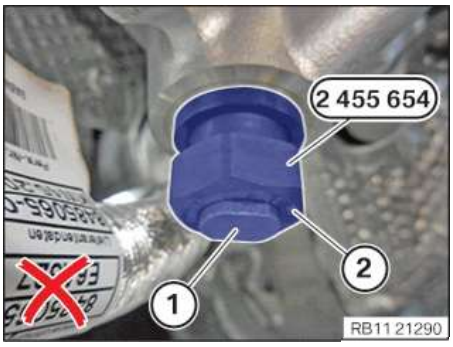
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- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

43 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the intake adjuster.

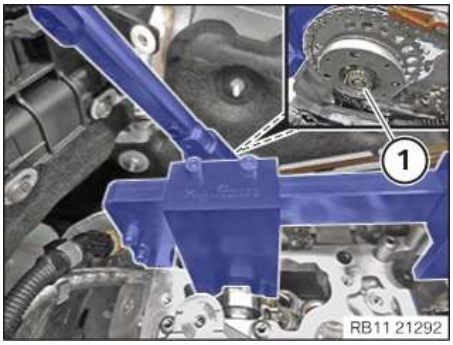
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

44 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

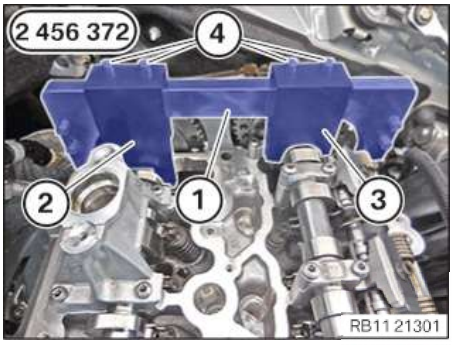


- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

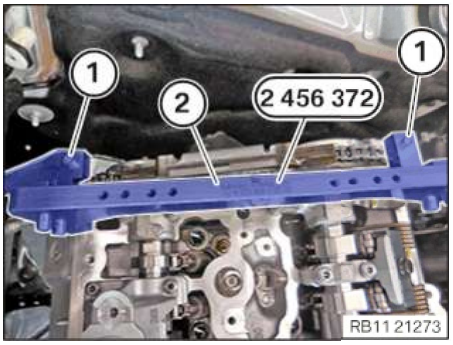
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

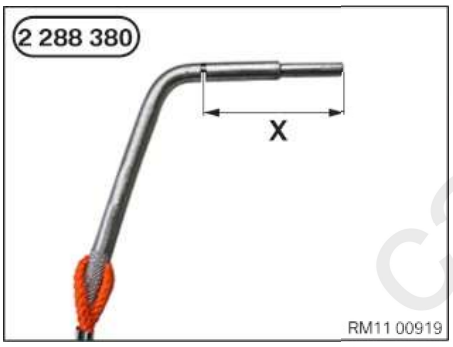
45 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.

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- Guide the special tool (1)2 455 654 out and remove.

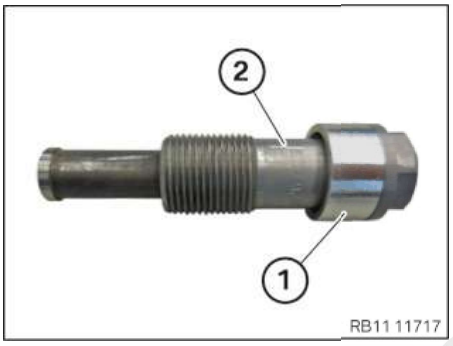
46 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

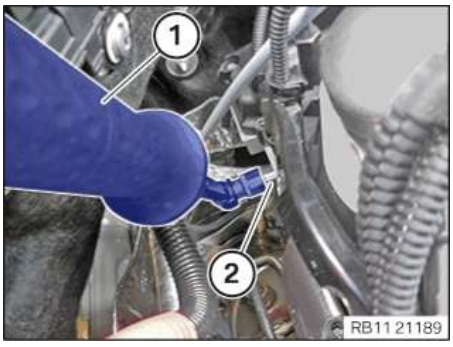


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).



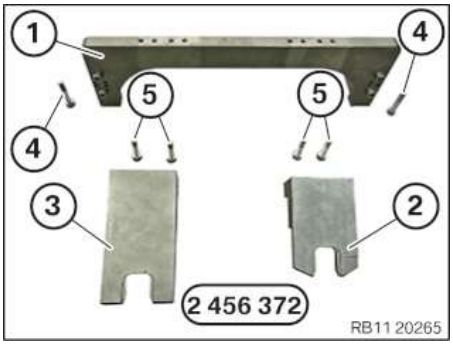
- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

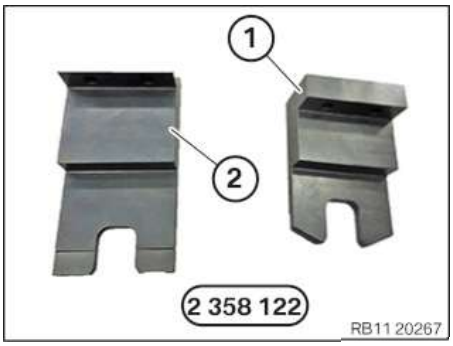
47 – Checking camshaft timing

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- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



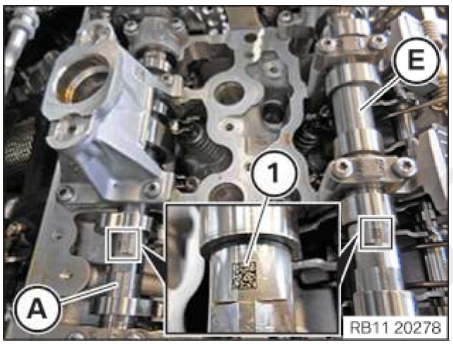
RISK OF DAMAGE

Damage to the engine.

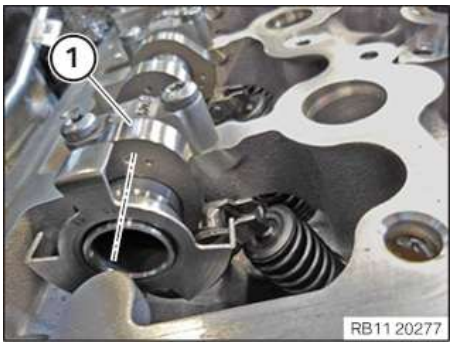
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

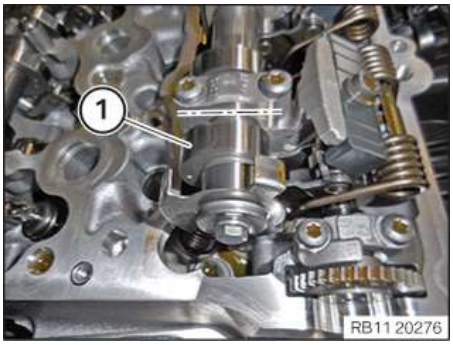


- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.

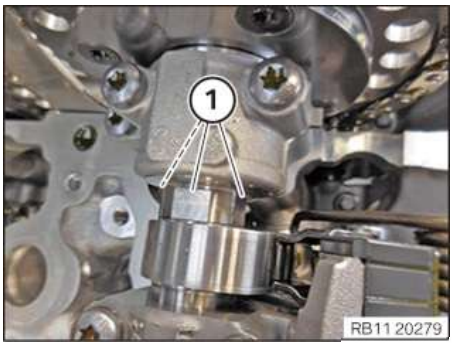


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

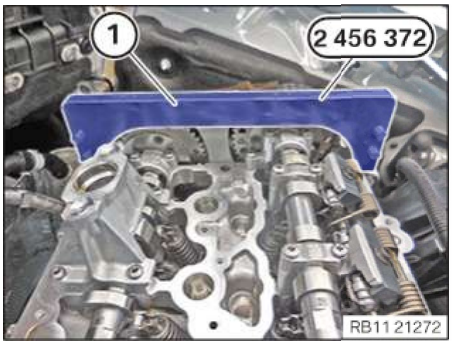
boardiagram.com



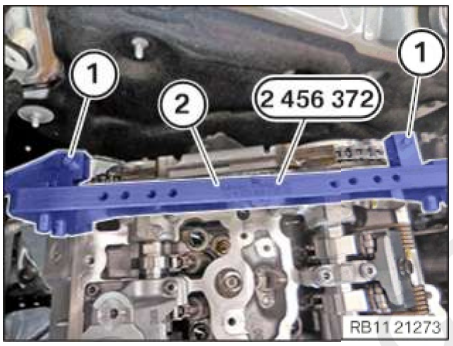
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



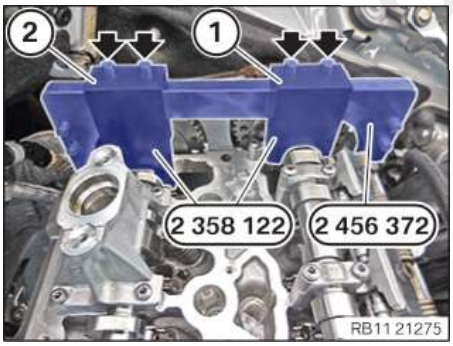
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

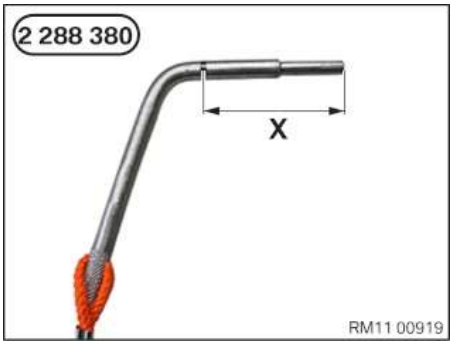
Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



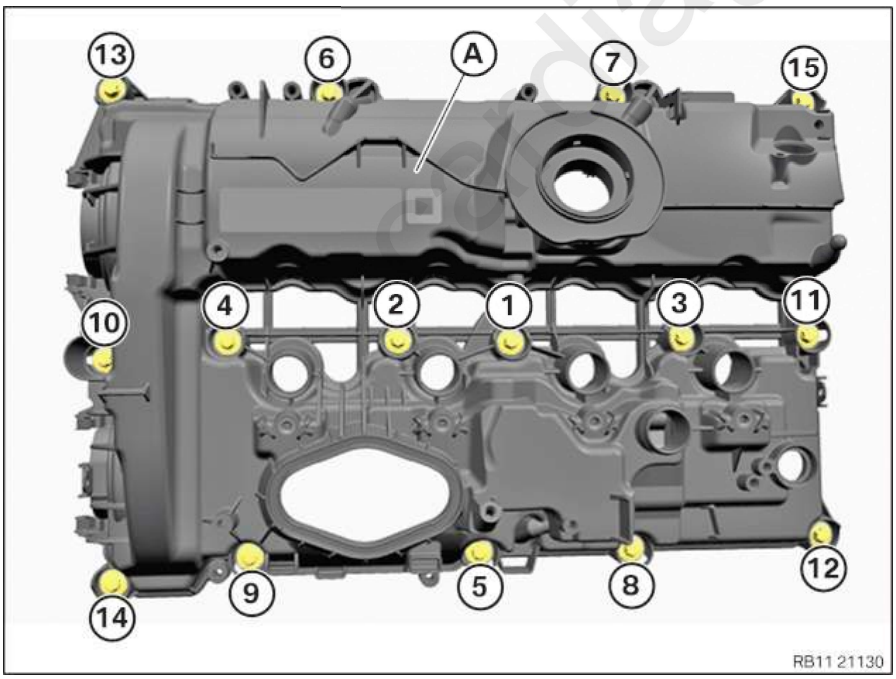
- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

48 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

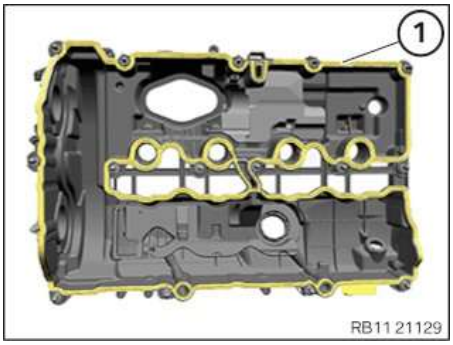
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RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

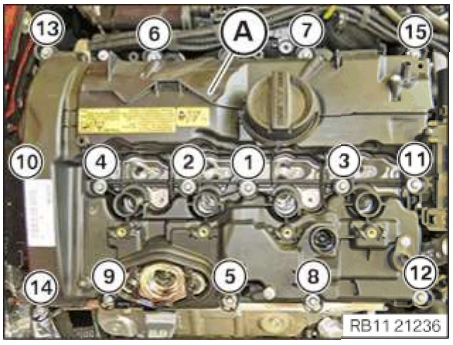
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal

- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

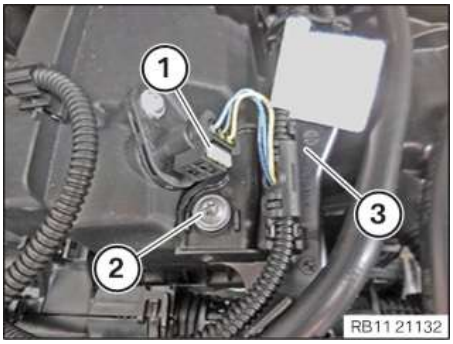
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

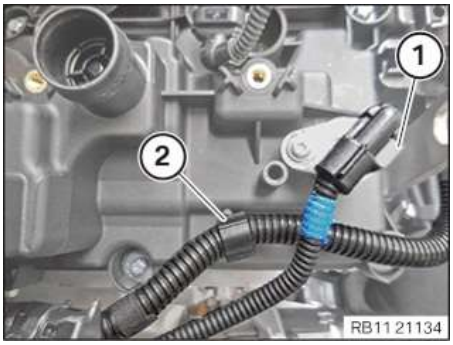


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

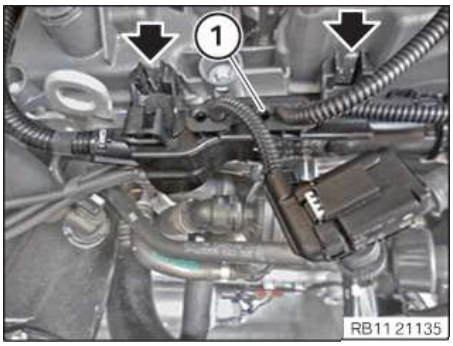
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

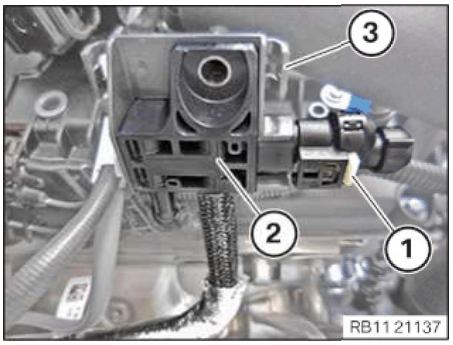
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



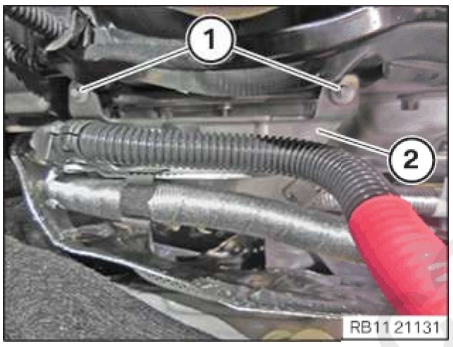
- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

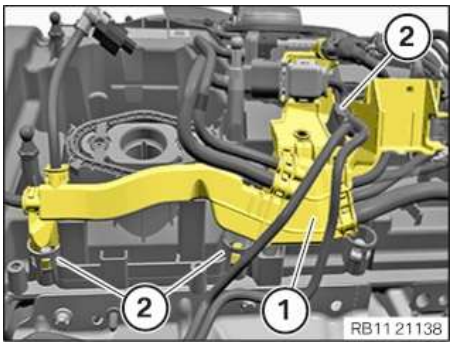
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

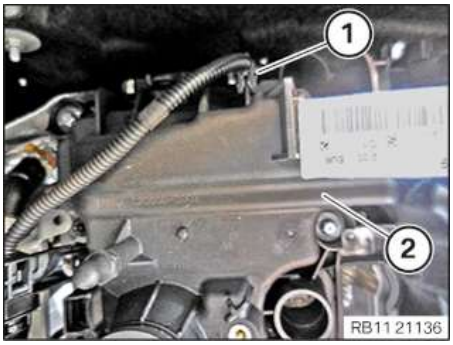
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

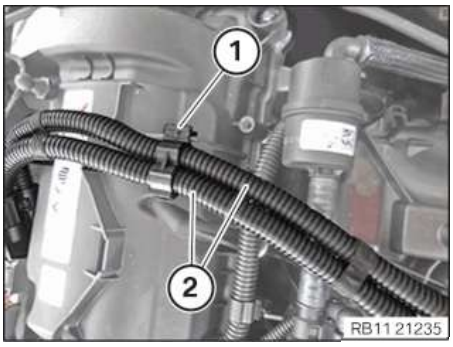


- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

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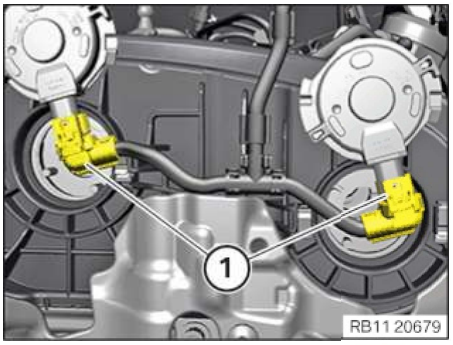


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

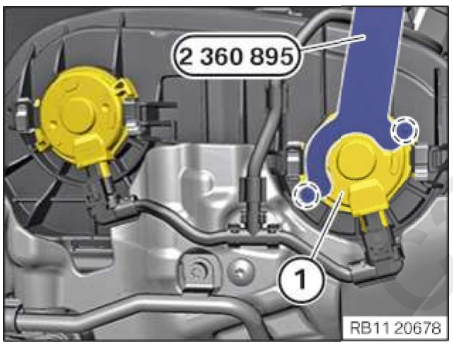
49 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

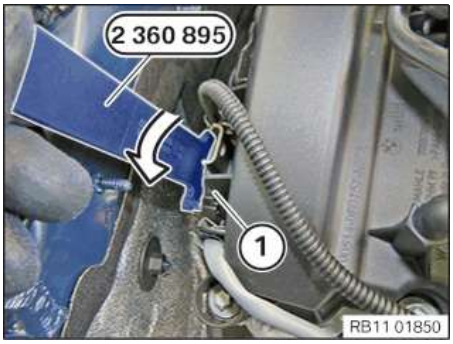
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



NOTICE

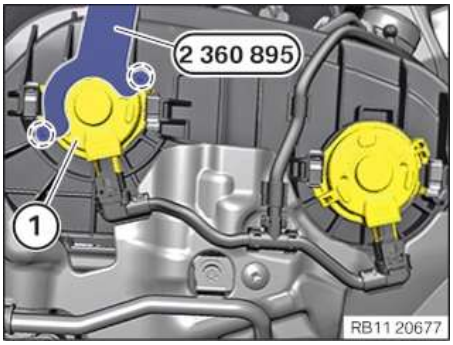
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

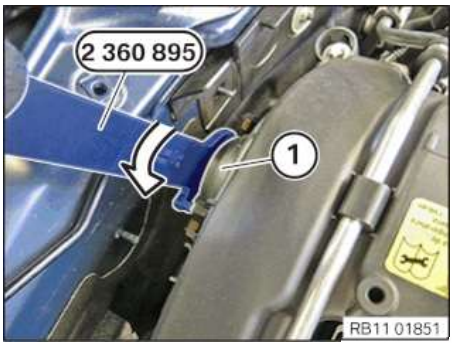
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NOTICE

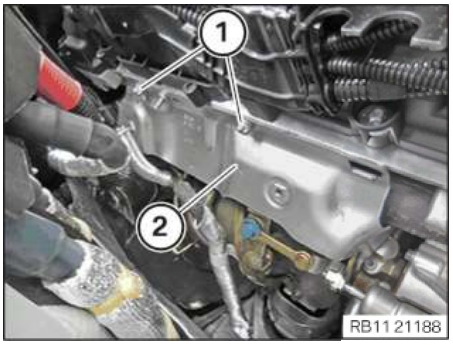
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

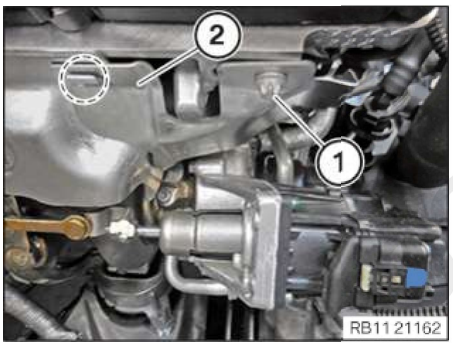
50 – Installing the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

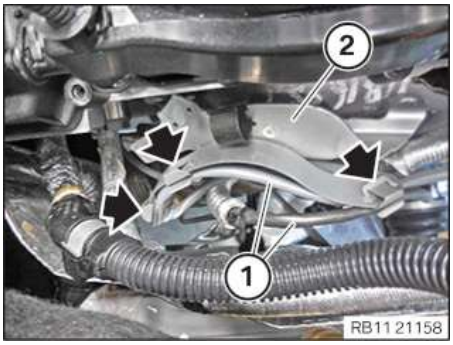


- Tighten down screw (1).

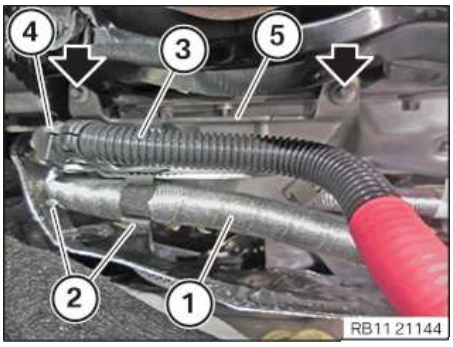
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

51 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

52 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

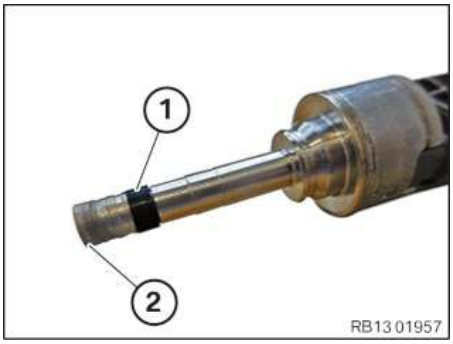
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

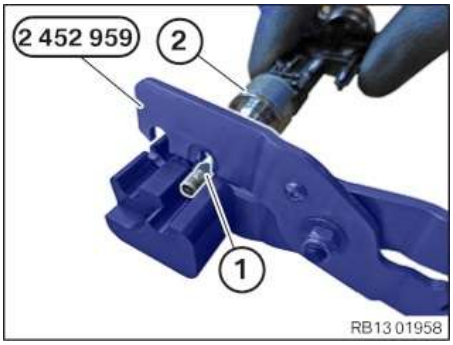
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).

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- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

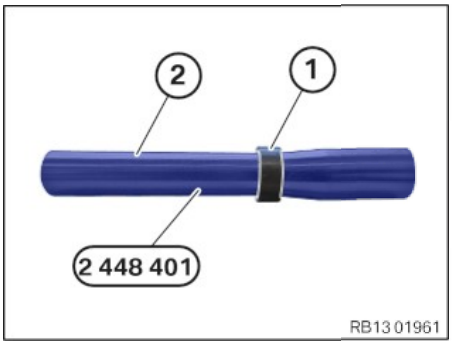


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

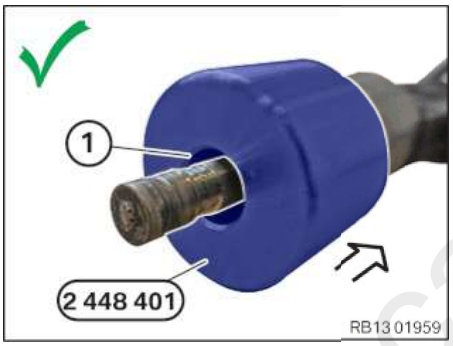
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve

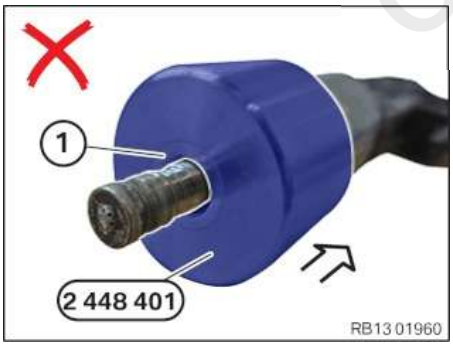


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



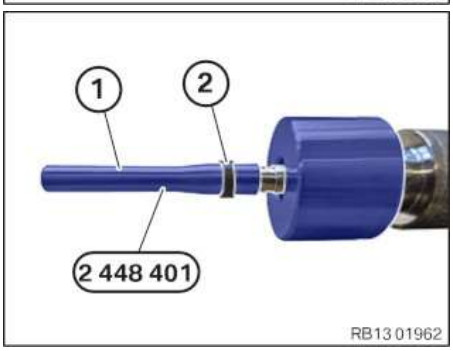
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.



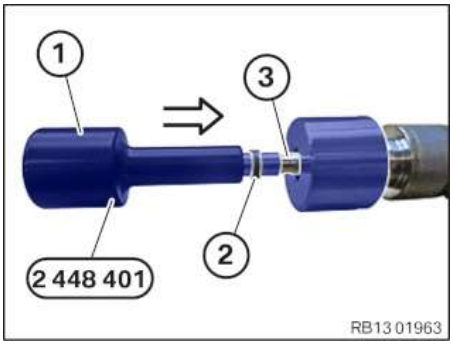
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.

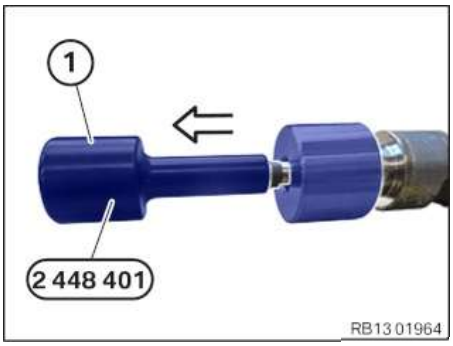


- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

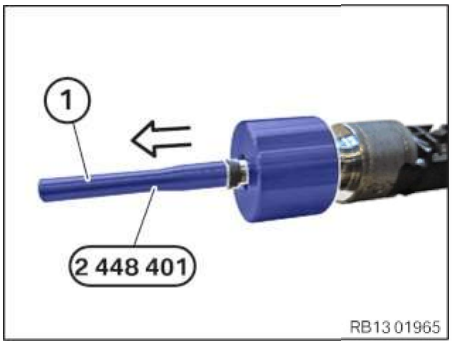
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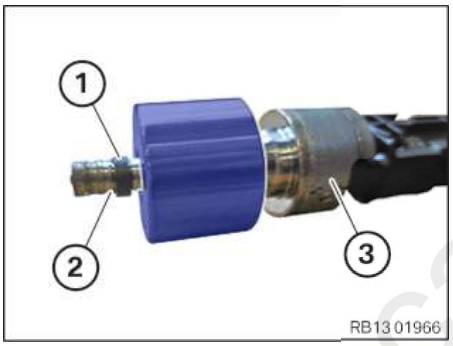
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



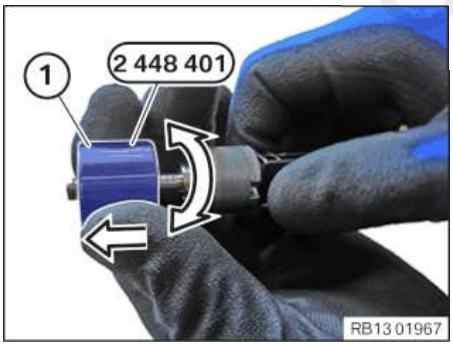
- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

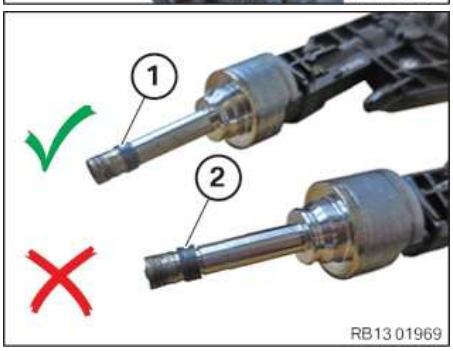


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).



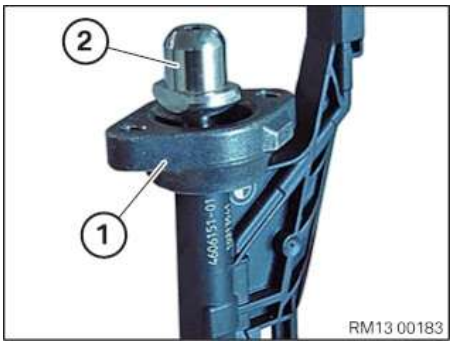
- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

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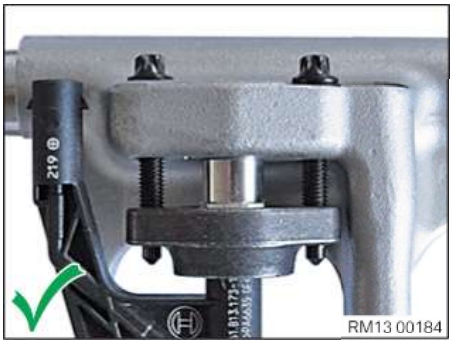
53 – Installing the rail with injectors

TECHNICAL INFORMATION

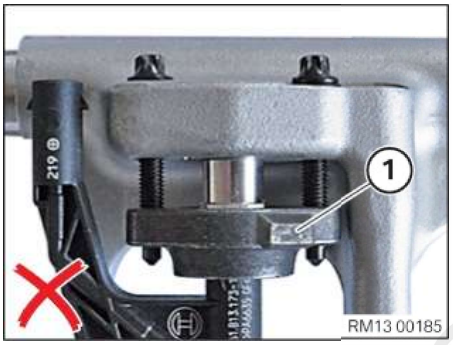
When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



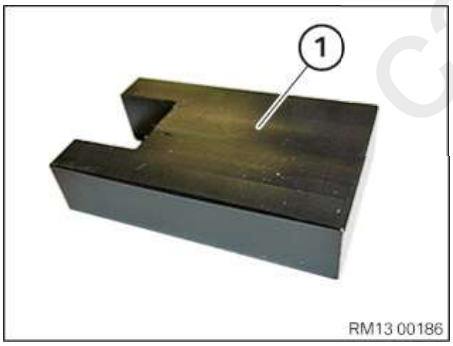
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:
  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:
  The holder is mounted **incorrectly** when the cast lug (1) is in front.



RISK OF DAMAGE

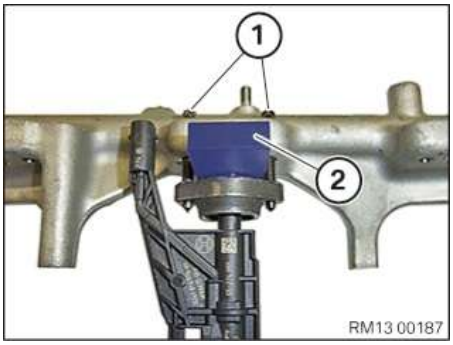
Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).

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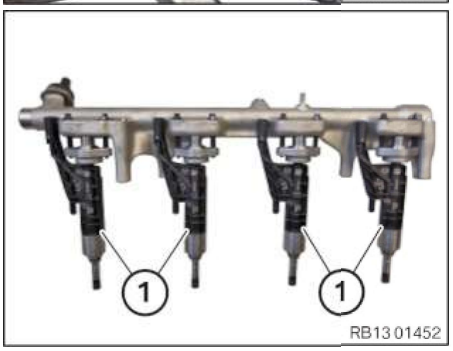
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



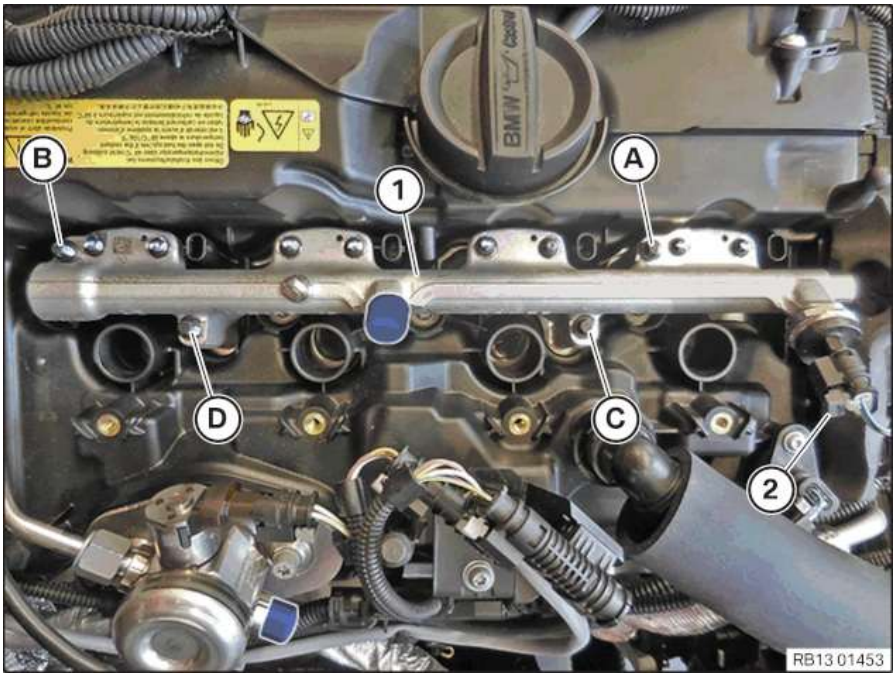
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

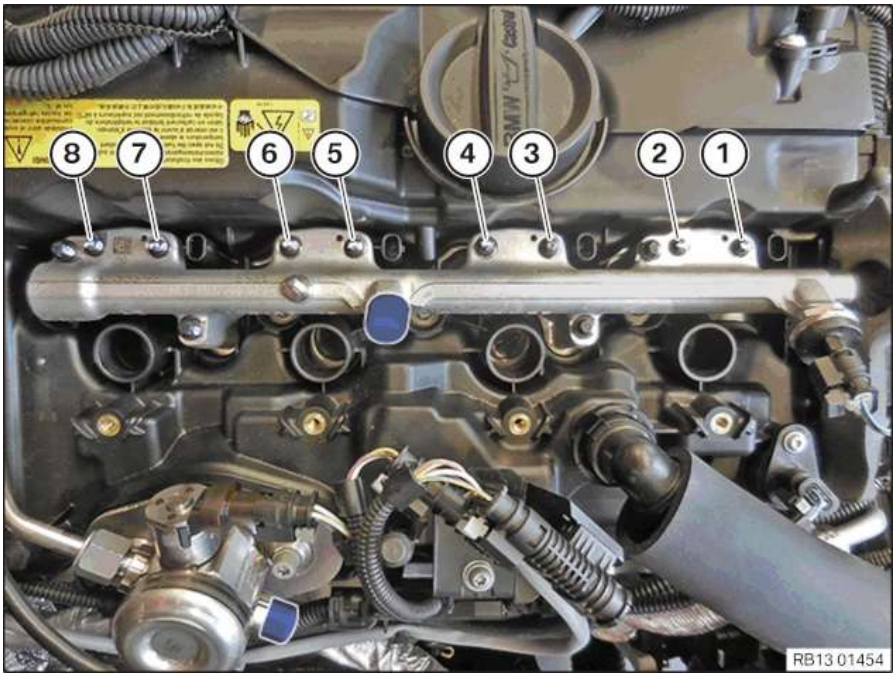
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

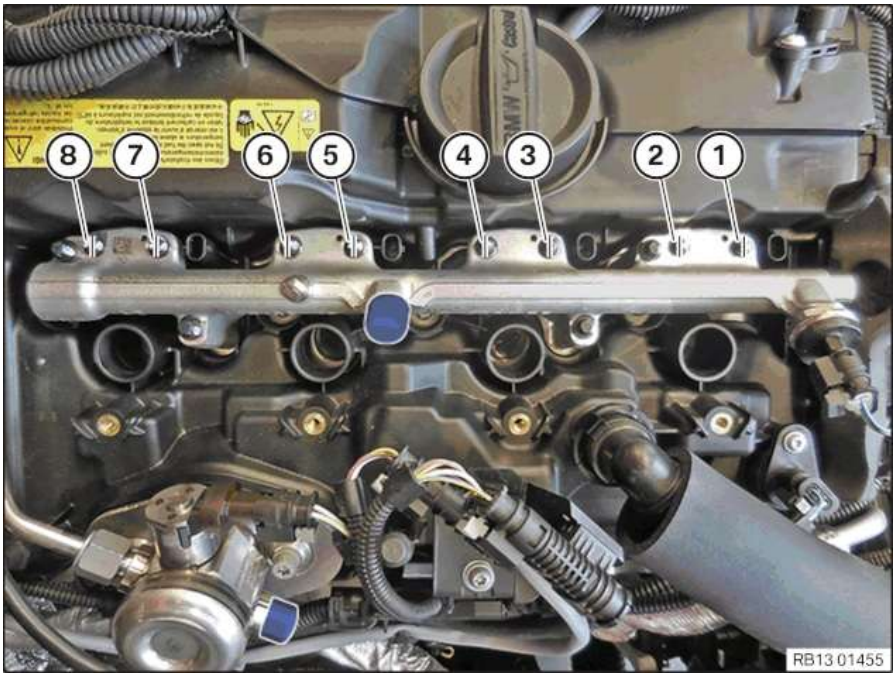
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

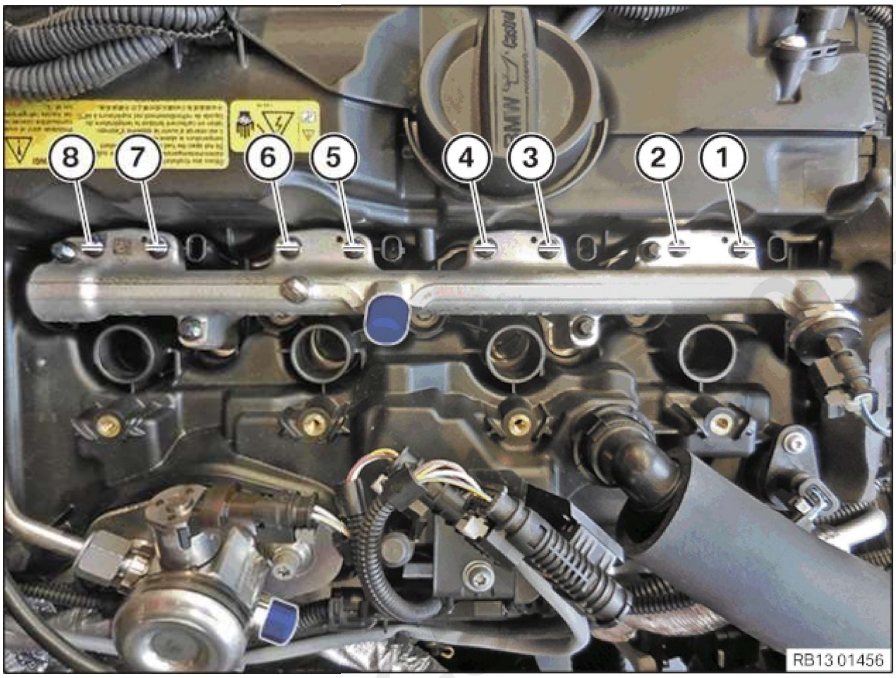
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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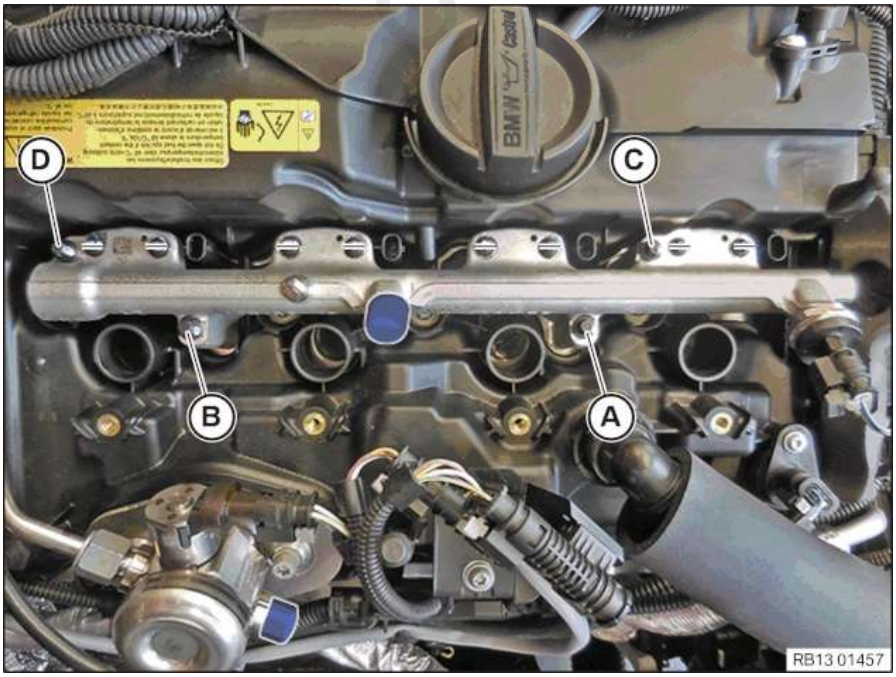


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

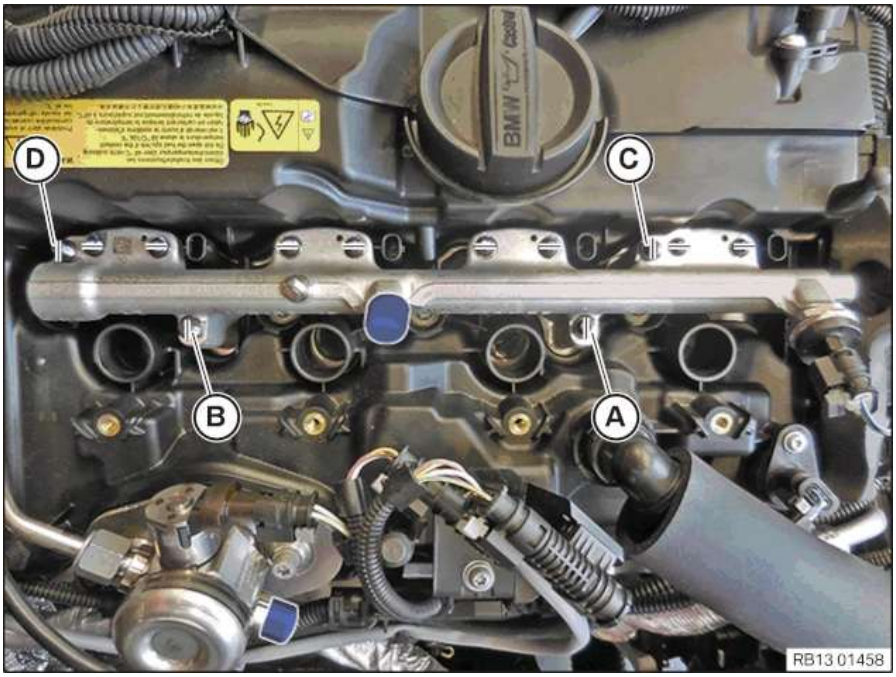
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

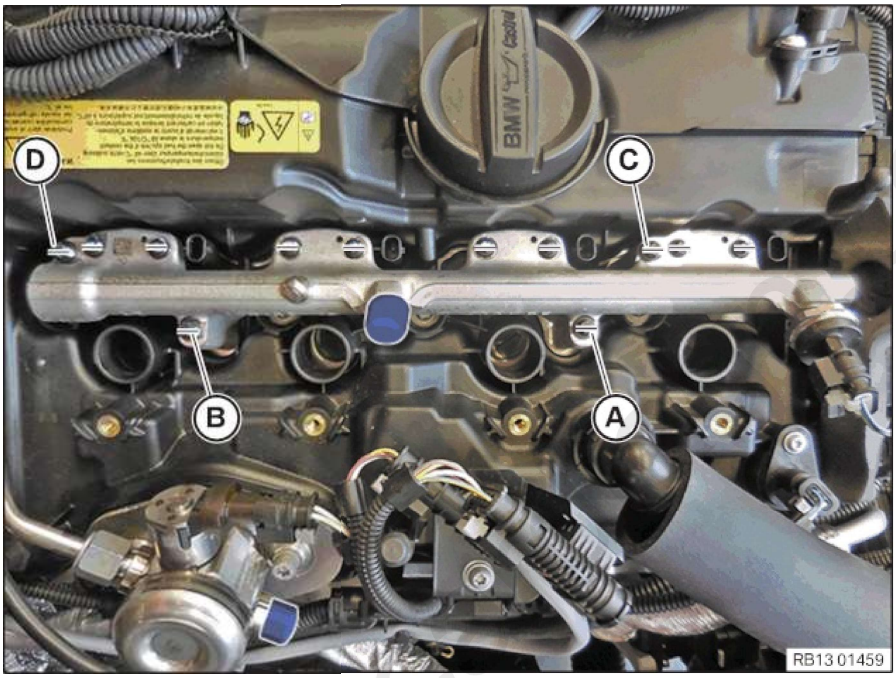
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

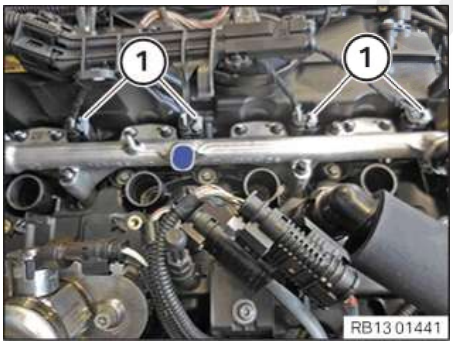


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



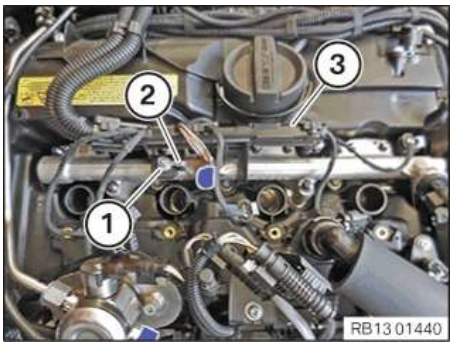
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

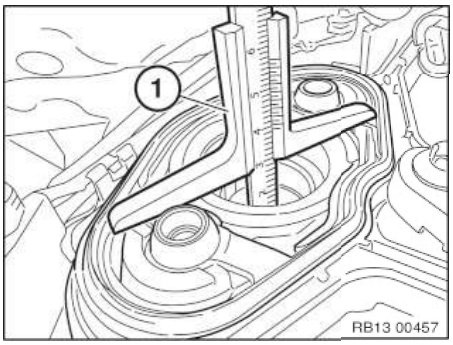
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

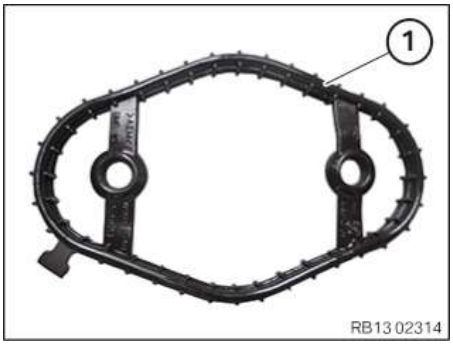
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

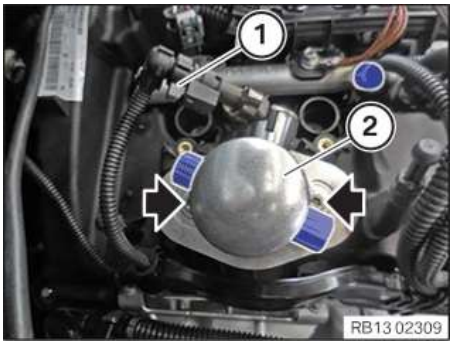
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

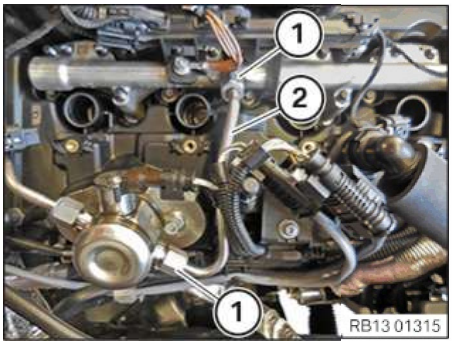
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

55 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

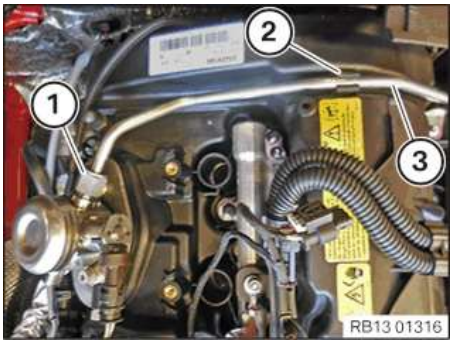
56 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

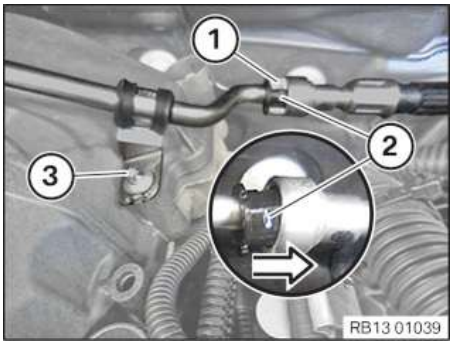


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

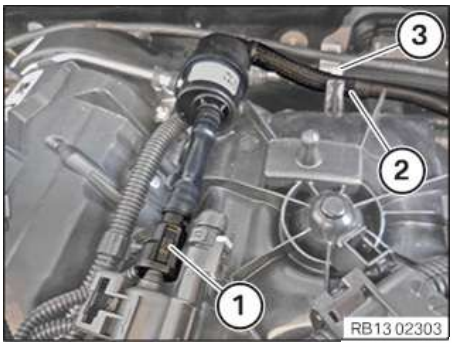
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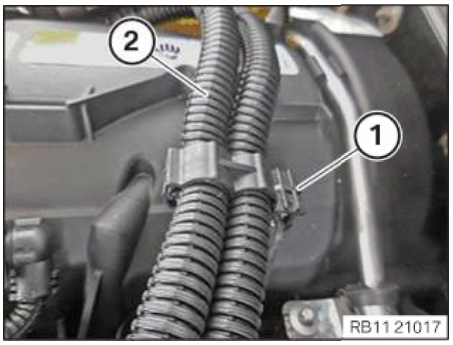
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

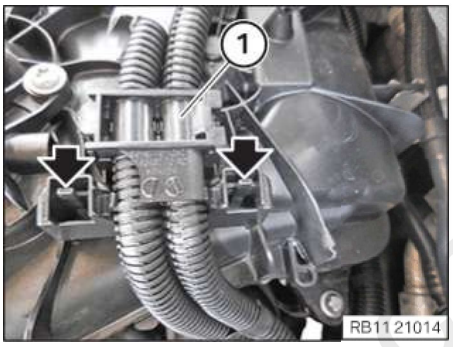
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

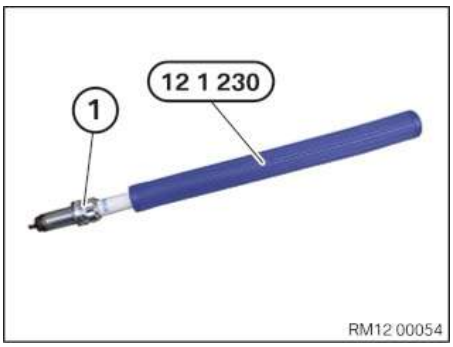


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

57 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

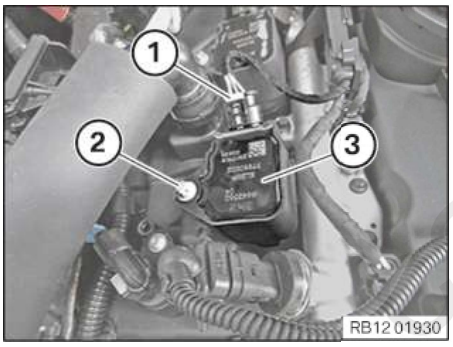
Spark plugs

M12x1.25		Tightening torque	23 Nm

58 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.



▸ **Install ignition coil.**

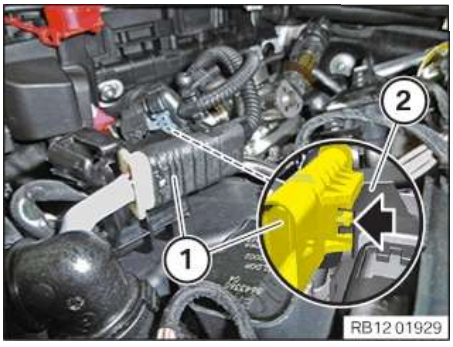
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

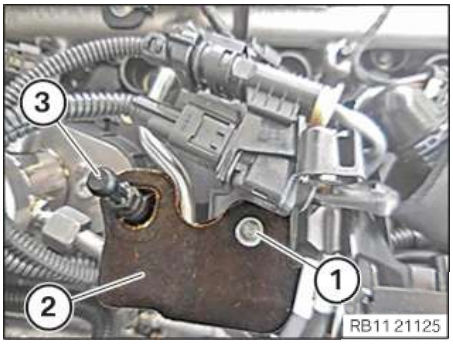
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

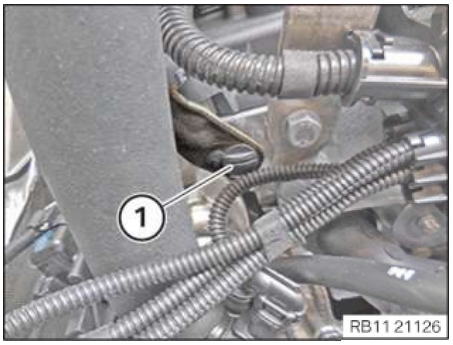
59 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

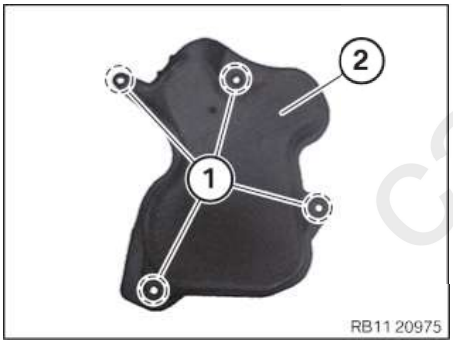
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



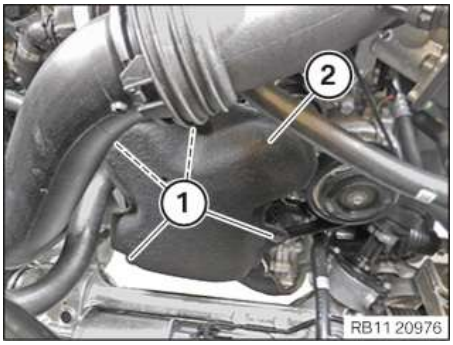
- Secure the clip (1).

60 – Install the acoustic cover for the engine at the front



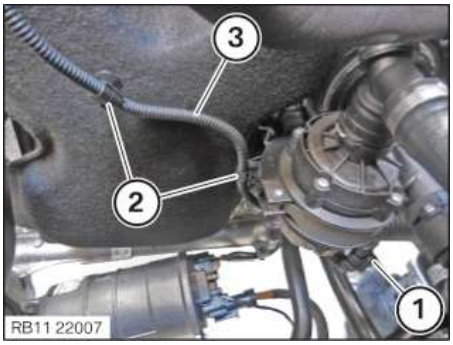
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



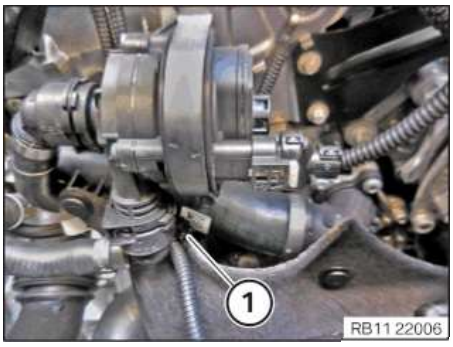
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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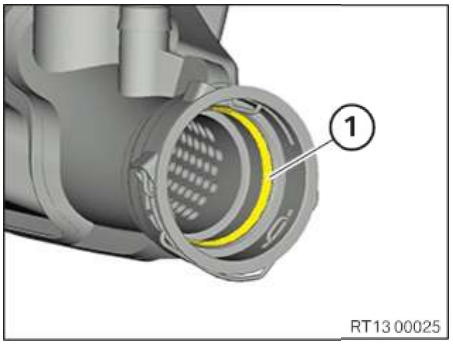
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

61 – Installing the clean air pipe with resonator

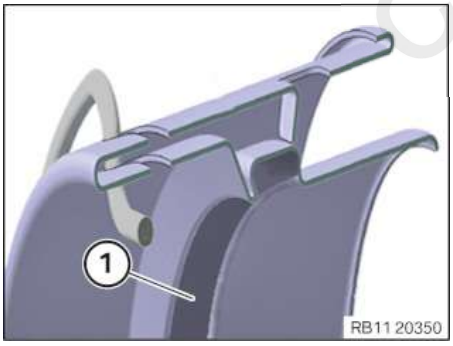


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

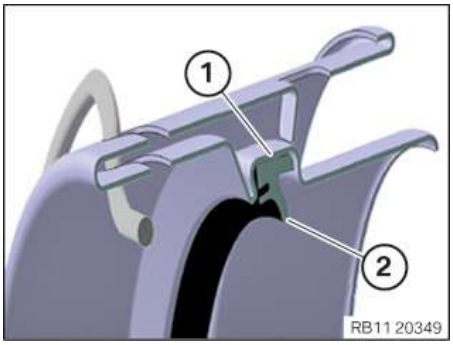
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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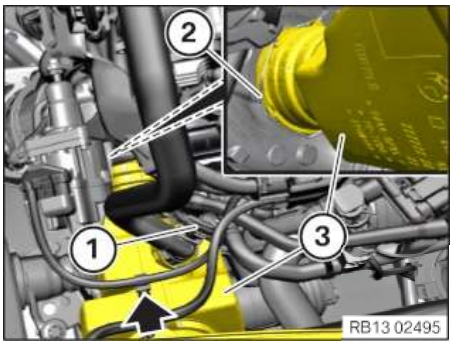
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

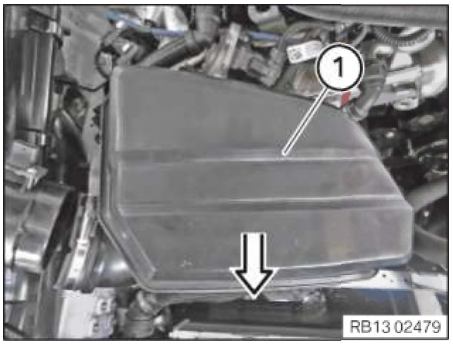
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



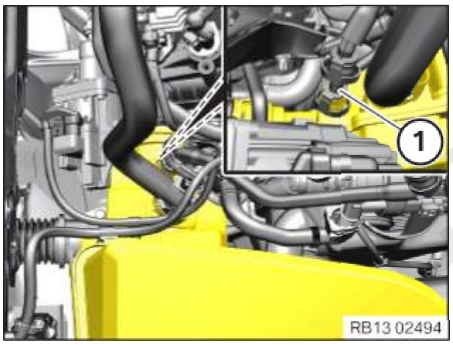
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

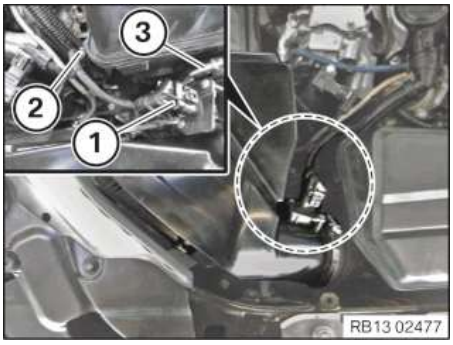
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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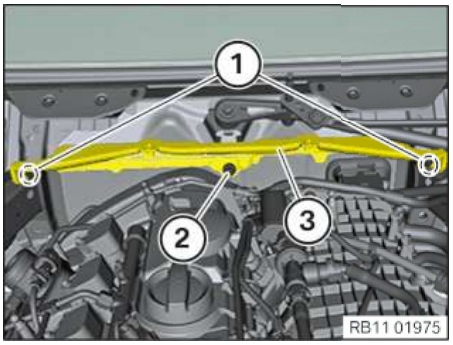
- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

62 – Disconnecting all battery earth leads



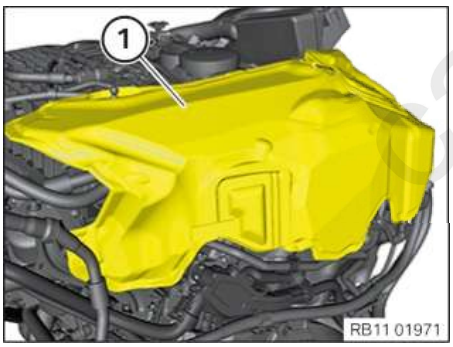
- See additional information.

63 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

64 – Installing acoustic cover at rear



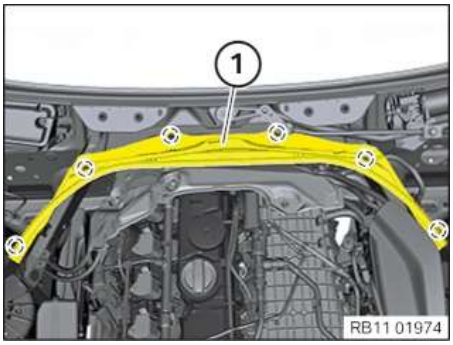
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

65 – Installing the centre bulkhead upper part

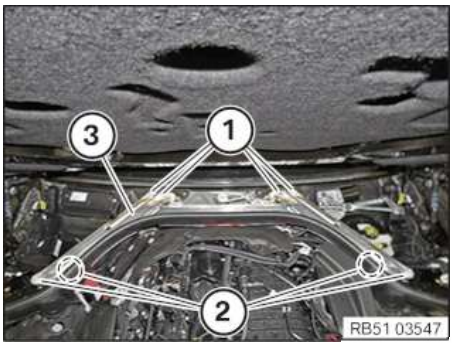
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- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

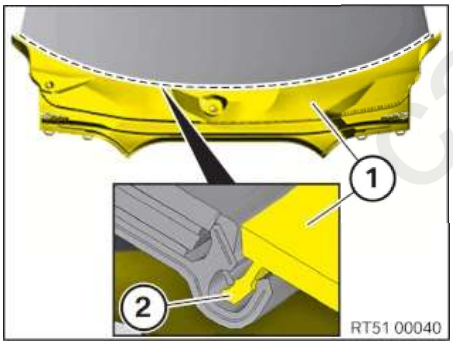
66 – Installing cowl panel cover

RISK OF DAMAGE

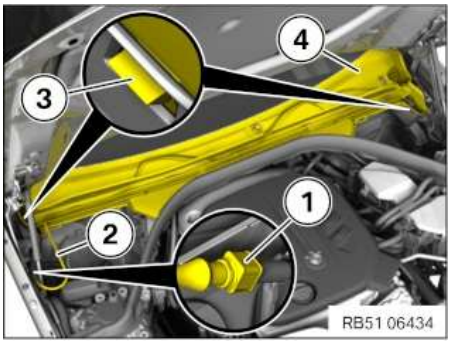
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

67 – Installing both wiper arms

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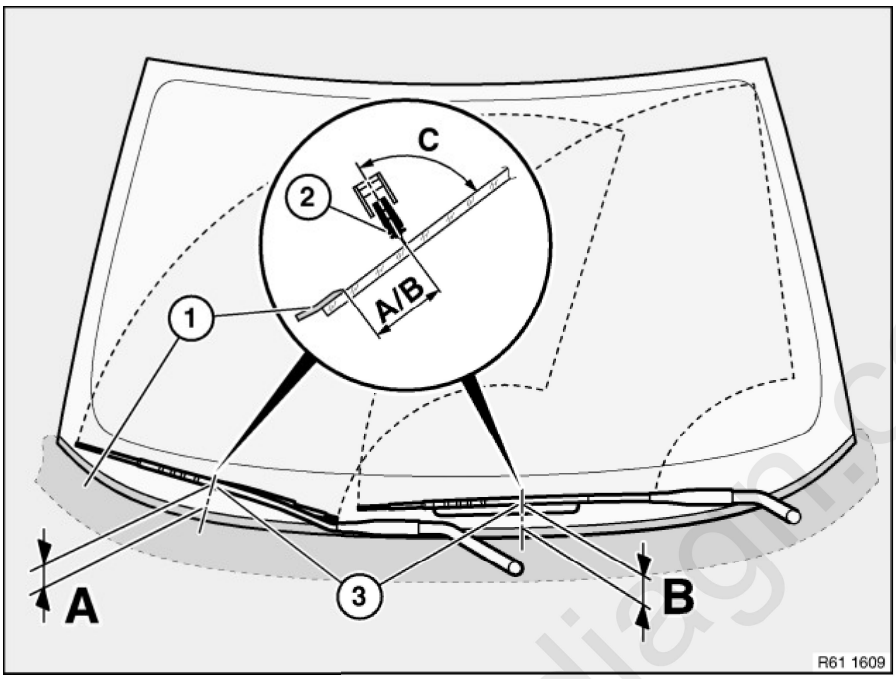
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

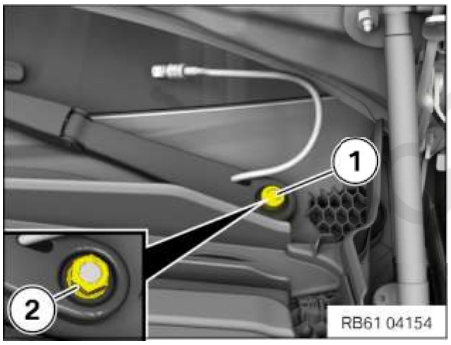
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

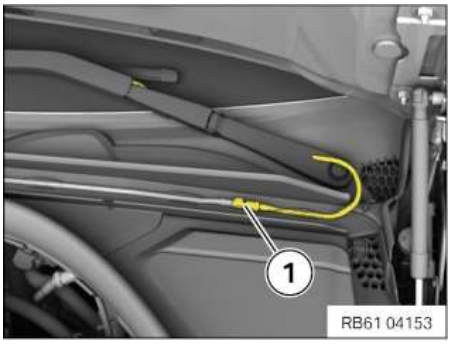


- Tighten nut (2).

Windscreen wiper arm

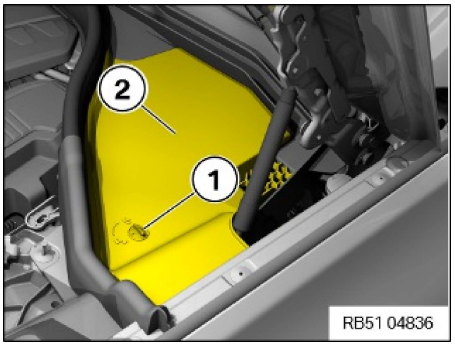
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



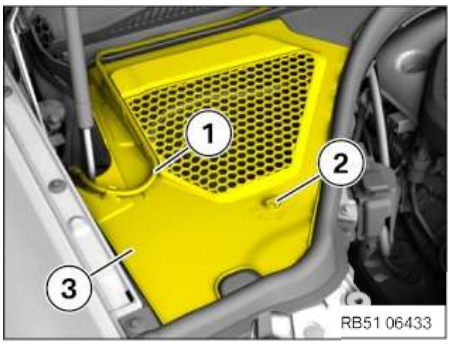
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

68 – Install the cover of the engine compartment on the rear left



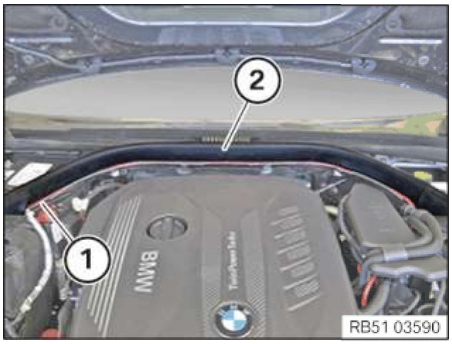
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

69 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

70 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

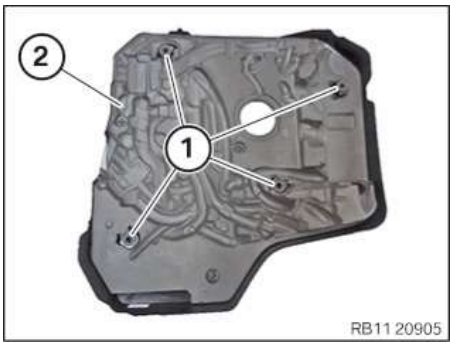
71 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

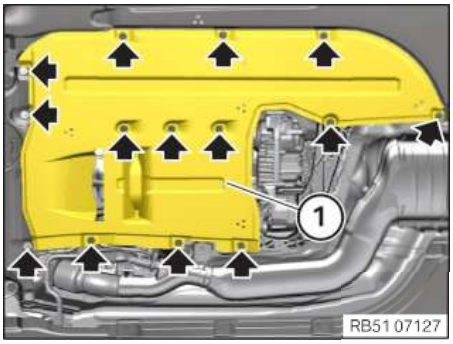
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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

72 – Installing underbody protection at rear



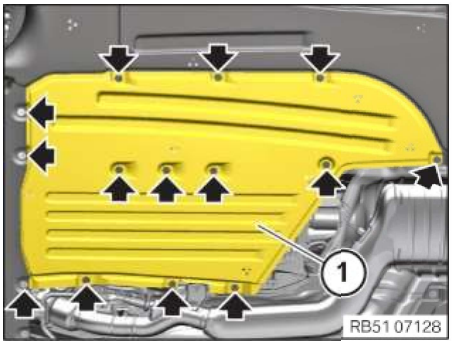
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

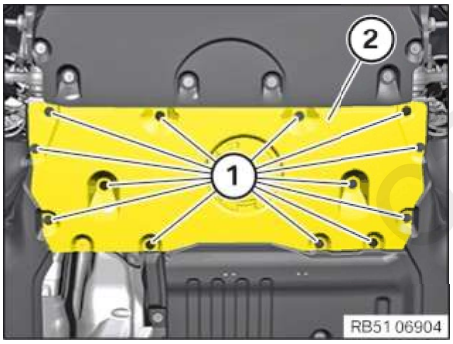
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

73 – Installing the centre underbody protection



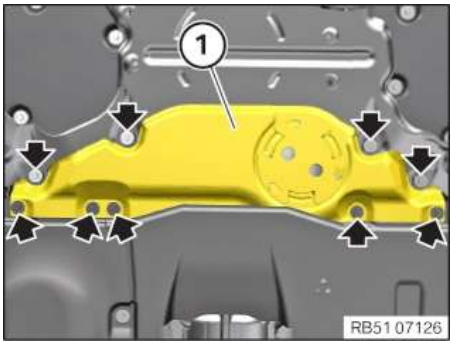
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

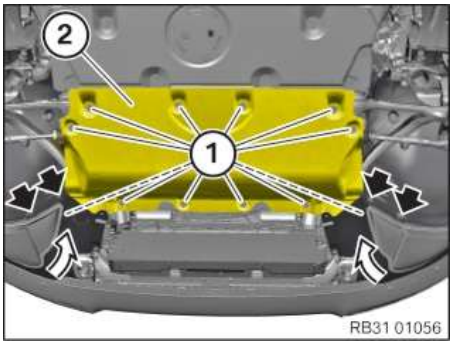
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

74 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

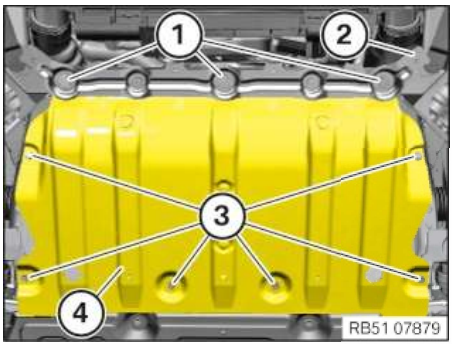
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

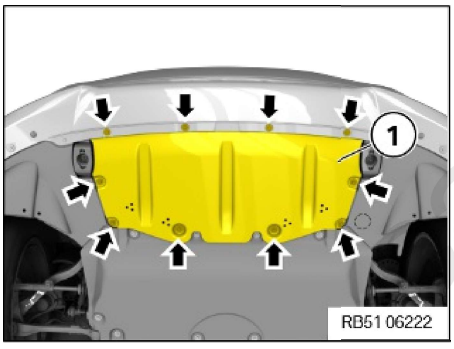
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

75 – Installing the front underbody protection



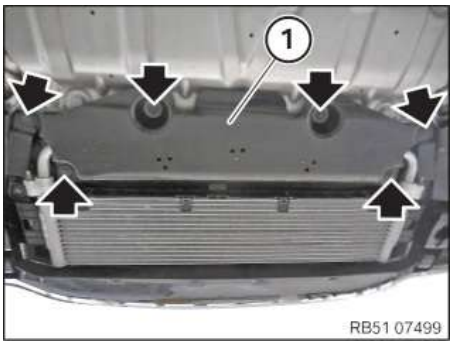
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 2:**

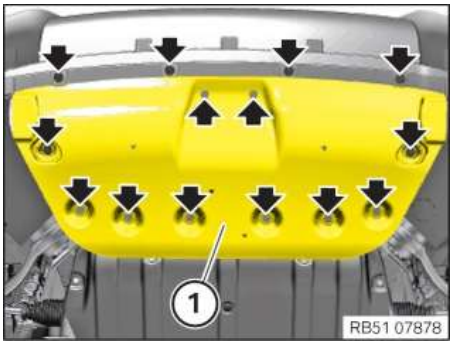
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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- **Version 3:**

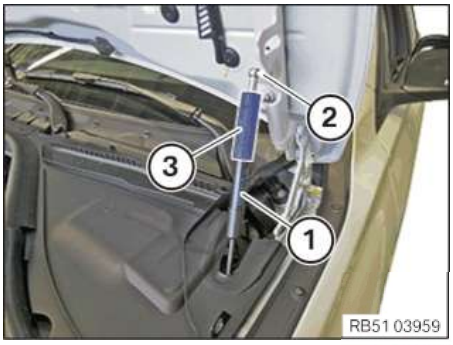
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

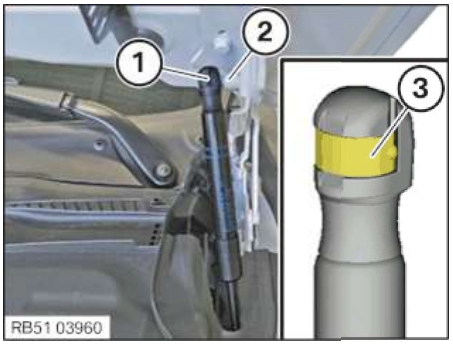
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

76 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head — Used in step 293747

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 293747

M6		Tightening torque	8 Nm

Exhaust camshaft to cylinder head — Used in step 36

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

VANOS central valve to camshaft — Used in step 4344

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

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Chain tensioner to cylinder head — Used in step 46

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Cylinder head cover to cylinder head — Used in step 48

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 48

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 4851

6X18		Tightening torque	6 Nm

Heat shield to cylinder head — Used in step 50

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 50

M6 x 12		Tightening torque	8 Nm

Ground cable to rail — Used in step 53

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 54

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 55

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 56

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 56

M6 screw		Tightening torque	6,5 Nm

Spark plugs — Used in step 57

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 58

Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover — Used in step 59

TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 61

Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead — Used in step 65

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 65

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 65

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

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Windscreen wiper arm			Used in step 67
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection			Used in step 7273
Hexagon screw		Tightening torque	3 Nm

Underbody protection of the steering gear			Used in step 74
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 74
Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support			Used in step 74
M10		Tightening torque	56 Nm

Underbody protection front			Used in step 75
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

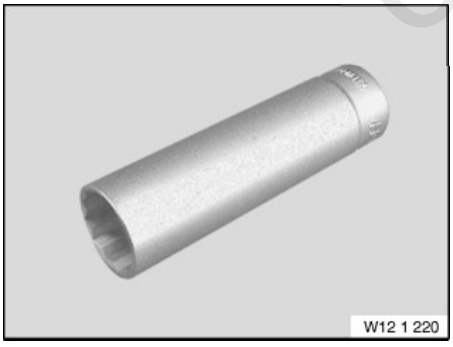
Overview of Special Tools

2 360 895 Pin wrench



Common		Used in step 1249
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).	
Included in the tool or work		
Storage location	A56	
Replaced by		
In connection with		
SI-Number	01 13 14 (098)	

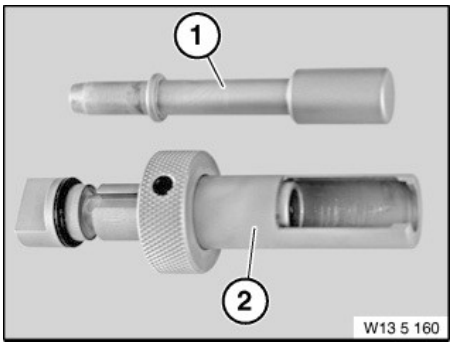
0 495 560 (12 1 220) Socket



Common		Used in step 1657
Usage	For removing and installing the spark plugs (WAF 14 bihexal).	
Included in the tool or work		
Storage location	C18	
Replaced by		
In connection with		
SI-Number	01 20 06 (299)	

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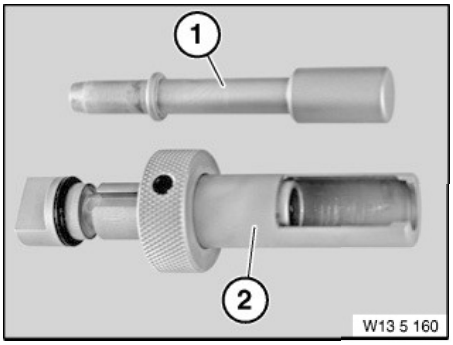
0 496 567 (13 5 161) Fastener



Common Used in step 19

Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

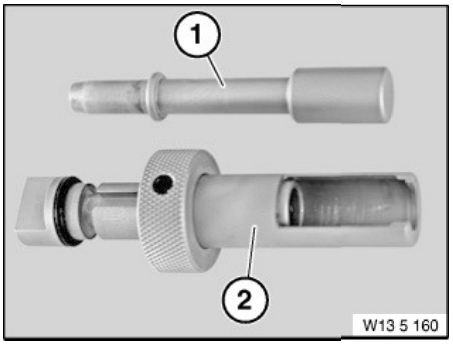
0 496 568 (13 5 162) Fastener



Common Used in step 19

Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener



Common Used in step 19

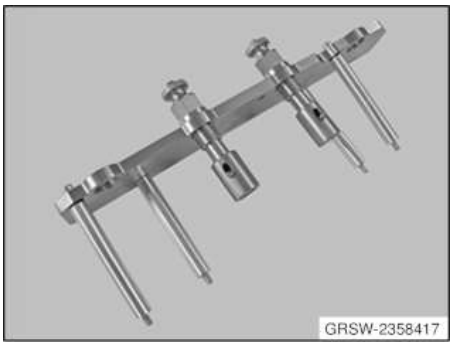
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

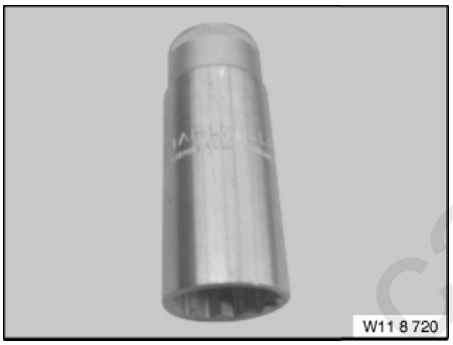
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2 358 417 Device



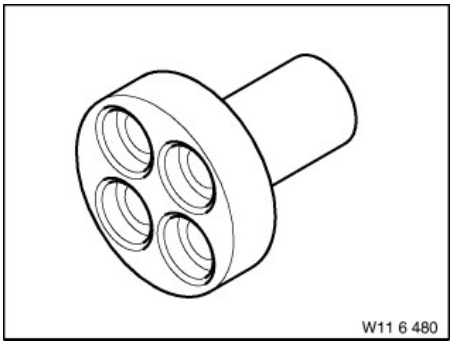
Common	Used in step 20
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 20
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 493 380 (11 6 480) Connector



Common	Used in step 29454754
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

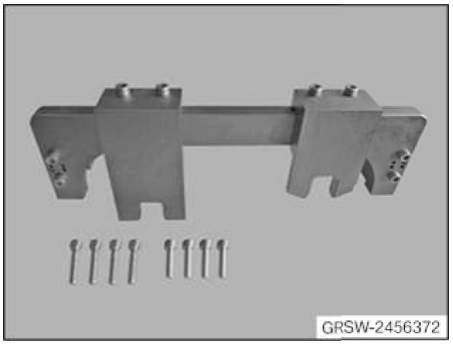
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2 288 380 Locating stud



Common	Used in step 294547
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 2934374547
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 293447
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



Common	Used in step 31404344
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

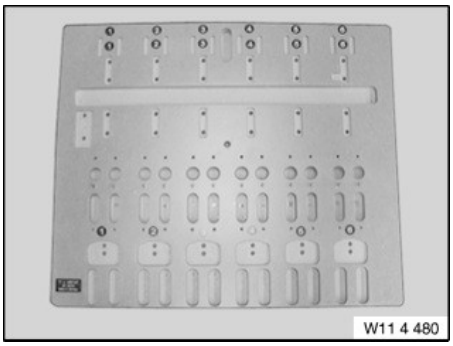
2 450 487 Socket



Common	Used in step 31404344
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

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0 495 105 (11 4 480) oddments tray



Common Used in step 35

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

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2 455 654 Tensioning tool



Common	Used in step 4245
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 52
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 52
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

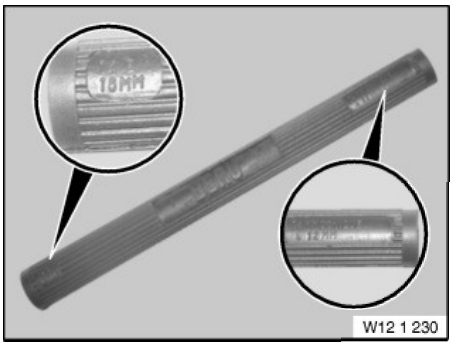
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2 358 022 Gauge



Common	Used in step 53
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



Common	Used in step 57
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 67
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	162
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	162
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
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61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162

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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 20 900 Disconnecting and connecting battery earth lead	162
61 35 ... Notes on ESD protection (Electro Static Discharge)	12
61 35 ... Notes on ESD protection (Electro Static Discharge)	121520
13 53 ... Clean the cylinder head around the injectors due to grit / dust	20
61 13 ... Unlocking and disconnecting different plug connections	202448

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11 31 025 Removing and installing/replacing intake camshaft

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

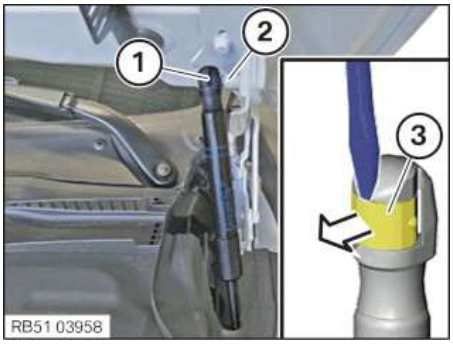
Engine compartment lid is open.

CAUTION

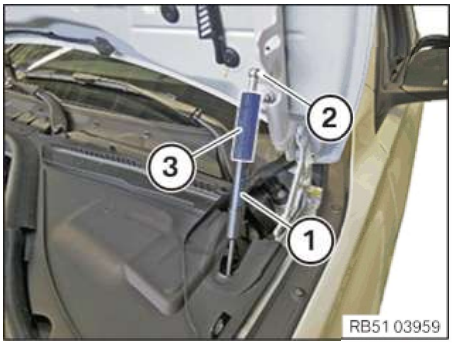
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

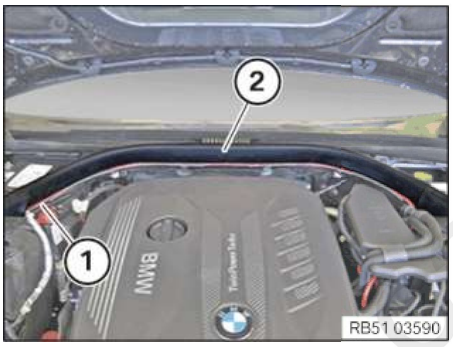


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

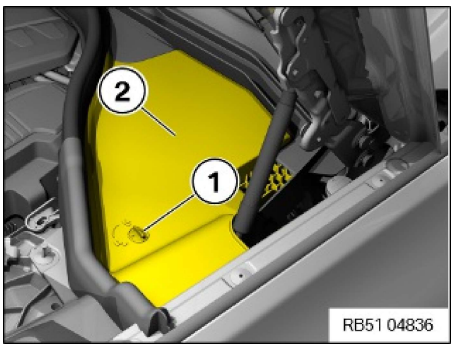
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

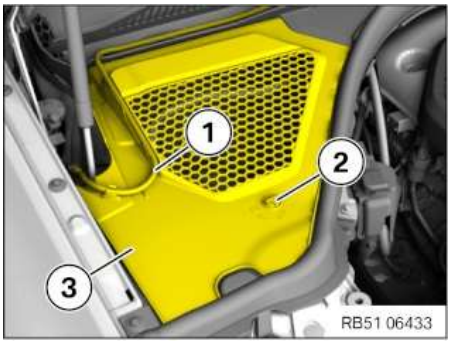
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

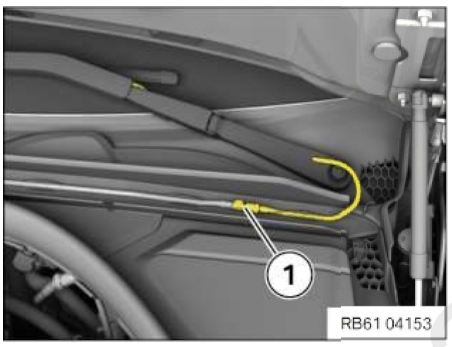
▶ **Remove the wiper arm**

RISK OF DAMAGE

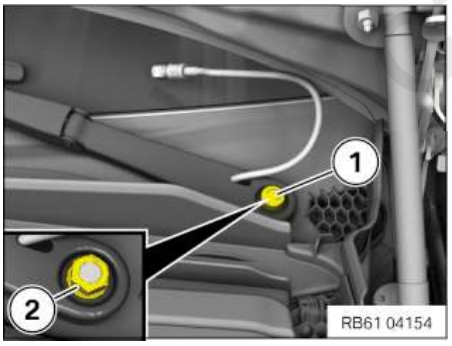
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

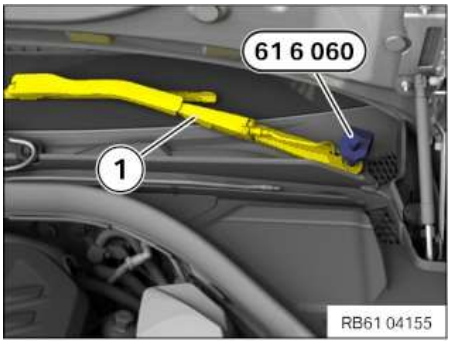
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



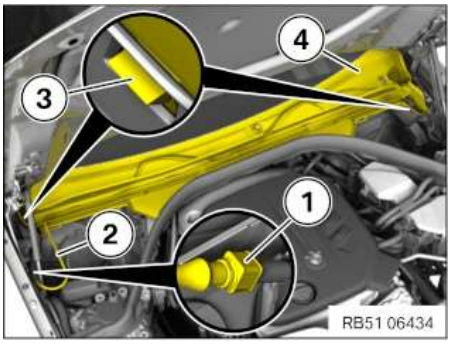
- Remove the protective cap (1).
- Loosen nut (2).



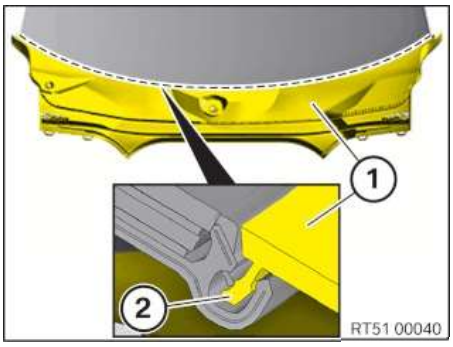
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

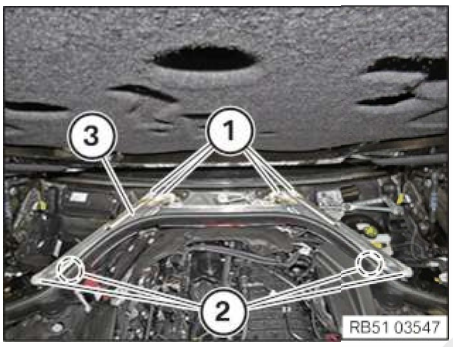


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

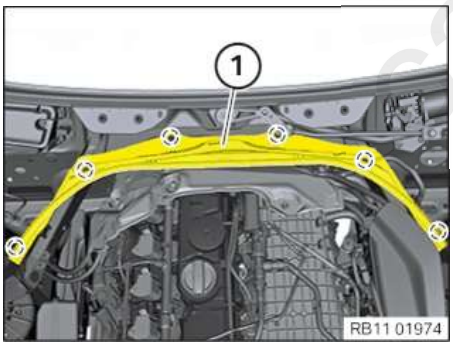
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

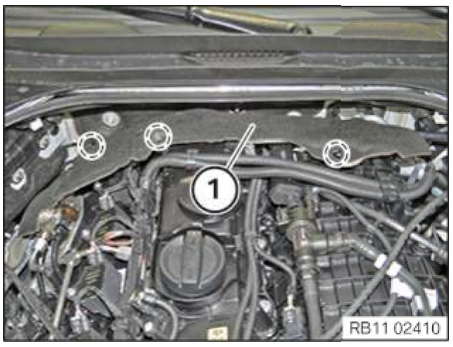
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



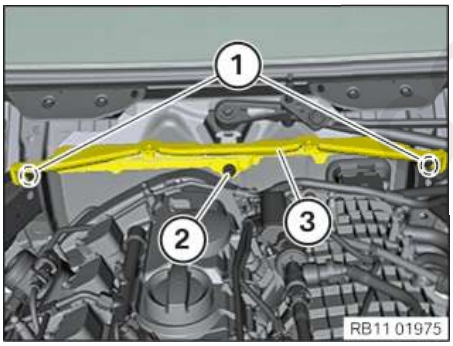
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

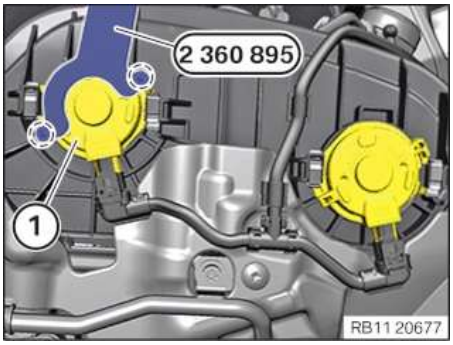
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

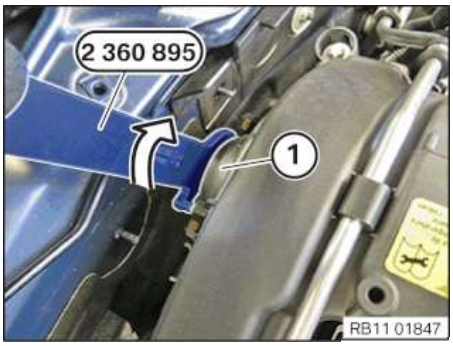
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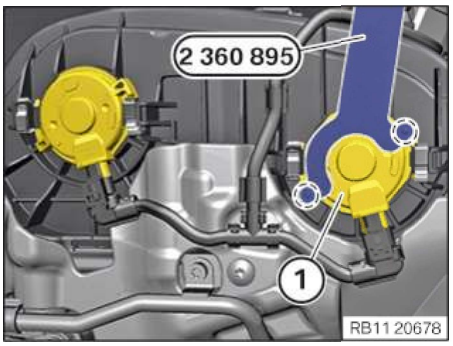
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



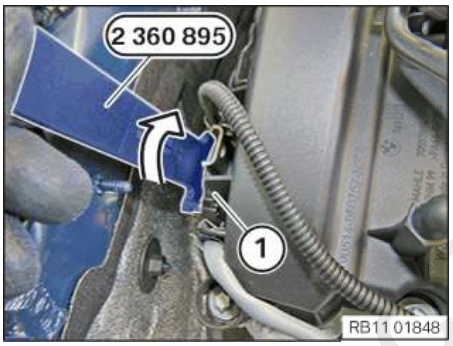
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



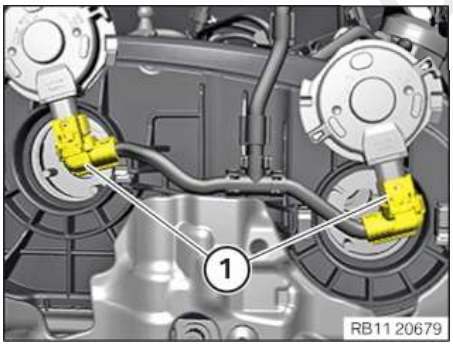
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

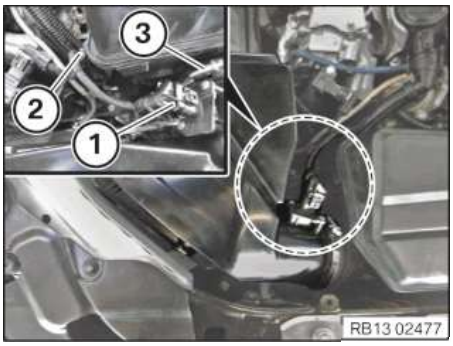
Risk of burning!

- Perform all work only on components that have cooled down.

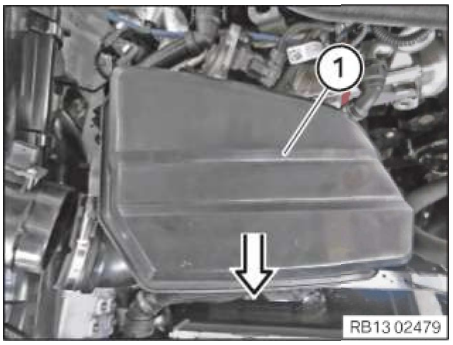
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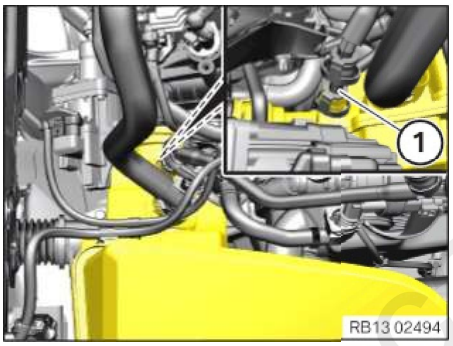
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



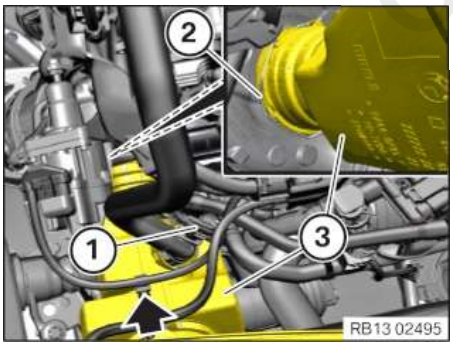
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



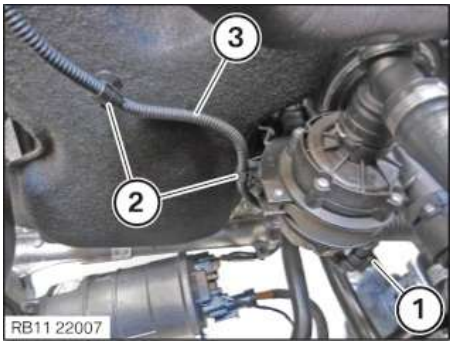
- Unlock and disconnect the tank ventilation line (1).



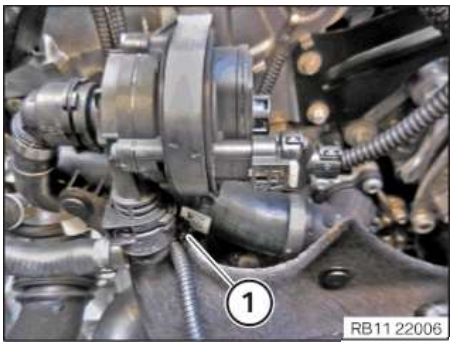
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

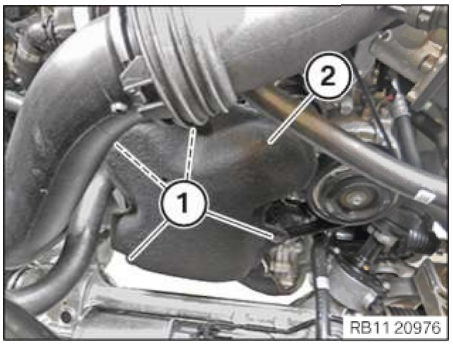
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

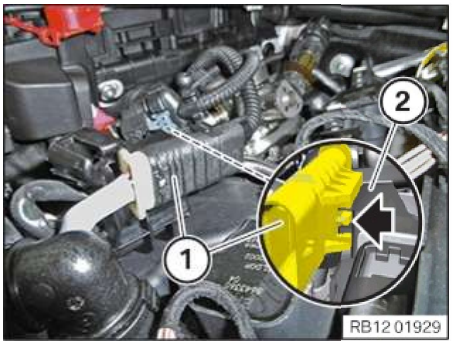
Electrostatic discharge.

Damage to or destruction of electrical components.

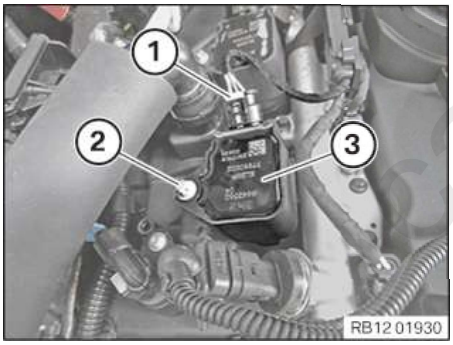
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

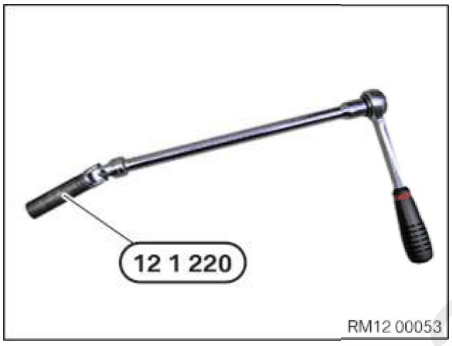
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

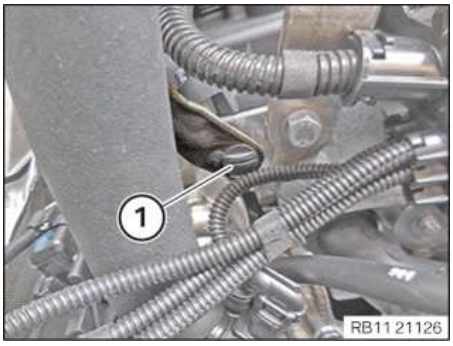
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

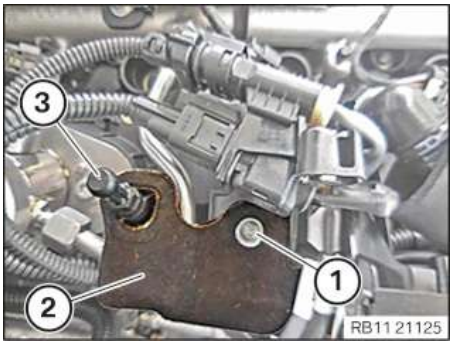


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

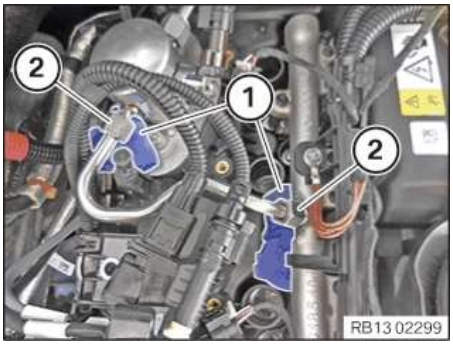
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

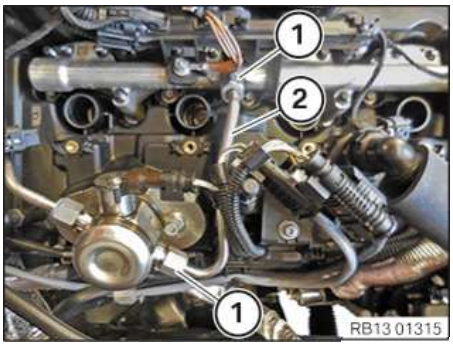


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

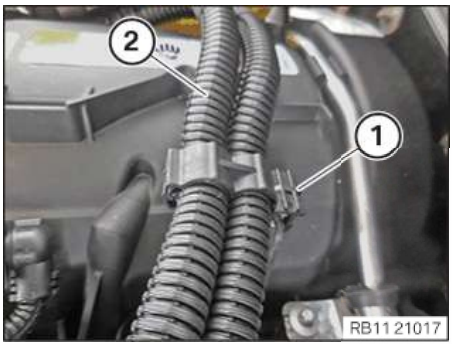
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

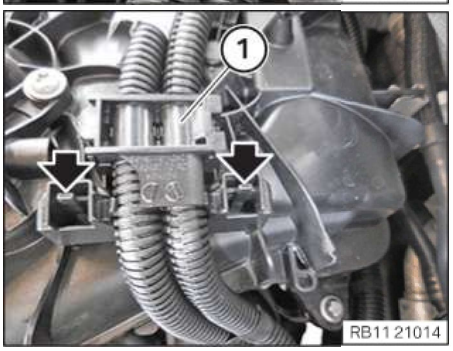
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

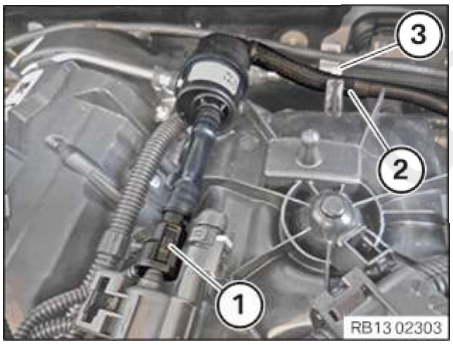
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



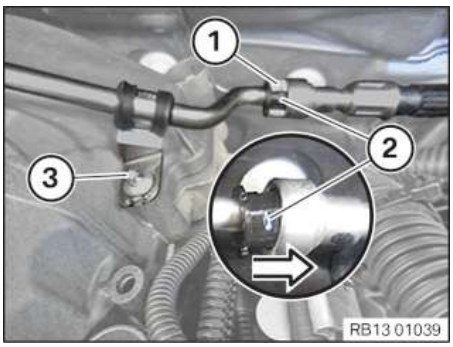
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

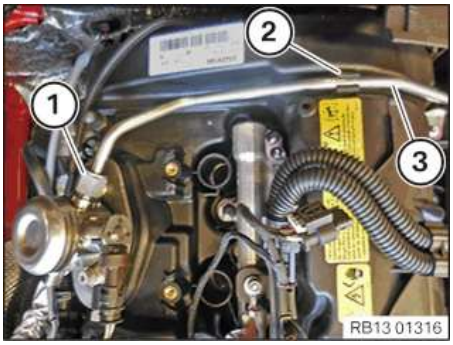


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

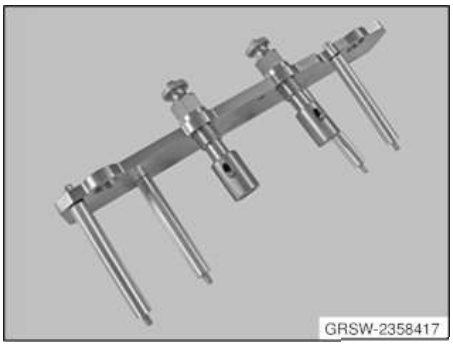
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



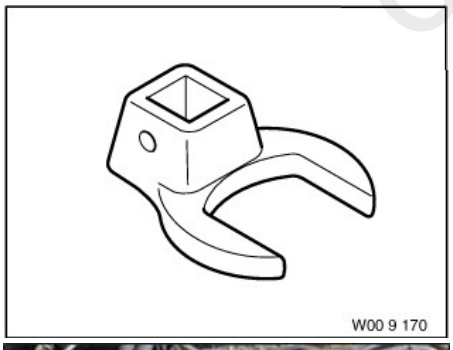
- Prepare special tool 2 358 417.



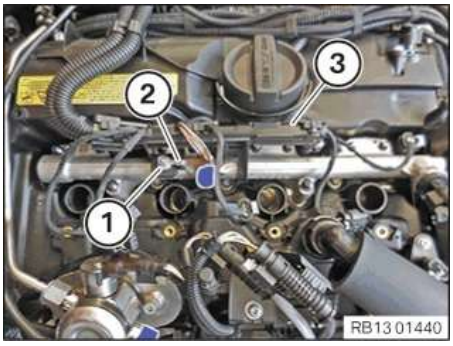
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

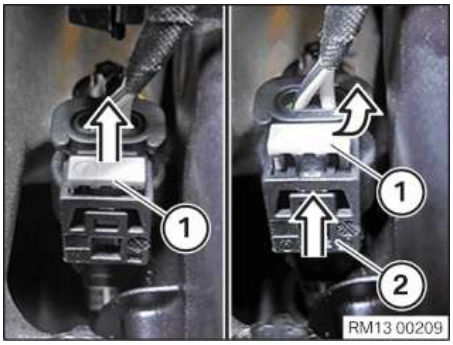


- Prepare special tool .

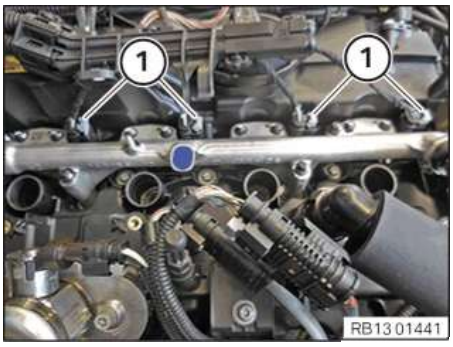


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



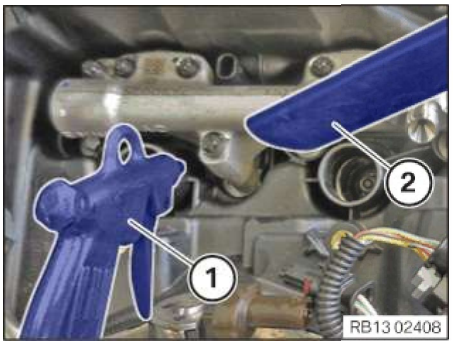
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

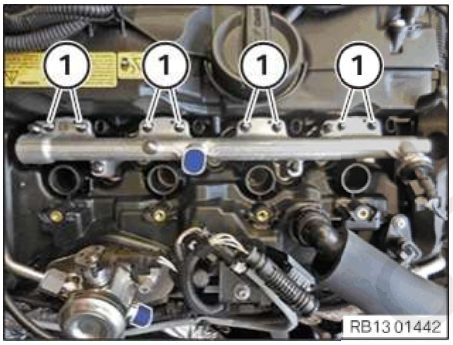


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

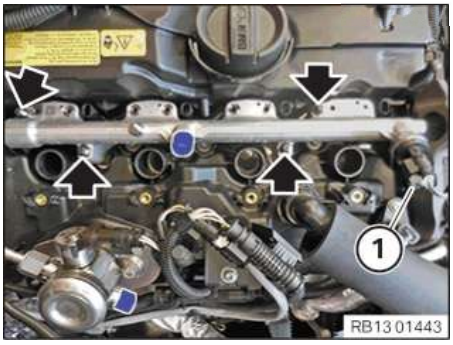
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



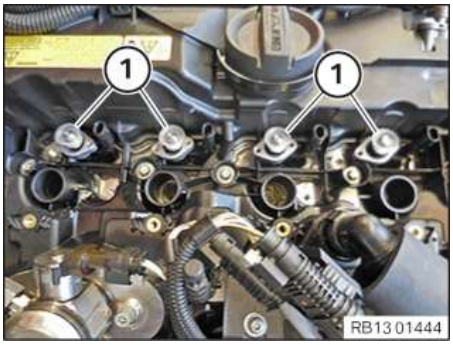
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

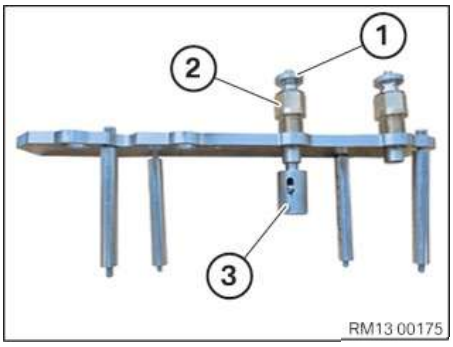
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

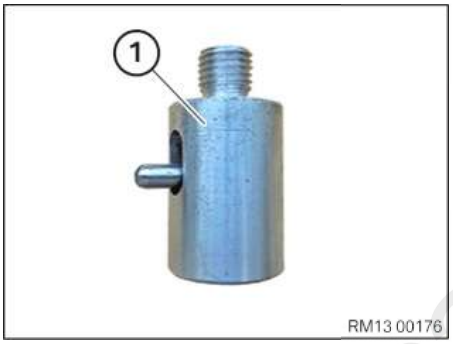
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

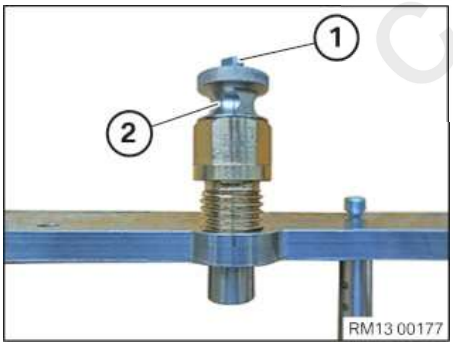
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

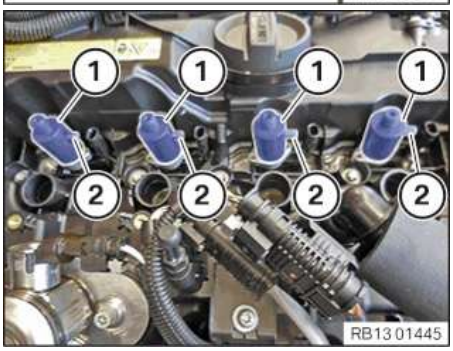
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



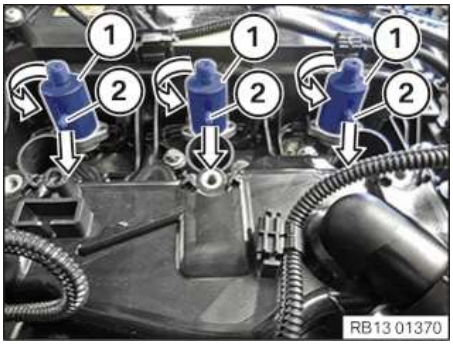
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



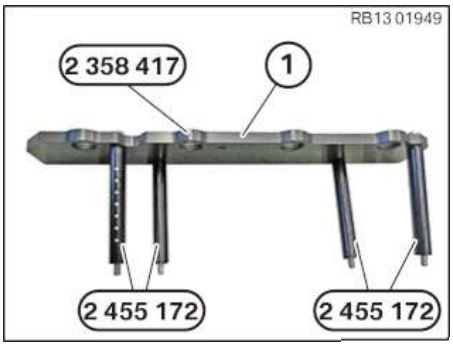
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

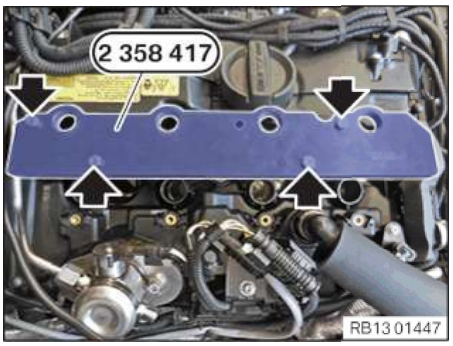
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



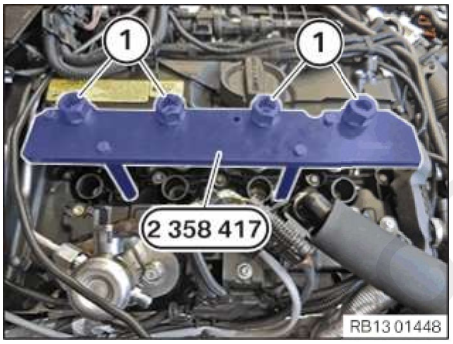
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

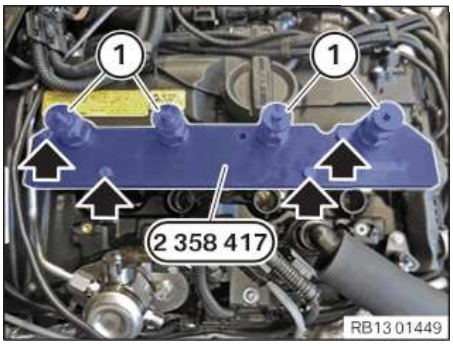
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

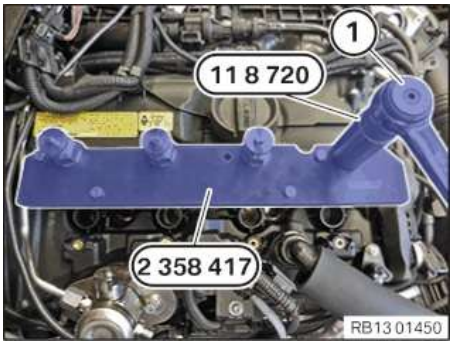
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

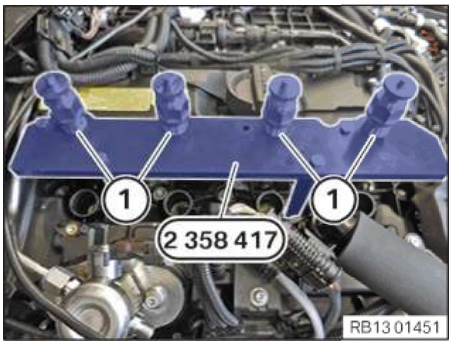


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

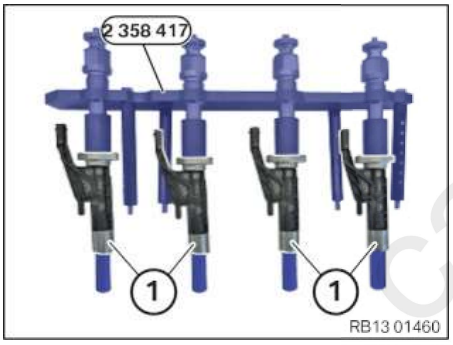
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

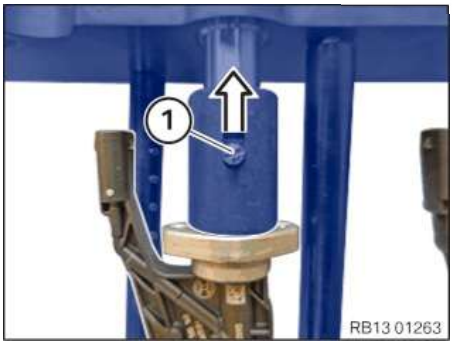


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

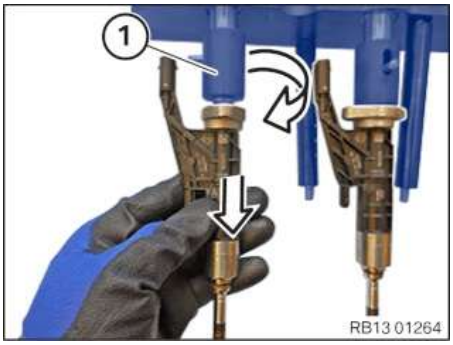


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

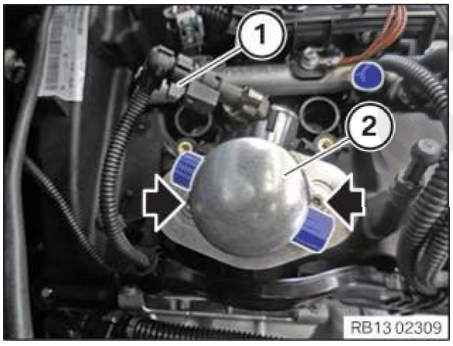
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

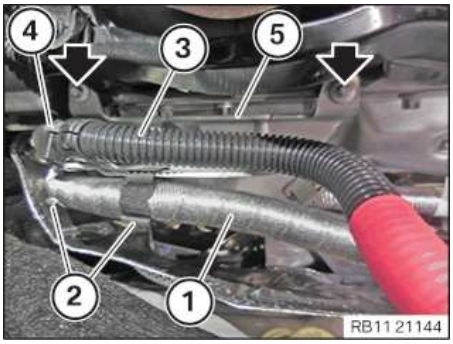
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

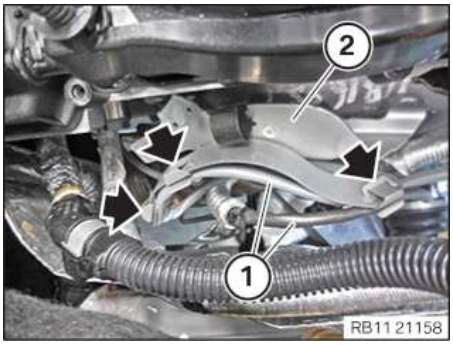


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

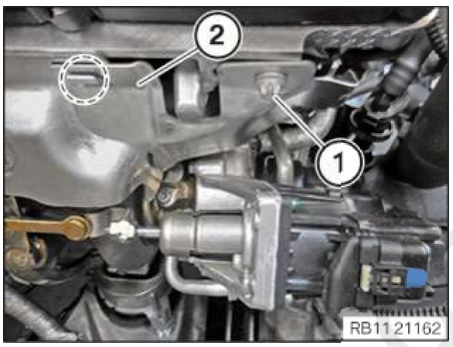
Hot surfaces.

Risk of burning!

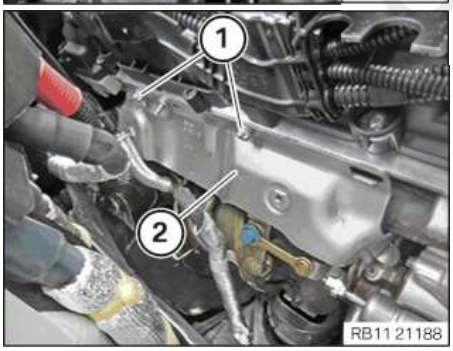
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

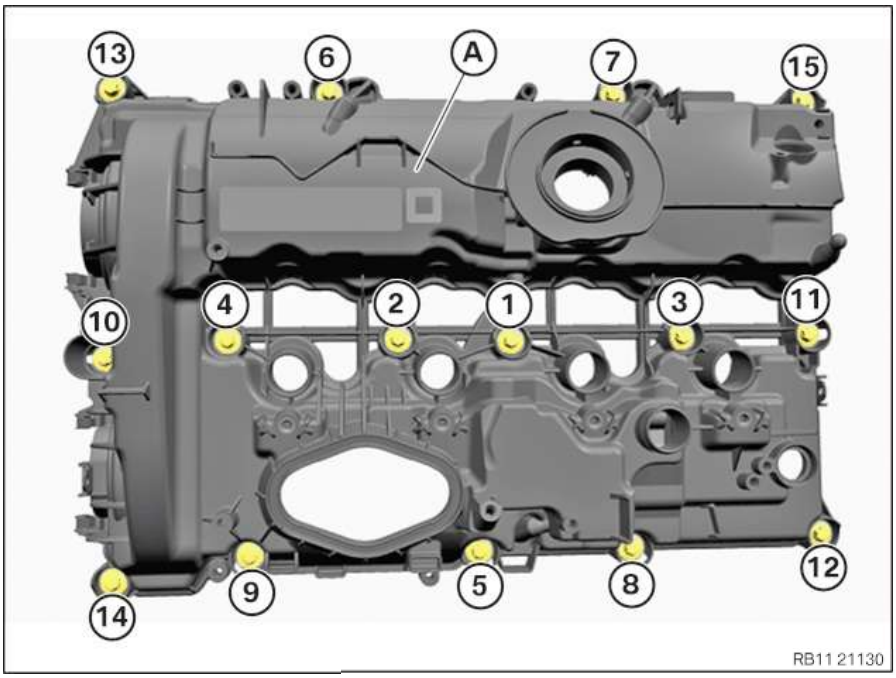


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

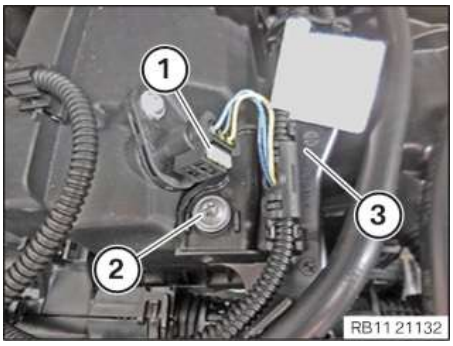
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

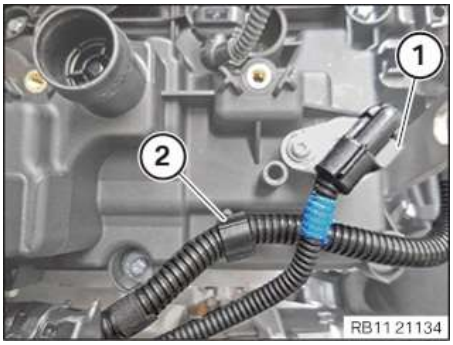
- Do not pull on the wires when disconnecting connectors and plug connections.



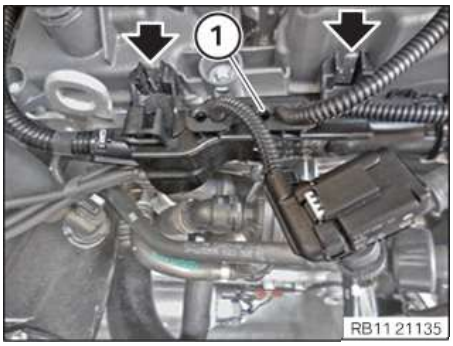
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



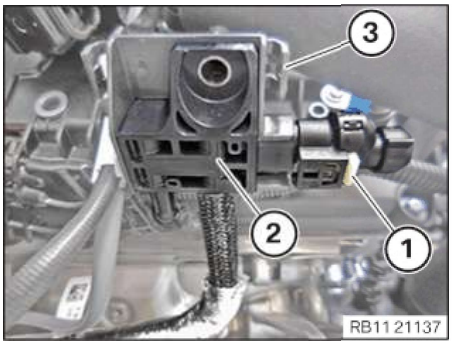
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



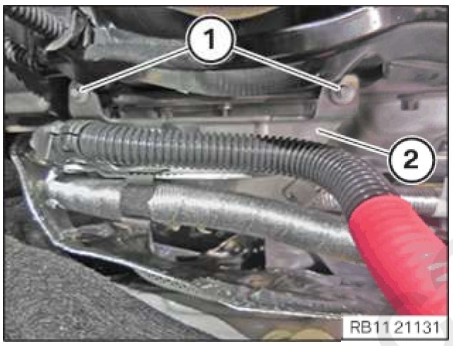
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



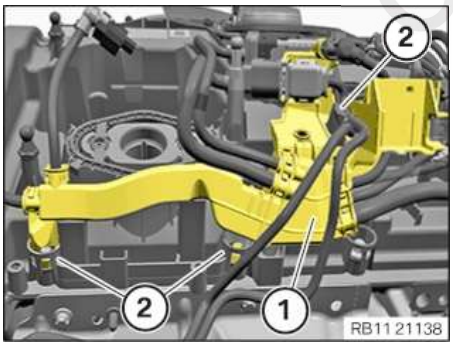
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



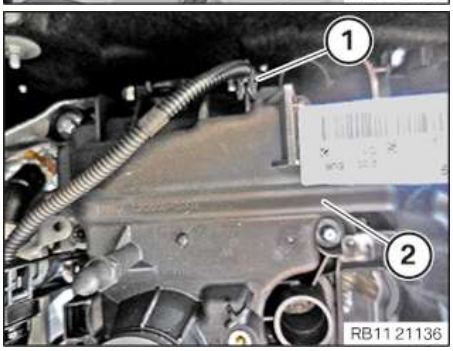
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

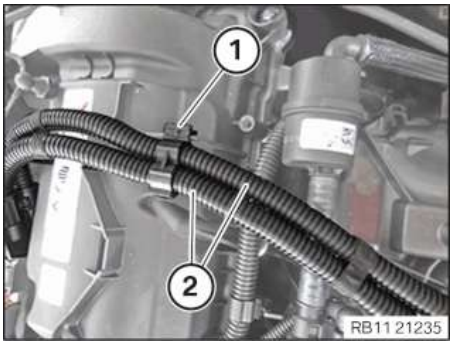


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

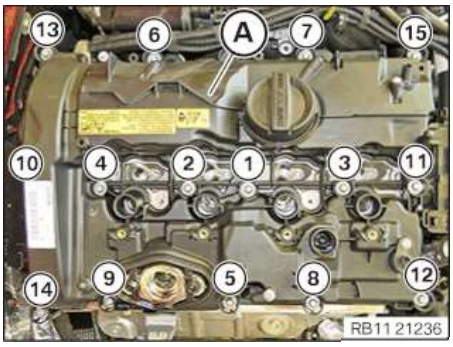


- Loosen clamp (1).

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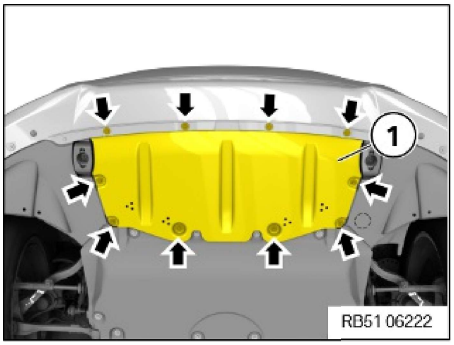


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

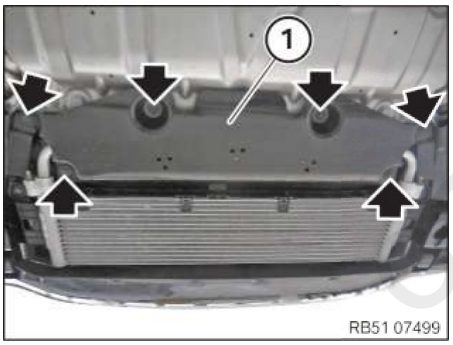
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

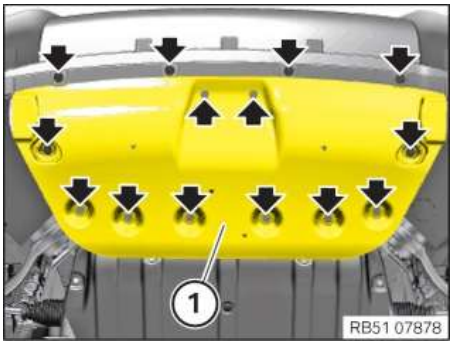
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

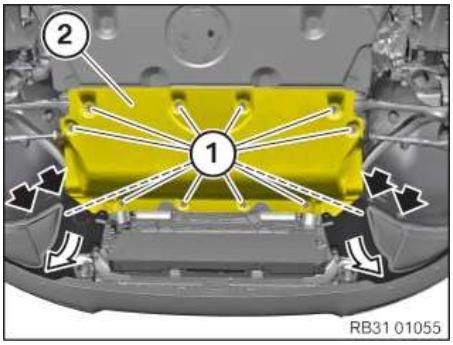


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



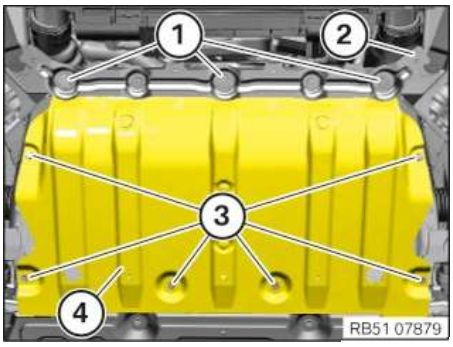
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

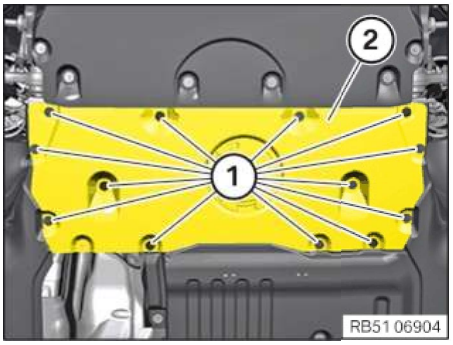
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

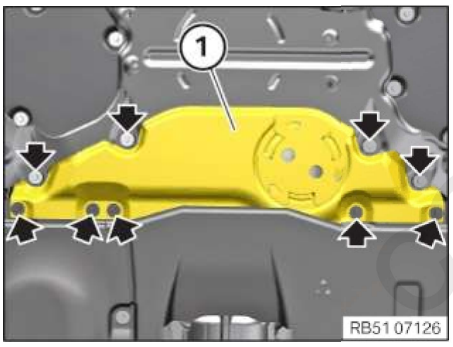
27 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

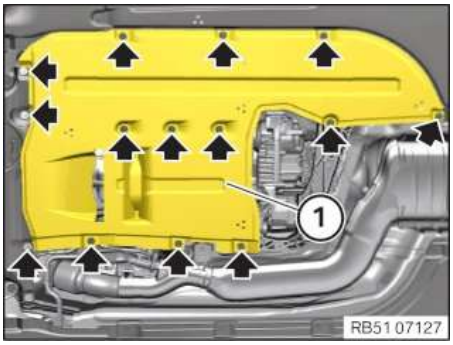


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

28 – Remove rear underbody protection

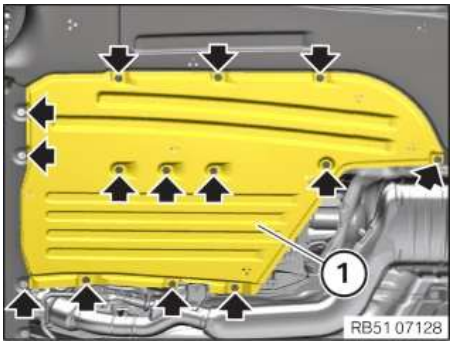


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

29 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

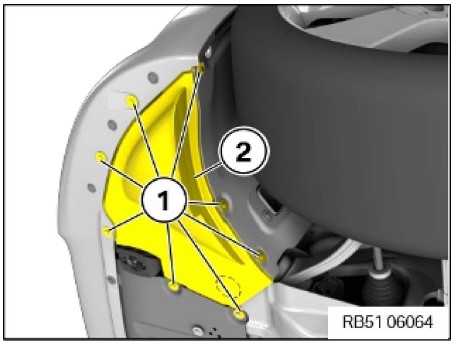
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

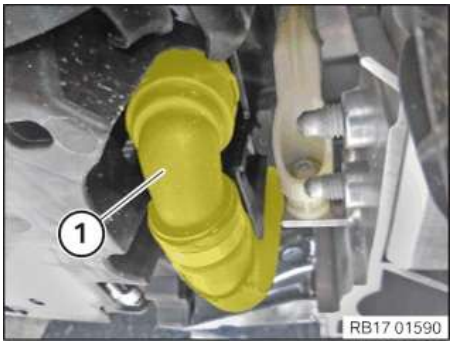


- Loosen sealing cap (1).



- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

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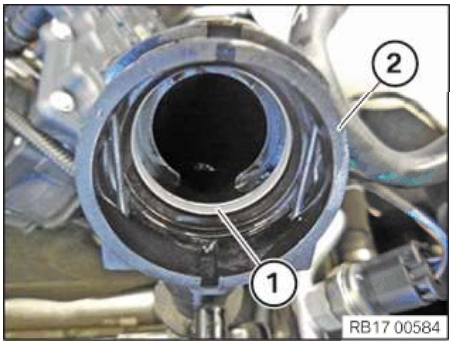


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

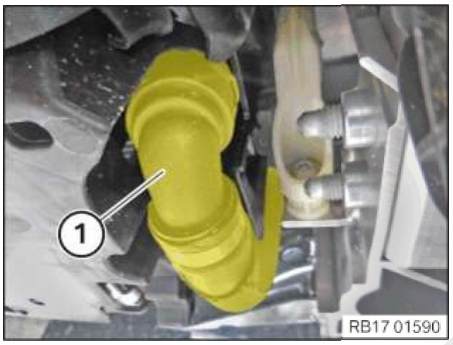
30 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

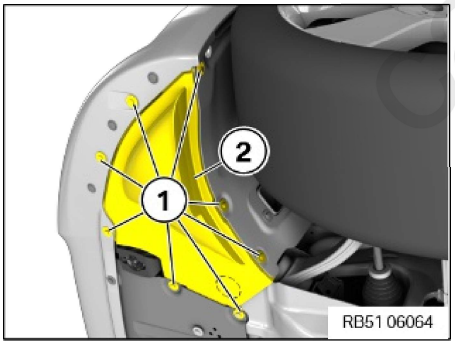


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

31 – Removing the DME control unit

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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

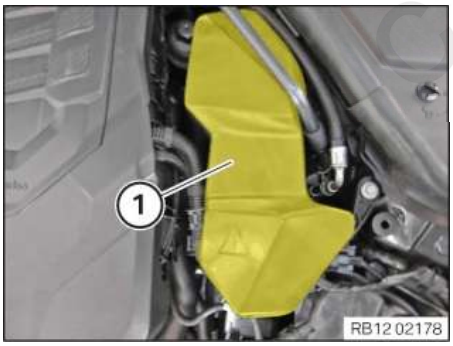
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

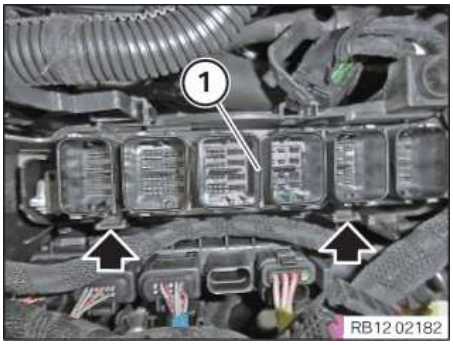


- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).

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- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

32 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

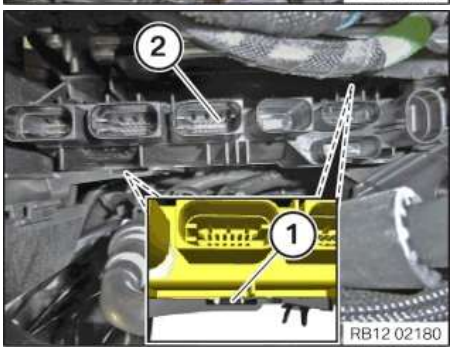
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



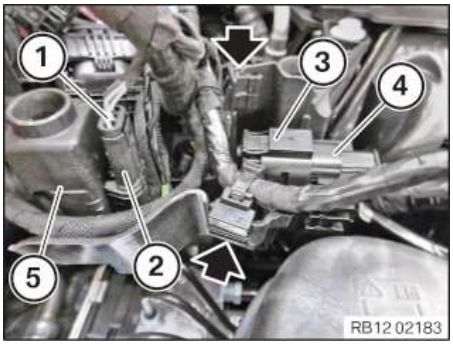
- Unlock and disconnect plug connections (1).



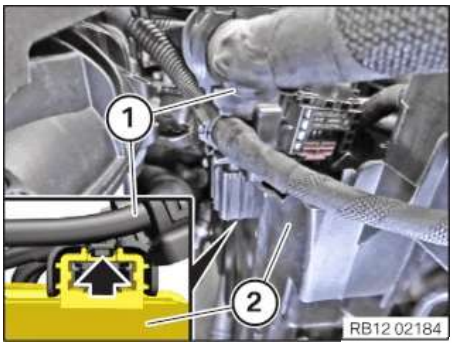
- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

33 – Removing the control unit holder

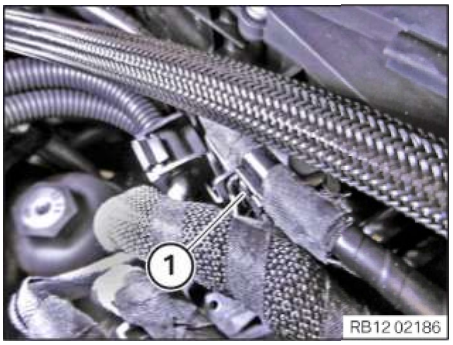
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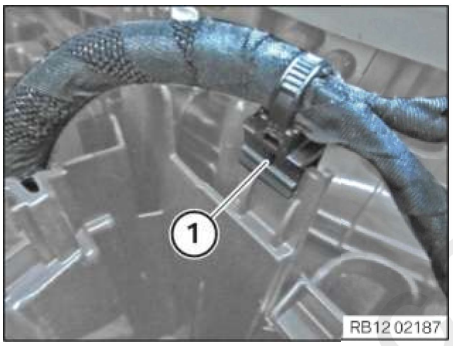
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).



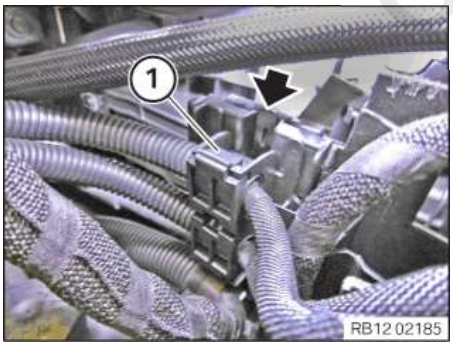
- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).



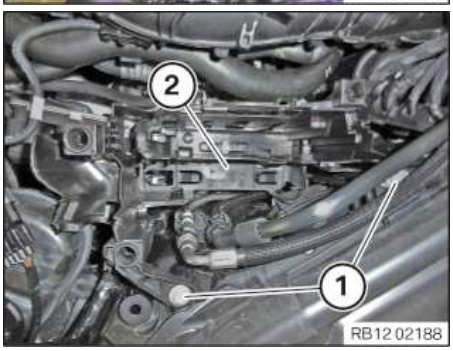
- Loosen clamp (1).



- Loosen clamp (1).



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

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34 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

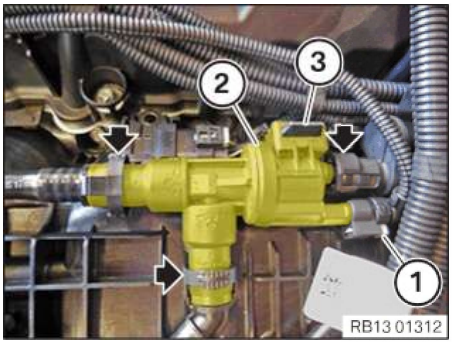
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

35 – Removing the intake plenum

RISK OF DAMAGE

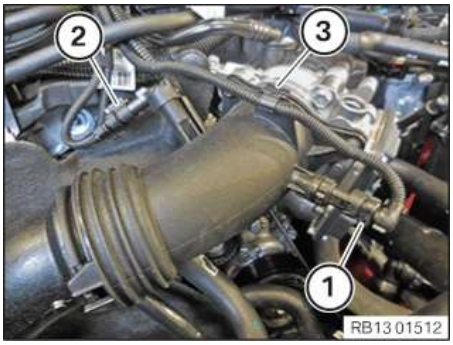
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

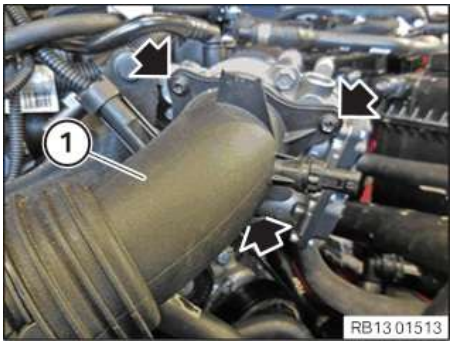
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

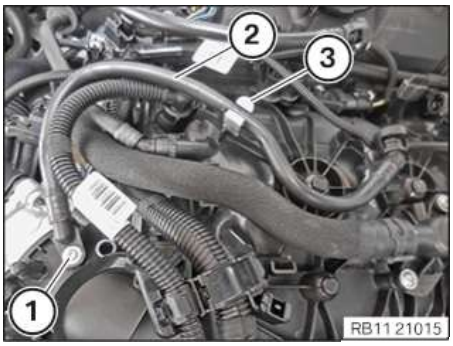


- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).

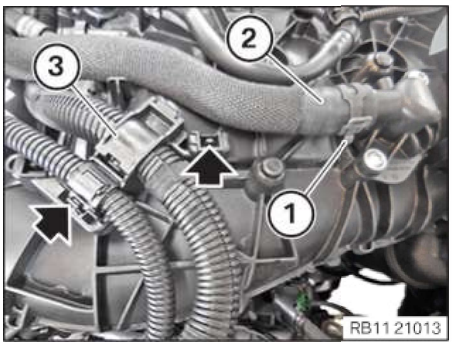
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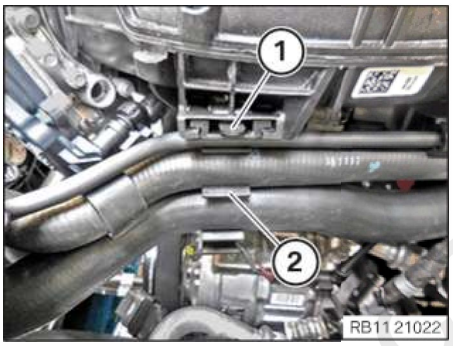
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



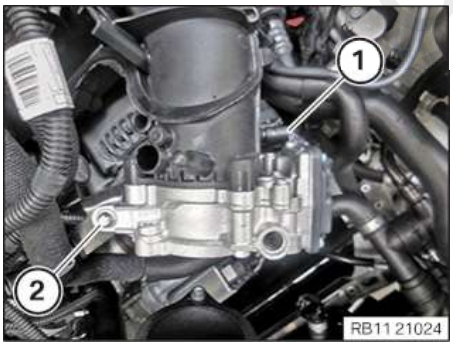
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



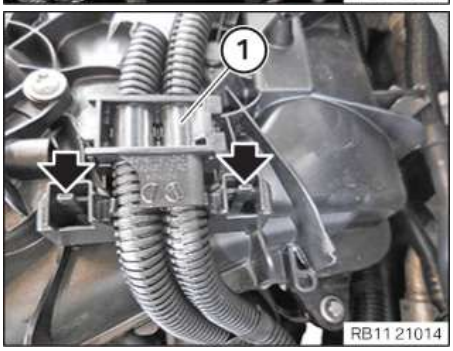
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

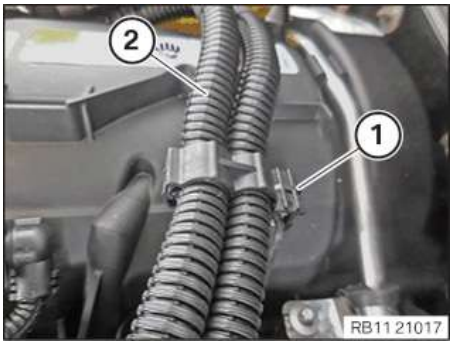


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

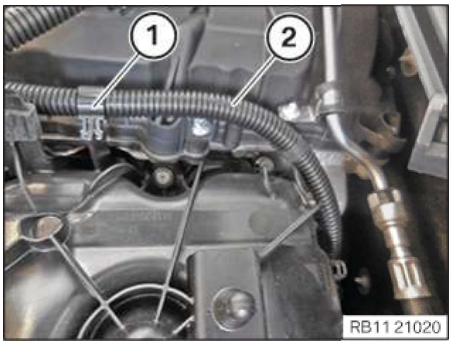
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- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



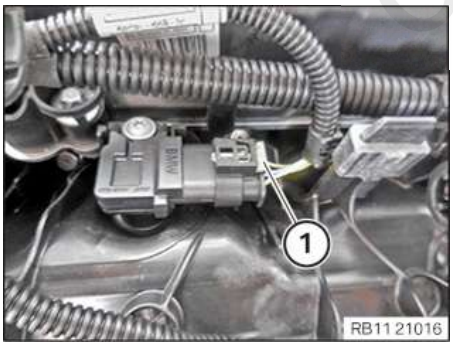
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



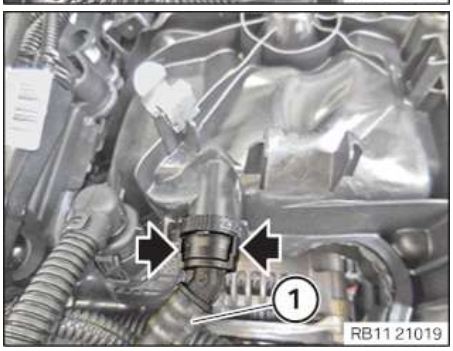
- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.



- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

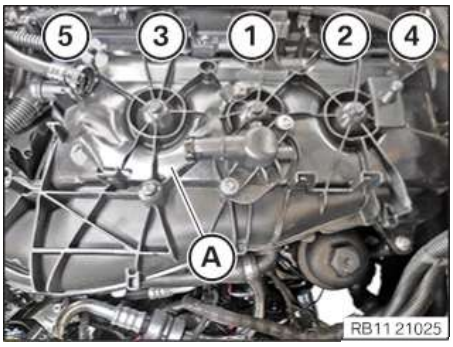


- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.

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- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.

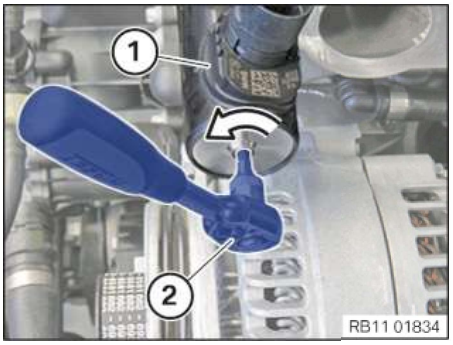


TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

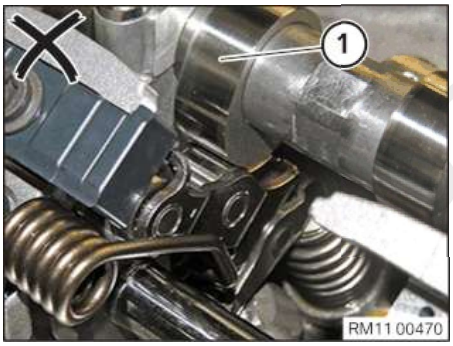
- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

36 – Adjusting the servomotor to minimum lift



- Slowly adjust the eccentric shaft with the servomotor (1) to the minimum lift using the tool (2).

37 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

38 – Remove all torsion springs

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

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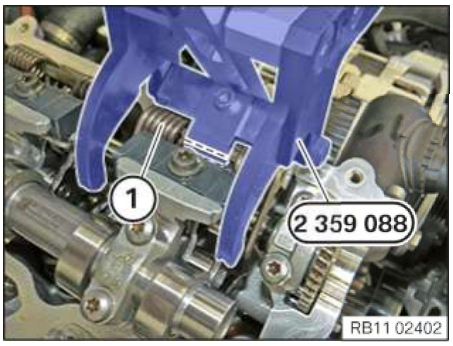
TECHNICAL INFORMATION

- Wear safety goggles.

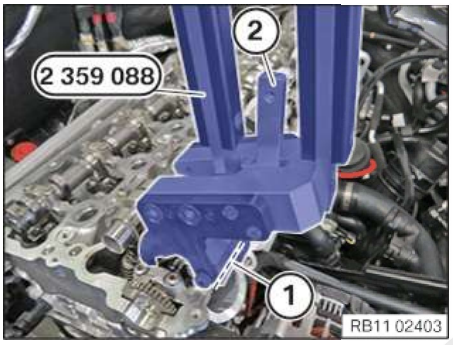


- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)



- Open the special tool 2 359 088 and position it at the torsion spring (1).



- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.

Check

- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.



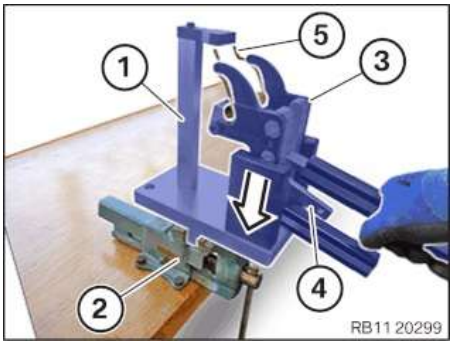
Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.

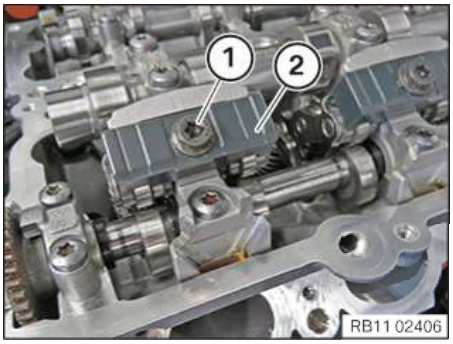
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- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

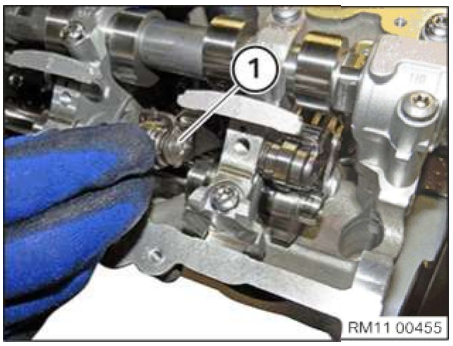
  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

39 – Removing all gates



- Loosen screw (1).
- Remove the gate (2) and place it arranged in order into 0 495 105 (11 4 480).
- Repeat the step for all the gates.

40 – Removing all intermediate levers



- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

41 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



RISK OF DAMAGE

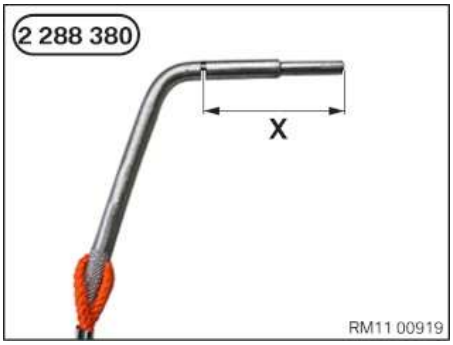
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

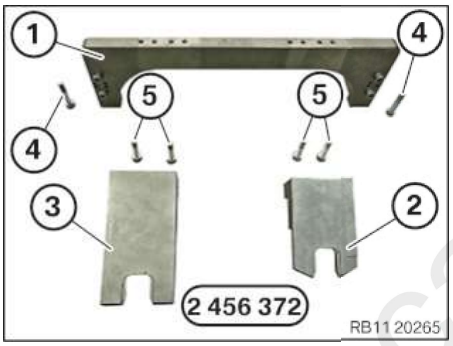
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

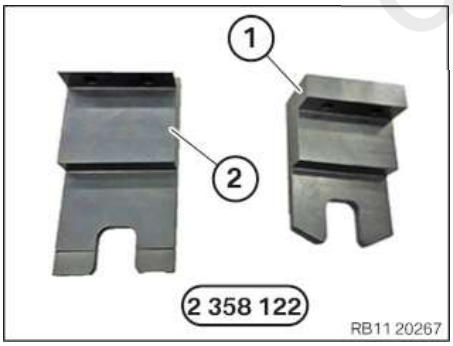
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



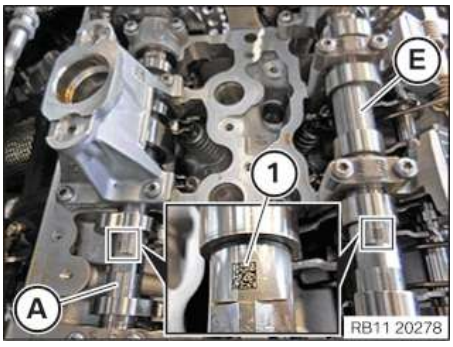
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



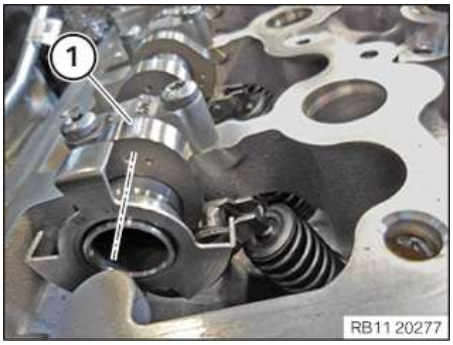
- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft

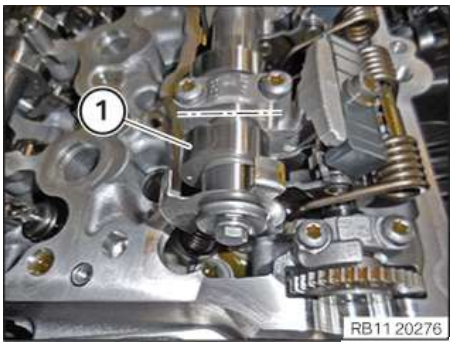


- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

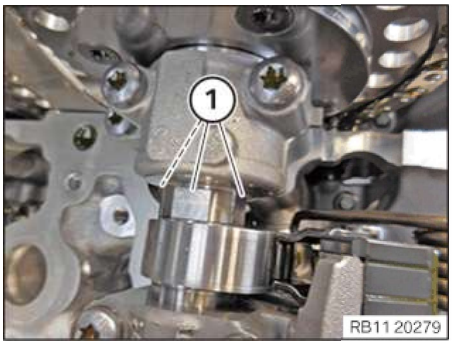
cardiagn.com



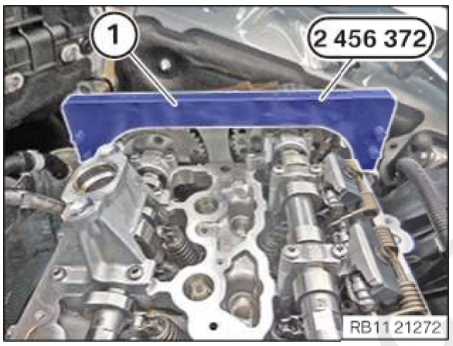
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



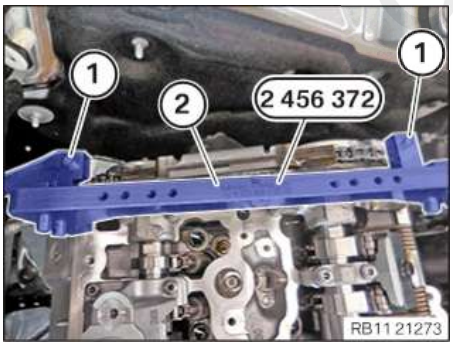
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



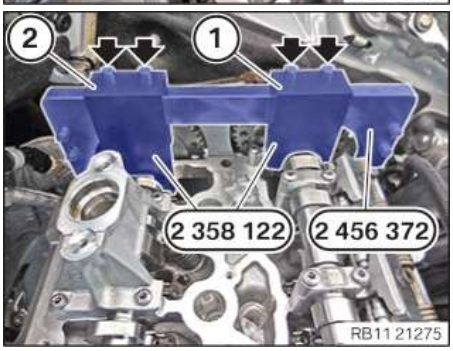
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

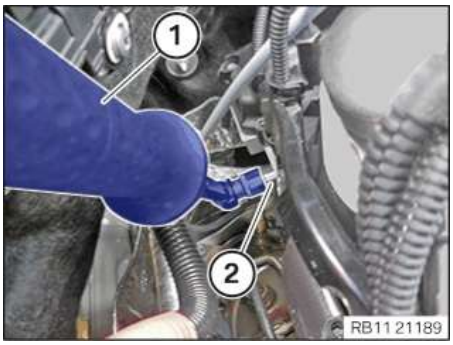
M6		Tightening torque	8 Nm

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42 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

43 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

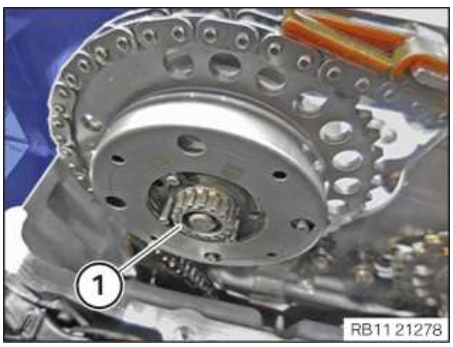


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

44 – Removing the VANOS central valve of the intake adjuster



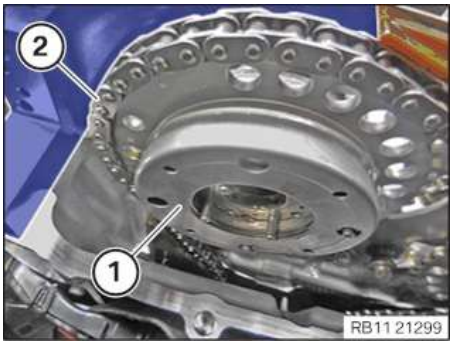
- Guide out and remove the VANOS central valve (1) of the intake adjuster.

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45 – Removing intake adjuster

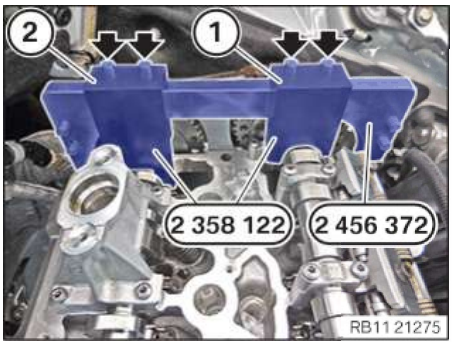
NOTICE

The figure shows the rear side of the engine.



- Guide out the intake adjuster (1) from the timing chain (2) and remove.

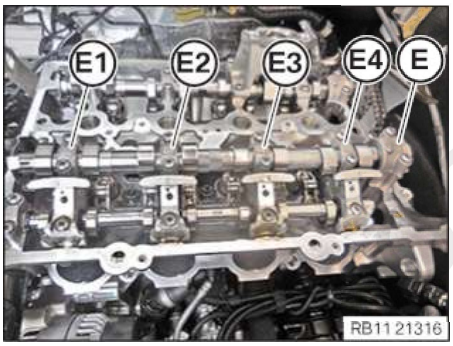
46 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

MAIN WORK

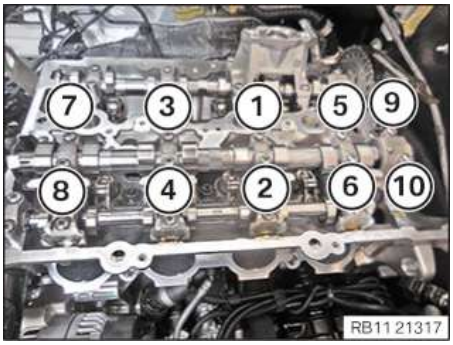
47 – Remove intake camshaft



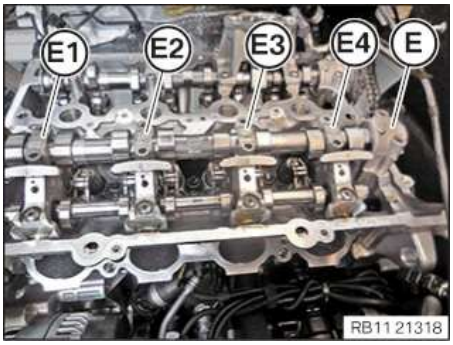
- Make sure that the exhaust camshaft bearing cap is placed in the correct position in the special tool 0 495 105 (11 4 480).

Note: The intake camshaft bearing caps can be read from the intake side and are identified by **E1**, **E2**, **E3 E4** and **E**.

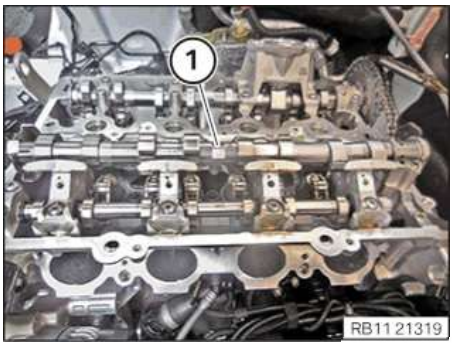
Note: Intake camshaft bearing cap **E** is a thrust bearing.



- Loosen all screws on the intake camshaft bearing caps in sequence from (10) to (1).

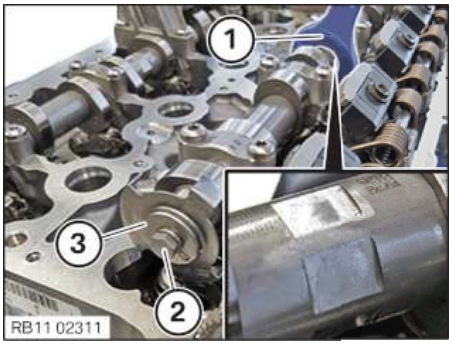


- Remove the intake camshaft bearing caps (E1), (E2), (E3), (E4), (E) place them in order in the special tool 0 495 105 (11 4 480).

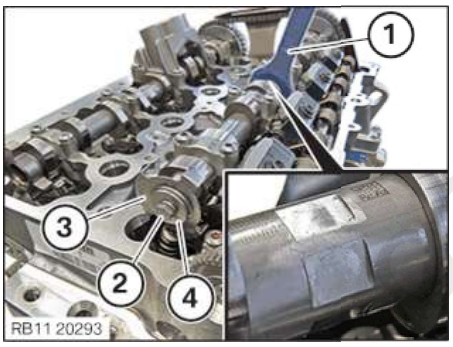


- Guide out the intake camshaft (1) in the direction of arrow and remove it.

48 – Replacement: Prepare the intake camshaft



- Secure the intake camshaft with a conventional open-end spanner (1).
- Loosen screw (2).
- Remove the camshaft sensor wheel (3).

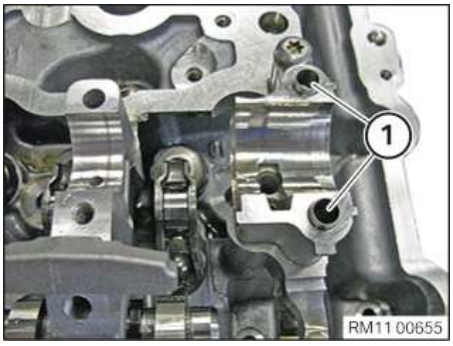


- Guide in the camshaft sensor wheel (3) and install.
- Ensure that the camshaft sprocket (3) is correctly positioned at the guide pin (4).
- Secure the intake camshaft with the open-end spanner (1).
- Tighten down screw (2).

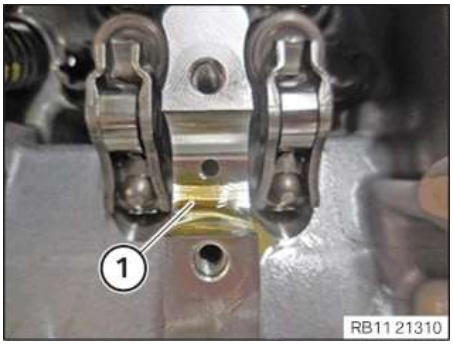
Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm

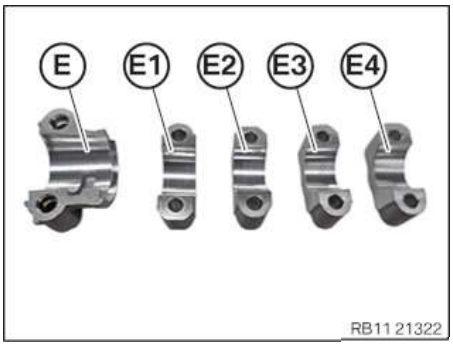
49 – Install intake camshaft



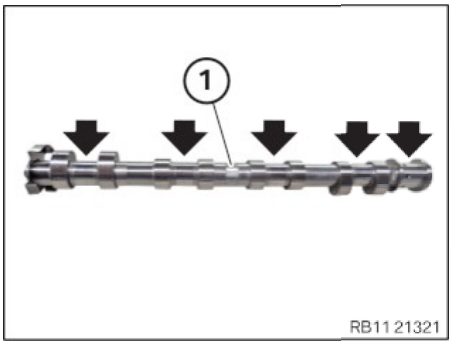
- Check the fitting sleeves (1) for correct fit and damage and replace where required.



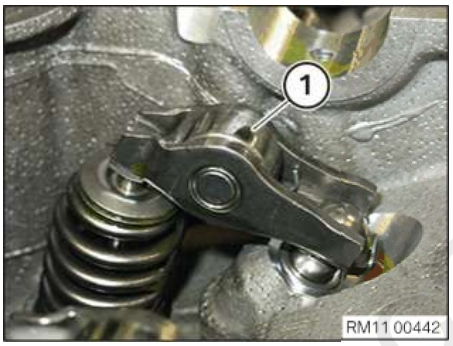
- Coat all bearing positions (1) with fresh engine oil.



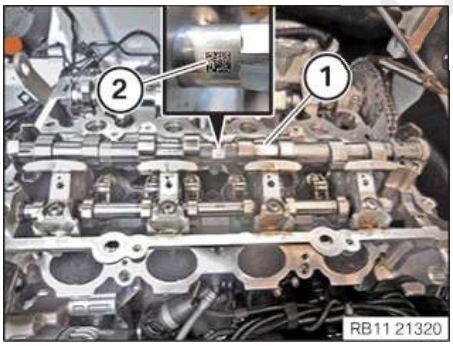
- Clean all the bearing positions of the intake camshaft bearing caps (E1), (E2), (E3), (E4) and (E) and coat with engine oil.



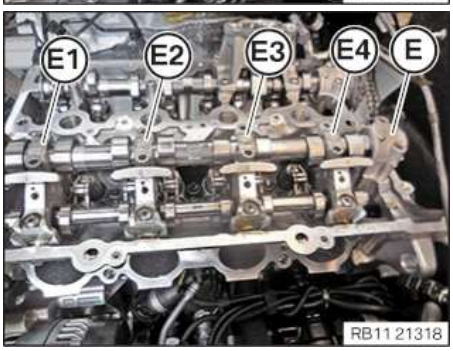
- Clean all bearing positions (arrows) of the intake camshaft (1) and coat with engine oil.



- Ensure the **correct** fit of the roller cam followers (1) before mounting the intake camshaft.
- Coat roller cam follower (1) with **new** engine oil.



- Insert the intake camshaft (1) into the cylinder head so that the mark (2) points up.

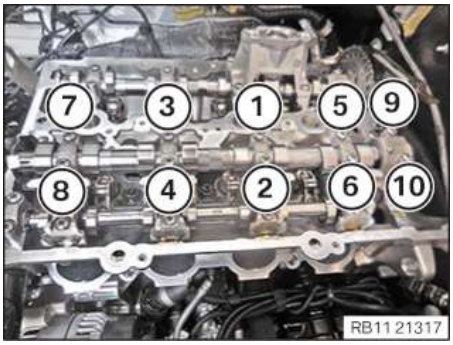


- Position the intake camshaft bearing cap on the cylinder head.

Note: The intake camshaft bearing caps can be read from the intake side and are identified by **E1**, **E2**, **E3 E4** and **E**.

Note: Intake camshaft bearing cap **E** is a thrust bearing.

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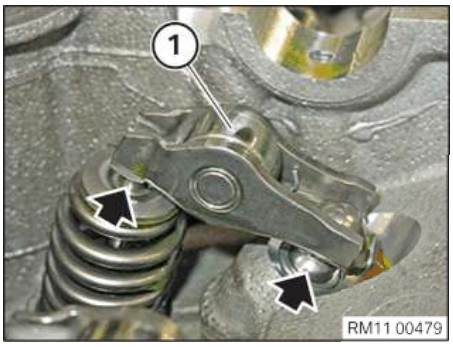
- Press intake camshaft bearing cap down and hand-tighten the bolts incrementally in sequence (1) to (10).
- Join bolts in sequence (1) to (10) **in half turns**.
- **Observe jointing torque.**
- **Tighten** all bolts in sequence from (1) to (10).

Intake camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

POSTPROCESSES

50 – Checking installation position of roller cam followers

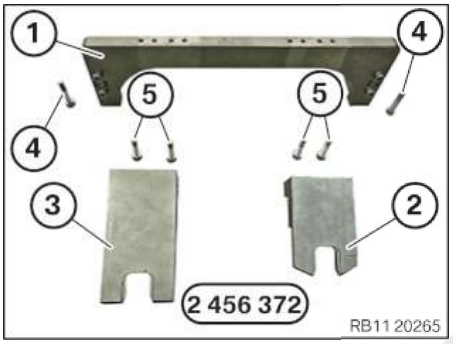


TECHNICAL INFORMATION

The rocker arms may slip slightly when the camshaft is positioned. Make sure rocker arms are correctly positioned on the hydraulic valve clearance compensating elements and on valves.

- Make sure the mounting orientation (arrows) of the roller cam followers (1) is correct.

51 – Adjust the camshafts with the special tool

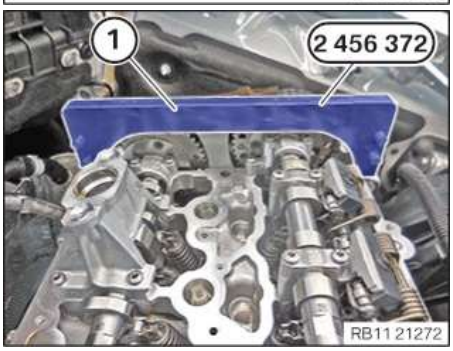


- Overview of the set of special tools 2 456 372:

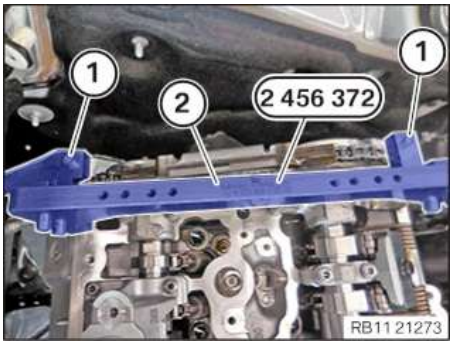
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



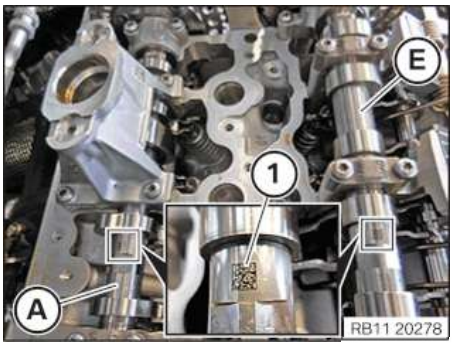
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



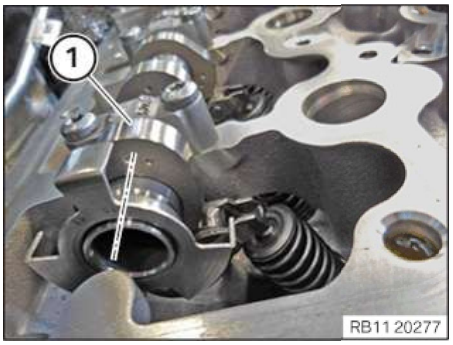
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

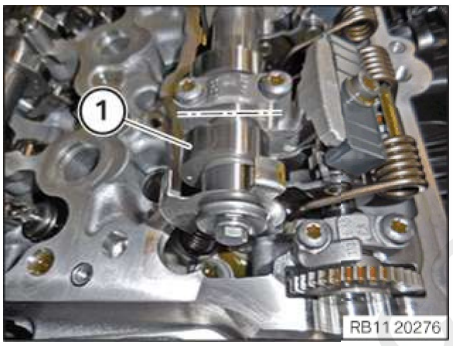
M6		Tightening torque	8 Nm



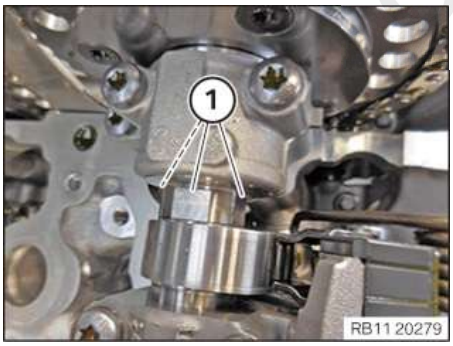
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



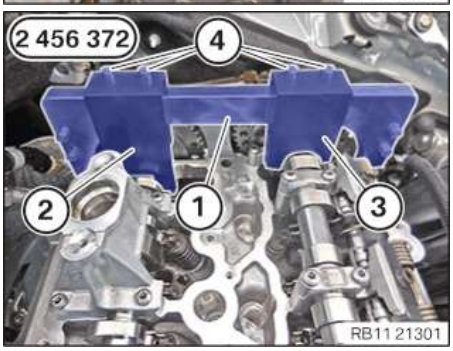
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

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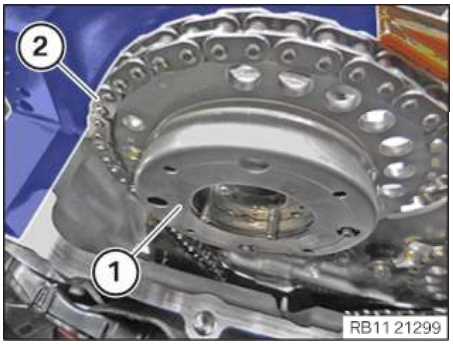
52 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

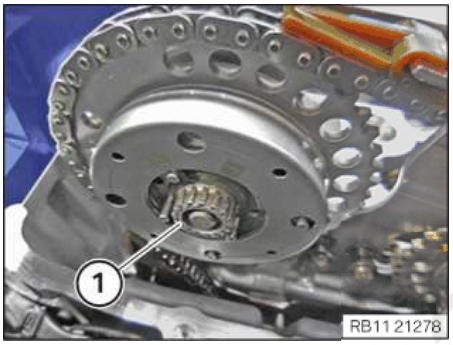


- Keep intake adjuster (1) marked IN ready.

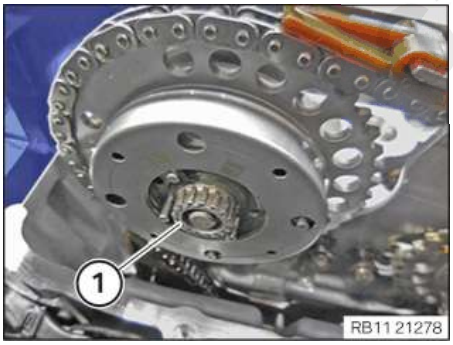


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

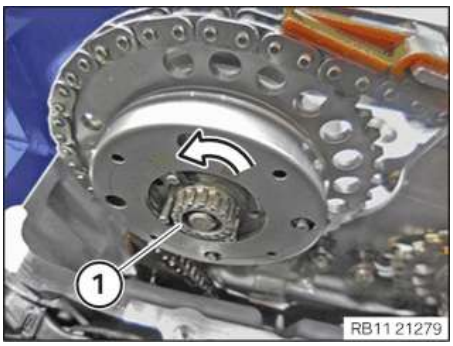
53 – Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.



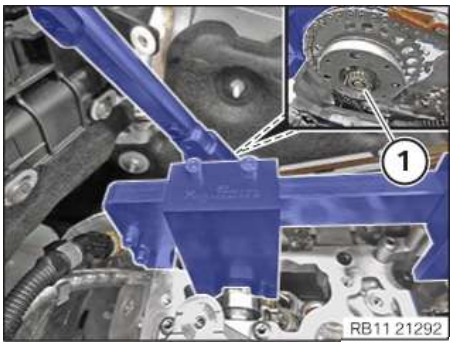
- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

54 – Releasing VANOS central valve of the exhaust camshaft adjuster

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- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

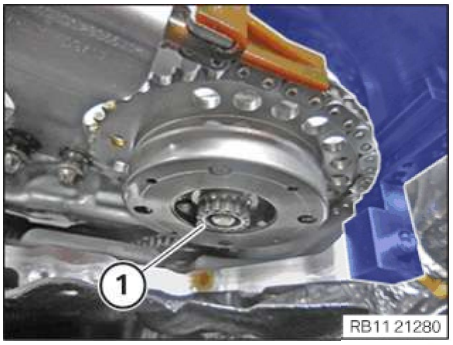


NOTICE

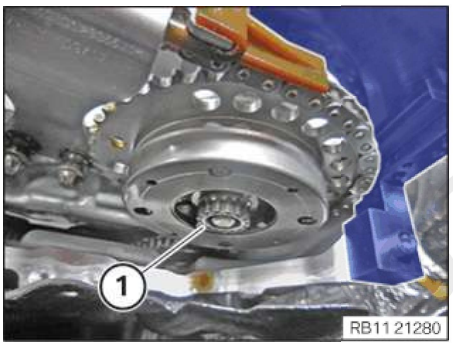
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

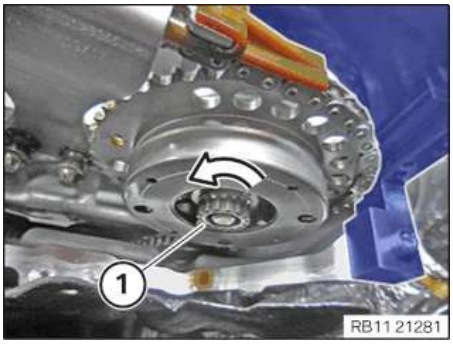
55 – Installing the VANOS central valve of the exhaust camshaft adjuster



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



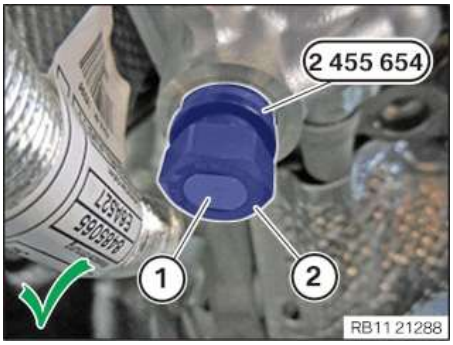
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

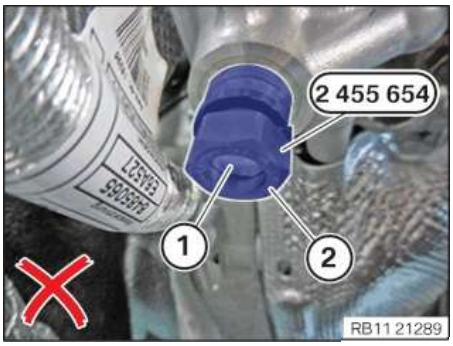
56 – Pretension the timing chain with the special tool

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- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

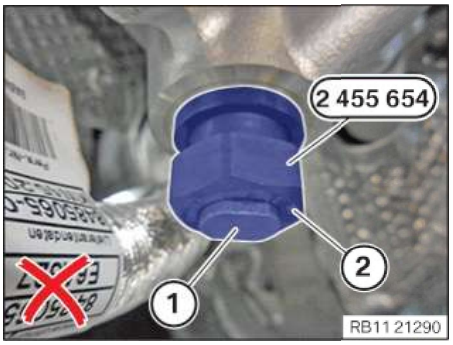
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

57 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

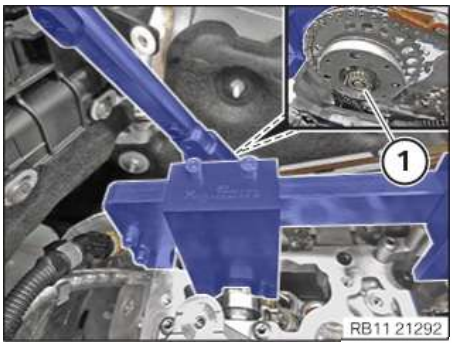
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

58 – Tightening the VANOS central valve of the exhaust camshaft adjuster

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- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

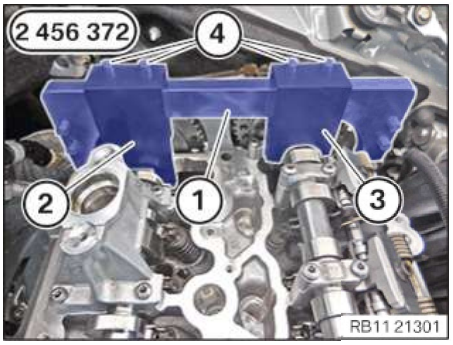


- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

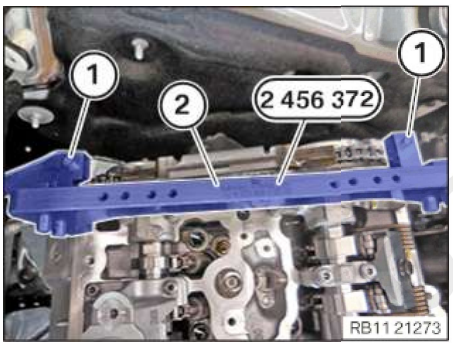
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

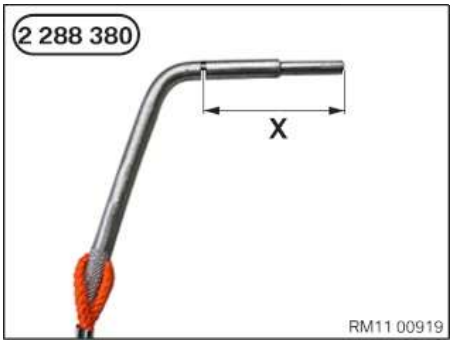
59 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

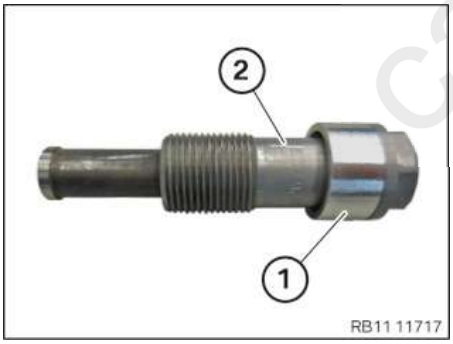
60 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



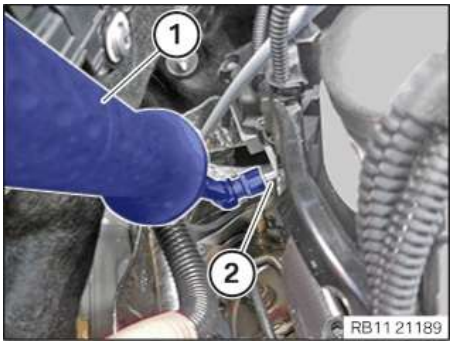
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

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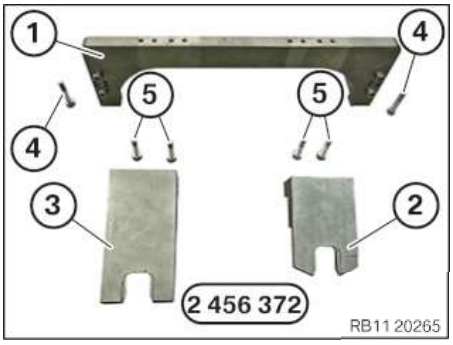


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

61 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



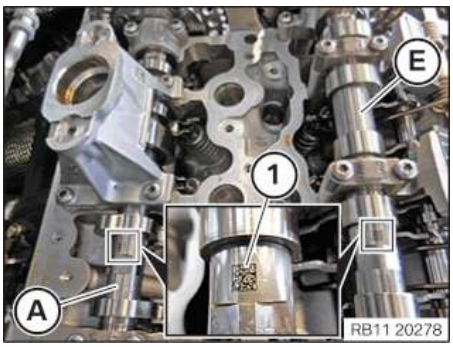
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

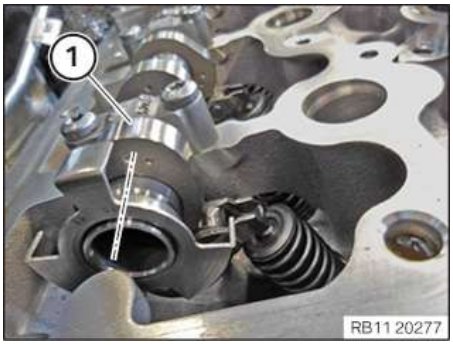
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

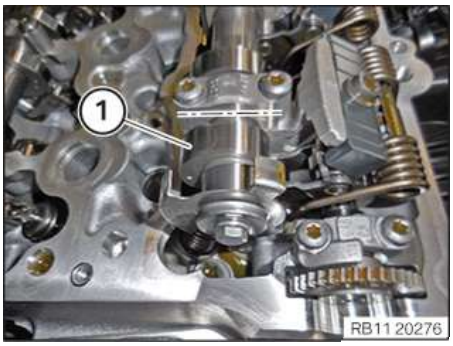


- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.

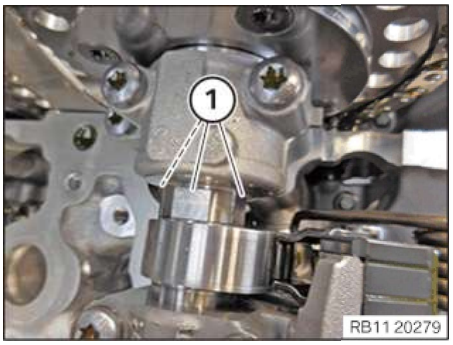
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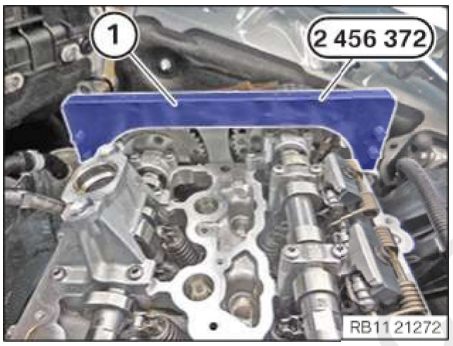
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



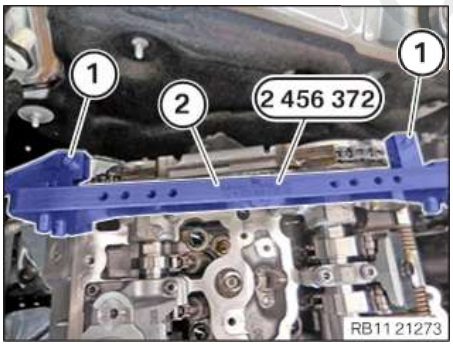
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



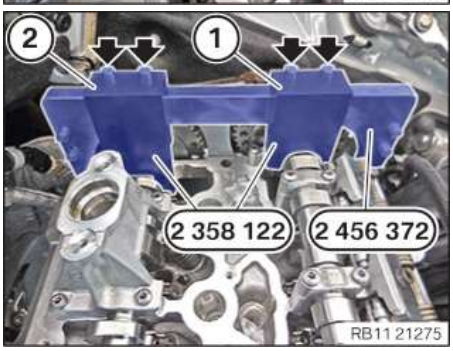
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

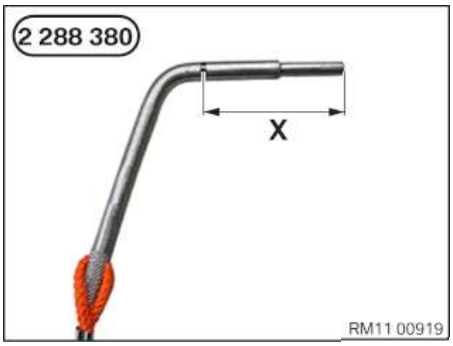
Test gauge to basic carrier

M6		Tightening torque	8 Nm

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- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

62 – Checking the intermediate lever classification



TECHNICAL INFORMATION

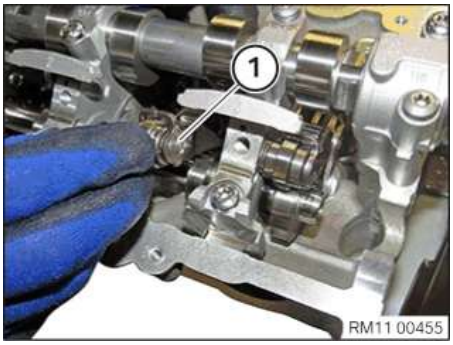
All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

- Check classification (arrow) of intermediate lever.

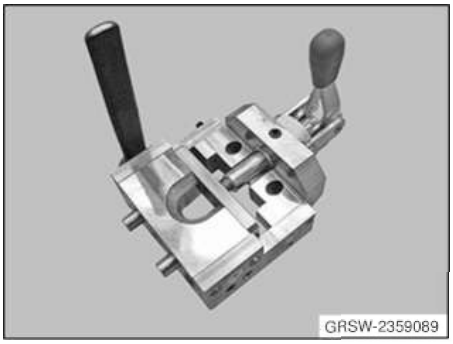
63 – Installing all intermediate levers

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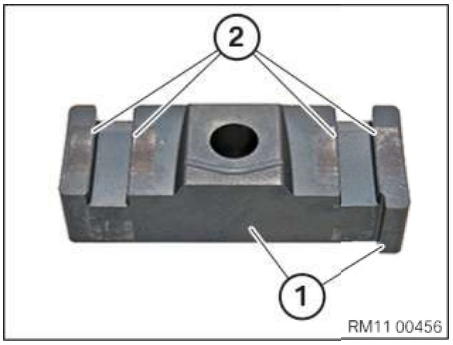


- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

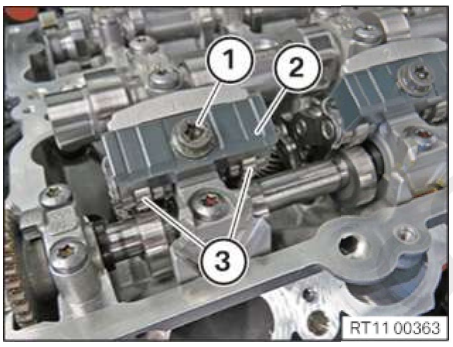
64 – Installing all gates



- Have the special tool 2 359 089 ready.

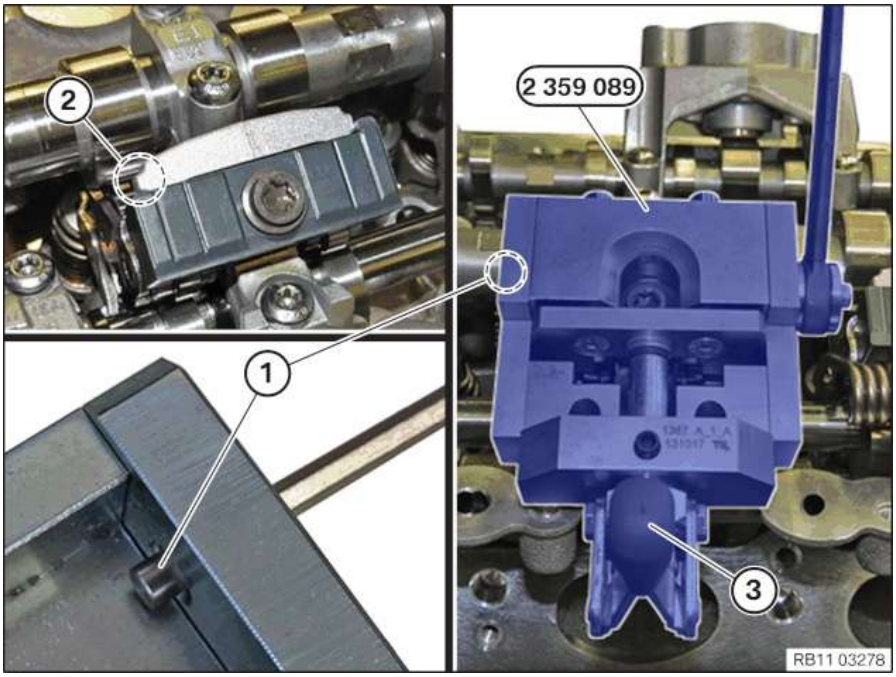


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

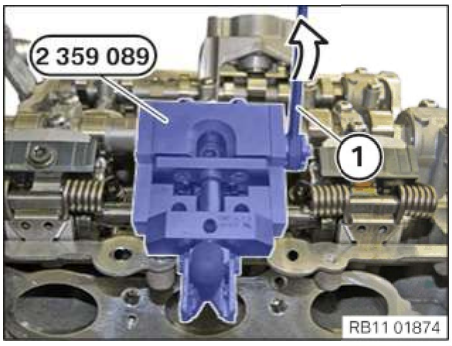


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.

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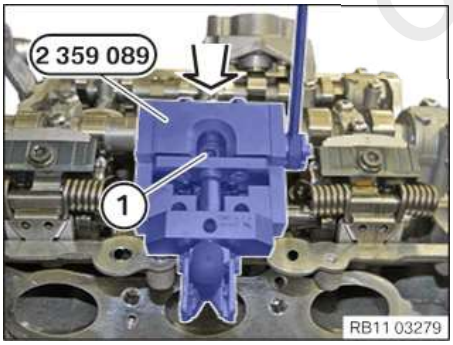
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1) in the direction of the arrow.



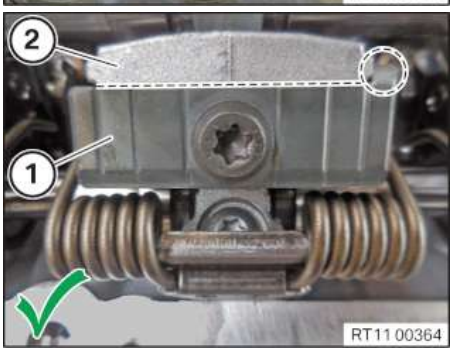
- Make sure that the special tool 2 359 089 rests flat against the cylinder head (arrows).



- Press the special tool 2 359 089 onto the cylinder head in the direction of the arrow.
- Tighten the bolt (1) at the same time.

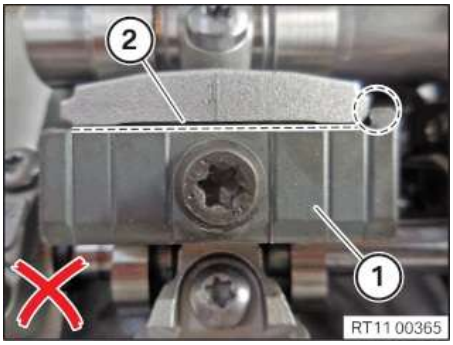
Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).
  Gate (1) is installed correctly in the marked area.

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- Ensure that gate (1) rests **correctly** against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area.

- Repeat the step for all the gates.

65 – Install all torsion springs

CAUTION

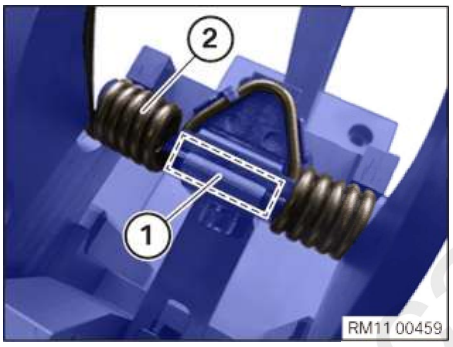
Spring preload.

Danger of injury!

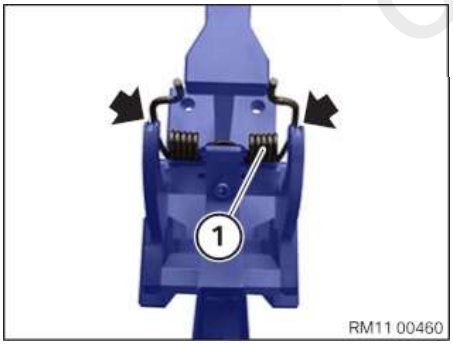
- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

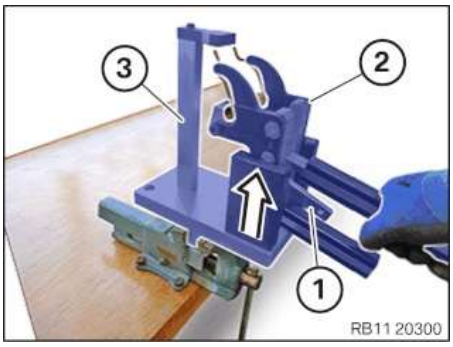
- Wear safety goggles.



- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.



- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

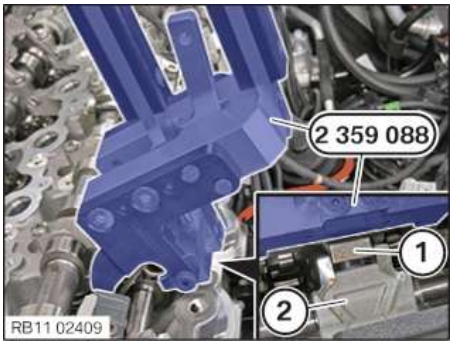


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the lever (1) audibly engages.

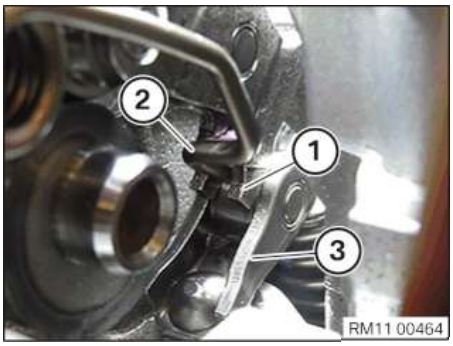
  The torsion spring is tensioned.

- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.

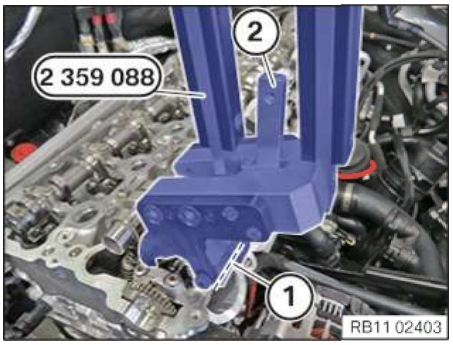
cardiagn.com



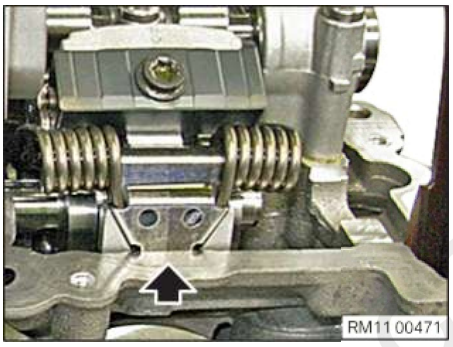
- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).



- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).
- Repeat the operations for the remaining torsion springs.

66 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

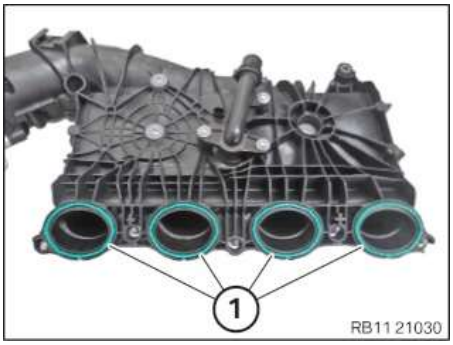
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

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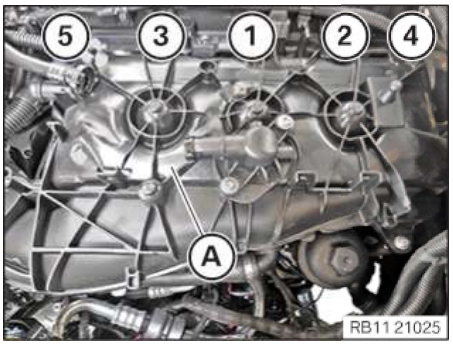


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6	Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

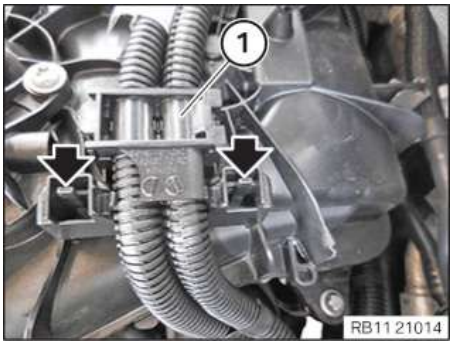


- Tighten down screw (1).

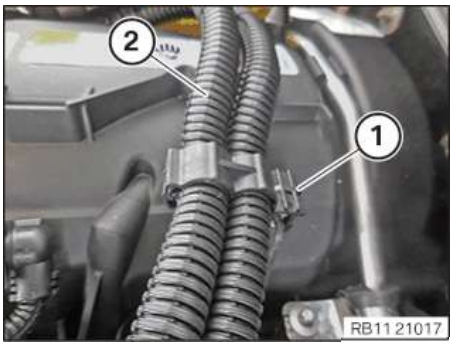
Intake plenum to support

M6X25		Tightening torque	8 Nm

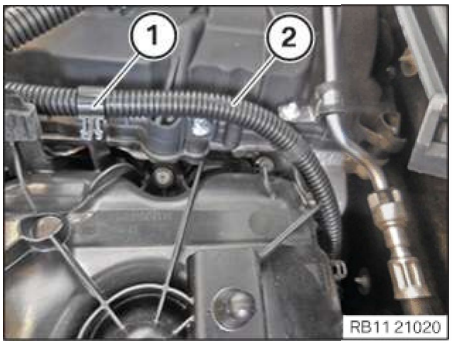
cardiagn.com



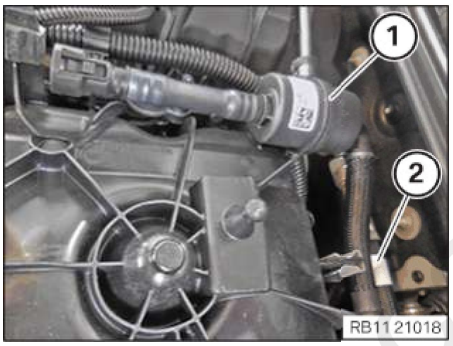
- Insert and install the wiring harness section (1) for the injectors and ignition coils.
  The locks (arrows) must engage audibly.



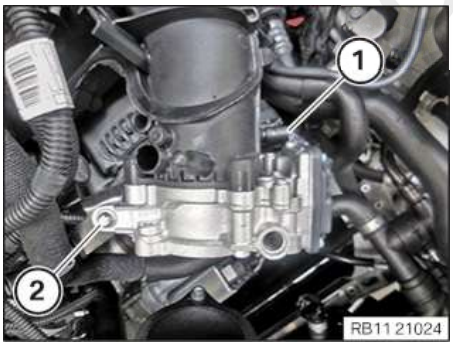
- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



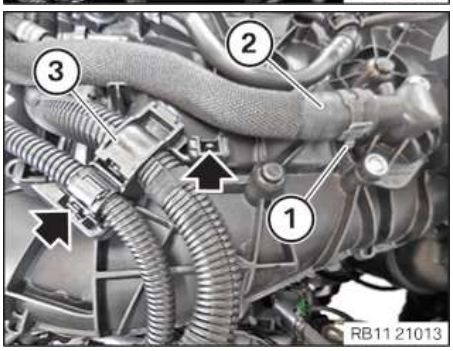
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

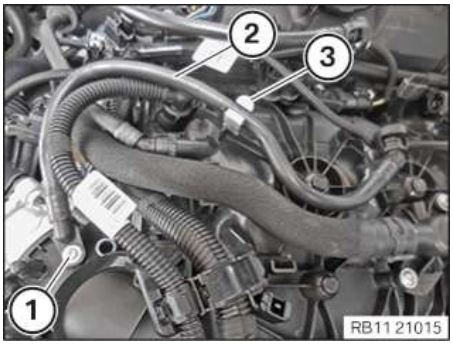
Throttle body to holder

M6X25		Tightening torque	8 Nm



- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

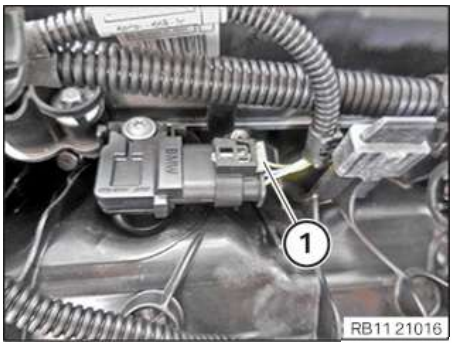
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- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

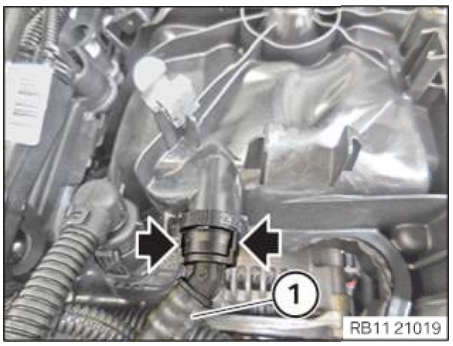
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



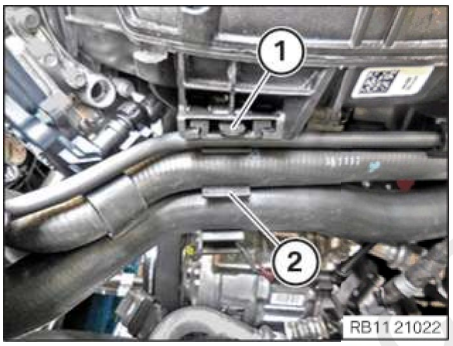
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

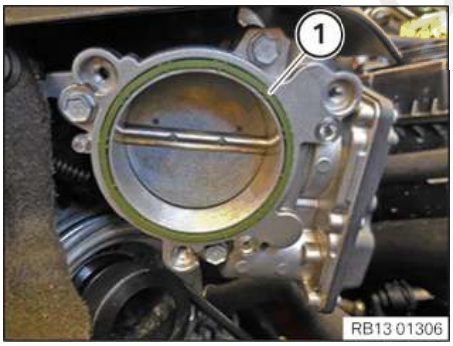


- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

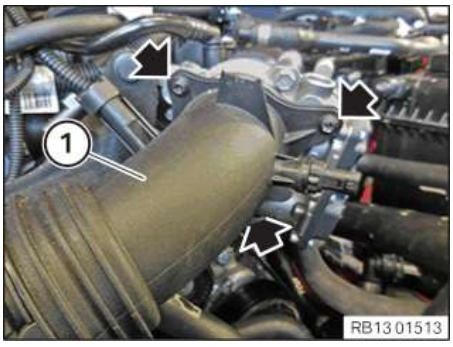


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

  Parts: Gasket

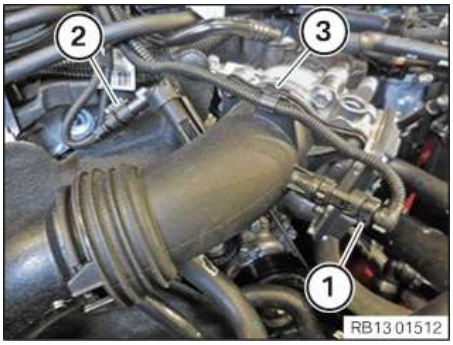


- Insert and install charge air line (1).
- Tighten screws (arrows).

Charge air line to throttle body

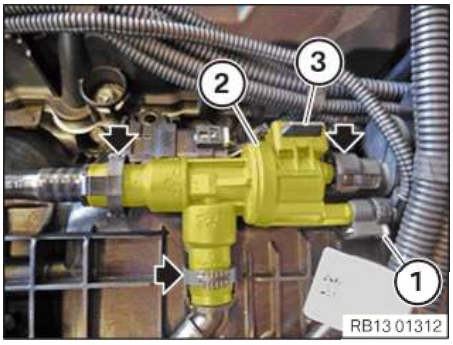
M6		Tightening torque	8 Nm

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- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

67 – Installing the tank vent valve

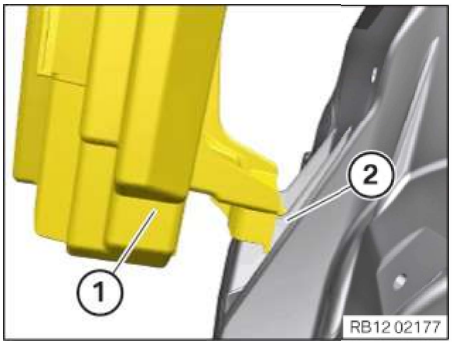


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

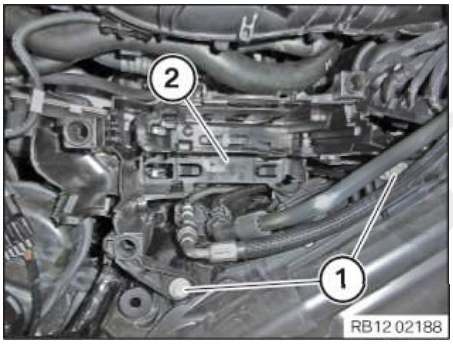
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

68 – Installing the control unit holder



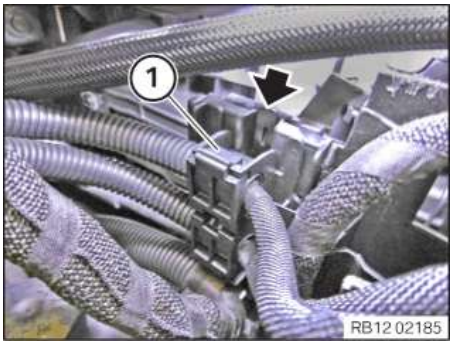
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

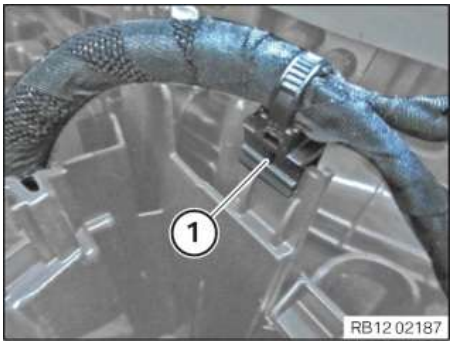
Hexagon screw		Tightening torque	8 Nm



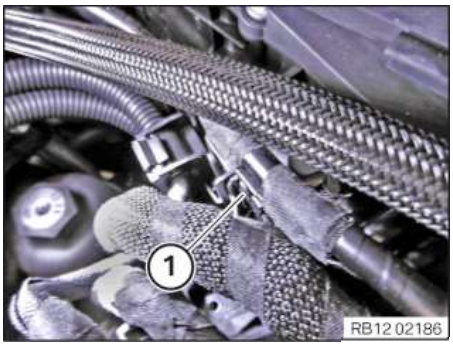
- Feed in and install the cable clip (1).

  Lock (arrow) must audibly engage.

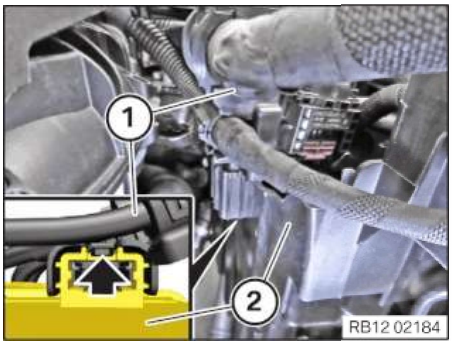
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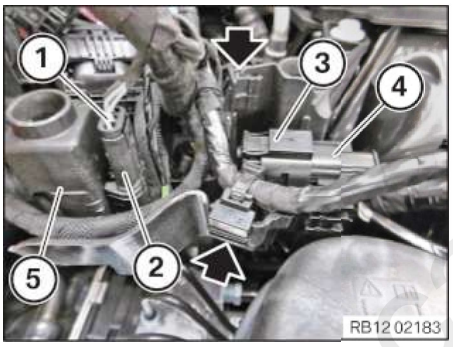
- Secure clamps (1).



- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

69 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

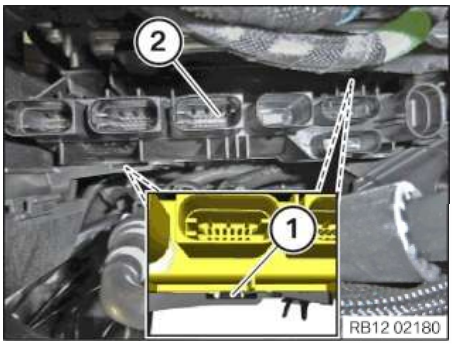
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Insert and install the integrated supply module (PDM) (2).

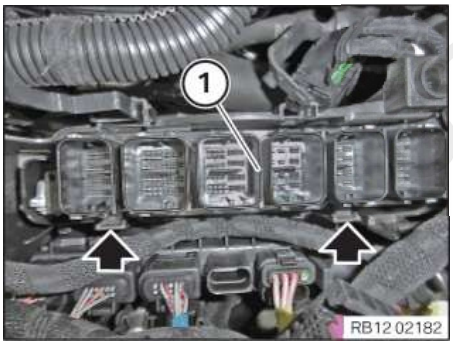
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



- Connect connectors (1) and lock.

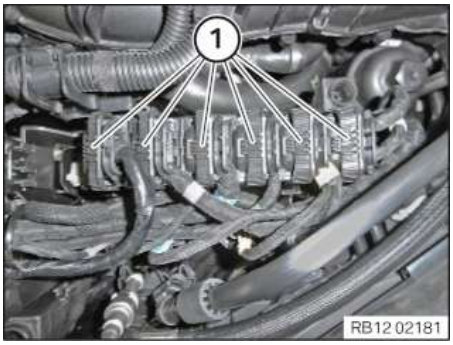
  The connectors (1) must engage audibly.

70 – Installing the DME control unit



- Feed in and install DME control unit (1).

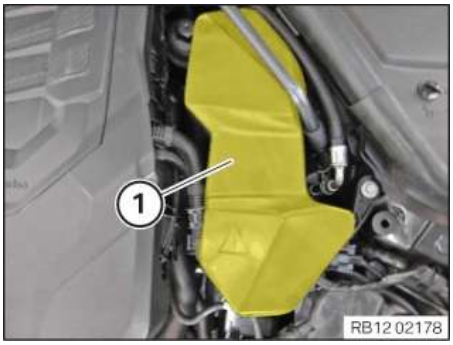
  The locks (arrows) must engage audibly.



- Connect connectors (1) and lock.

  All connectors (1) must engage audibly.

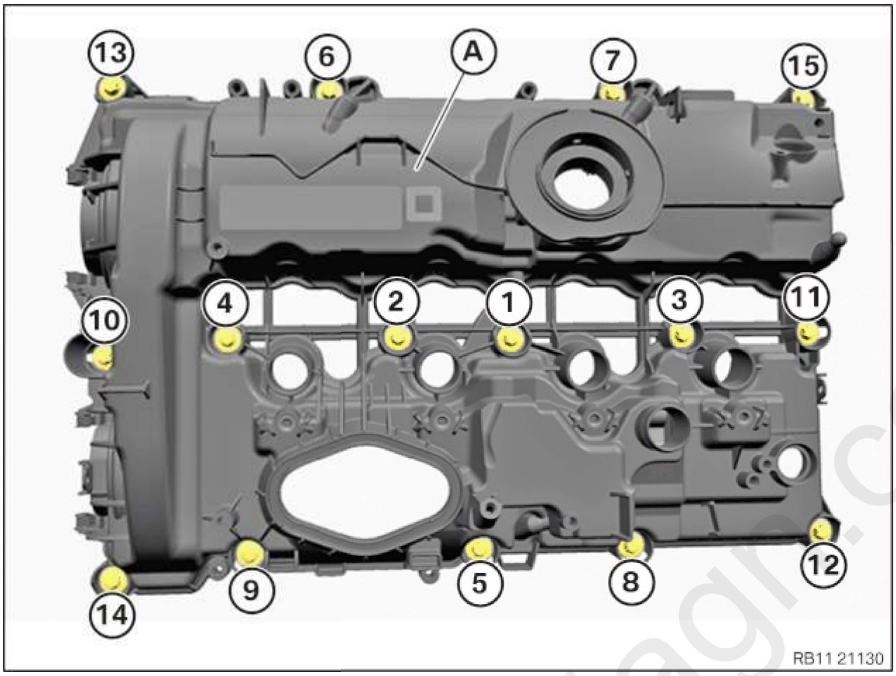
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- Insert and install cover (1) into guides.

71 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

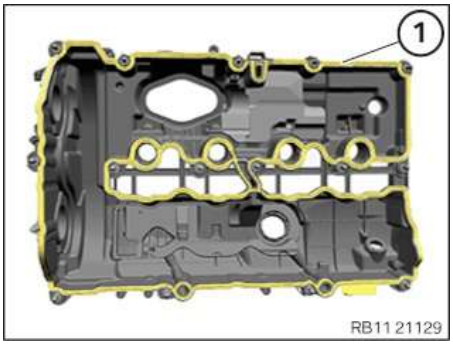
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

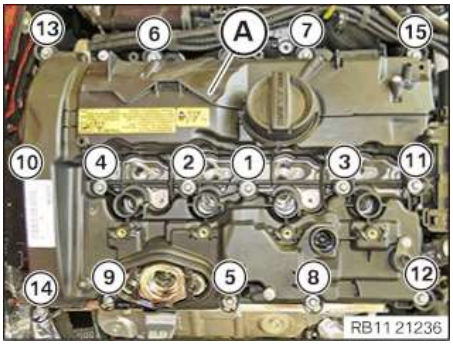
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

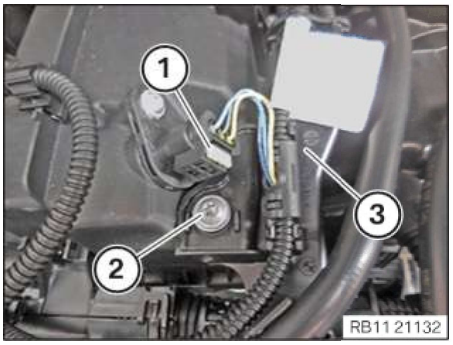
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

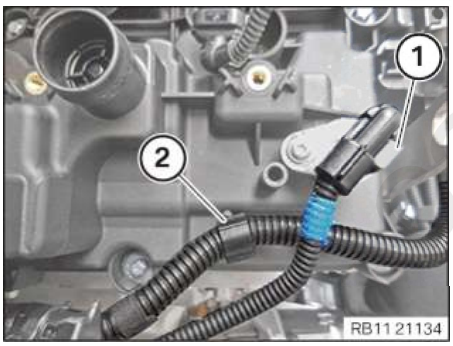


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

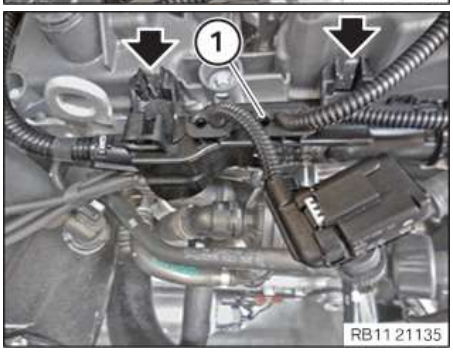
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

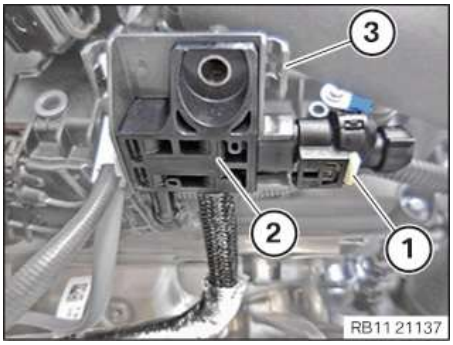


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

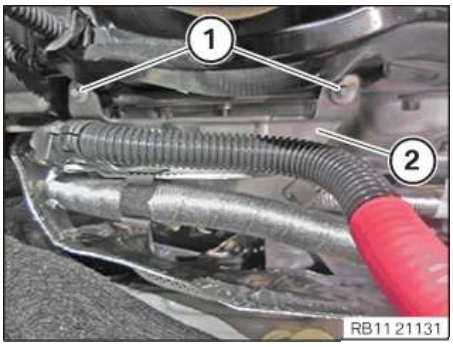


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

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- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

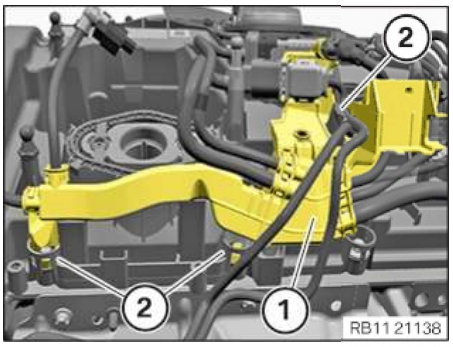
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

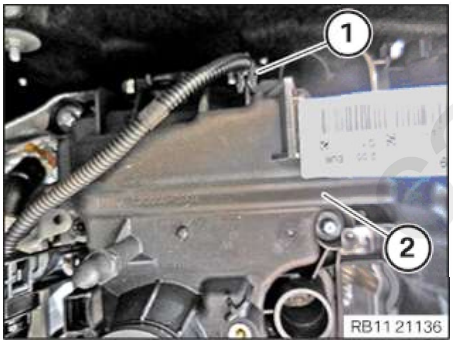
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

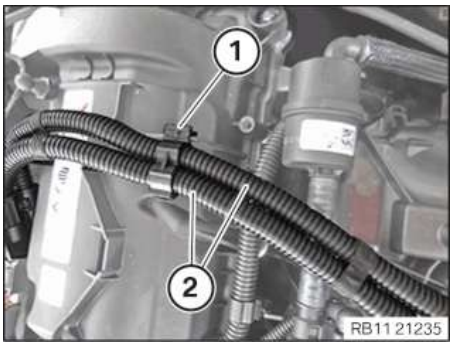
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.



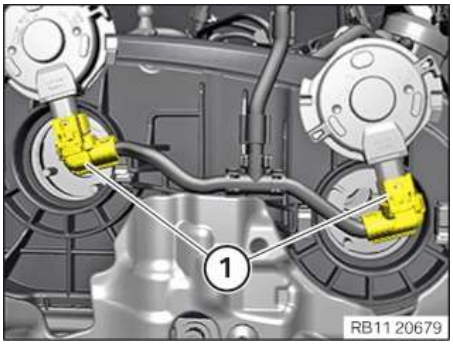
- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

72 – Installing both actuators

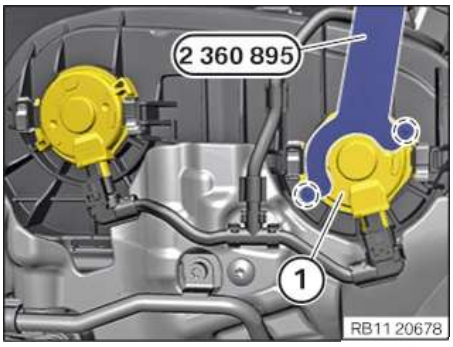
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NOTICE

The figure shows the rear side of the engine.

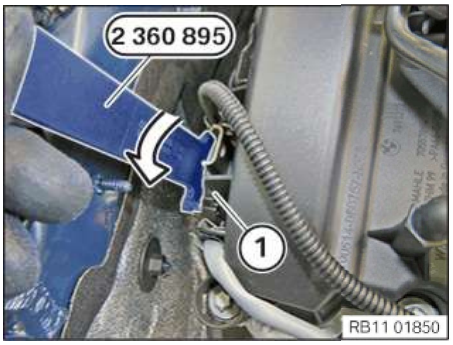
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



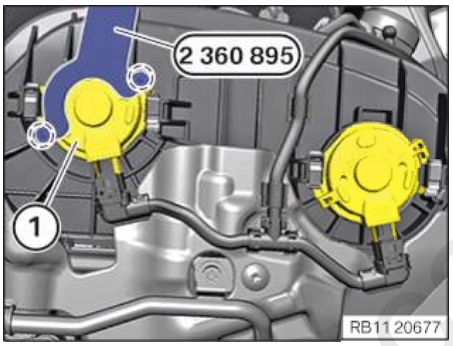
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



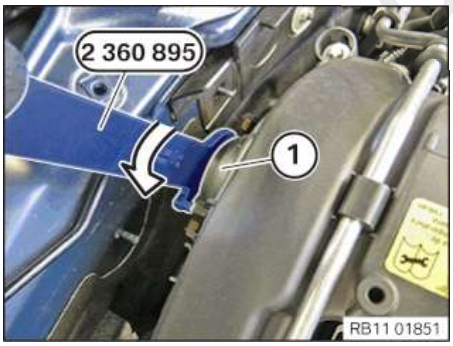
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

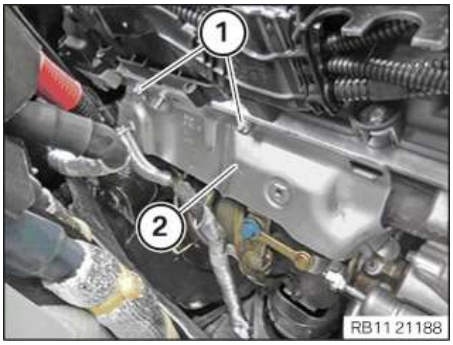
- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

73 – Installing the heat shield on the cylinder head

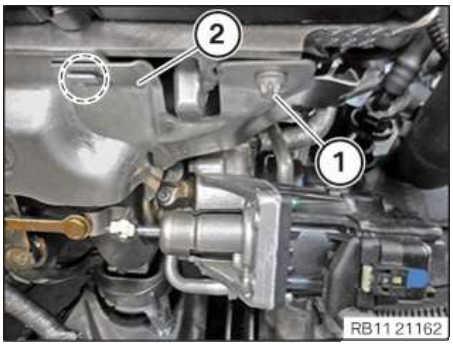
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- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

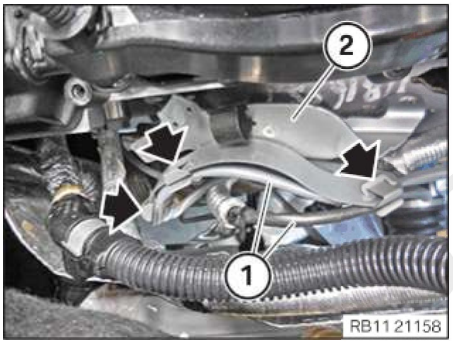


- Tighten down screw (1).

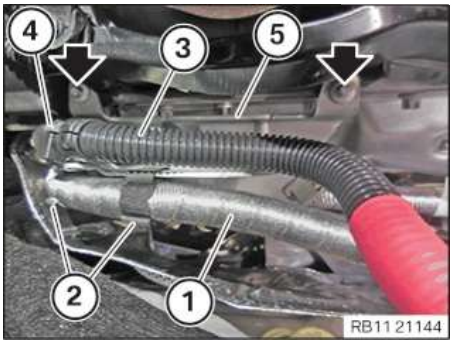
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

74 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

75 – Prepare the injectors for installation

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RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

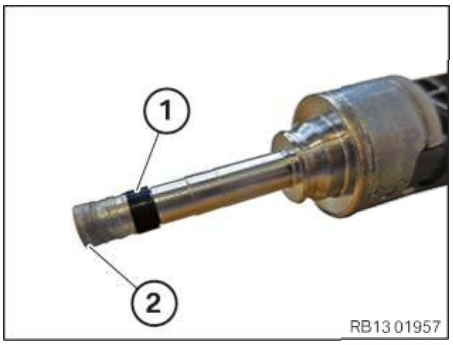
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

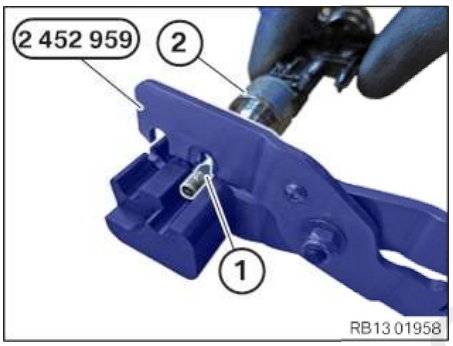
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

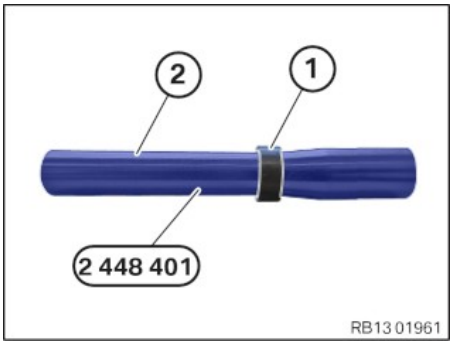


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

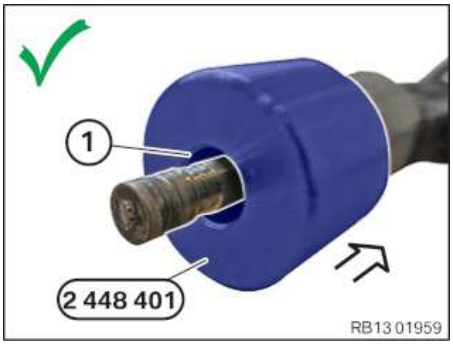
  (2) Sliding sleeve

  (3) Assembly sleeve



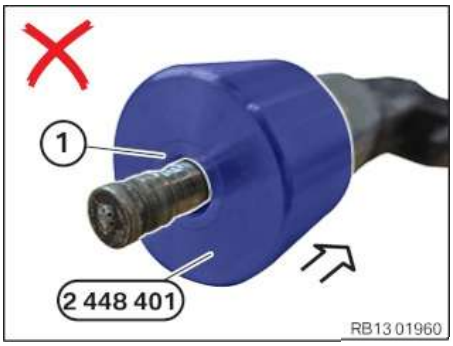
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.

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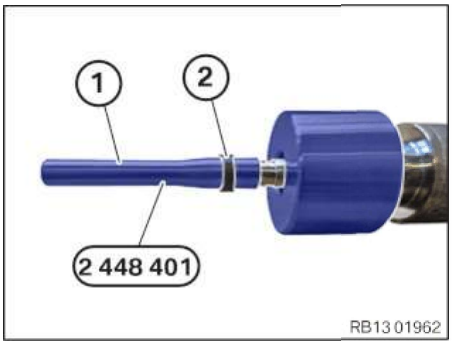
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

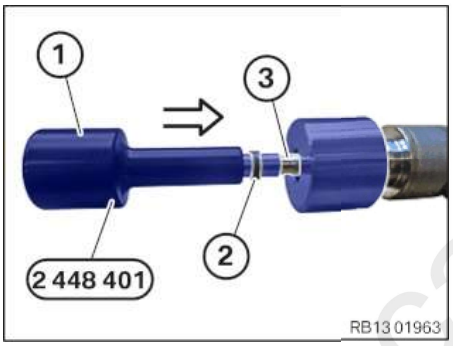


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

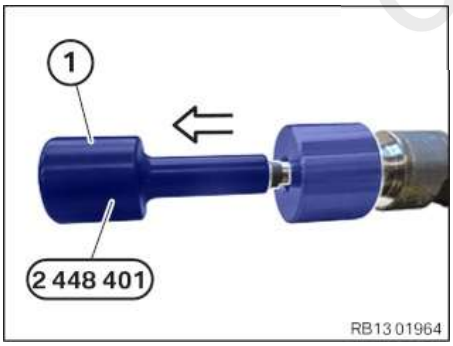
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



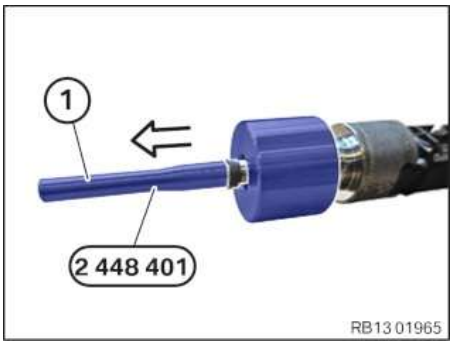
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

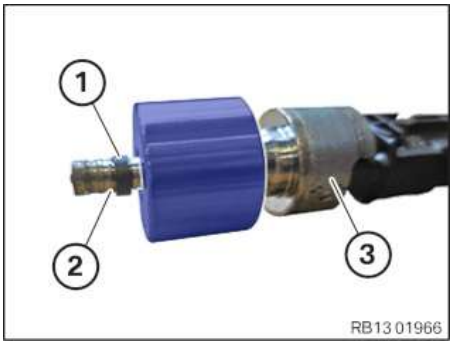


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

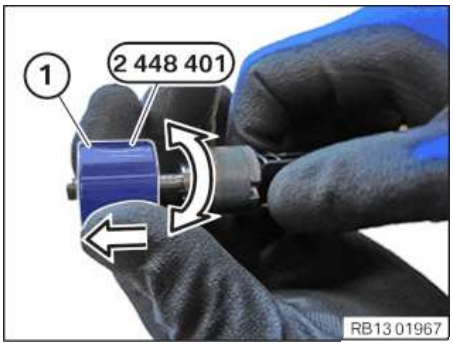


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

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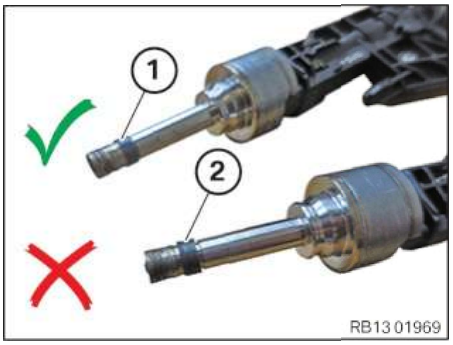


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

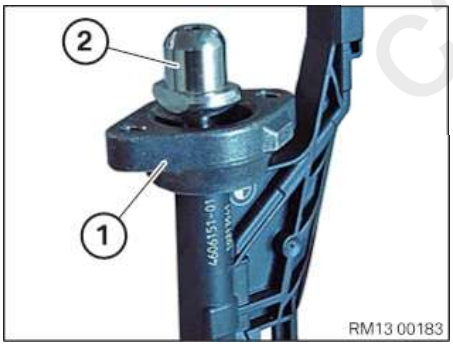


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

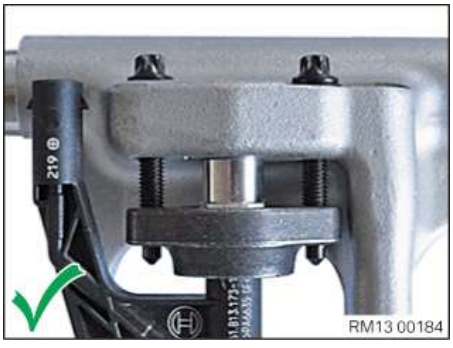
76 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



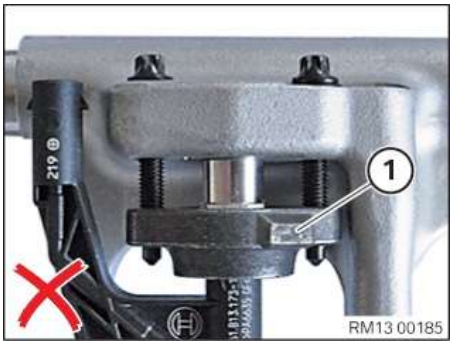
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

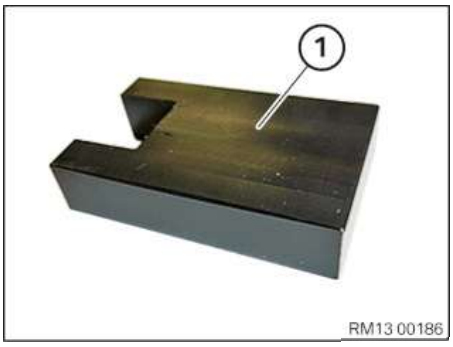
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



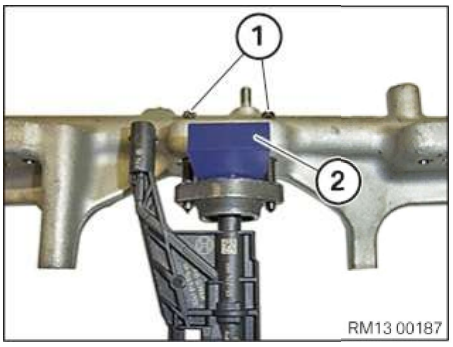
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



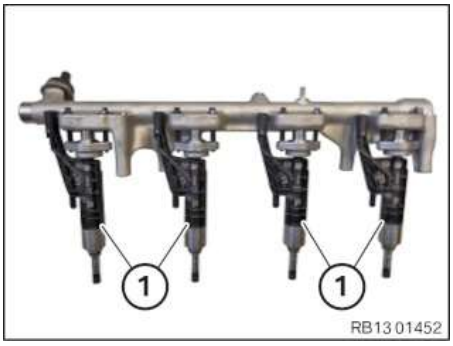
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



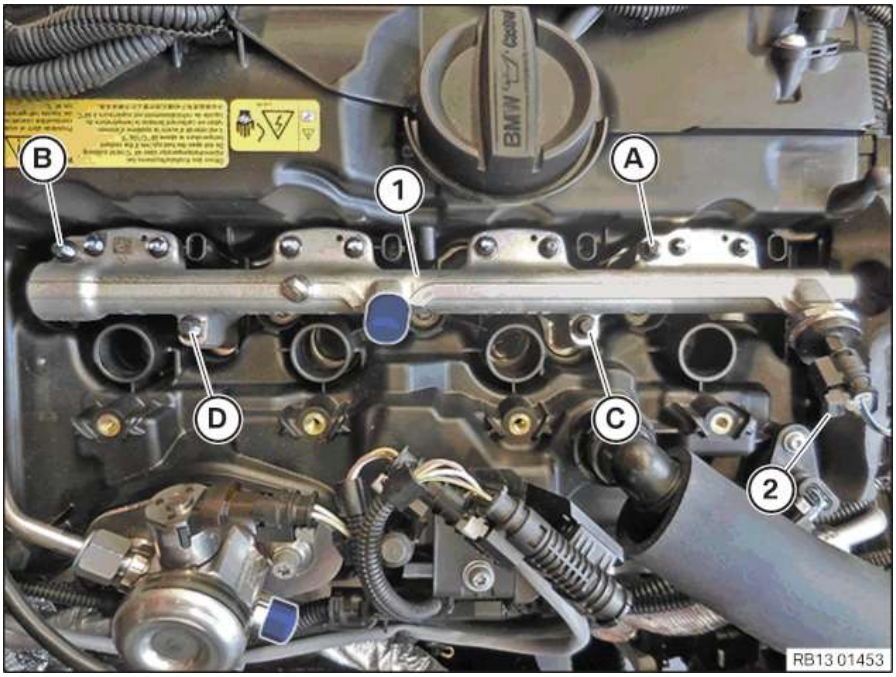
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

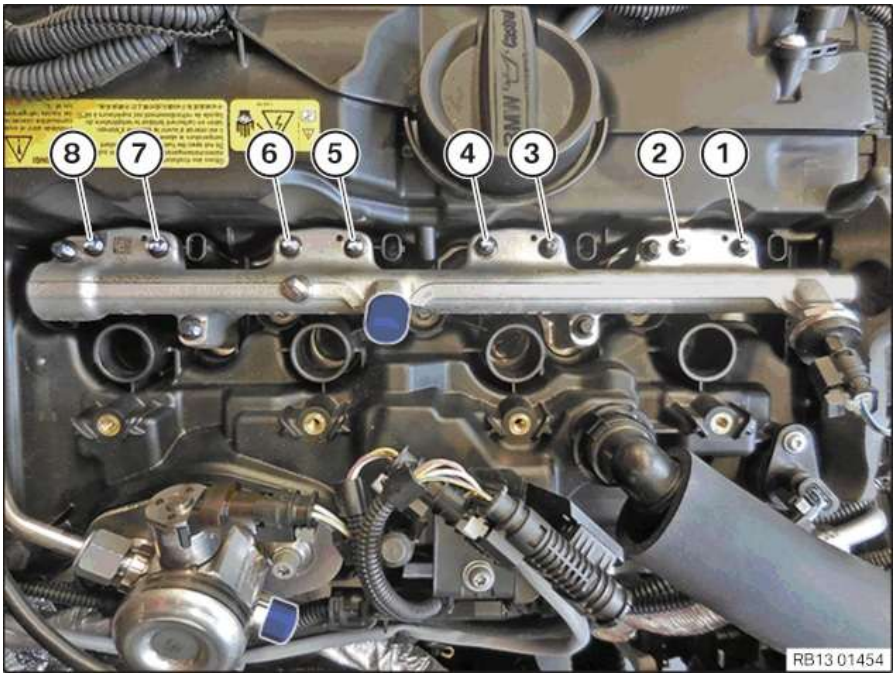
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

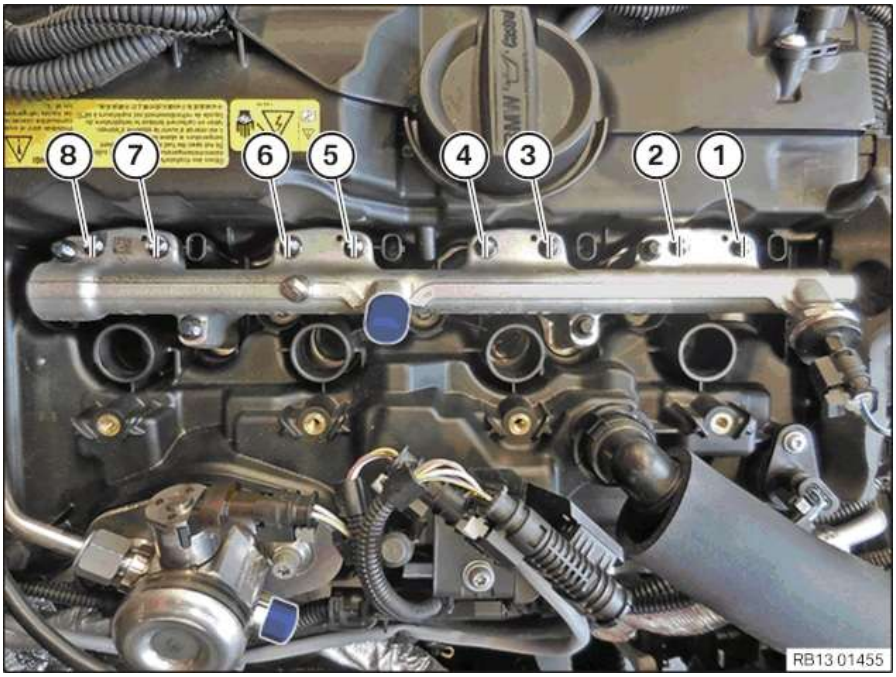
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

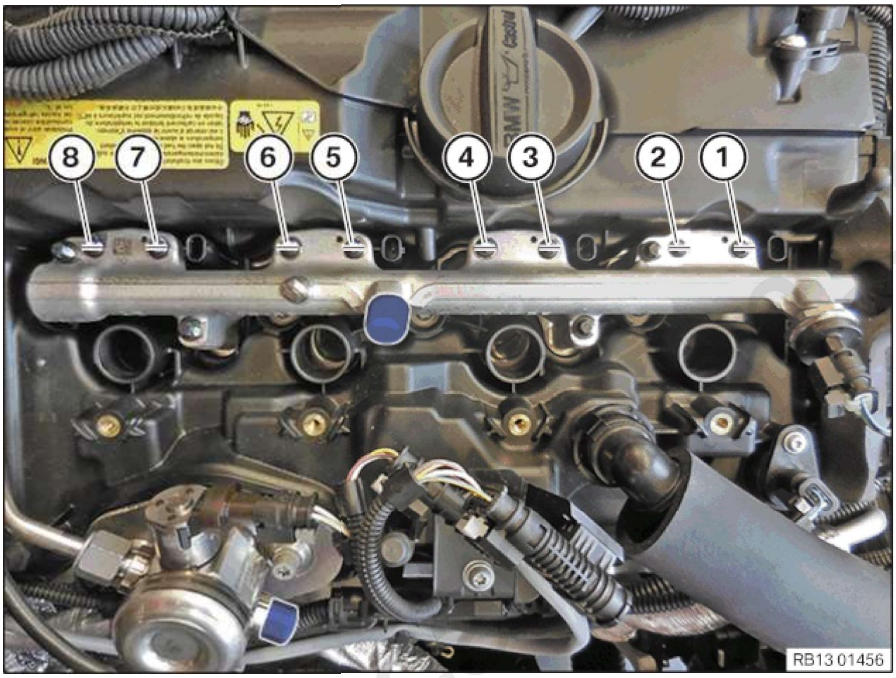
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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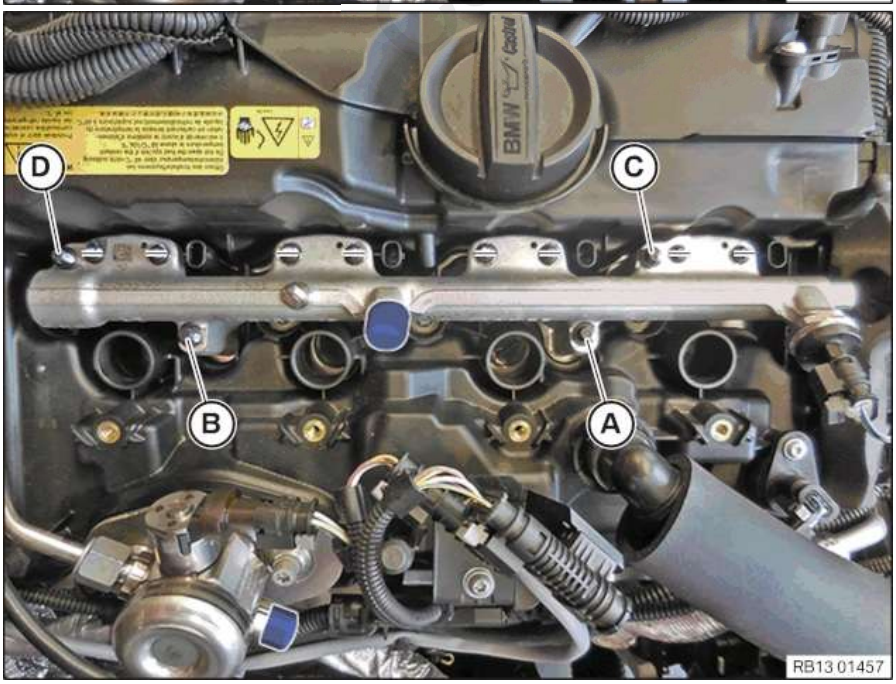


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

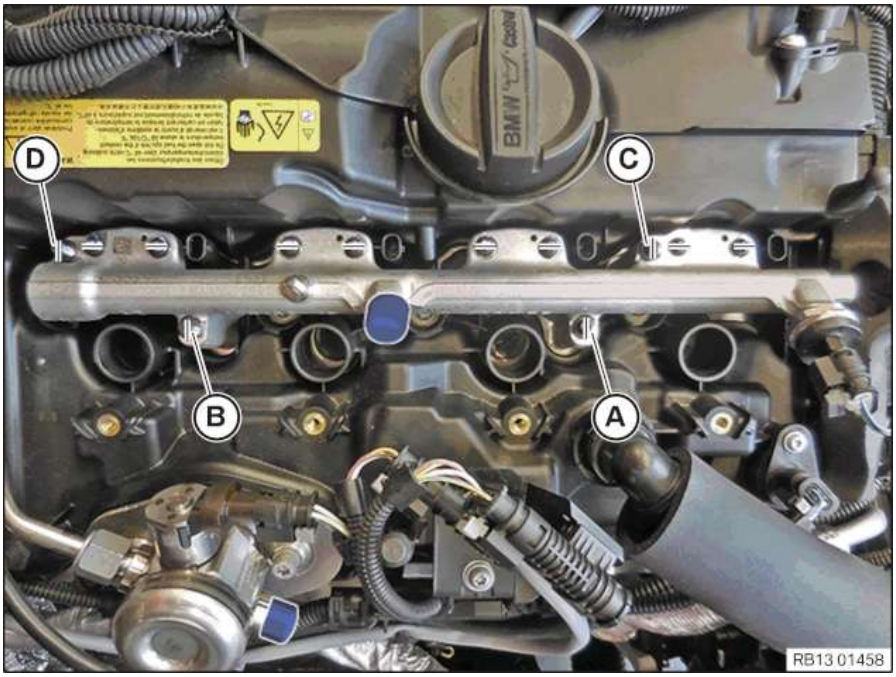
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

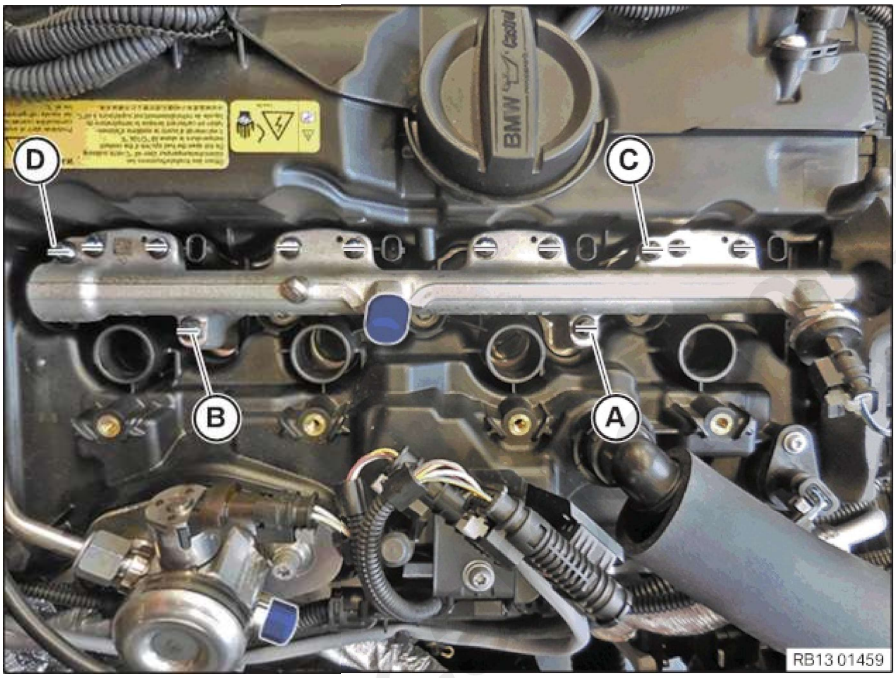
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

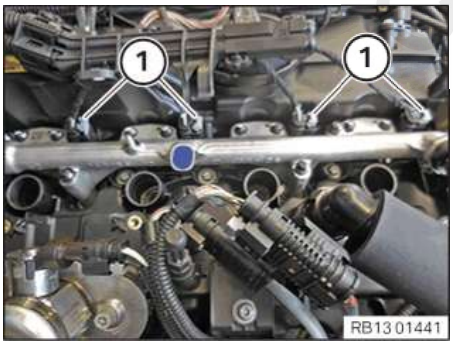


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



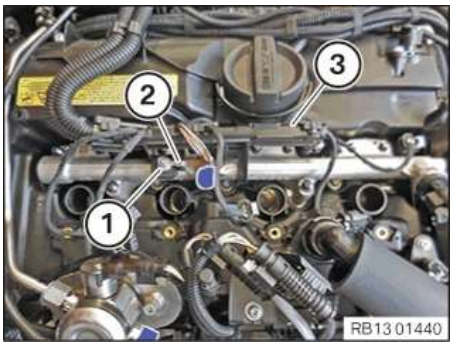
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

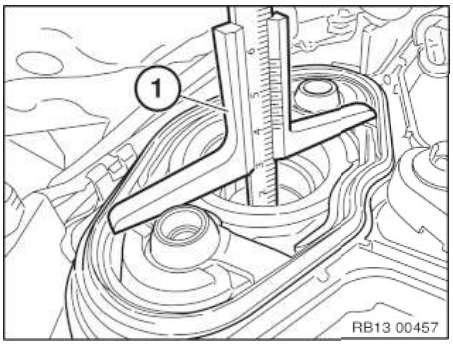
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

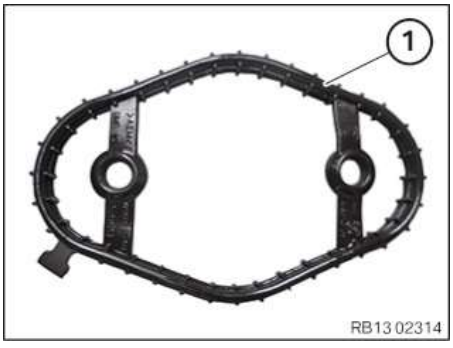
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

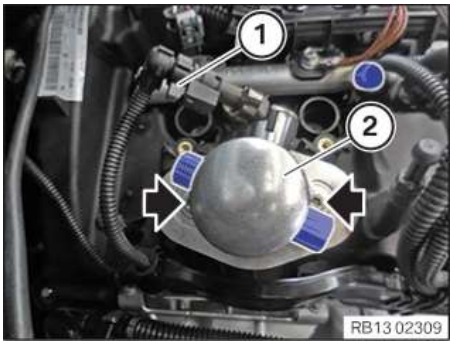
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

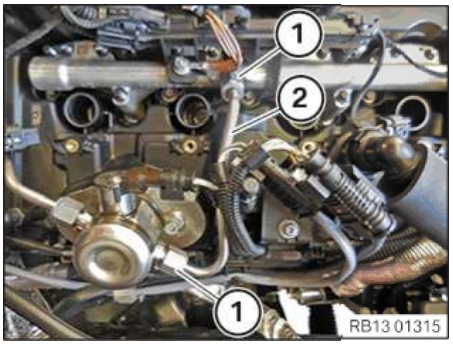
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

78 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

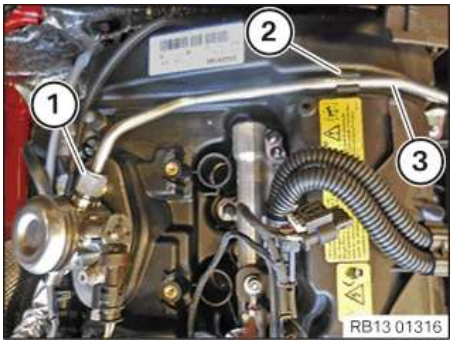
79 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

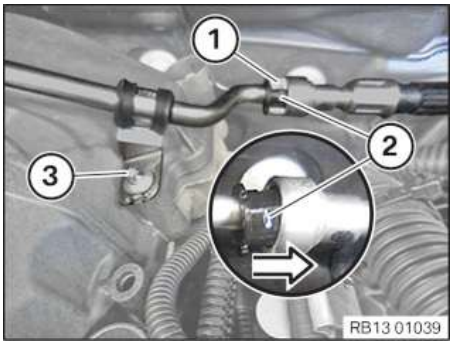


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

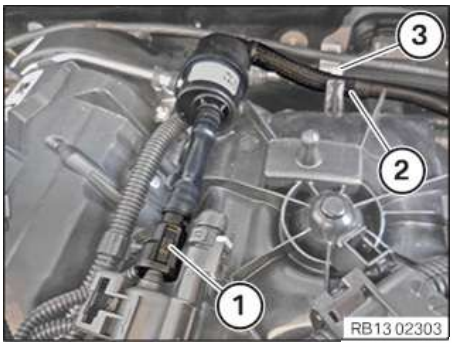
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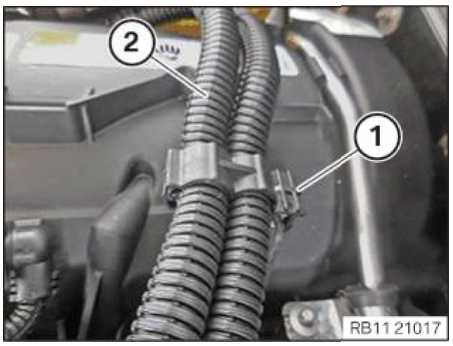
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

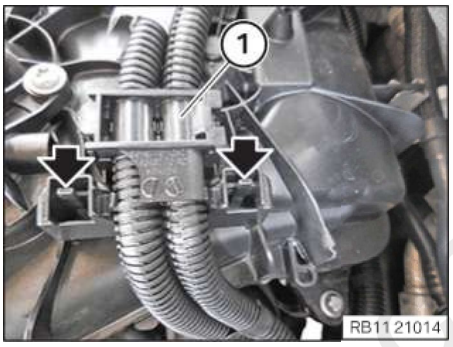
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

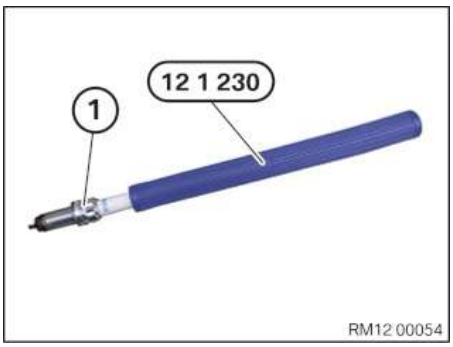


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

80 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

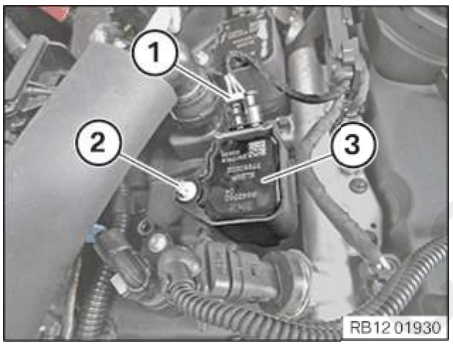
M12x1.25		Tightening torque	23 Nm

81 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



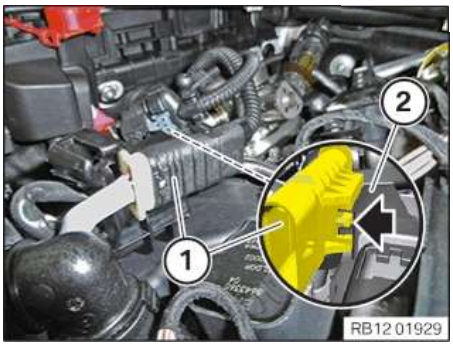
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

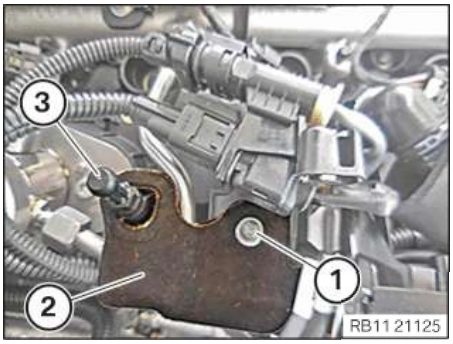
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

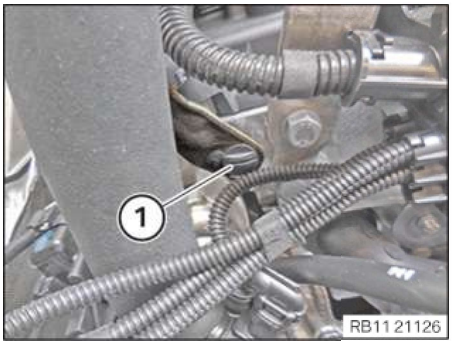
82 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

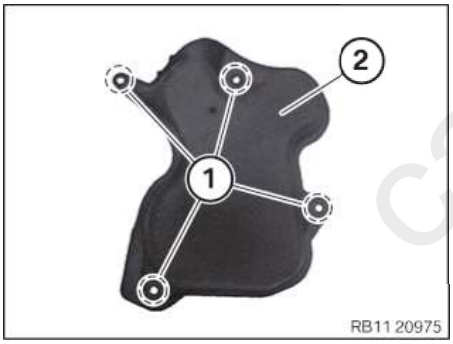
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



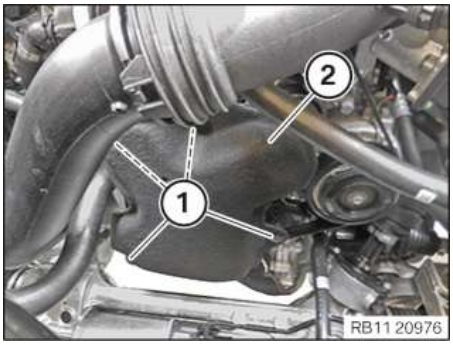
- Secure the clip (1).

83 – Install the acoustic cover for the engine at the front



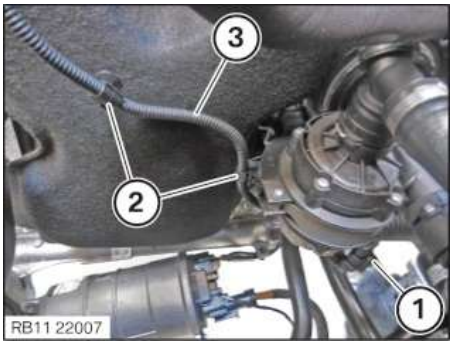
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



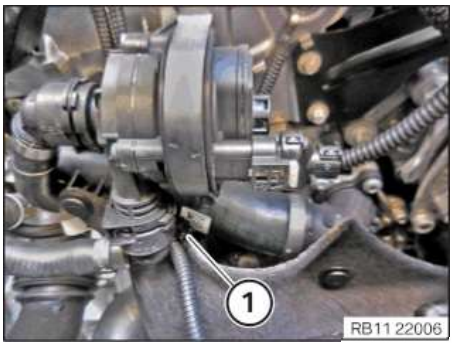
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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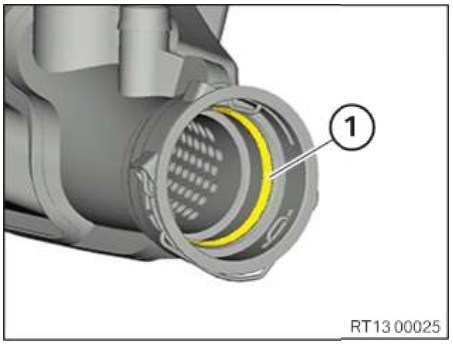
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

84 – Installing the clean air pipe with resonator

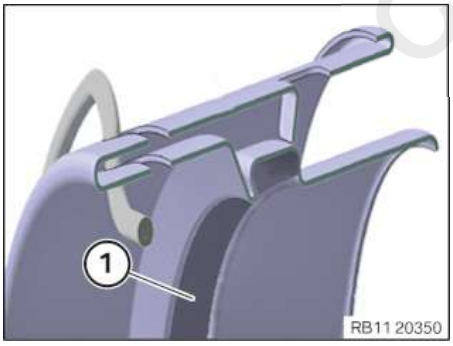


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

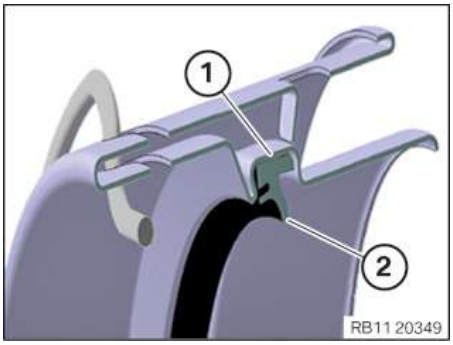
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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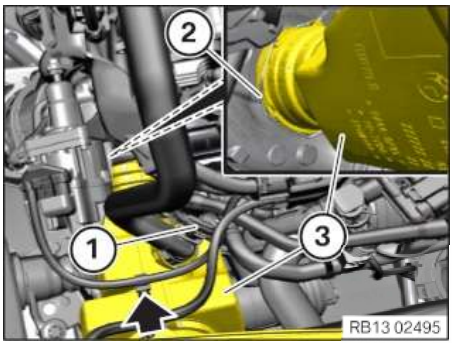
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

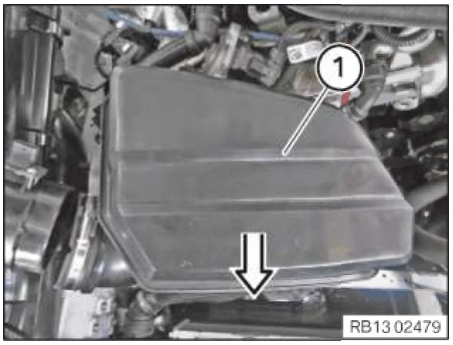
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



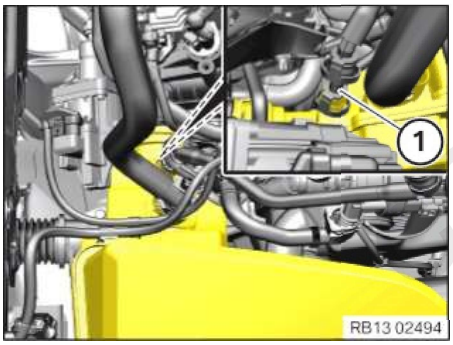
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

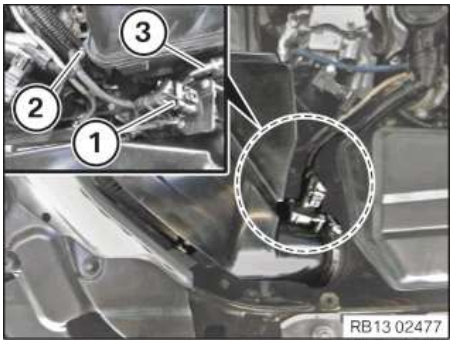
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

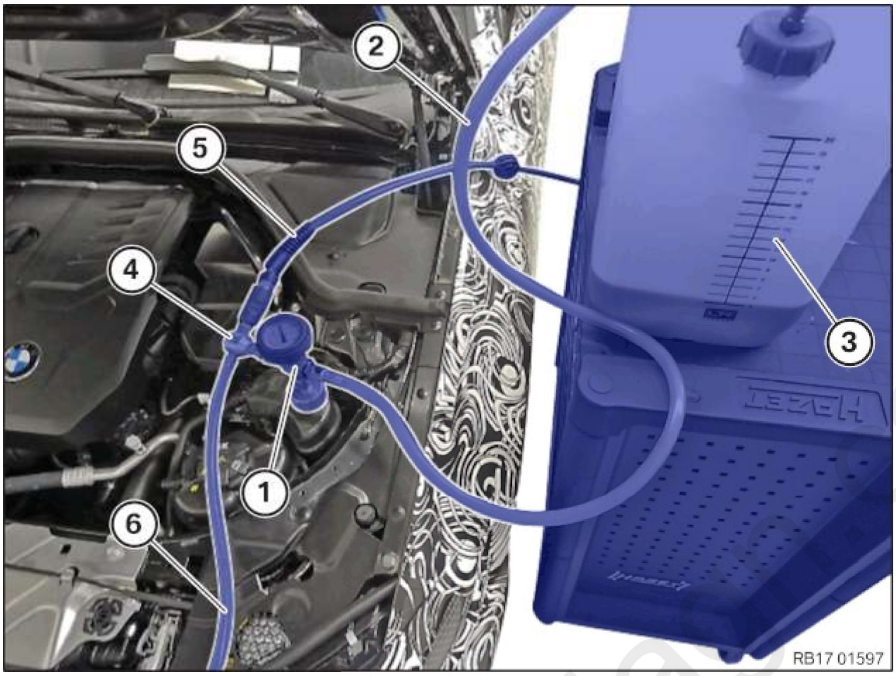
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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

85 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

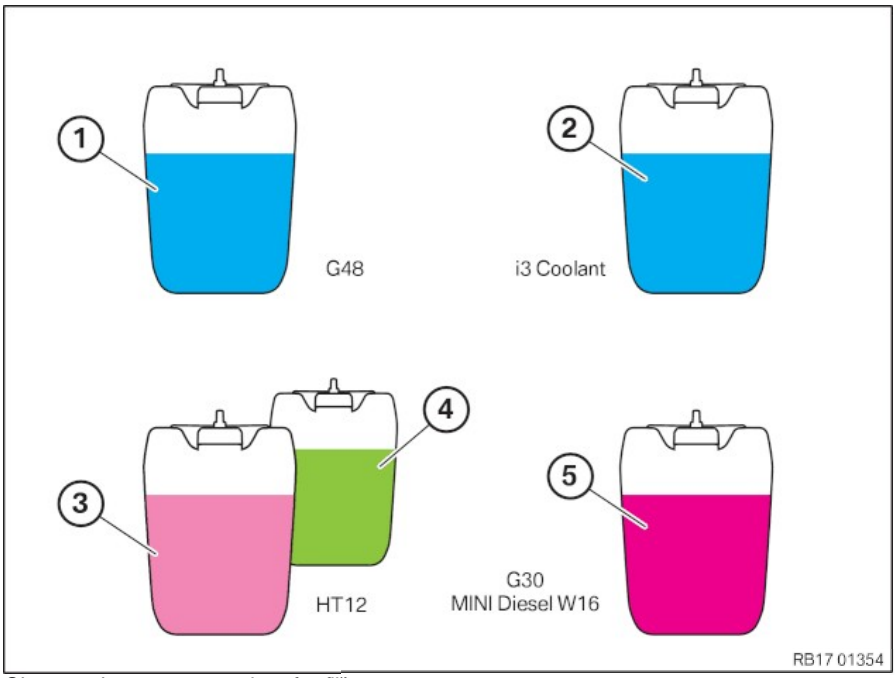
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

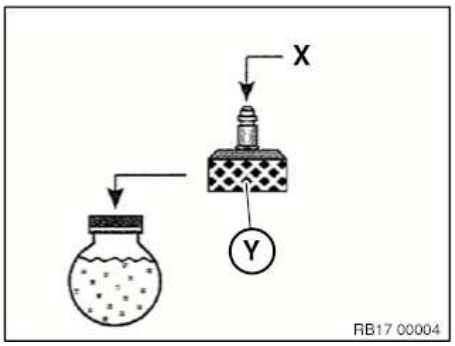
- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

Capacity of low-temperature coolant circuit G20

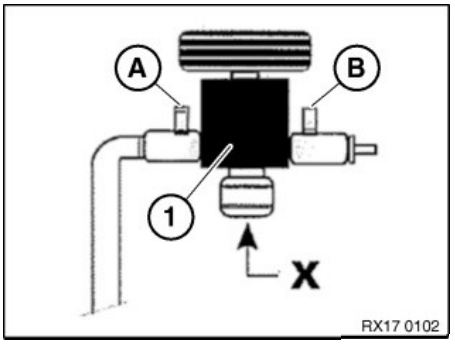
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

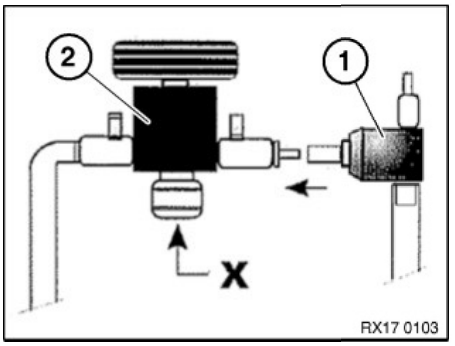
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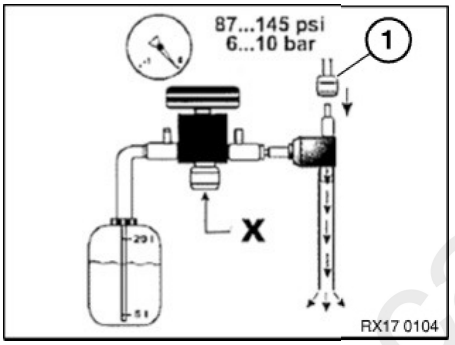
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



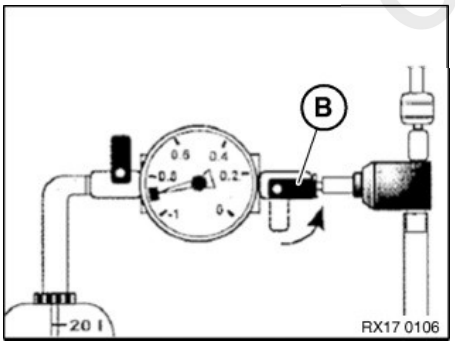
- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



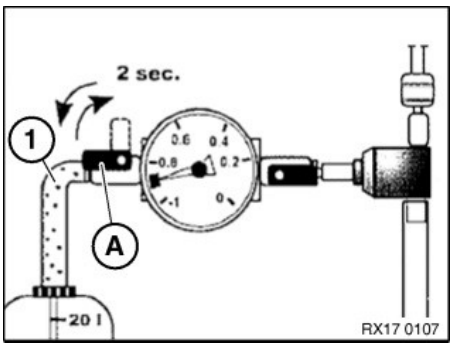
- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.



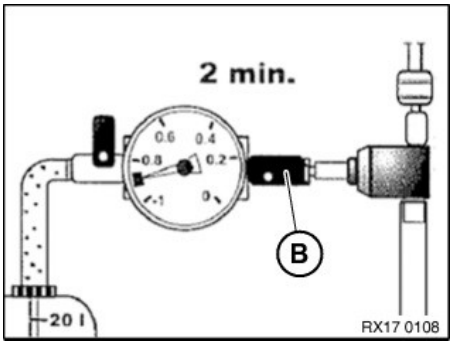
- Open shut-off valve (B).
  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

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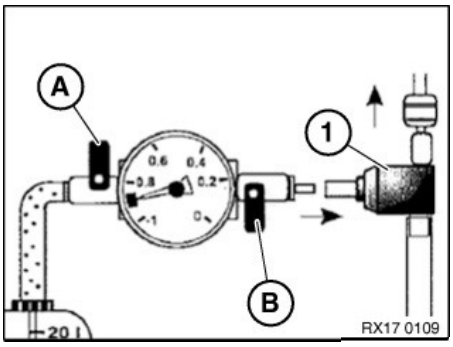


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

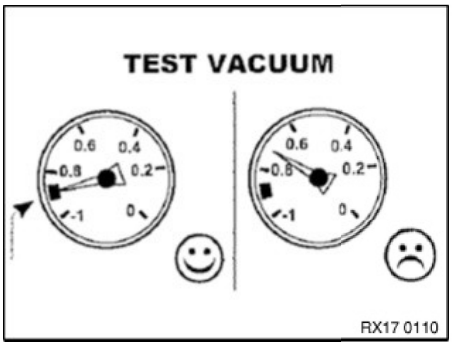
- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.



Result

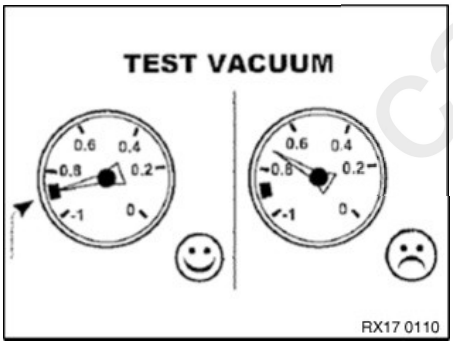
» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

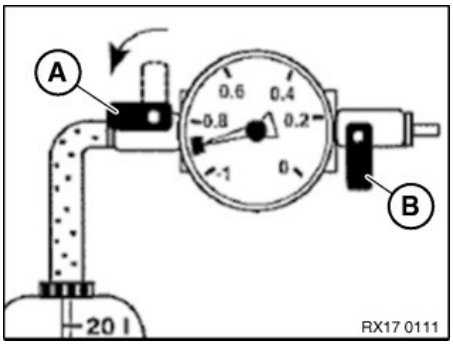


Result

» Vacuum remains constant.

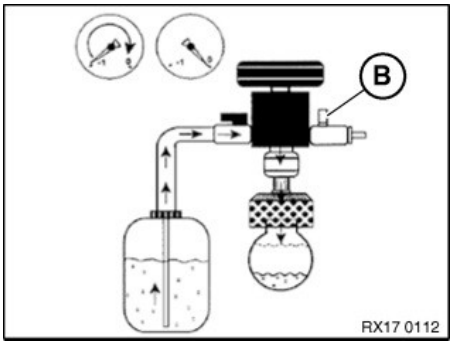
Measure

- Continue with filling.

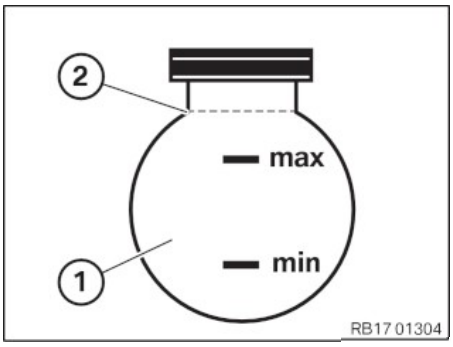


- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.

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- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

86 – Disconnecting all battery earth leads



- See additional information.

87 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

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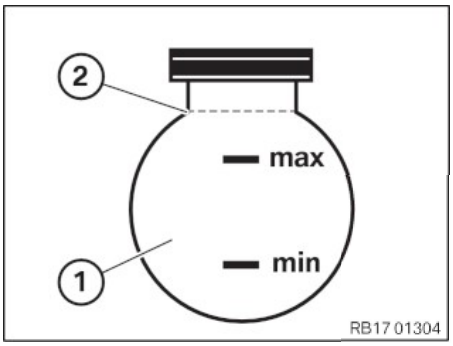
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

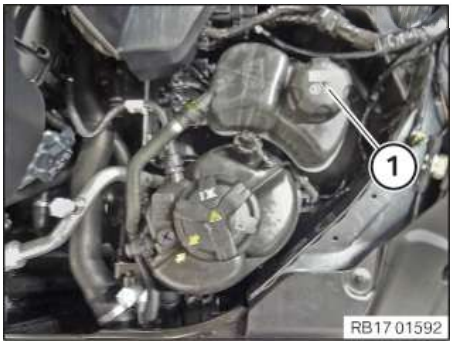
  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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TECHNICAL INFORMATION

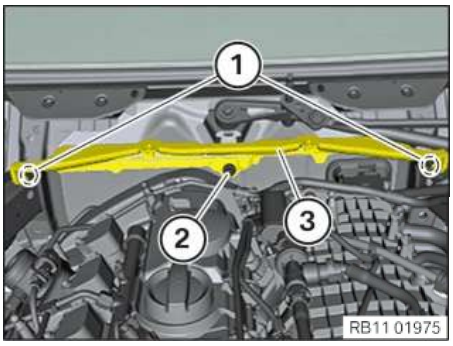
After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

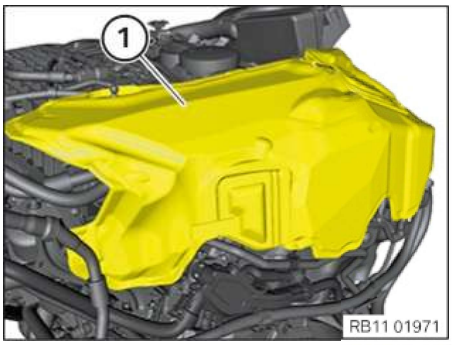
- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

88 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

89 – Installing acoustic cover at rear

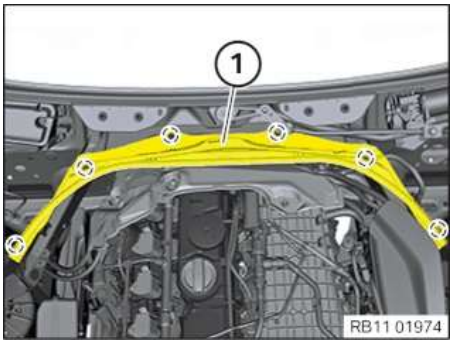


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

90 – Installing the centre bulkhead upper part

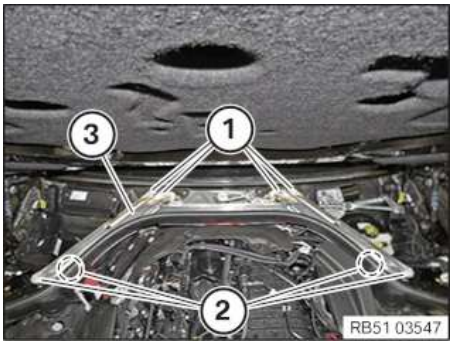


- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

	Tightening torque	3 Nm

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- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

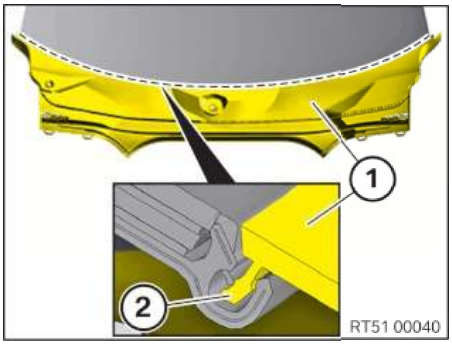
91 – Installing cowl panel cover

RISK OF DAMAGE

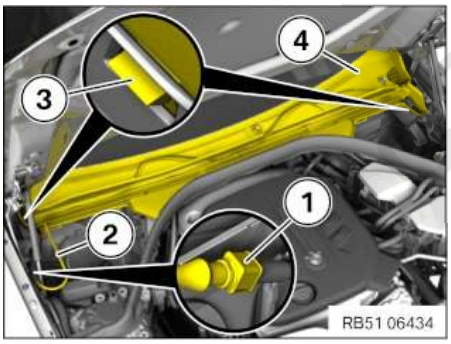
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

92 – Installing both wiper arms

NOTICE

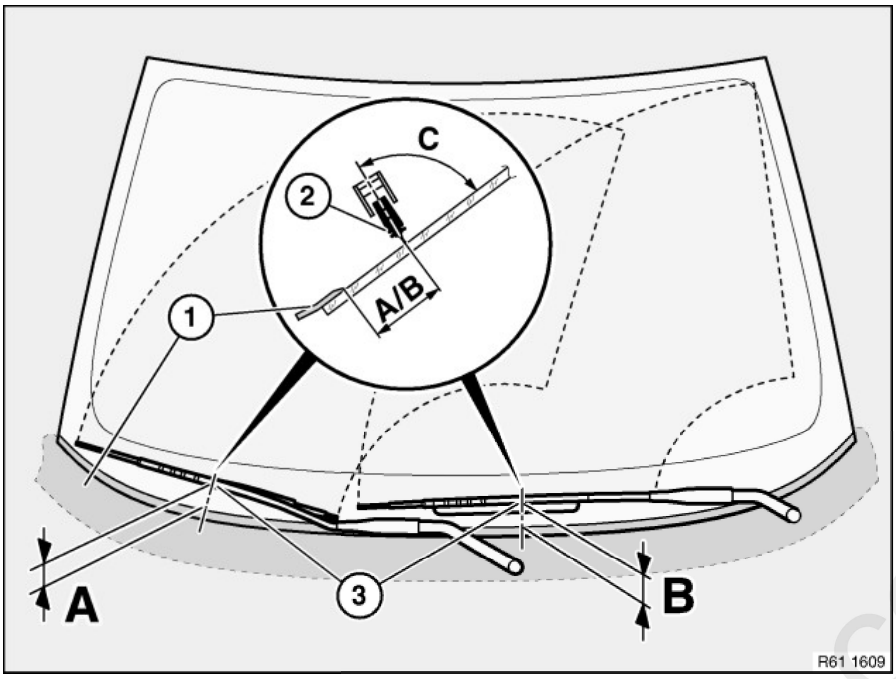
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

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TECHNICAL INFORMATION

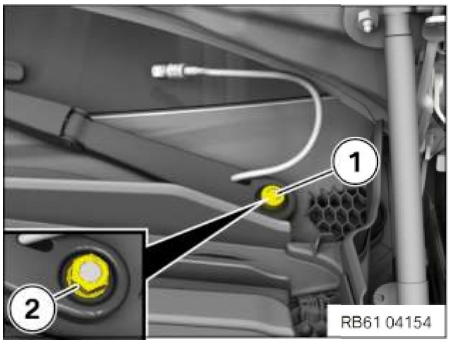
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

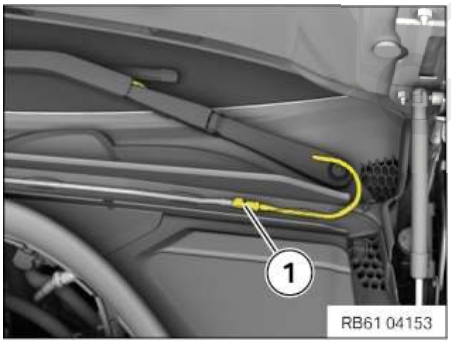


- Tighten nut (2).

Windscreen wiper arm

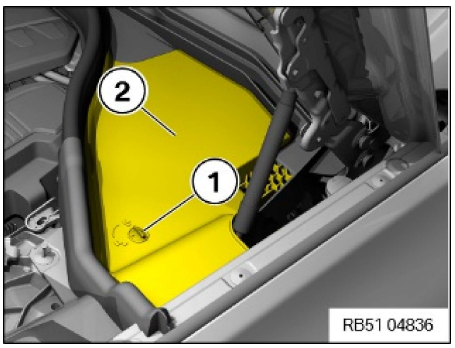
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

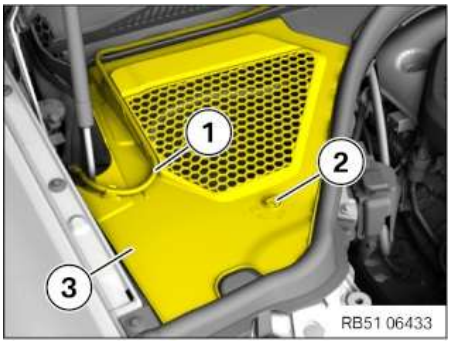
93 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

94 – Install the rear right engine compartment cover

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- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

95 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

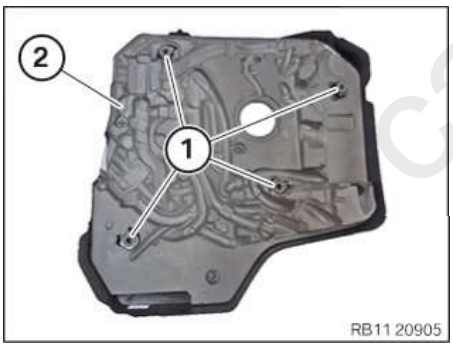
96 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

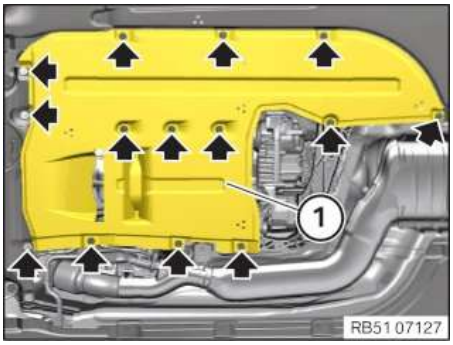


- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

97 – Installing underbody protection at rear

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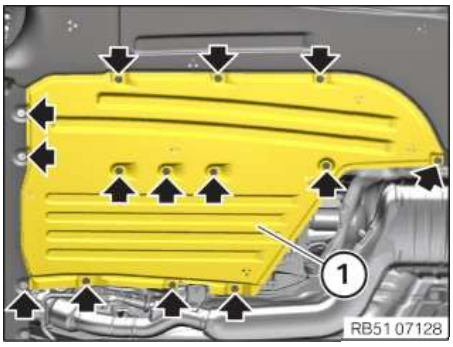
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

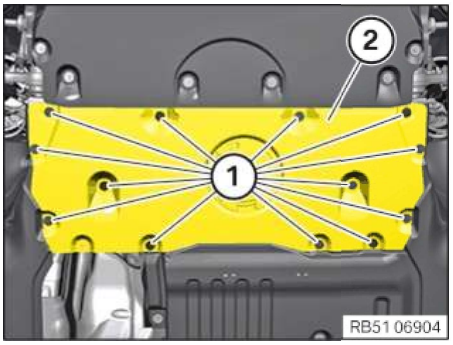
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

98 – Installing the centre underbody protection



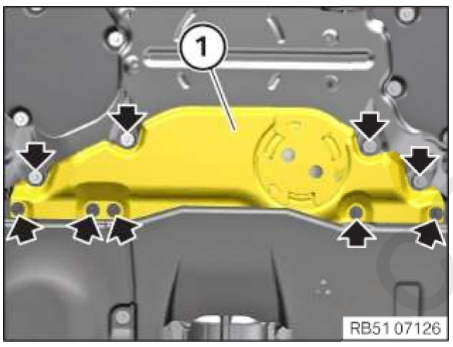
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

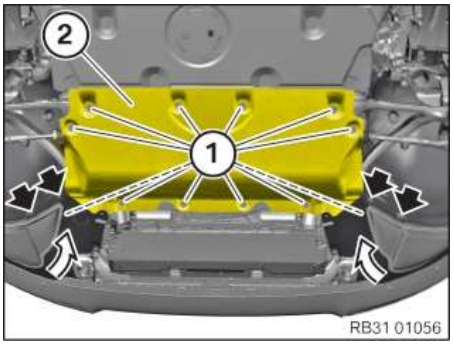
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

99 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

Underbody protection of the steering gear

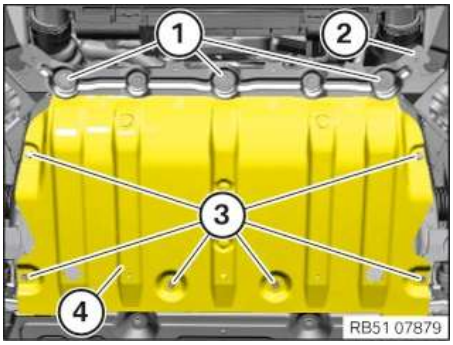
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm

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- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

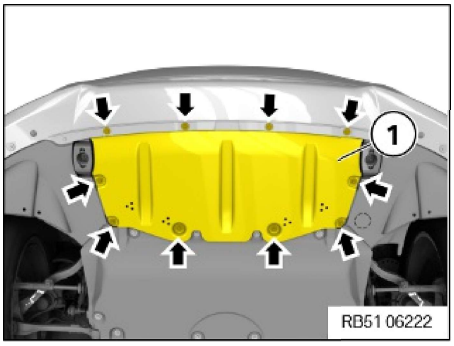
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

100 – Installing the front underbody protection



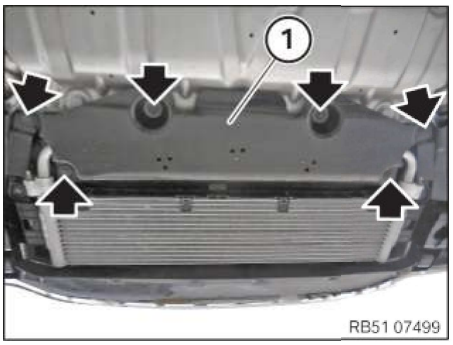
- **Version 1:**

Feed in the front underbody protection (1) towards the front under the bumper panel and position.

Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



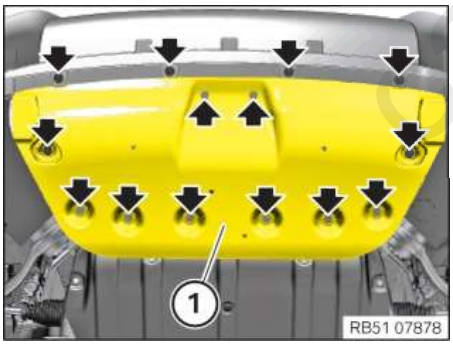
- **Version 2:**

Feed in and position the front underbody protection (1).

Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

Feed in and install front underbody protection (1).

Tighten screws (arrows).

Underbody protection front

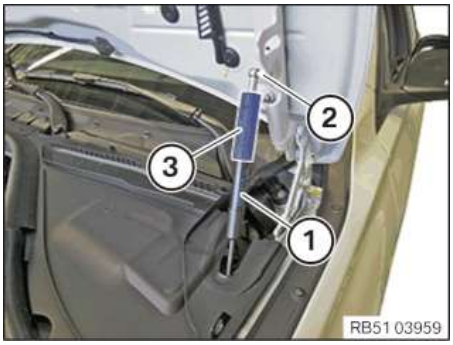
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

101 – Check engine oil level

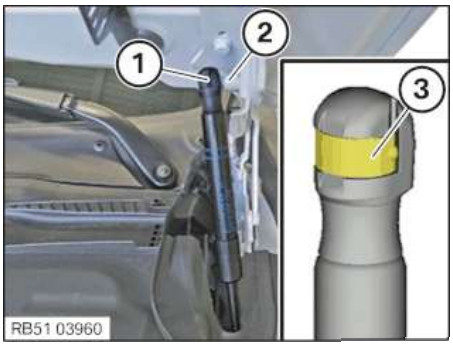
- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

102 – Take bonnet out of the service position

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- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 30

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head — Used in step 415161

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 415161

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 48

M6x16		Tightening torque	8 Nm

Intake camshaft to cylinder head — Used in step 49

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

VANOS central valve to camshaft — Used in step 5758

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 60

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Gate to bearing bracket — Used in step 64

M8			20 Nm

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Intake plenum to cylinder head — Used in step 66

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 66

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 66

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 66

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 66

M6		Tightening torque	8 Nm

Control unit holder on spring strut dome — Used in step 68

Hexagon screw		Tightening torque	8 Nm

Cylinder head cover to cylinder head — Used in step 71

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 71

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 7174

6X18		Tightening torque	6 Nm

Heat shield to cylinder head — Used in step 73

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 73

M6 x 12		Tightening torque	8 Nm

Ground cable to rail — Used in step 76

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 77

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 78

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 79

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 79

M6 screw		Tightening torque	6,5 Nm

Spark plugs — Used in step 80

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 81

Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover — Used in step 82

TS6 x 20			8 Nm

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Clean air pipe to upper section of intake filter housing — Used in step 84

Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead — Used in step 90

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 90

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 90

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 92

Combination hexagon nut		Tightening torque	35 Nm

Underbody protection — Used in step 9798

Hexagon screw		Tightening torque	3 Nm

Underbody protection of the steering gear — Used in step 99

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 99

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 99

M10		Tightening torque	56 Nm

Underbody protection front — Used in step 100

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

2 360 895 Pin wrench

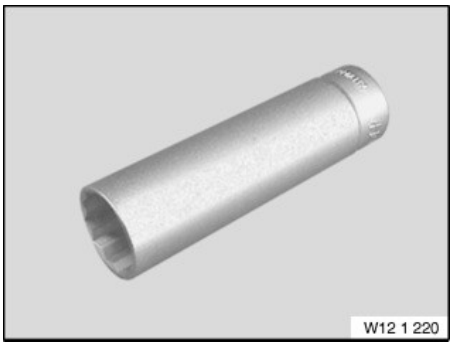


Common — Used in step 1272

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

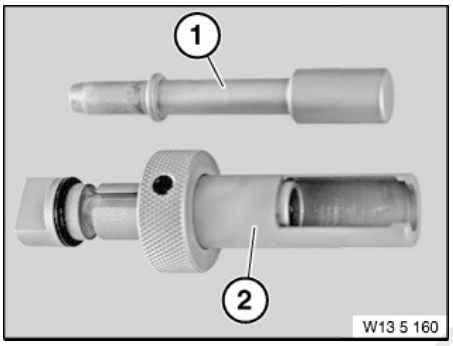
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0 495 560 (12 1 220) Socket



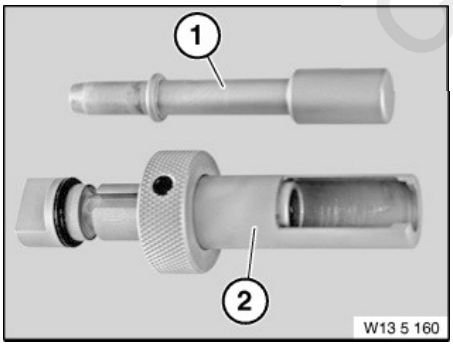
Common	Used in step 1680
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 496 567 (13 5 161) Fastener



Common	Used in step 19
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

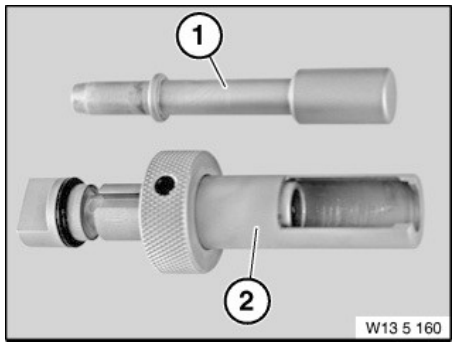
0 496 568 (13 5 162) Fastener



Common	Used in step 19
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 565 (13 5 160) Fastener



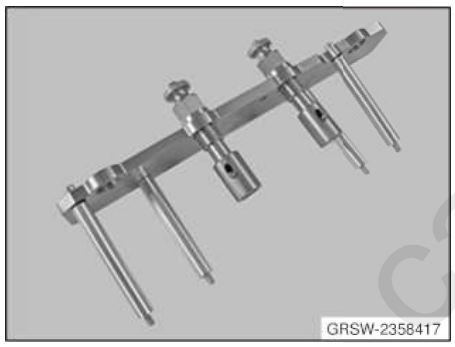
Common Used in step 19

Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

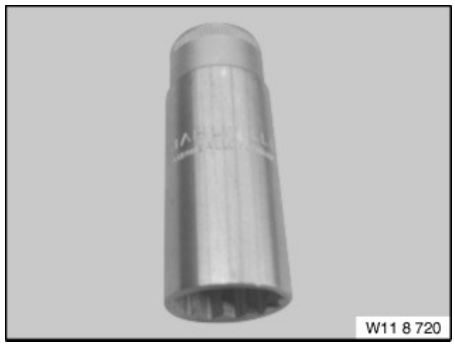
2 358 417 Device



Common Used in step 20

Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46

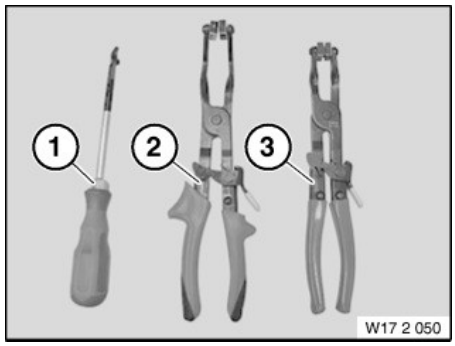


Common Used in step 20

Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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0 495 794 (17 2 050) Pliers



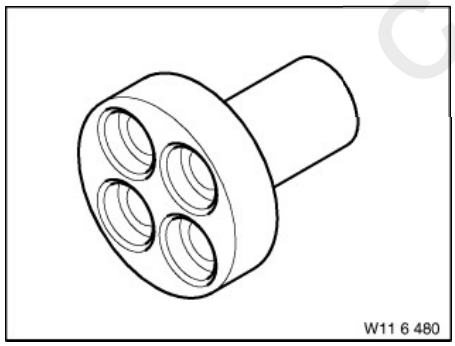
Common Used in step 3566

Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

0 493 380 (11 6 480) Connector



Common Used in step 3741596177

Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

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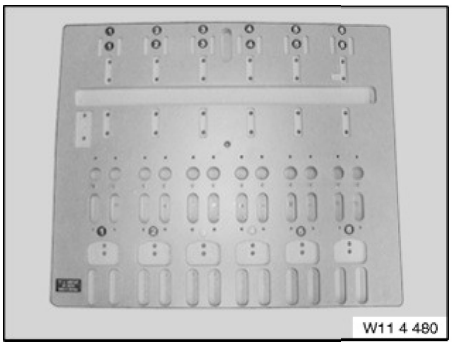
2 359 088 Device



Common Used in step 3865

Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 105 (11 4 480) oddments tray



Common Used in step 38394047

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

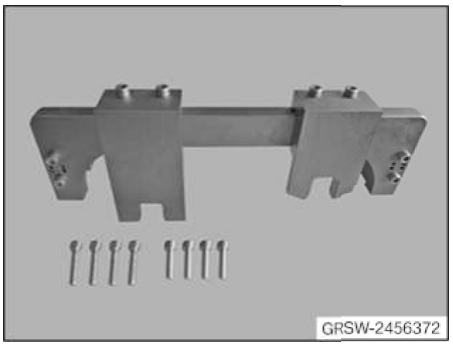
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2 288 380 Locating stud



Common	Used in step 415961
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 4146515961
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 414661
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



Common	Used in step 43545758
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 43545758
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

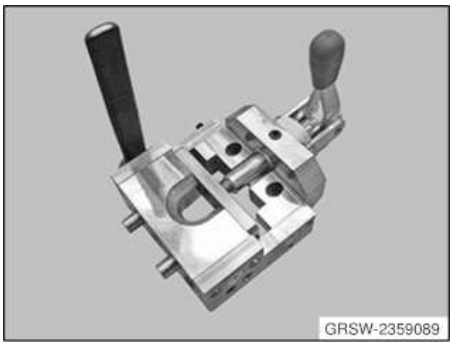
2 455 654 Tensioning tool



Common	Used in step 5659
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

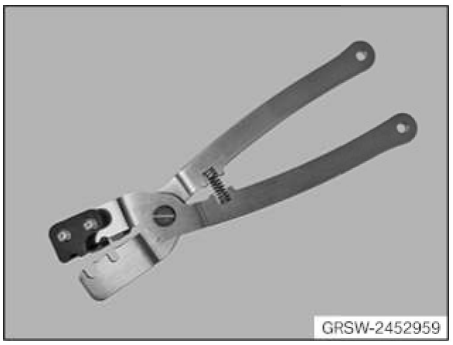
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2 359 089 Device



Common	Used in step 64
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

2 452 959 Pliers



Common	Used in step 75
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 75
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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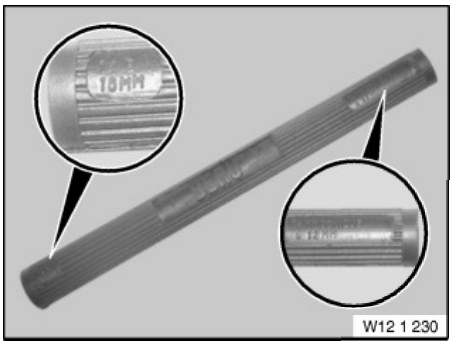
2 358 022 Gauge



Common Used in step 76

Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



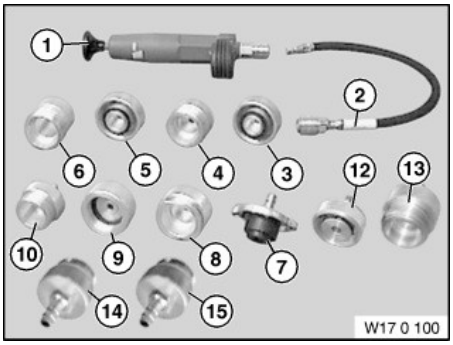
Common Used in step 80

Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 494 417 (17 0 100) Tester

Used in step 85

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Common

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Distance from window pane edge to wiper blade — Used in step 92

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Capacity of low-temperature coolant circuit G20 — Used in step 85

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B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	3170

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	186
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	186
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
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61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 20 900 Disconnecting and connecting battery earth lead	186
61 35 ... Notes on ESD protection (Electro Static Discharge)	1234
61 35 ... Notes on ESD protection (Electro Static Discharge)	12152031323469
13 53 ... Clean the cylinder head around the injectors due to grit / dust	20
61 13 ... Unlocking and disconnecting different plug connections	202471
61 00 730 Encode/program control unit(s) (after vehicle test)	70
17 00 ... Notes for working on cooling system.	85

Operating materials	Used in step
Main group 17	85

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This documentation refers to special tools that were not yet available when going to press.

11 31 051 Replacing the timing chain

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Removing engine



- See additional information.

2 – Mount engine on assembly stand

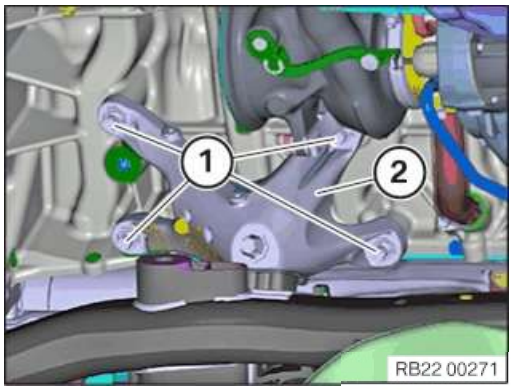
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CAUTION

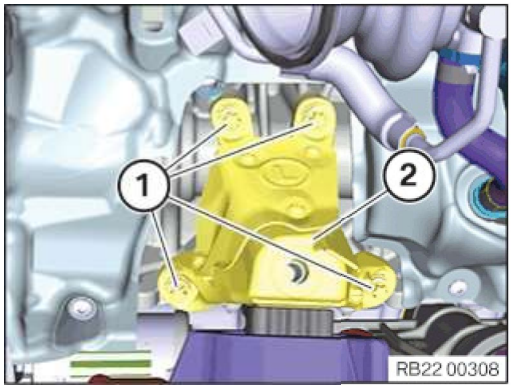
Heavy component.

Heavy components can lead to injury or damage.

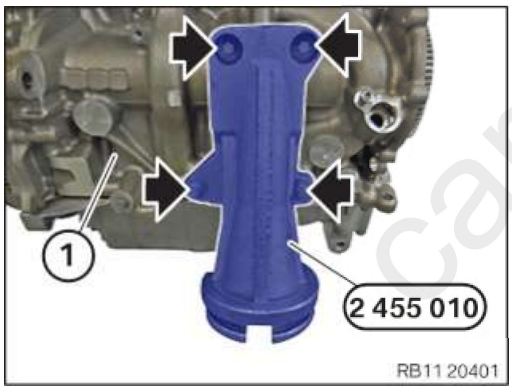
- Remove and install heavy components with the aid of another person/other persons.



- **Type: Rear-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



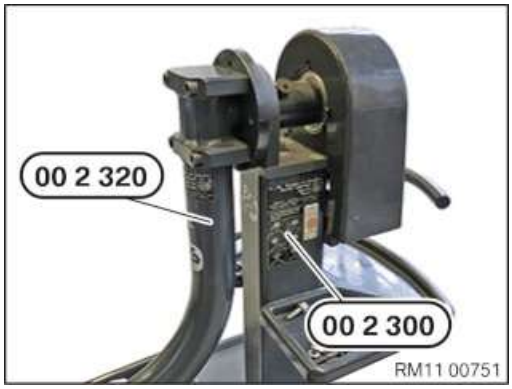
- **Type: Four-wheel drive**
- Loosen screws (1).
- Remove engine mounting bracket (2).



- Position the special tool 2 455 010 on the engine (1).
- Position the standard bolts **M10x30**.
- Tighten the standard bolts (arrows).

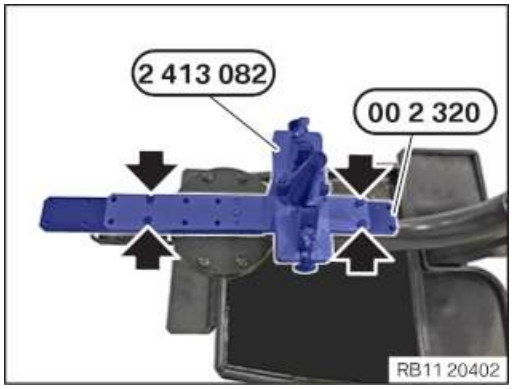
Special tool 2 455 010 to crankcase

M10x30		Tightening torque	38 Nm



- Prepare the assembly stand 0 495 187 (00 2 300) with the special tool 0 495 196 (00 2 320).

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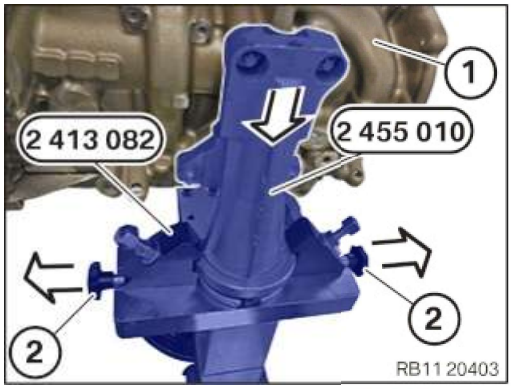
- Screw the special tool to the 0 495 196 (00 2 320) special tool.
- Tighten screws (arrows).

Special tool 11 8 930 to special tool 00 2 320

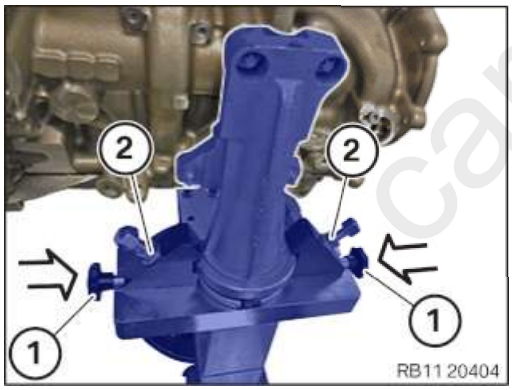
M14x35		Tightening torque	160 Nm



- Position the engine lifter with the special tool and the engine on the special tool 0 495 187 (00 2 300).



- Detach the holder (2) in the direction of the arrow.
- Position the engine (1) with the special tool 2 455 010 in the direction of the arrow on the special tool .



- Lock the holder (1) in direction of arrow.
- Tighten nuts (2).

3 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

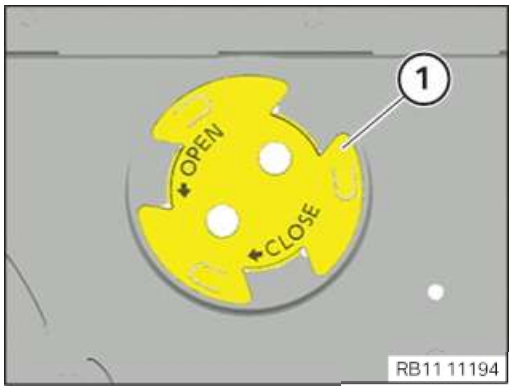
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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).



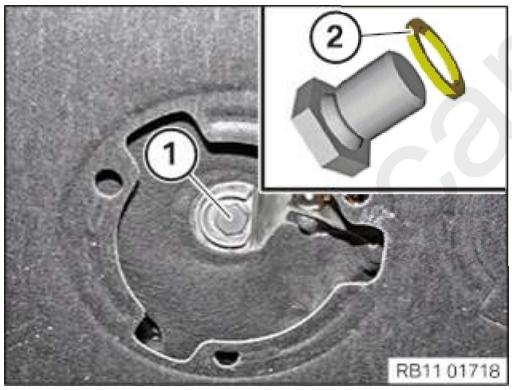
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

4 – Tightening the oil drain plug

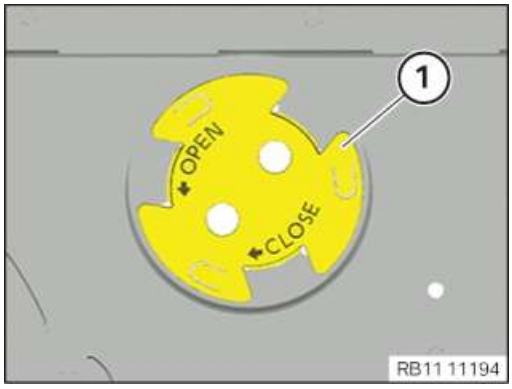


- Renew sealing ring (2).

  Parts: Sealing ring
- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

M12x16	Renew the sealing ring.	Tightening torque	25 Nm



- Install service cap (1).

5 – Removing all spark plugs

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.



- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

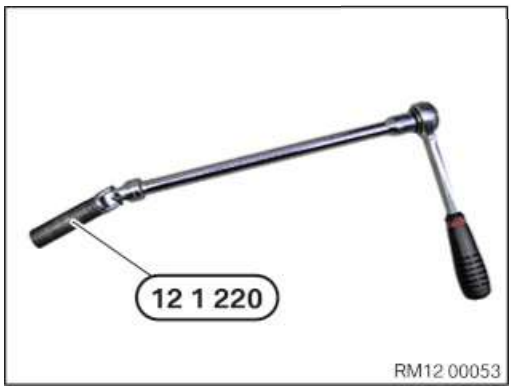
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

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- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

6 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

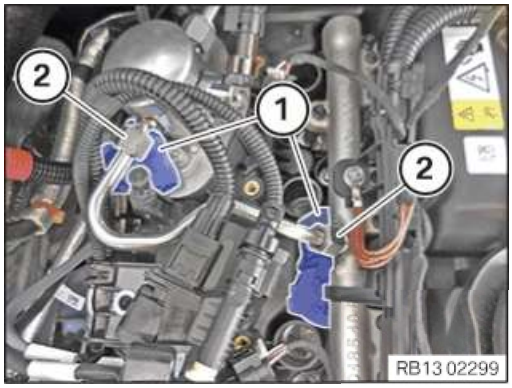
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

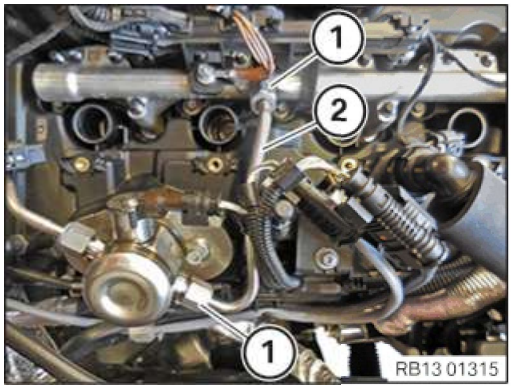
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- Have the special tool ready.



- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

7 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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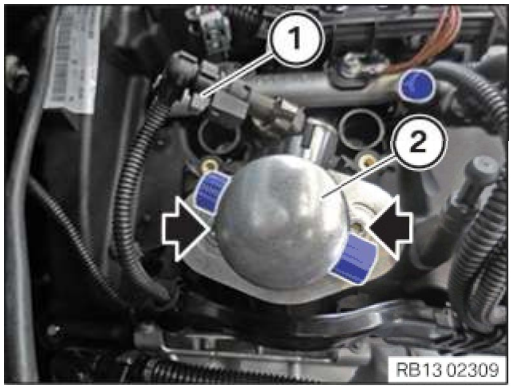
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

8 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

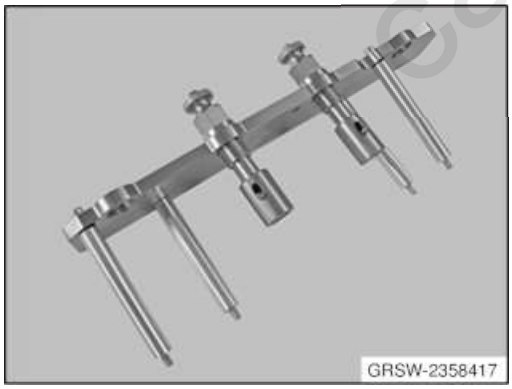
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Prepare special tool .

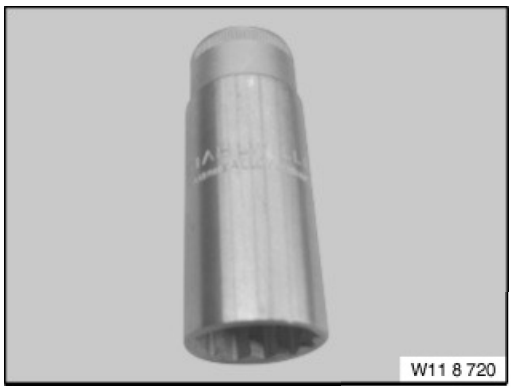


- Prepare special tool 2 358 417.

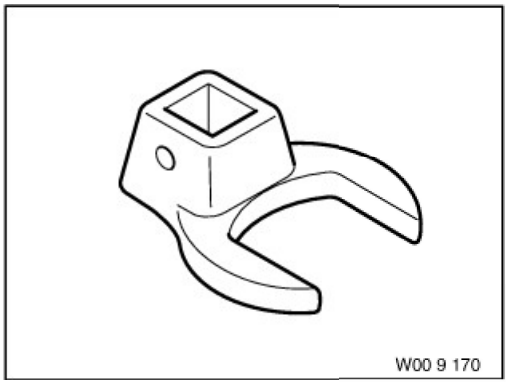
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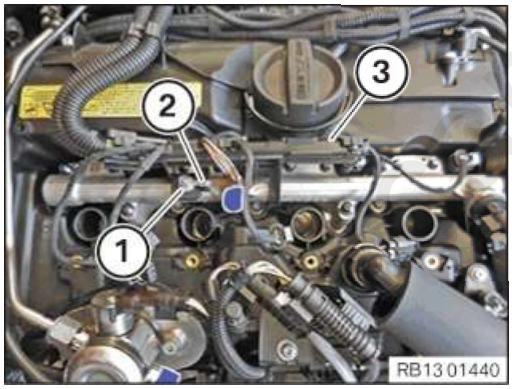
- Prepare special tool .



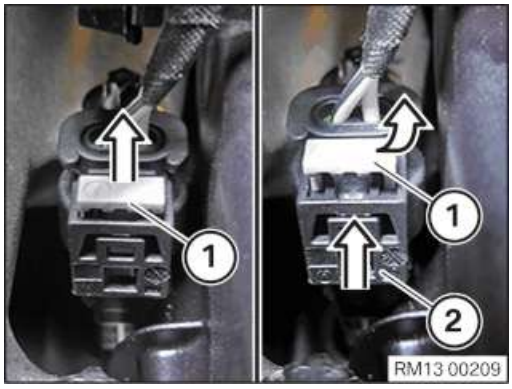
- Prepare special tool 0 496 106 (11 8 720).



- Prepare special tool .

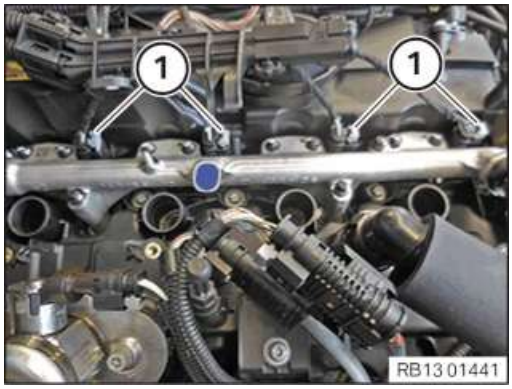


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.



- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.

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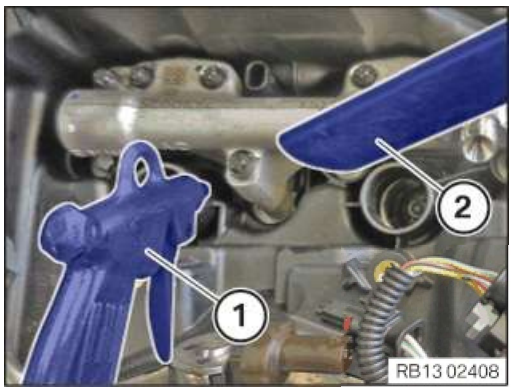
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

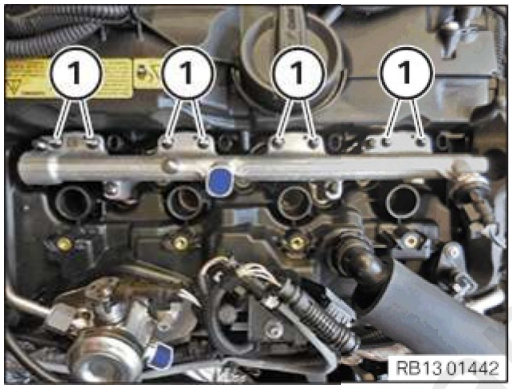


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

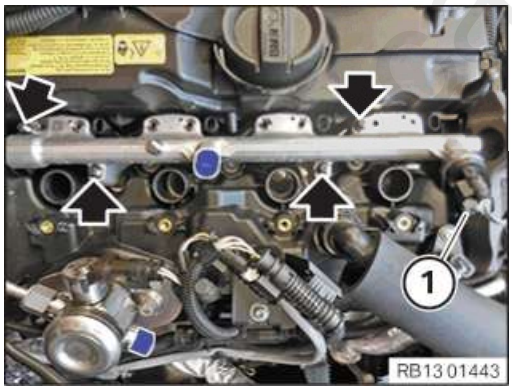
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.

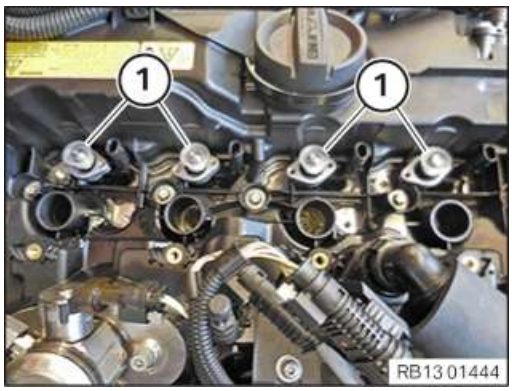


- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

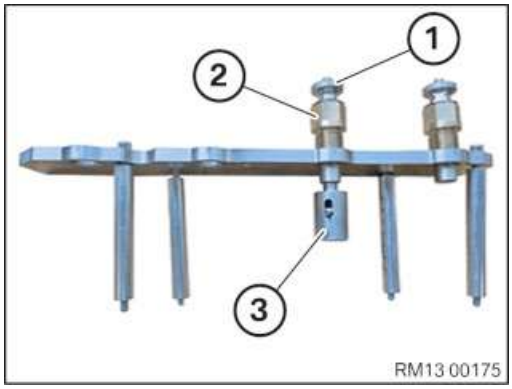
  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

  The injectors remain in the cylinder head.



- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

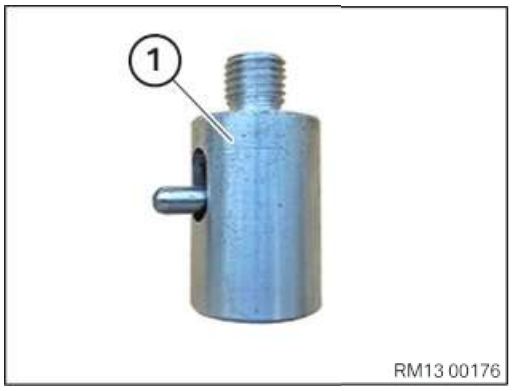
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

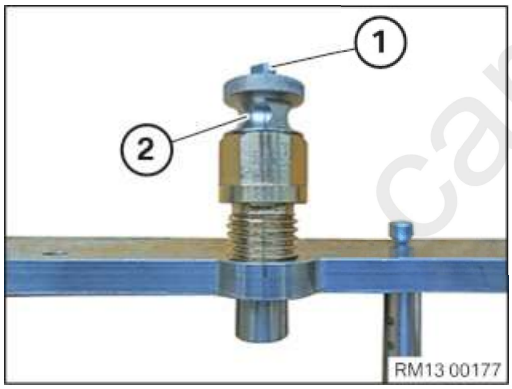
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

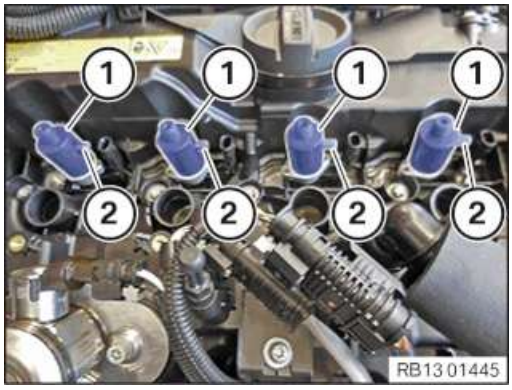
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



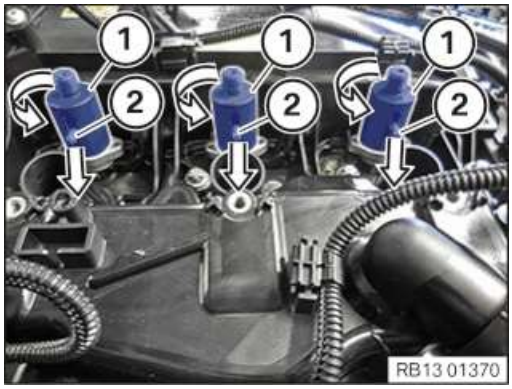
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



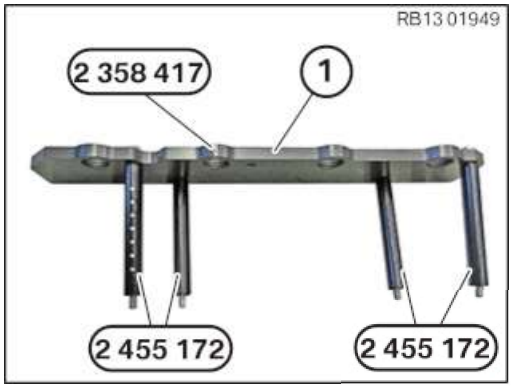
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

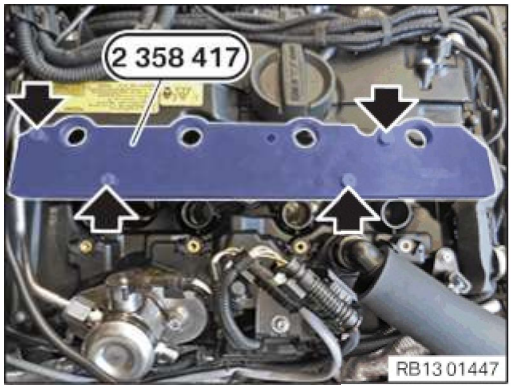
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



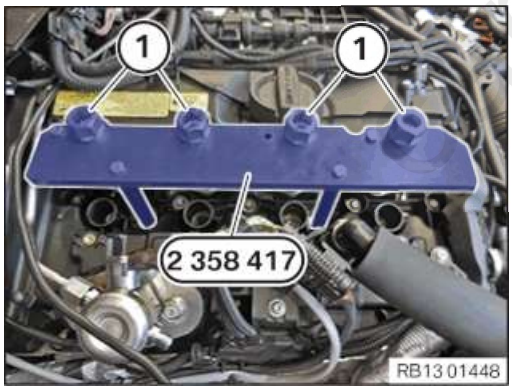
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

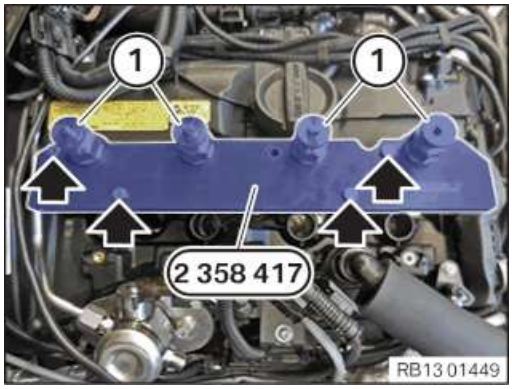
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

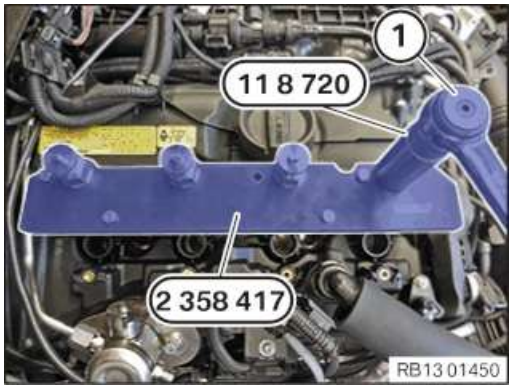
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

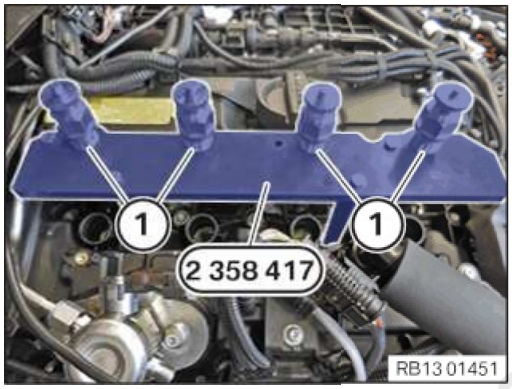


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

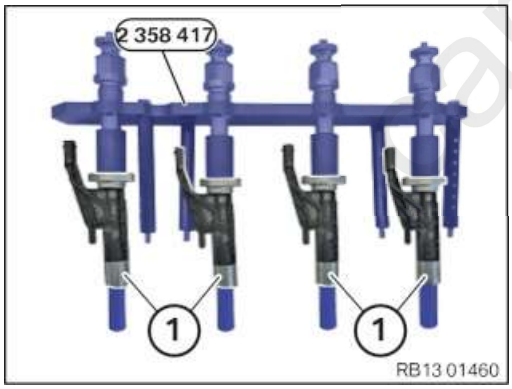
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

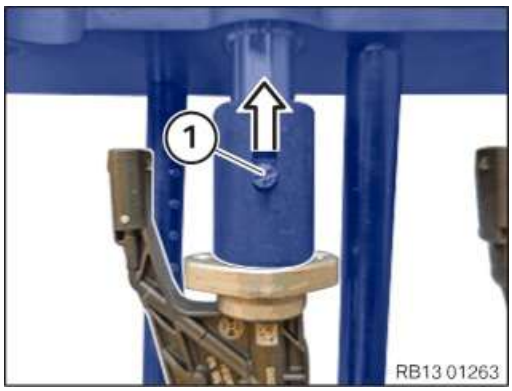


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

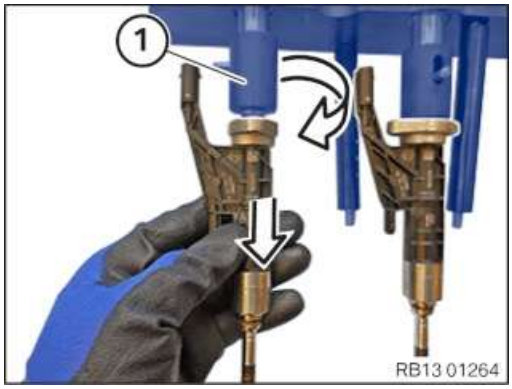


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

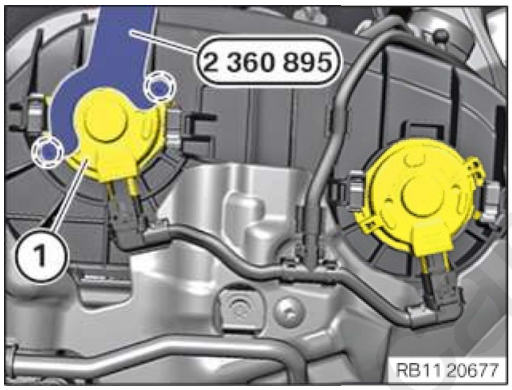
9 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

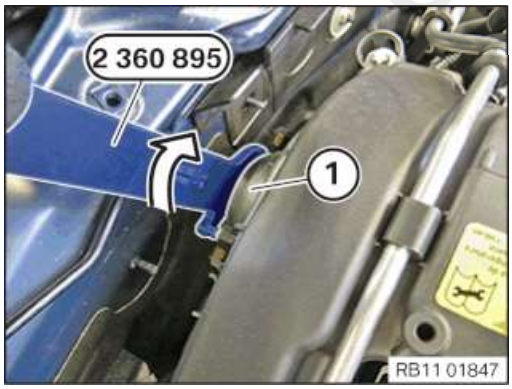
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



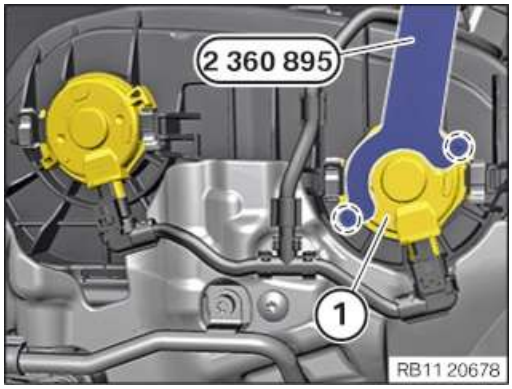
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



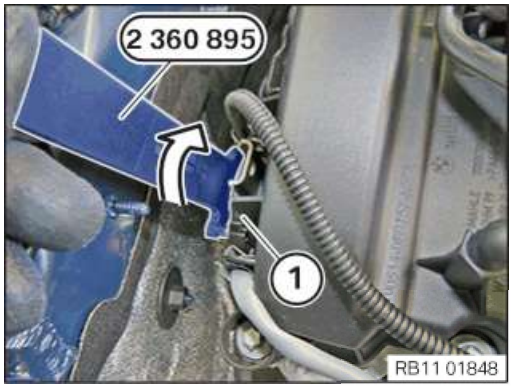
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



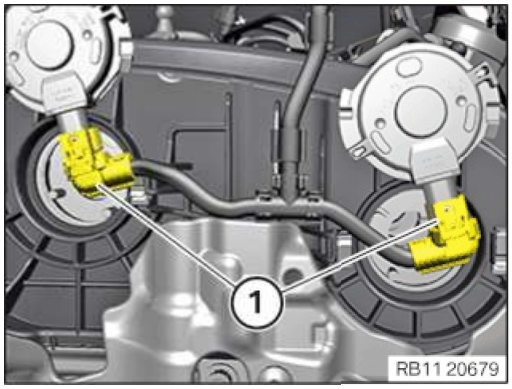
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

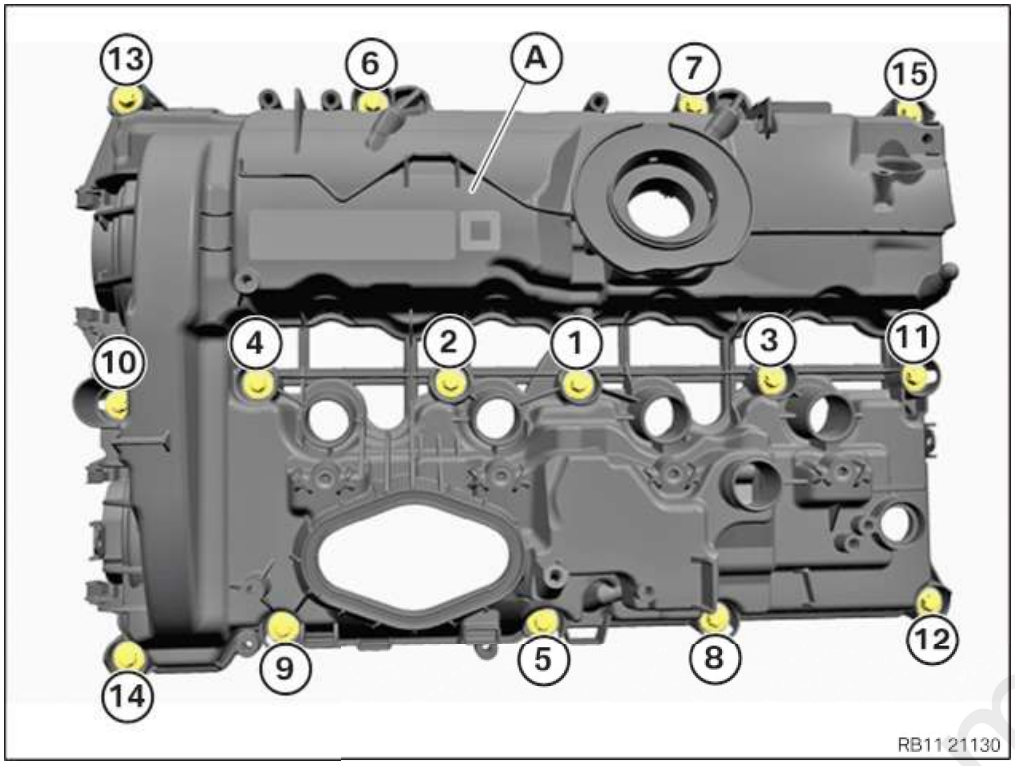
The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

10 – Removing the cylinder head cover

cardiagn.com

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

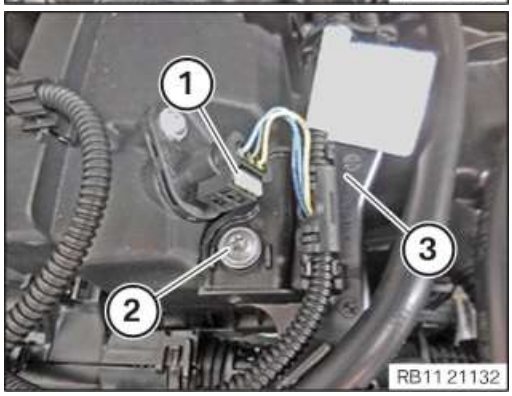
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

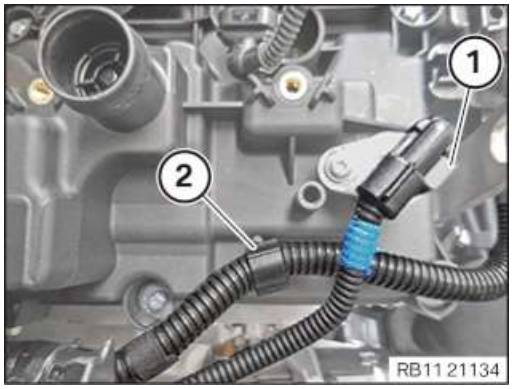
- Do not pull on the wires when disconnecting connectors and plug connections.



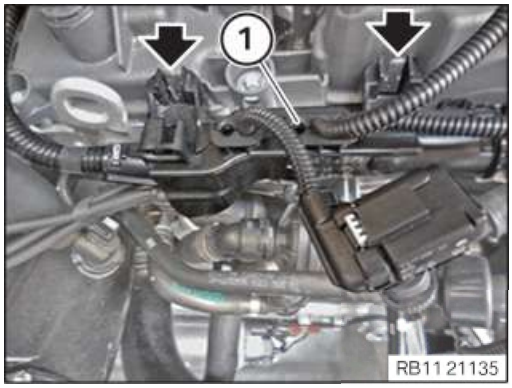
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



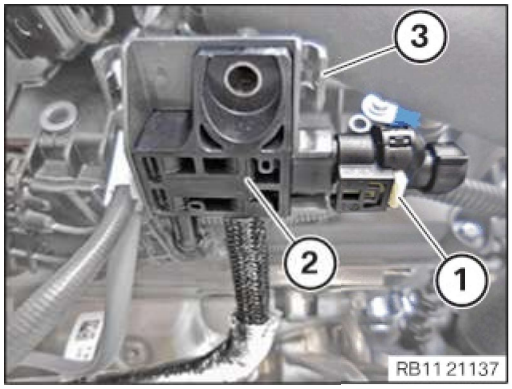
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



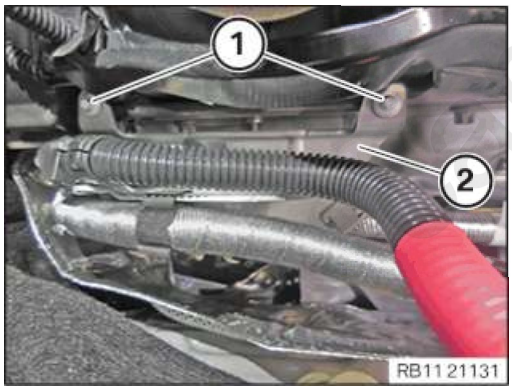
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



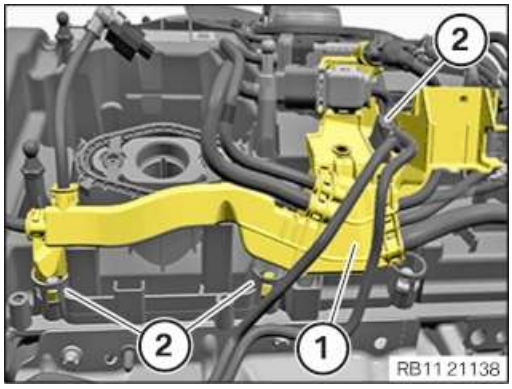
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.

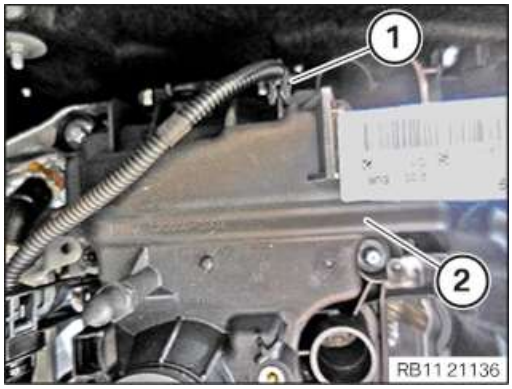


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

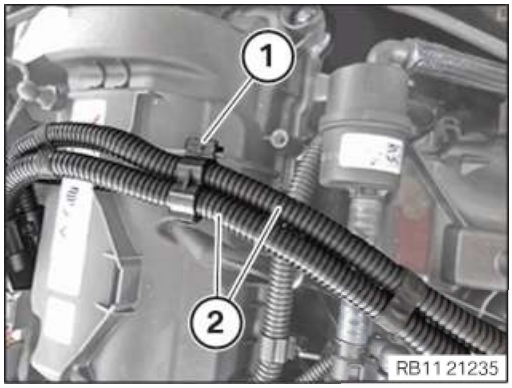


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

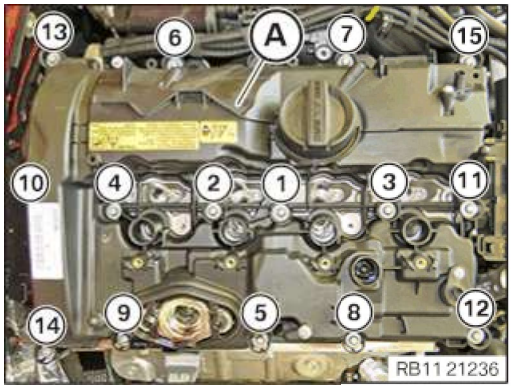
ardiagn.com



- Loosen clamp (1).



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

11 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

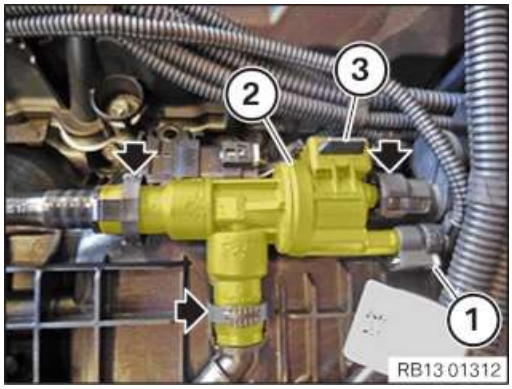
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

12 – Removing the intake plenum

RISK OF DAMAGE

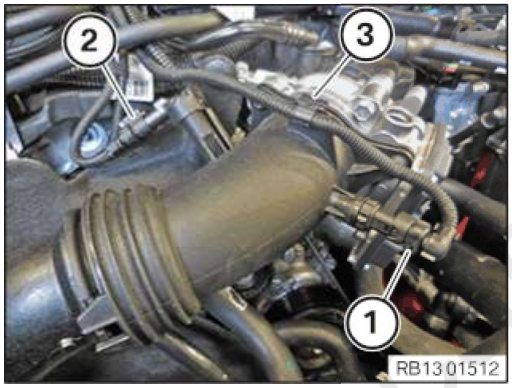
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

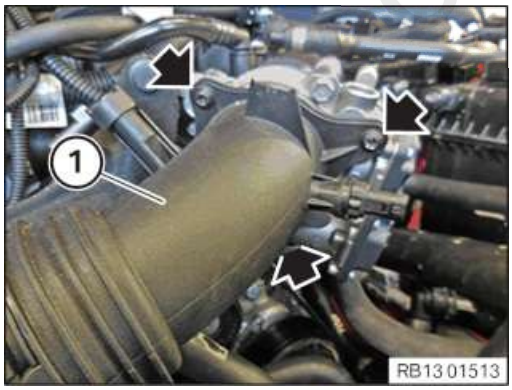
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

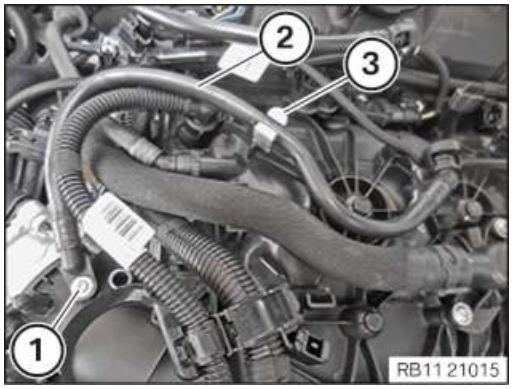
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



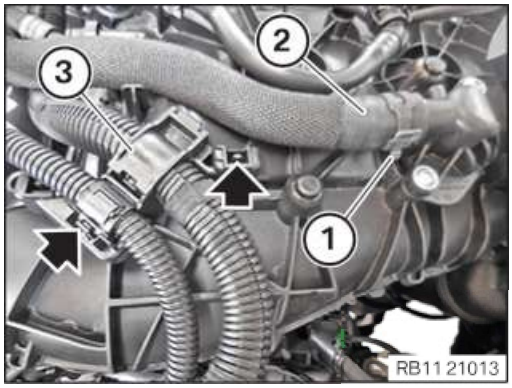
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



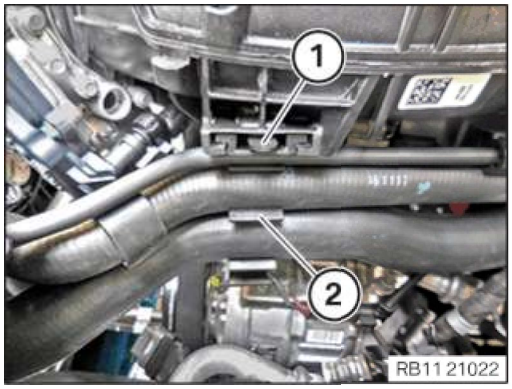
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



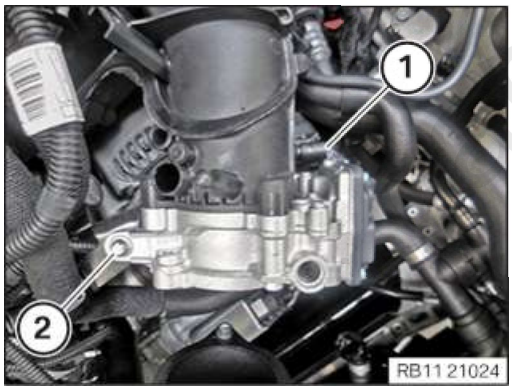
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



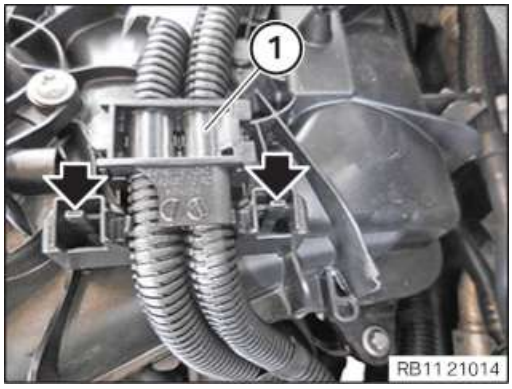
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

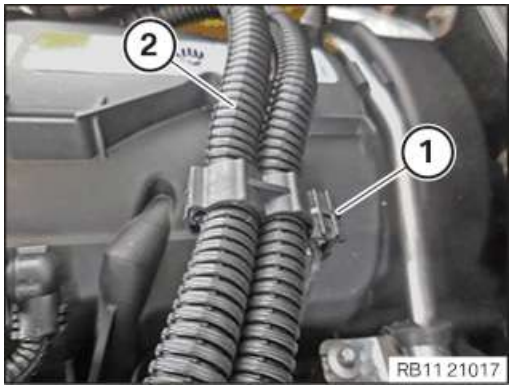


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

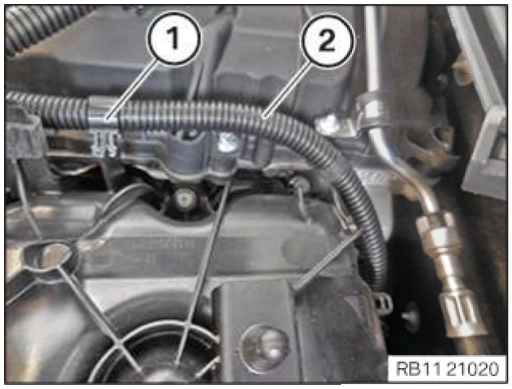
mdiagn.com



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



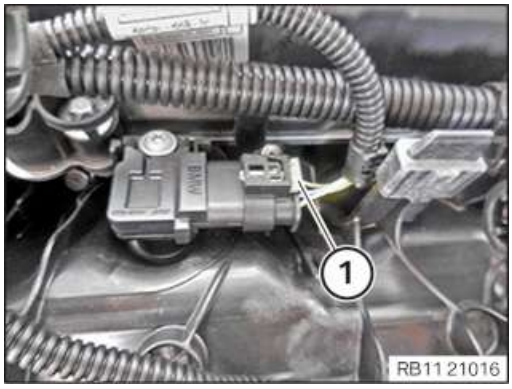
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

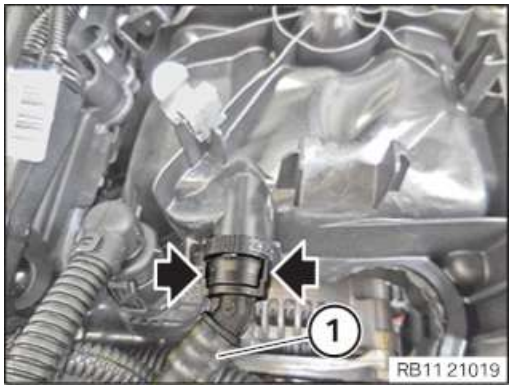


- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

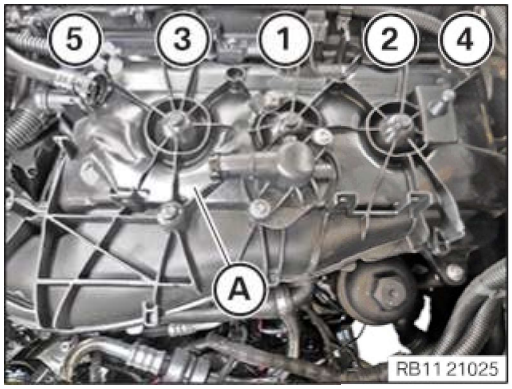
rdiagn.com



- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

13 – Remove the heat shield on the cylinder head

WARNING

Hot surfaces.

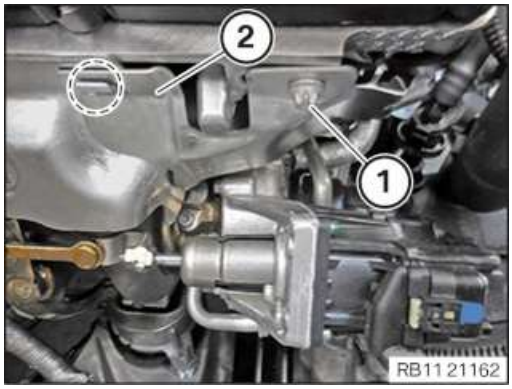
Risk of burning!

- Perform all work only on components that have cooled down.

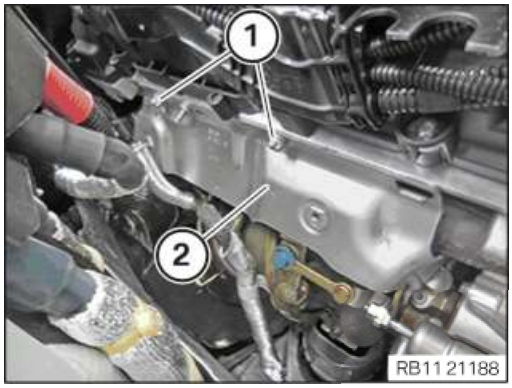


- Loosen screw (1).

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- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

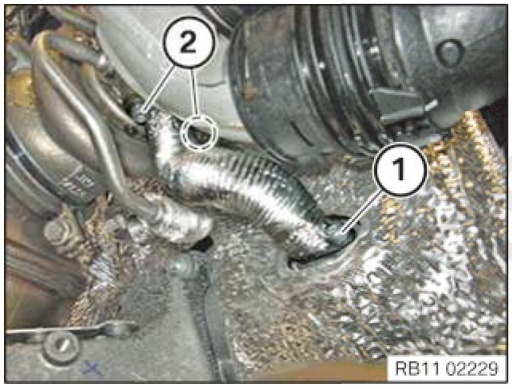


- Loosen screws (1).
- Feed out and remove the heat shield (2).

14 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

15 – Remove the coolant return line for the exhaust turbocharger

WARNING

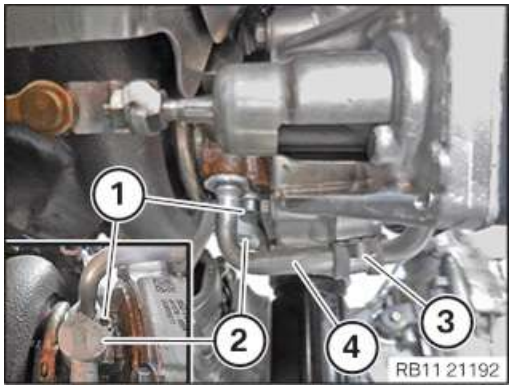
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

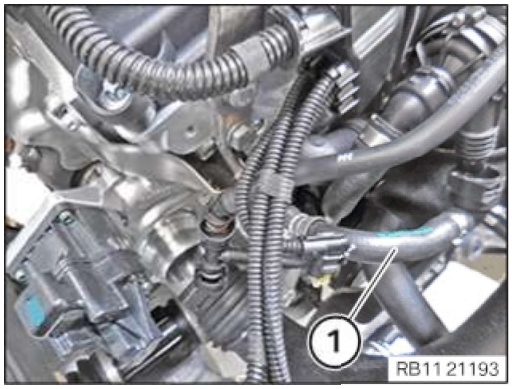
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

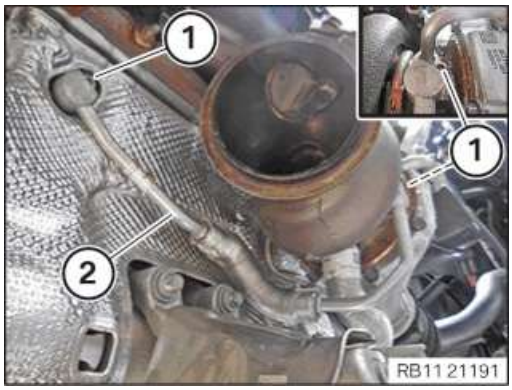


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

16 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

17 – Block the engine with the special tool in TDC firing position

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- Thread the sealing cap (1) out and remove.



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

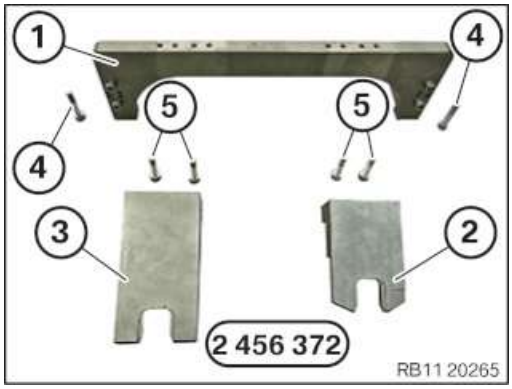


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

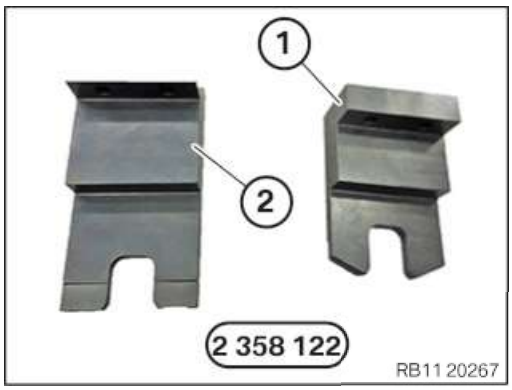
  The engine is in the TDC firing position of cylinder 1.

erdiagn.com



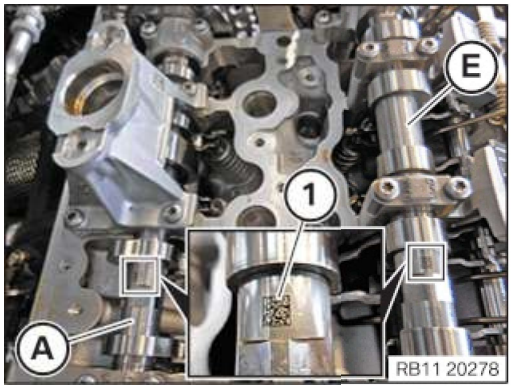
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

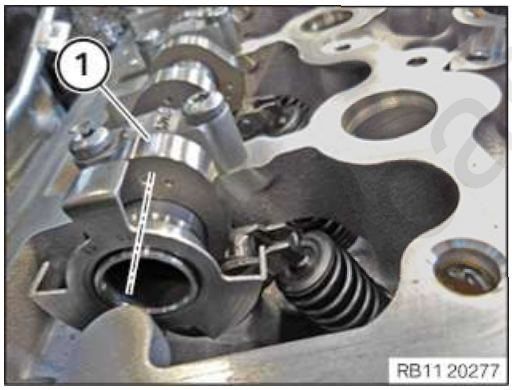


- Overview of the test gauges from the set of special tools 2 358 122:

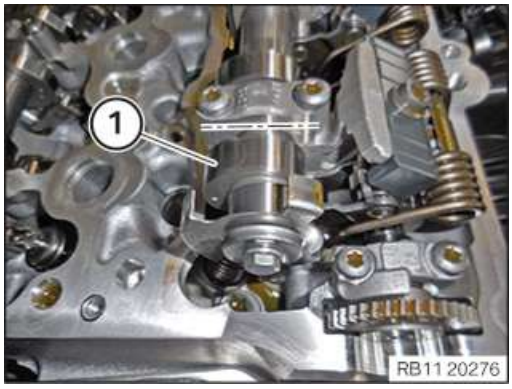
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

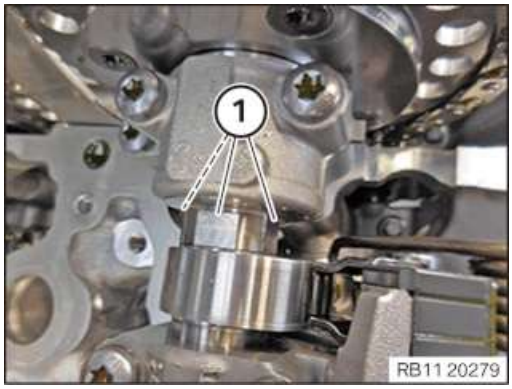


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

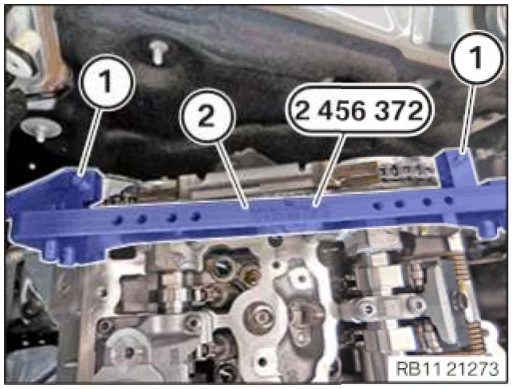
ardiagn.com



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



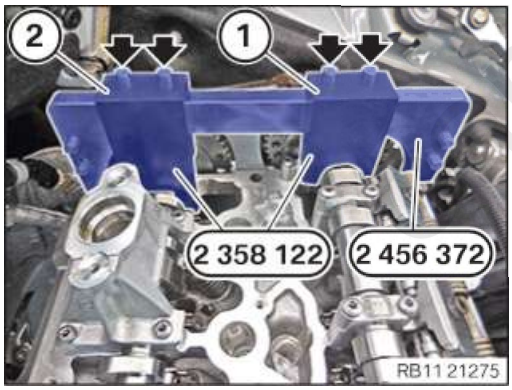
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

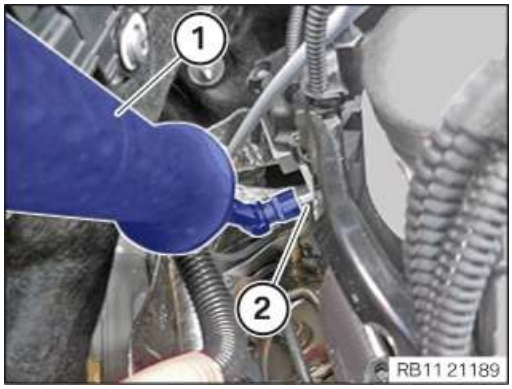
M6		Tightening torque	8 Nm

18 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

19 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

The figure shows the rear side of the engine.

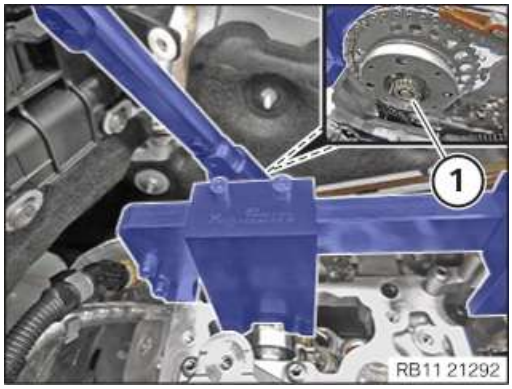
- Release the VANOS central valve (1) of the intake adjuster.

20 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

carsdiagn.com

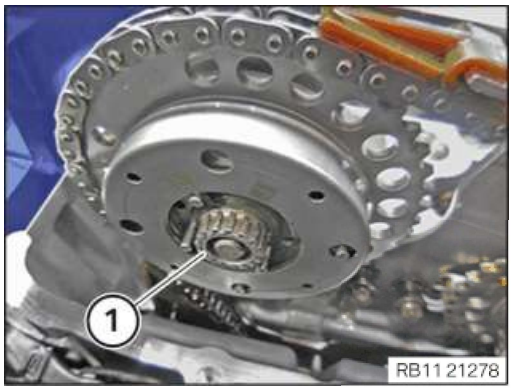


NOTICE

The figure shows the rear side of the engine.

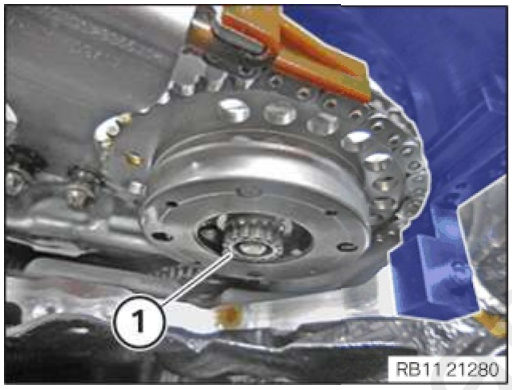
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

21 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

22 – Remove the VANOS central valve of the exhaust camshaft adjuster



- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

23 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.



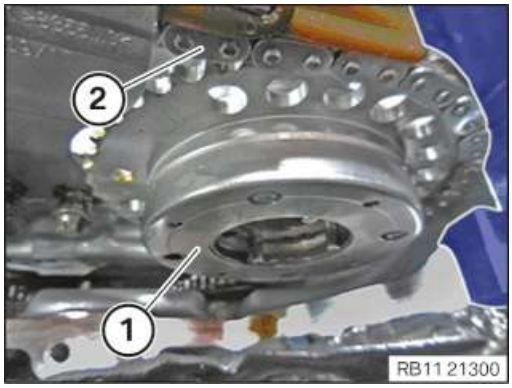
- Guide out the intake adjuster (1) from the timing chain (2) and remove.

24 – Remove exhaust camshaft adjuster

cardiagn.com

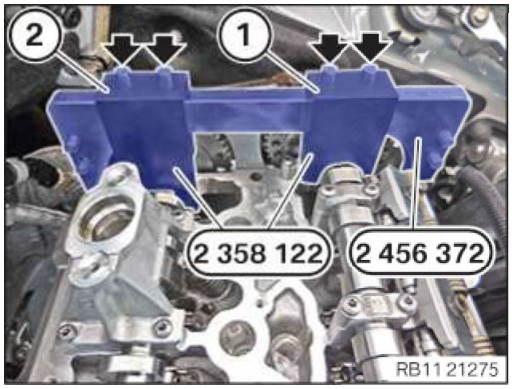
NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

25 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

26 – Remove cylinder head.

CAUTION

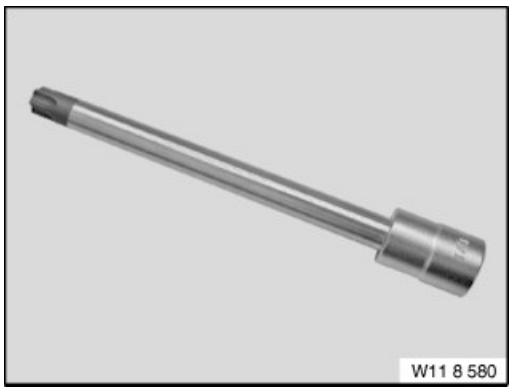
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

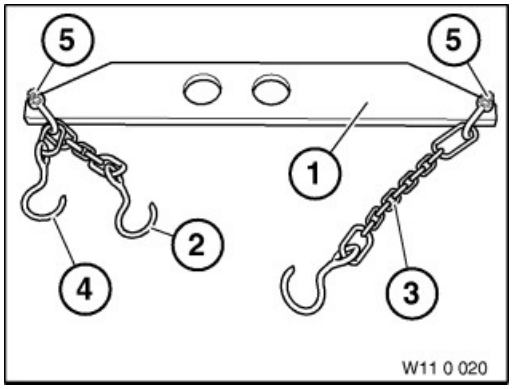
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Prepare special tool 0 495 747 (11 8 580).

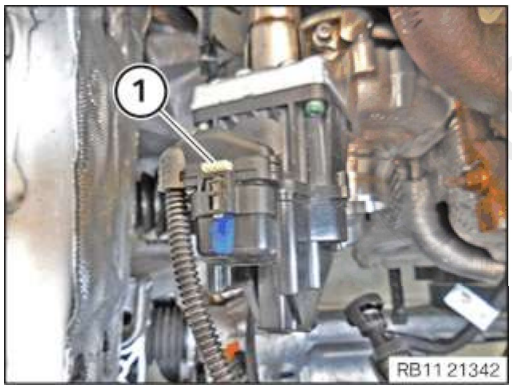
cardiagn.com



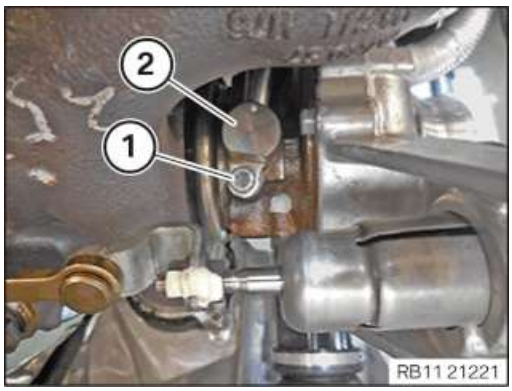
- Prepare special tool .



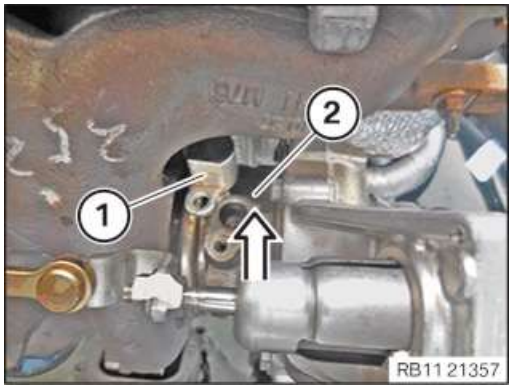
- Prepare the workshop crane 2 220 718.



- Unlock plug connection (1) and disconnect.



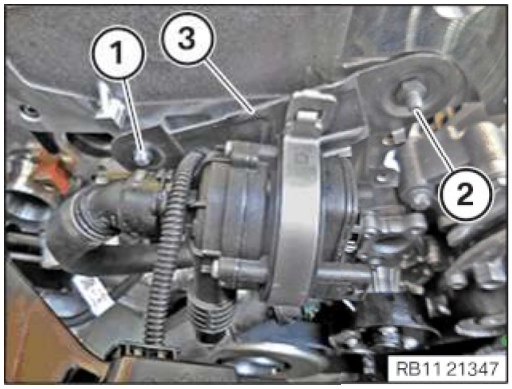
- Loosen screw (1).
- Release the oil feed line (2) on the exhaust turbocharger.



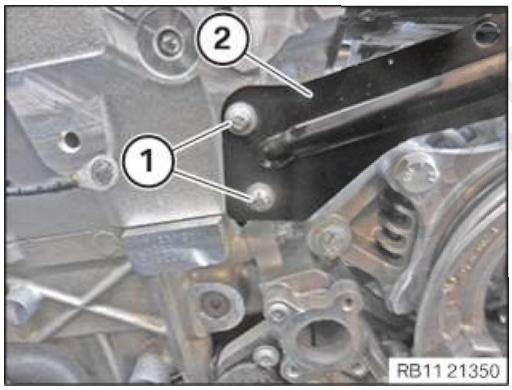
- Guide out the oil feed line (1) at the exhaust turbocharger (2) in the direction of the arrow and set aside.



- Loosen nut (1).
- Feed out ground cable (2) and set it aside.



- Loosen screw (1).
- Loosen screw (2).
- Thread out holder (3) and set aside.

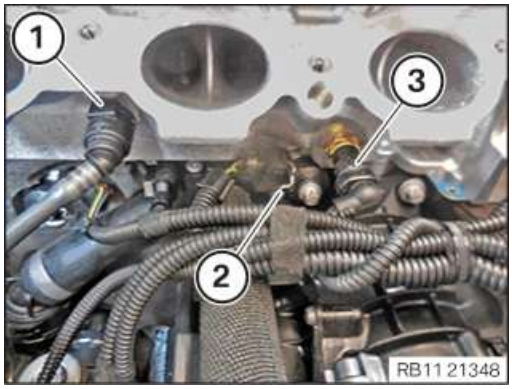


- Loosen screws (1).
- Thread out holder (2) and set aside.

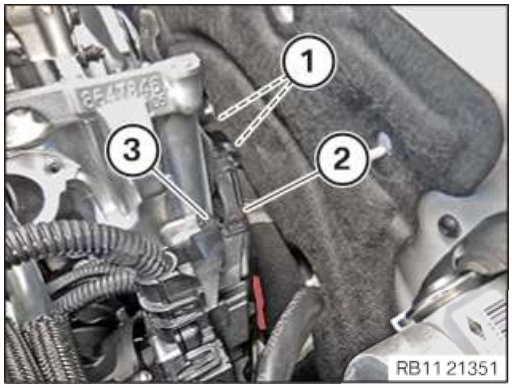


- Unlock plug connection (1) and disconnect.

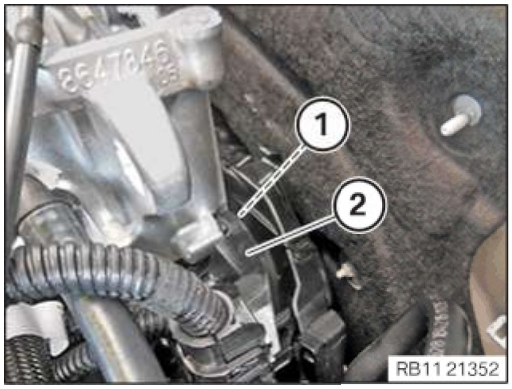
rdiagn.com



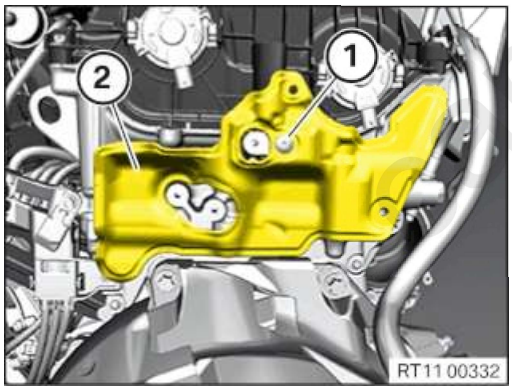
- Unlock and loosen coolant line (1).
- Unlock and disconnect plug connection (2) on the knock sensor.
- Unlock and disconnect plug connection (3) on coolant temperature sensor .



- Loosen screws (1).
- Guide out transmission wiring harness (2) on wiring harness section (3) for sensor system 1 and set it aside.



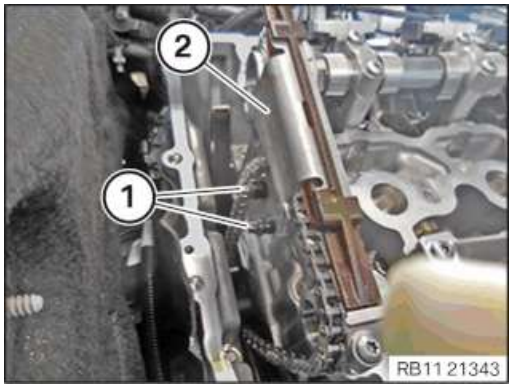
- Loosen screw (1).
- Guide out the wiring harness section (2) for sensor system 1 and place to one side.



NOTICE

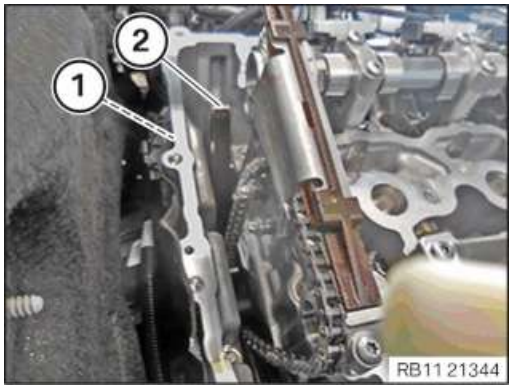
The figure shows the rear side of the engine.

- Loosen screw (1).
- Guide out and remove the cover (2).



- Loosen screws (1).
- Guide out the slide rail (2) and remove.

carsdiagn.com



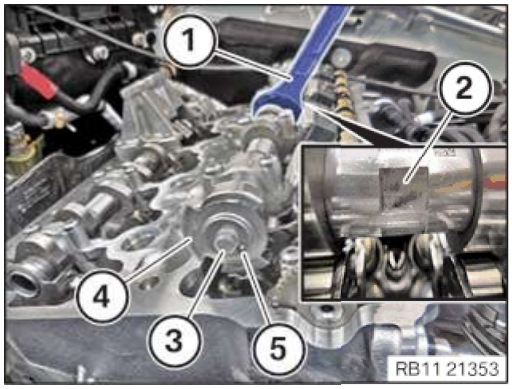
- Release the bearing journal (1) from the guide rail (2).



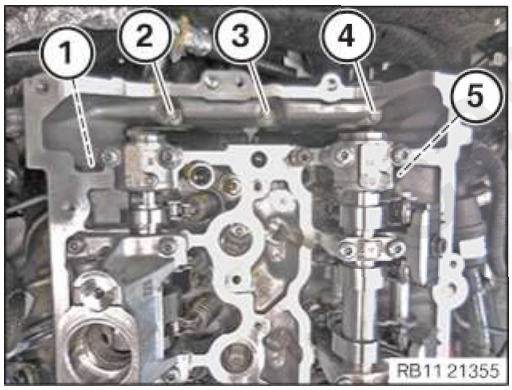
- Guide in and position special tool 2 459 012 on the cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm



- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Loosen screw (3).
- Guide out camshaft sensor wheel (4) on guide pin (5) and remove it.

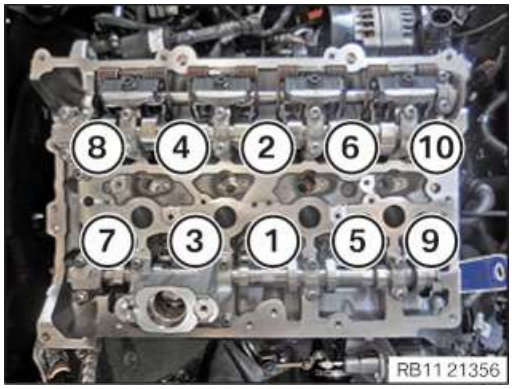


- Loosen the cylinder head bolts in the sequence from (5) to (1).

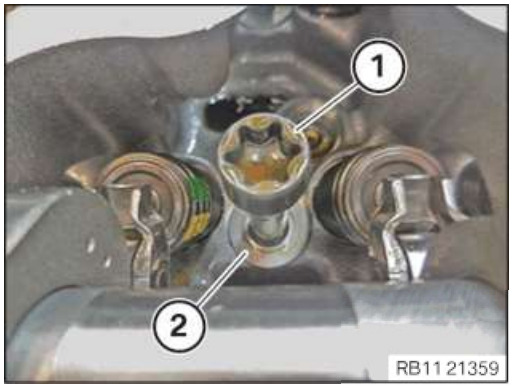


- Release cylinder head bolts with the special tool 0 495 747 (11 8 580).

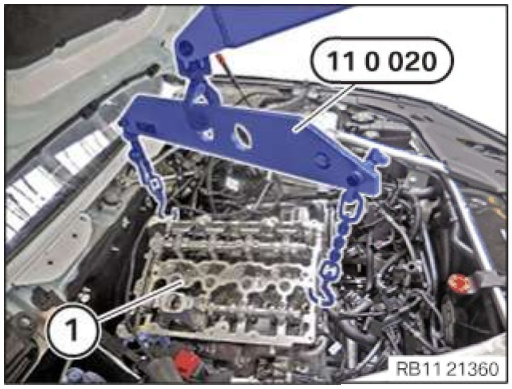
tdiagn.com



- Release the cylinder head bolts with the special tool 0 495 747 (11 8 580) in the order of (10) to (1).



- Feed out and remove all the cylinder head bolts (1).
- Feed out and remove all the washers (2).



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to the guide rails.

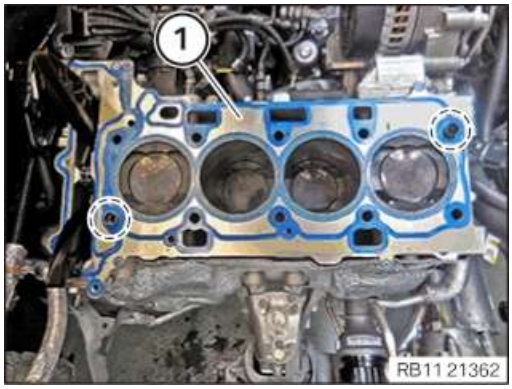
Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Attach special tool to workshop crane.
- Lift out cylinder head (1) and the exhaust turbocharger with an **auxiliary person**, the workshop crane and special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

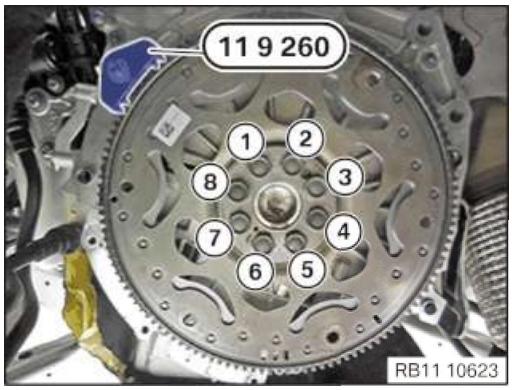
27 – Removing the cylinder head gasket

carmagn.com



- Guide out and remove cylinder head gasket (1) in the **marked** area.

28 – Removing flywheel

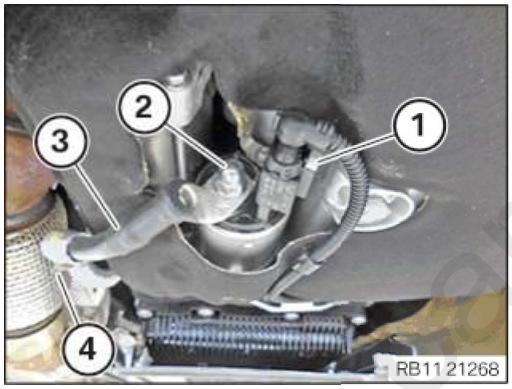


- Fasten the flywheel with the special tool 0 493 938 (11 9 260) and tighten with the special tool 0 494 130 (11 9 264).
- Loosen screws (1-8).

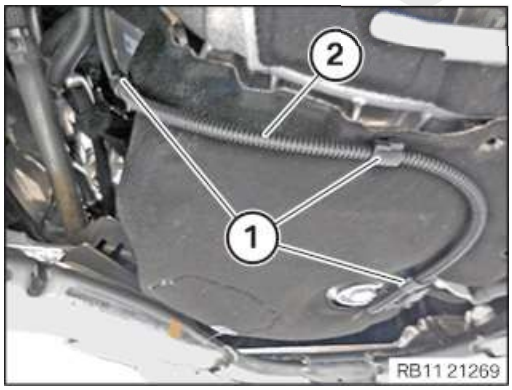
29 – Removing the acoustic cover of the oil sump

Prerequisite

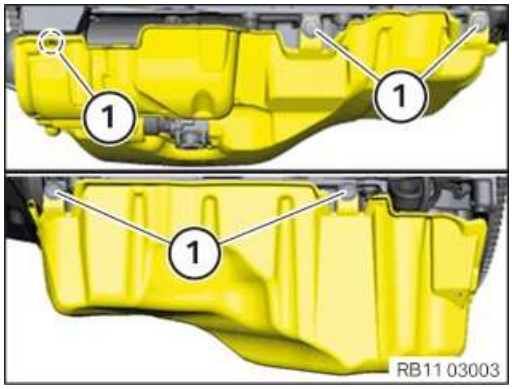
Disconnect all negative battery cables.



- Unlock and loosen connector (1).
- Loosen nut (2).
- Guide the positive battery cable (3) out of the clamp (4) and lay to one side.



- Unlock and loosen the clamps (1).
- Guide out the wiring harness section of automatic transmission (2) and set it aside.



- Detach all expanding rivets (1).



- Guide out acoustic cover (1) downwards to the rear and remove it.

30 – Remove oil sump

RISK OF DAMAGE

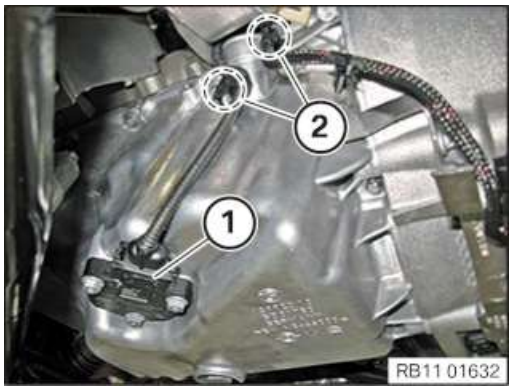
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

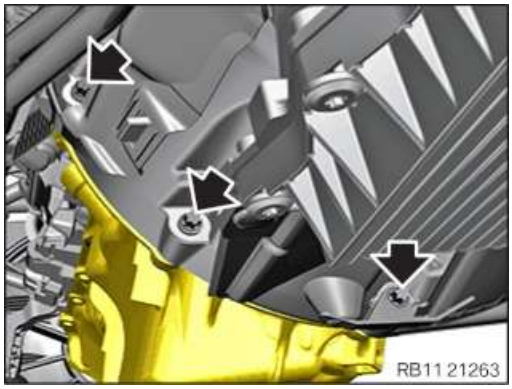
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

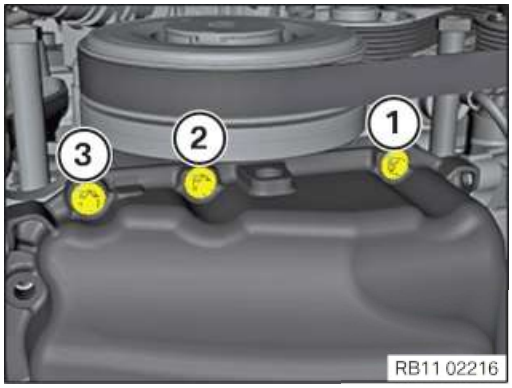


- Unlock and loosen connector (1).
- Release the cable from the clips (2) of the oil sump.

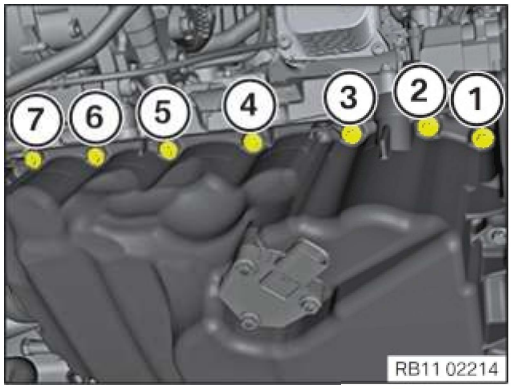
cardiagn.com



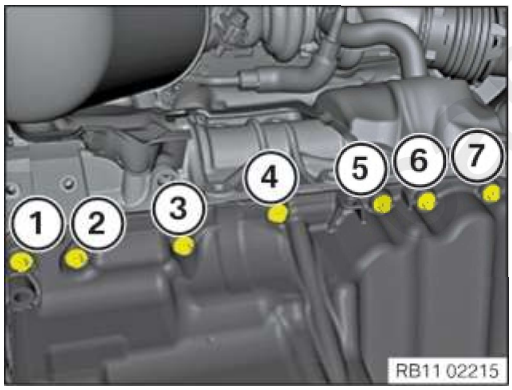
- Unscrew the transmission bolts (arrows).



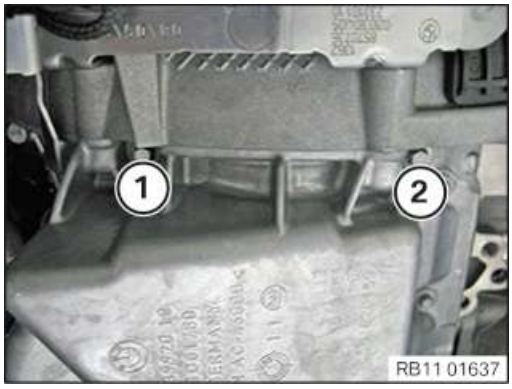
- Loosen screws (1), (2) and (3).



- Loosen screws (1) to (7).



- Loosen screws (1) to (7).



- Loosen screws (1) and (2).

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TECHNICAL INFORMATION

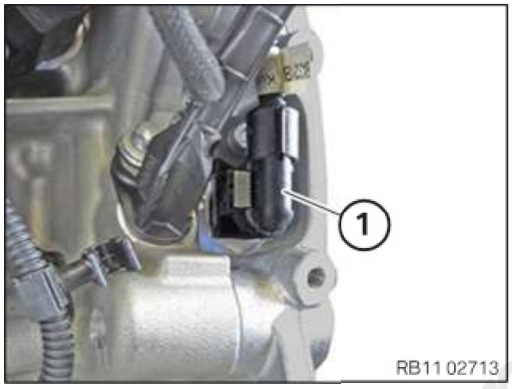
Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump in the **marked** areas using suitable tools (1).

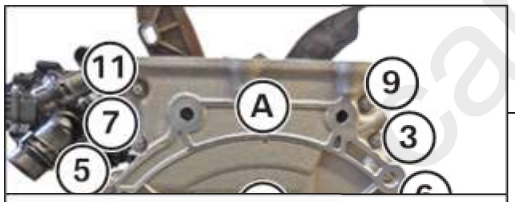


- Guide out the oil sump (1) downwards to the rear and remove.

31 – Remove rear timing case cover



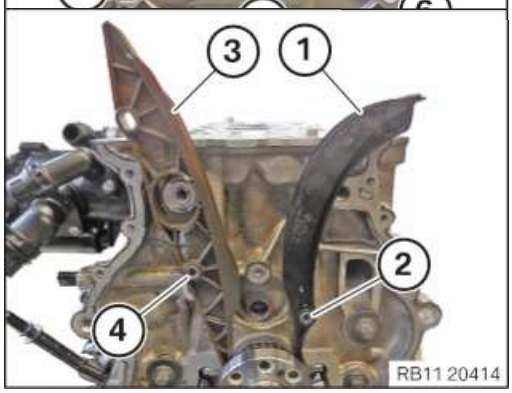
- Unlock the connector (1) and pull it off the crankshaft sensor.



- Loosen screws in the order (11) to (1).

TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

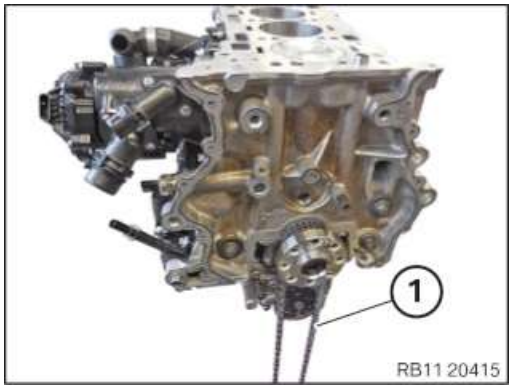


- Thread the tensioning rail (1) out of the bearing journal (2) and remove.

The bearing journal does not have to be removed.

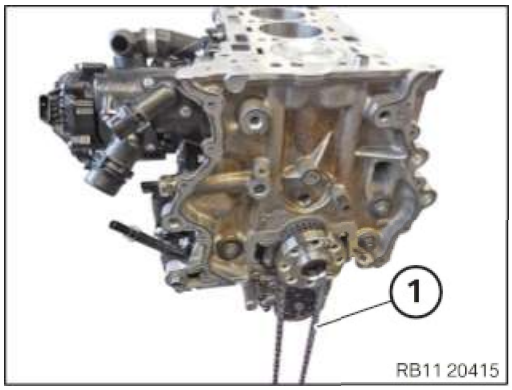
- Carefully loosen and remove the timing case cover (A).
- Guide out the guide rail (3) and remove.

car-diagn.com

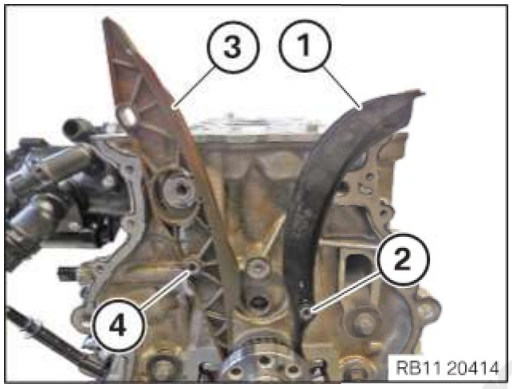


- Guide out the timing chain (1) and remove.

33 – Installing timing chain



- Insert and install the timing chain (1).



- Insert and install the tensioning rail (1) on the bearing journal (2).
- Insert and install the guide rail (3).
- Renew bearing journal (4).

  Parts: Bearing journal
- Tighten the bearing journals (4).

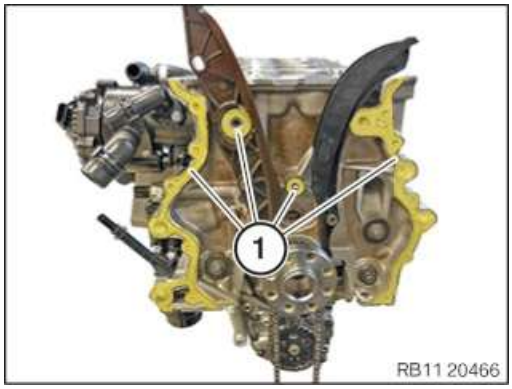
Bearing journal to crankcase

Bearing journal	Replace bearing journal.	Tightening torque	20 Nm

POSTPROCESSES

34 – Install the rear timing case cover

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RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

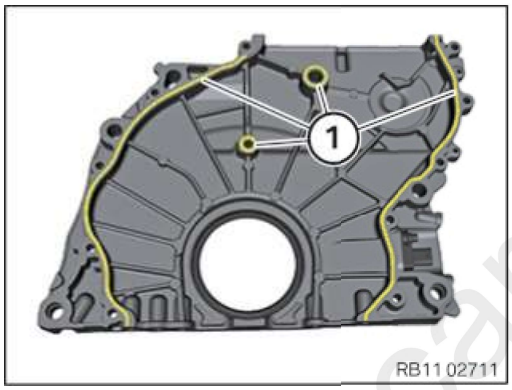
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove sealing residue in this area (1) using special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

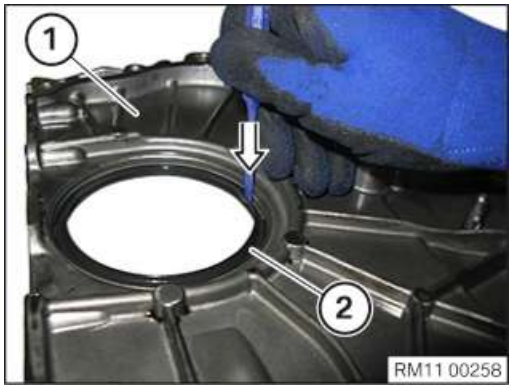
The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove sealing residue in this area (1) using special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

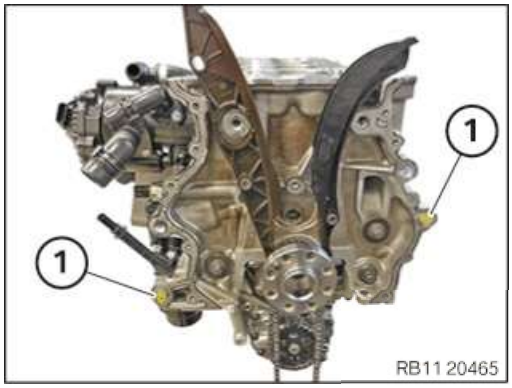
Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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- Position the timing case cover (1) underneath.
- Position the inner punch in the crankshaft sealing ring (2).
- Remove the crankshaft sealing ring (2) outward in the direction of the arrow.



- Check the fitting sleeves (1) for damage and renew, if necessary.
- Check for correct fit of fitting sleeves(1).



- Have the special tool ready.



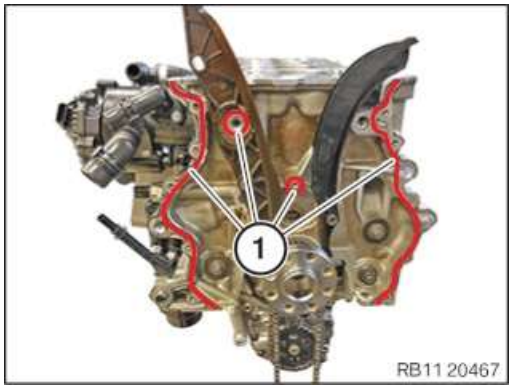
TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

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TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound in area (1)along the inner edge.

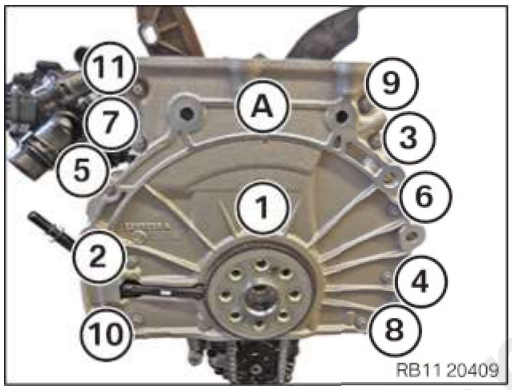
Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

Height of the sealing bead

2,0 mm ... 2,5 mm

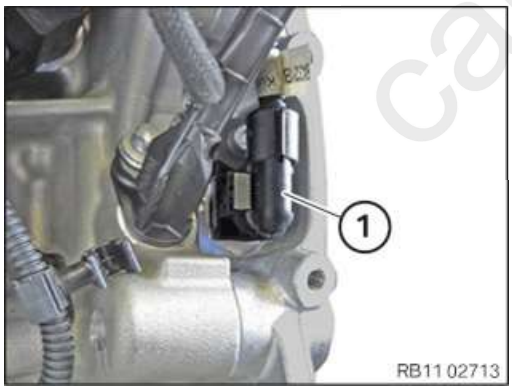


- Renew screws (1) to (11).

  Parts: Bolts
- Carefully mount the timing case cover (A).
- Tighten screws in the order (1) to (11).

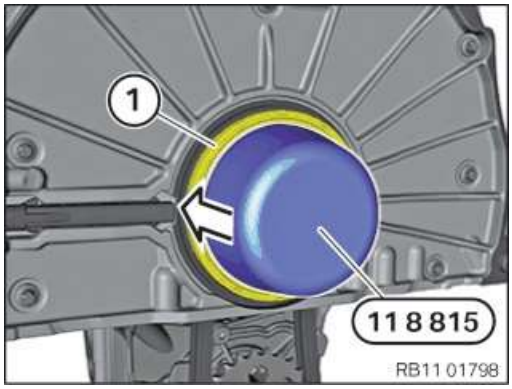
Rear timing case cover to crankcase

M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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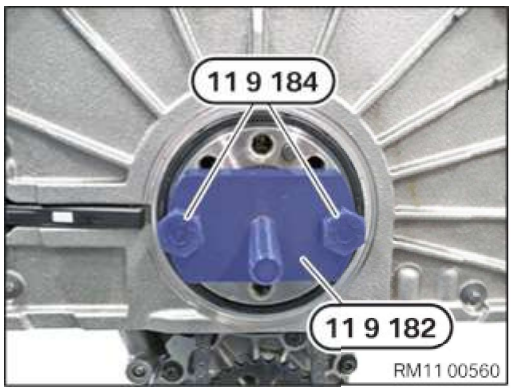
RISK OF DAMAGE

Radial shaft seal damage.

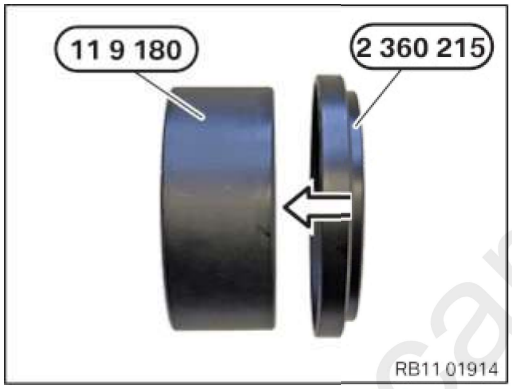
Touching the sealing lip (inner) and applying oil to the radial shaft seal will lead to its destruction.

- Do not touch the sealing lip (inner) of the radial shaft seal.
- Do not apply oil to the radial shaft seal.
- Install the radial shaft seal dry.

- Preassemble special tool 0 496 137 (11 8 815) on crankshaft.
- Carefully slide the new crankshaft sealing ring (1) straight off the special tool 0 496 137 (11 8 815) using a rotational movement until the new crankshaft sealing ring is positioned parallel on the timing case cover.



- Secure special tool 0 494 029 (11 9 182) to the crankshaft using special tool 0 494 031 (11 9 184).

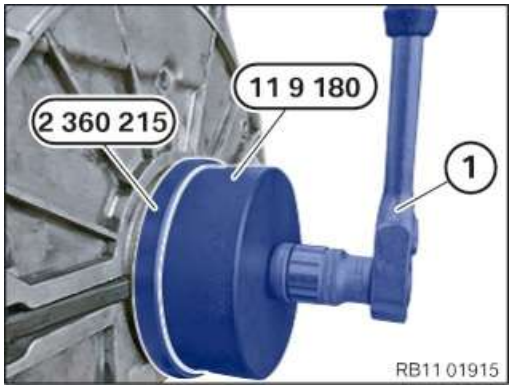


- Connect special tool 2 360 215 onto special tool 0 493 881 (11 9 180).



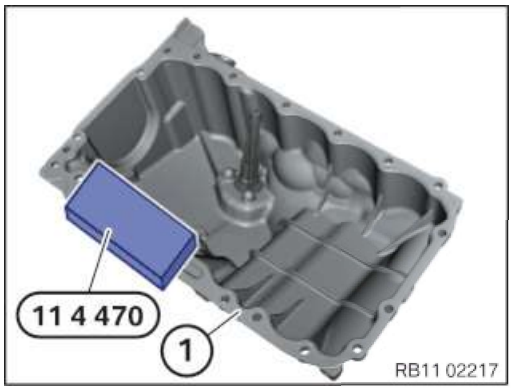
- Pull in the new crankshaft sealing ring with special tools 0 494 028 (11 9 181) and 2 360 215 together with the special tool 0 494 030 (11 9 183).

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- Screw in the new crankshaft sealing ring with the tool (1) to the stop.

35 – Refitting sump



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the rough seal remains on the sealing surface (1) of the crankcase with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



- Have the special tool ready.



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

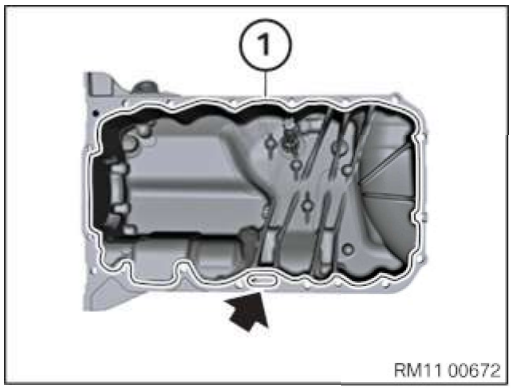
- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

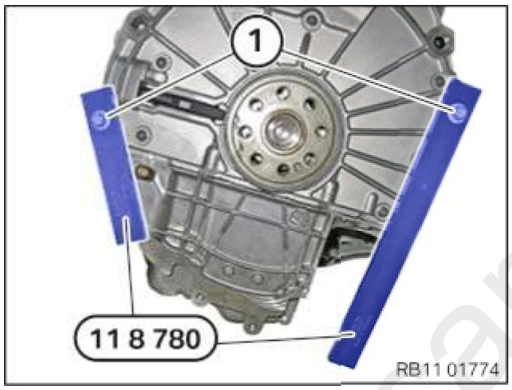


TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound along the line (1) with a thickness of 2 mm to 2.5 mm.

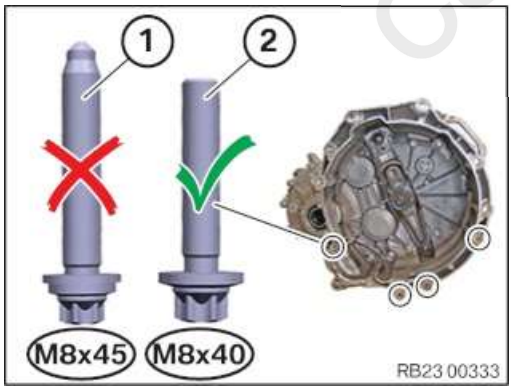
  Apply the sealing compound along the inner edge.
- Completely encircle the oil return orifice (arrow) with the sealing compound.



TECHNICAL INFORMATION

The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with engine block.
- If necessary, renew fitting sleeves.



RISK OF DAMAGE

Component damage caused by incorrect screw length.

The use of screws with the incorrect screw length can damage the component.

- Check for correct screw length.
- Re-install screws that correspond to the original screw length.

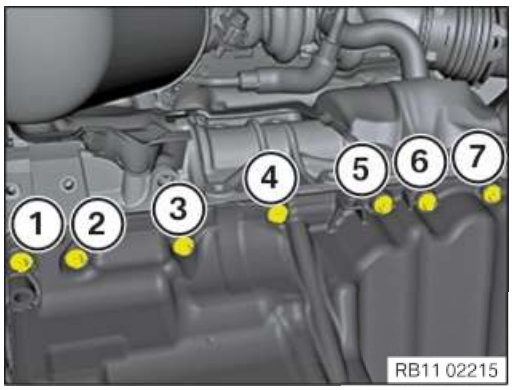
- Ensure that the **correct** screw (2) (M8x40) is used for mounting the oil sump on the transmission.

  The screw (1) (mounting bolt of the starter motor) may **never** be used for mounting the oil sump.

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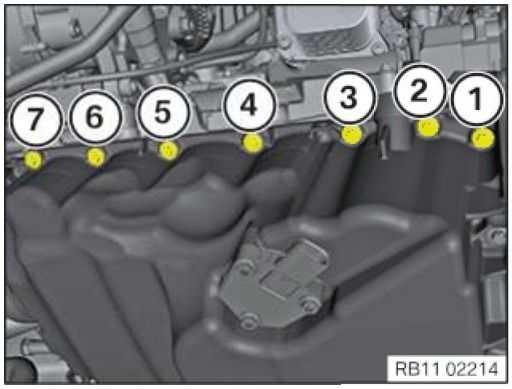
- Install oil sump (1) to top front.
- **Hand-tighten** all oil sump screws but do not tighten completely.



- Tighten the screws (1) to (7).

Oil sump to crankcase

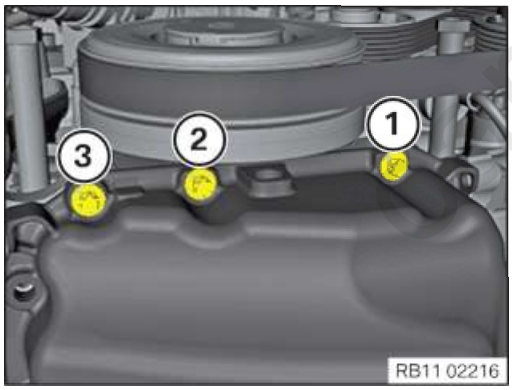
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1) to (7).

Oil sump to crankcase

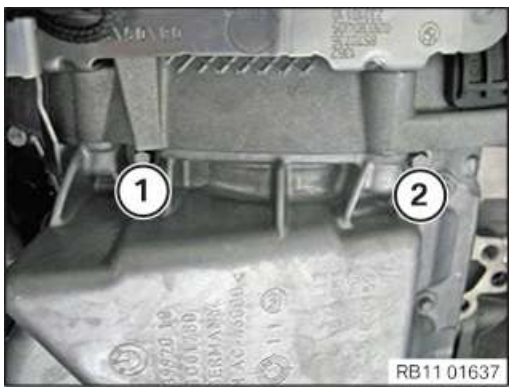
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1), (2) and (3).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

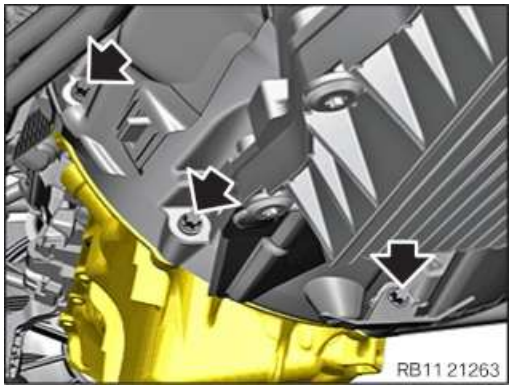


- Tighten down screws (1) and (2).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

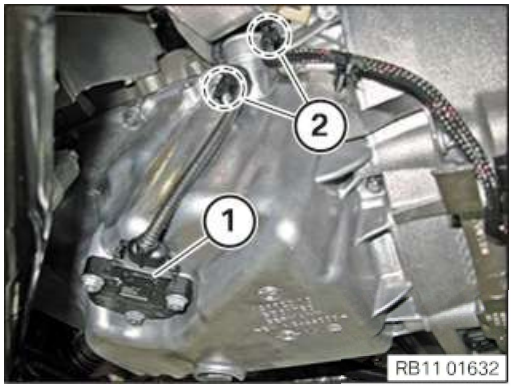
rdiagn.com



- Tighten transmission screws (1).

Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm



- Fasten cable on the clips (2) from the oil sump.
- Connect and lock the connector (1).
- Make sure the connector 1 engages audibly.

36 – Installing the flywheel



TECHNICAL INFORMATION

Clean all threads with a screw tap.

- Clean all the screw threads (1).



- Use the set of special tools 2 285 058.

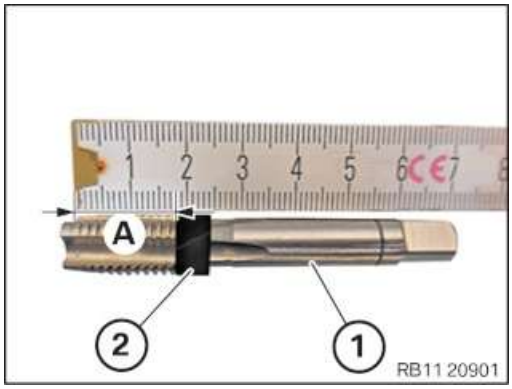
Description
Twist drill
Thread cutter M12x1.5
Depth
Insertion tool



- Assemble tool set.

Number	Description
1	Tool holder
2	Thread cutter M12X1,5

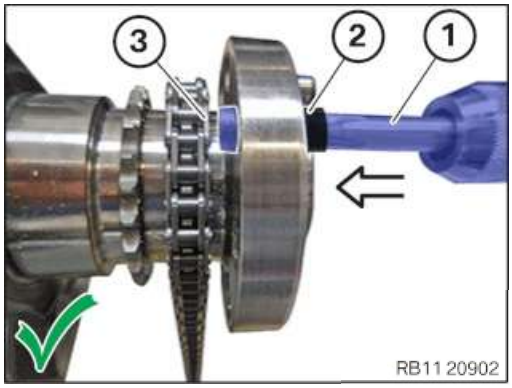
cardiagn.com



- Mark the screw-in depth (A) on thread cutter (1) from the set of special tools 2 285 058 with a standard tool (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm



NOTICE

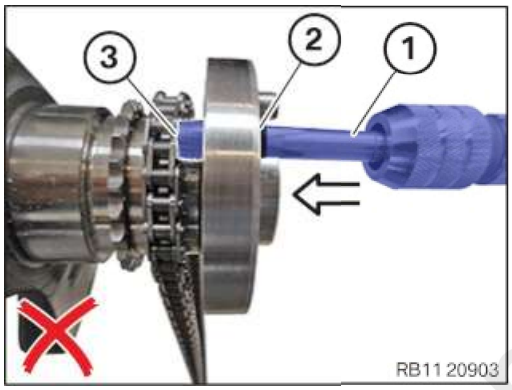
To provide a better overview: Shown with engine removed.

- Screw in the thread cutter (1) from the set of special tools 2 285 058 in direction of arrow up to the screw-in depth (2).

Screw-in depth of thread cutter

Screw-in depth	18 mm

- Make sure that the thread cutter does (1) **not** rest on the timing chain (3).



TECHNICAL INFORMATION

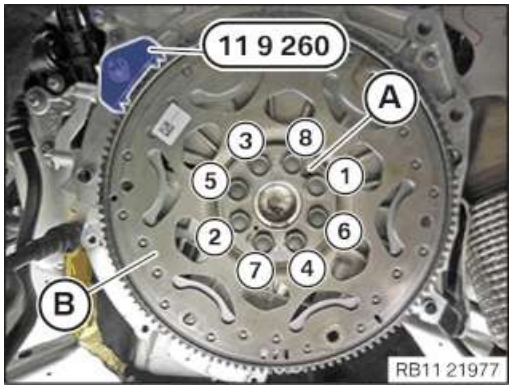
- **Carefully** handle the timing chain, to protect the timing chain and timing chain drive against damage.

- Make sure that the screw-in depth (2) of the screw tap (1) is not exceeded.

  The thread cutter (1) may not rest on the timing chain (3).



- Make sure the magnet wheel (1) is installed correctly.



- Renew screws (1) to (8).

  Parts: Bolts
- Position flywheel (B) .
- Screw in flywheel bolt (1) to (8) by hand.
- Fix the flywheel (B) with the special tool 0 494 034 (11 9 261) and screw the special tool 0 494 130 (11 9 264) tightly.
- Make sure the tightening sequence starts at dowel pin (A).
- Tighten flywheel bolts in sequence (1) to (8).

Flywheel to crankshaft

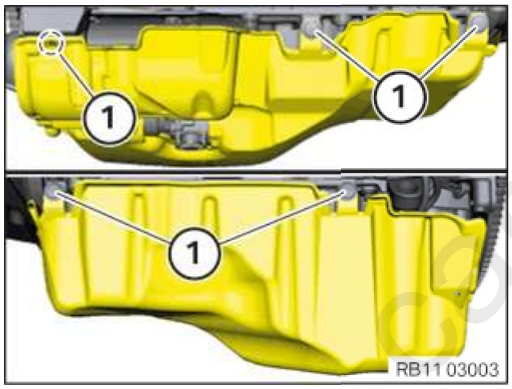
M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

- Remove special tool 0 493 938 (11 9 260).

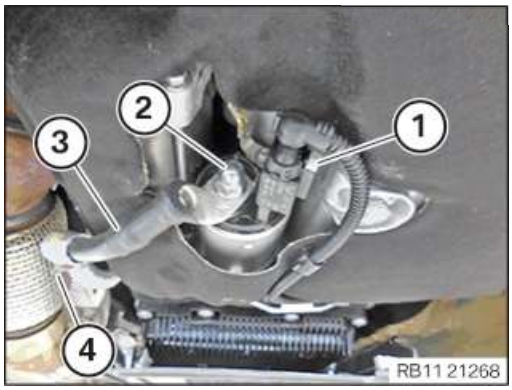
37 – Installing the acoustic cover for the oil sump



- Install acoustic cover (1) to the top front.

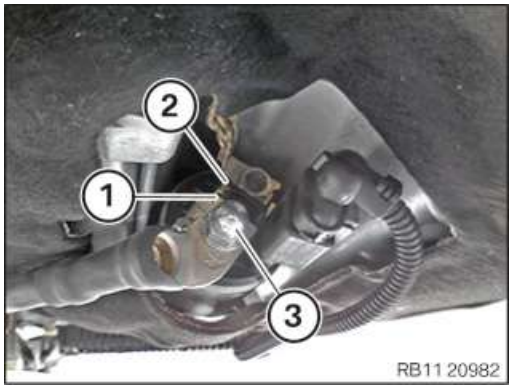


- Secure all expanding rivets (1).



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.
- Insert and install the positive battery cable (3).
- Secure positive battery cable (3) at the clamp (4).
- Tighten the nut (2) hand-tight.

carsdiagn.com



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

38 – Block the crankshaft in he TDC firing position of cylinder 1



RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

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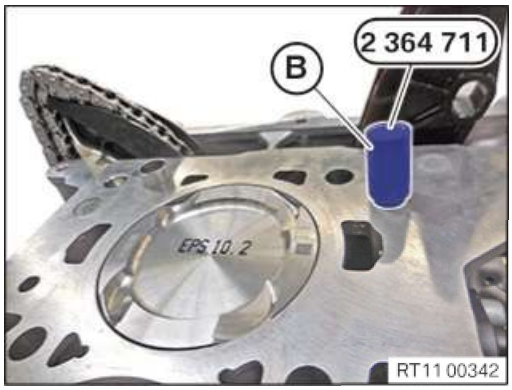


- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.

39 – Sealing the oil duct



- Seal the oil duct using special tool (B) from the set of special tools 2 364 711.

40 – Clean sealing surfaces

RISK OF DAMAGE

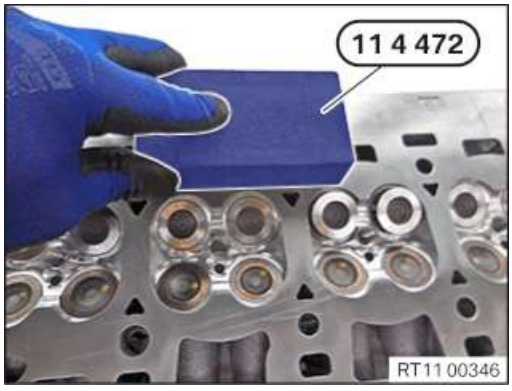
Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.



- Remove coarse backlogs from the sealing surfaces of the cylinder head using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the cylinder head using special tool 0 495 104 (11 4 472).

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- Clean all blind holes (1) of the cylinder head.



- Remove coarse backlogs from the sealing surfaces of the crankcase using special tool 0 495 103 (11 4 471).



- Remove fine backlogs from the sealing surfaces of the crankcase using special tool 0 495 104 (11 4 472).
- Clean all blind holes of the crankcase.



CAUTION

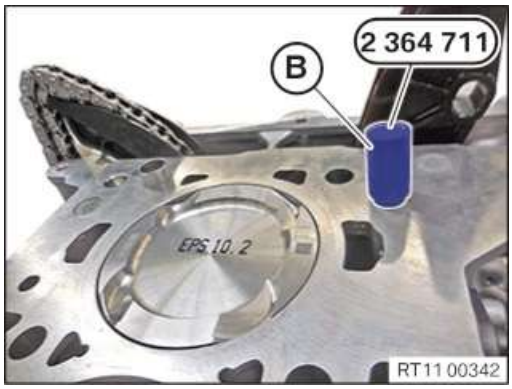
Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

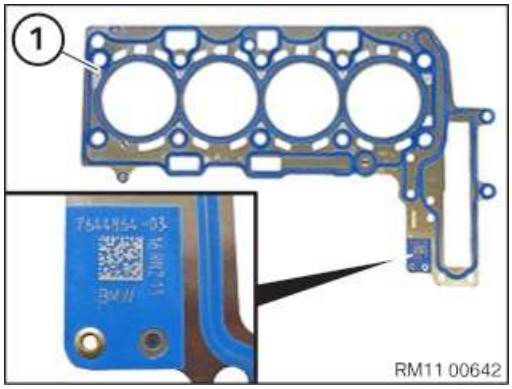
- Wear safety goggles.

- Clean all the threaded holes in the **marked** area of the crankcase with compressed air.



- Remove special tool (B) contained in the set of special tools 2 364 711.

41 – Renewing the cylinder head gasket

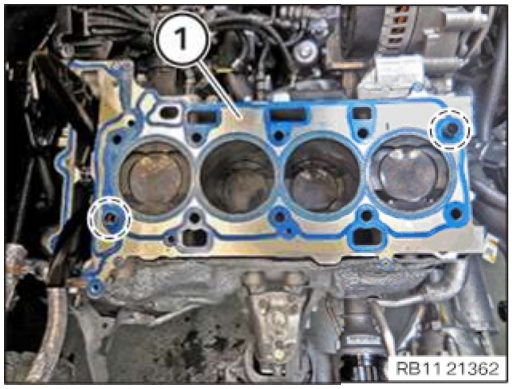


- Identify the cylinder head gasket (1) using the part number.

Note: If the cylinder head is reworked, an additional thicker gasket 0.3 mm is available for service personnel.



- Check fitting sleeves (1) in the **marked** area for damage and, if necessary, renew them.



- Guide cylinder head gasket (1) into the **marked** area and install it.

42 – Installing the cylinder head

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

RISK OF DAMAGE

Damage to threads.

Fluid in the threaded hole may damage the thread when screws are tightened in the threads.

- Dry threaded holes (e.g. using compressed air).

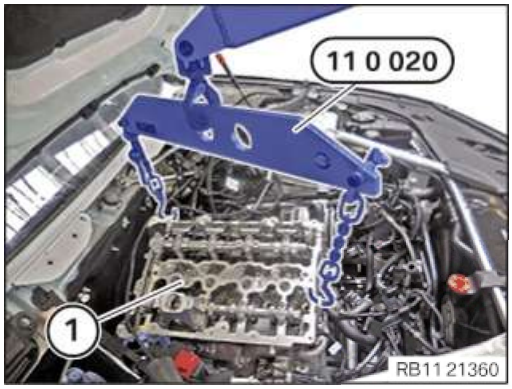
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TECHNICAL INFORMATION

Do not remove bolt coating.

TECHNICAL INFORMATION

When replacing the cylinder head: The complete valve control and the Valvetronic servomotor are already pre-assembled for new cylinder heads.



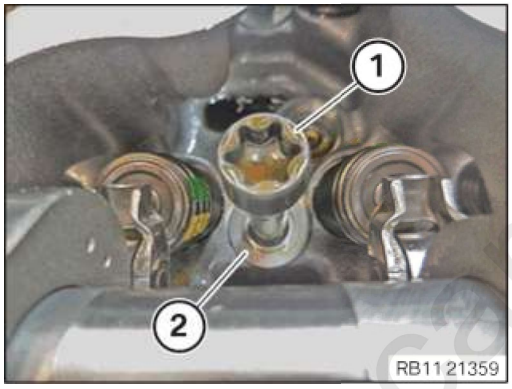
RISK OF DAMAGE

Damage to the guide rails.

Large amounts of force may damage the guide rails of the timing chain.

- Make sure not to damage the guide rail with the cylinder head when removing and installing the cylinder head.

- Feed in, position and install cylinder head (1) and exhaust turbocharger with the help of an auxiliary person, the workshop crane and the special tool .
- Ensure that the **guide rails** of the timing chain are **not** damaged.

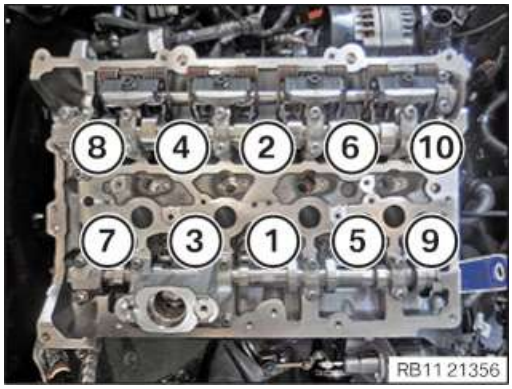


- Insert and install washer (2).
- Renew the cylinder head bolts (1).

  Parts: Cylinder head bolts
- Do not wash off the coating (1) **of the cylinder head bolts** .
- **Lightly** oil contact surfaces of cylinder head bolt screw heads.

  No coolant, water or engine oil must be present in threaded holes of engine block.
- Guide in and install cylinder head bolts (1).

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TECHNICAL INFORMATION

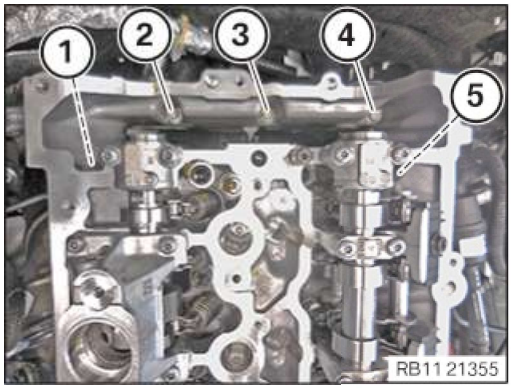
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Feed in cylinder head bolts (1) to (10) and install.
- Screw in the cylinder head bolts in the sequence (1) to (10).
- Tighten cylinder head bolts using special tools 0 495 747 (11 8 580) and 0 490 504 (00 9 120) in sequence (1) to (10).

Cylinder head to crankcase

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque 2. Angle of rotation 3. Angle of rotation	30 Nm 90 ° 180 °



- Renew cylinder head bolts (1) to (5).

  Parts: Cylinder head bolts
- Make sure that there is **no** coolant, water or engine oil in the threaded holes of the timing case cover.
- Screw in cylinder head bolts (1) to (5).
- Tighten the cylinder head bolts in the order (1) to (5).

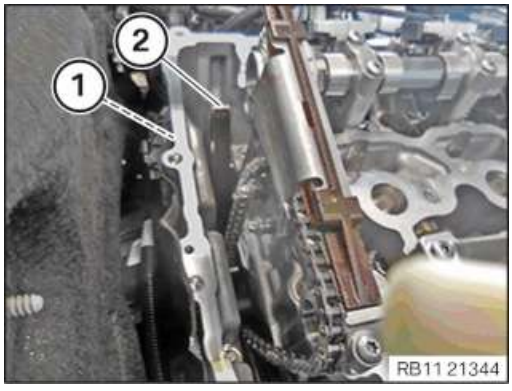
Cylinder head bolt to timing case cover

M8x40	Renew screws.	Tightening torque	19 Nm



- Renew bearing journal (1).

  Parts: Bearing journal

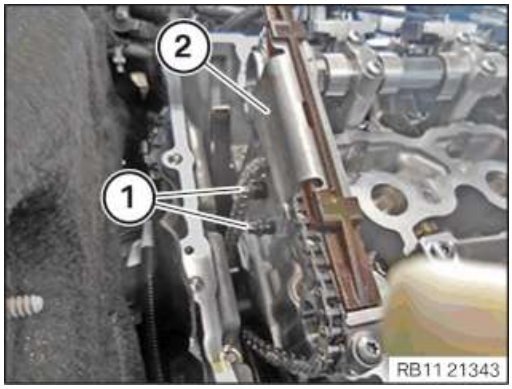


- Feed in and install bearing journal (1) on the guide rail (2).
- Tighten the bearing journals (1).

Bearing journal to cylinder head

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

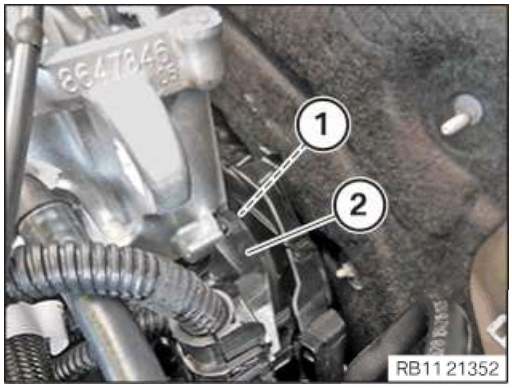
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- Insert slide rail (2) and install.
- Tighten the screws (1).

Sliding rail to cylinder head

M6x16			8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

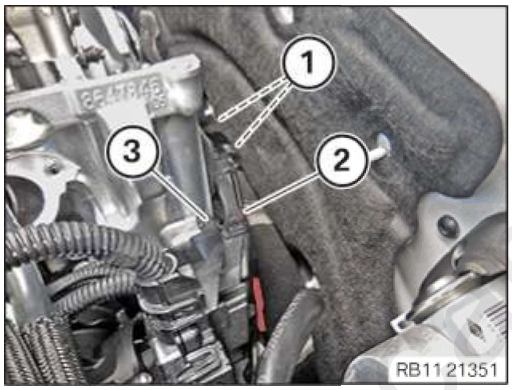
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install wiring harness section (2) for sensor system 1.
- Tighten down screw (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm



RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

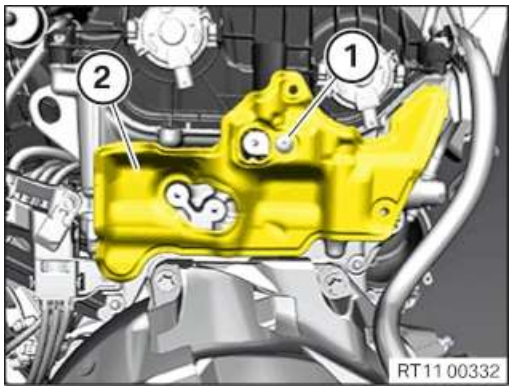
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and install transmission wiring harness (2) on wiring harness section (3) for sensor system 1.
- Tighten the screws (1).

Cable routing to cylinder head, rear

M6 x 20		Tightening torque	8 Nm

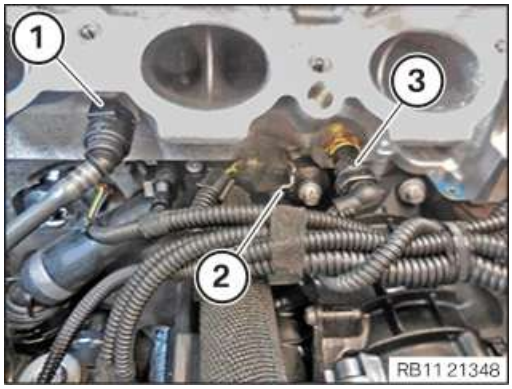


- Guide in and install cover (2).
- Tighten down screw (1).

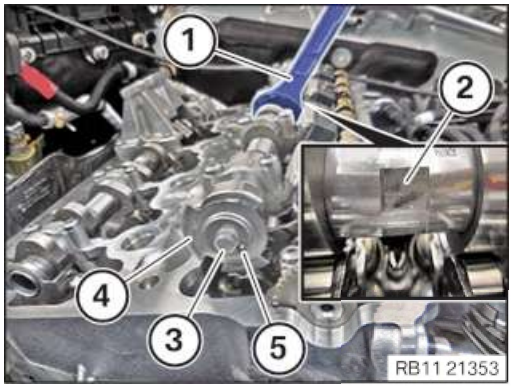
Cover on rear cylinder head

M6		Tightening torque	8 Nm

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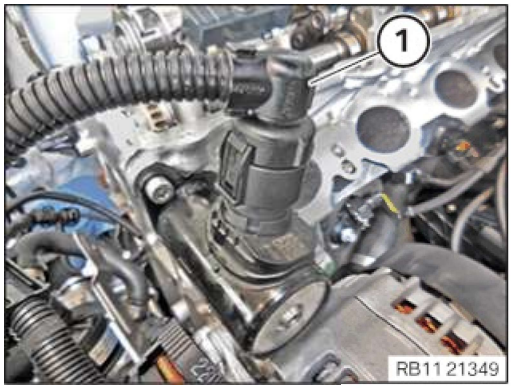
- Connect connector (3) on the coolant temperature sensor and lock it.
- Make sure that the connector (3) engages audibly on the coolant temperature sensor.
- Connect connector (2) on the knock sensor and lock it.
- Ensure that connector (2) engages audibly on the knock sensor.
- Connect and lock coolant line (1).
- Make sure that the cooling line (1) engages audibly.



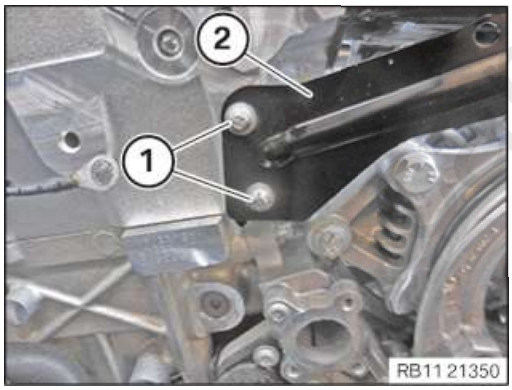
- Guide in and position camshaft sensor wheel (4) on guide pin (5).
- Fix intake camshaft (2) with a commercially available open-end spanner (1).
- Tighten down screw (3).

Camshaft sensor wheel to intake camshaft

M6x16		Tightening torque	8 Nm



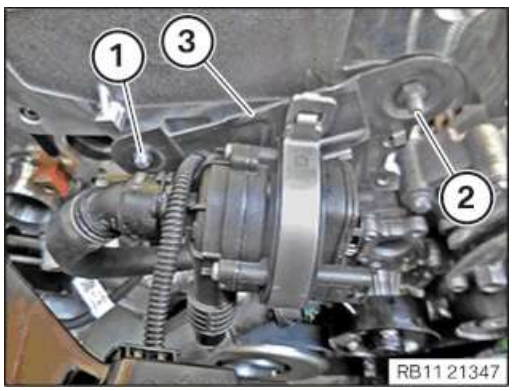
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten the screws (1).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm



- Insert and position the holders (3).
- Tighten down screws (1) and (2).

Holder for electrical auxiliary coolant pump on cylinder head

M6		Tightening torque	7 Nm

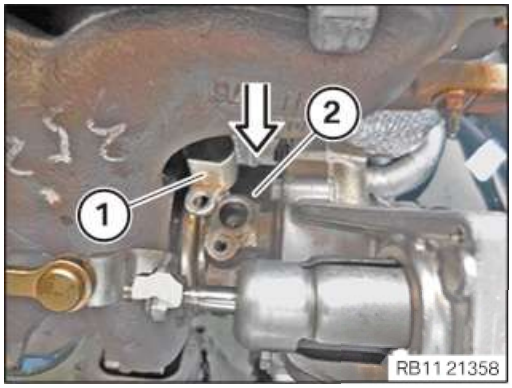
mdiagn.com



- Thread in ground cable (2) and install.
- Tighten nut (1).

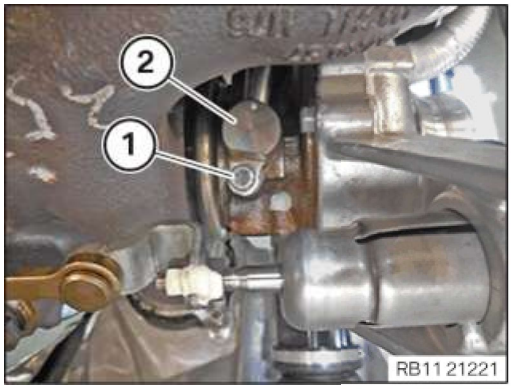
Standard screw connection M6

M6		8 Nm



- Renew the sealing ring of oil feed line (1) with special tool 0 496 714 (00 9 030).

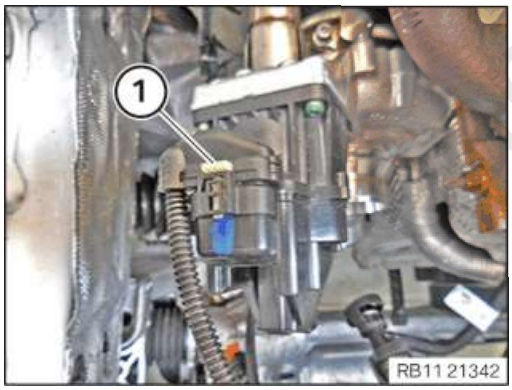
  Parts: Sealing ring
- Guide in and install oil feed line (1) in the direction of the arrow on exhaust turbocharger (2).



- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm



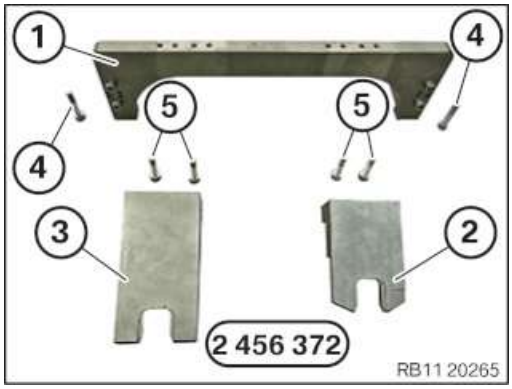
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

43 – Adjust the camshafts with the special tool

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- Overview of the set of special tools 2 456 372:

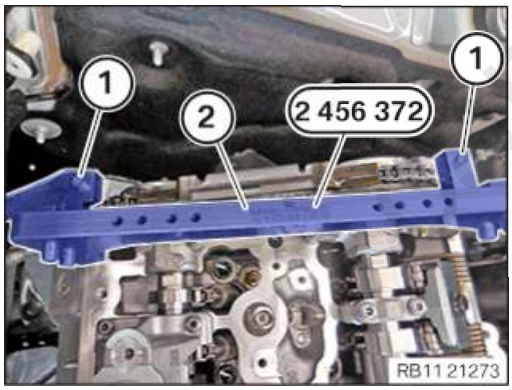
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



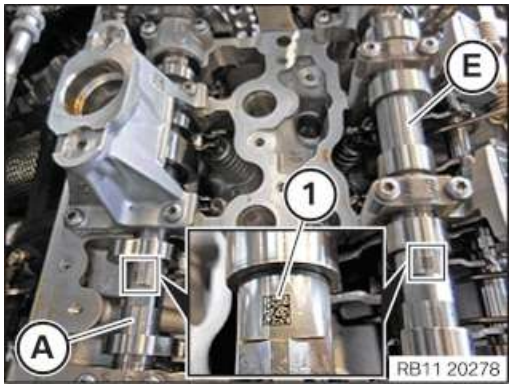
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

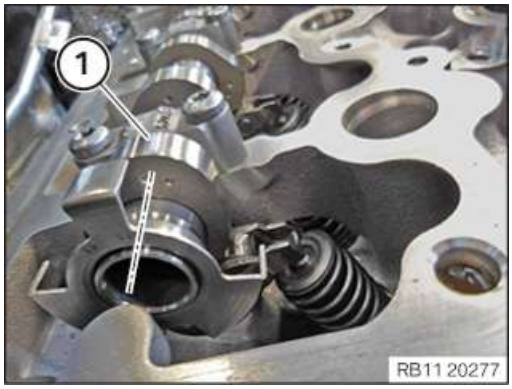
Basic carrier to cylinder head

M6		Tightening torque	8 Nm

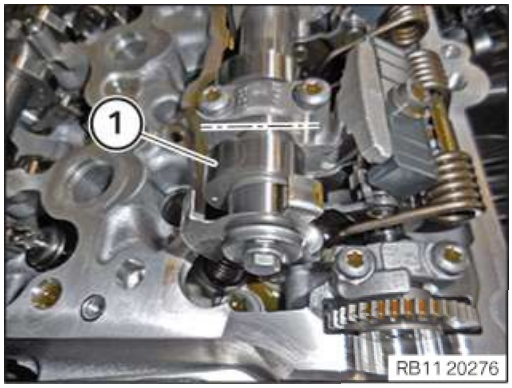


- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.

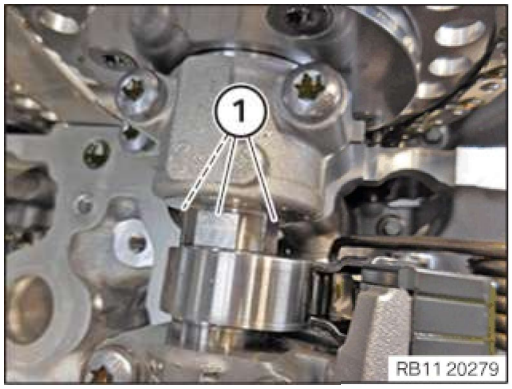
.diagn.com



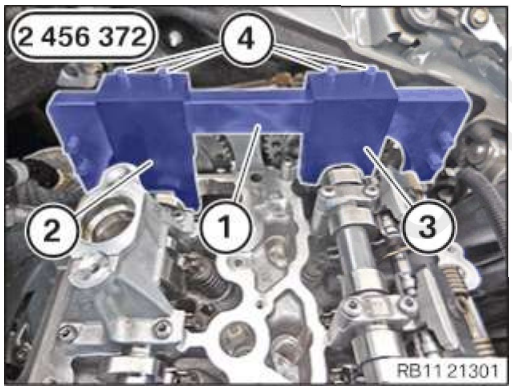
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

44 – Install exhaust camshaft adjuster

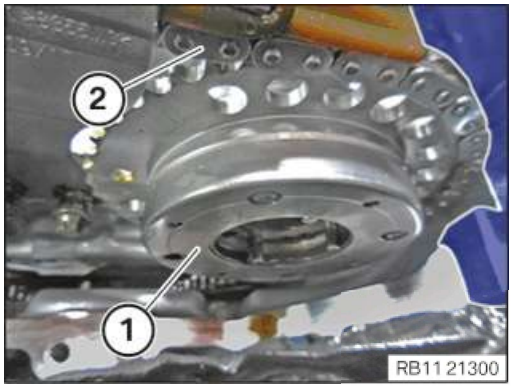
NOTICE

The figure shows the rear side of the engine.

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- Keep exhaust camshaft adjuster (1) marked EX ready.



- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

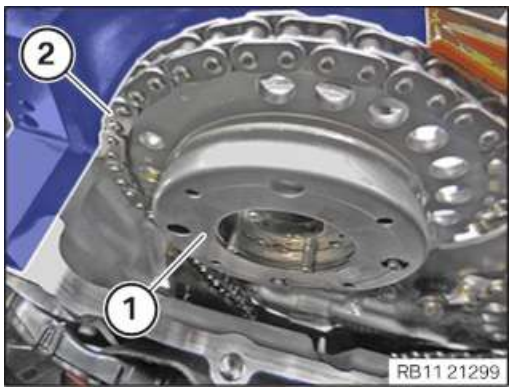
45 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.



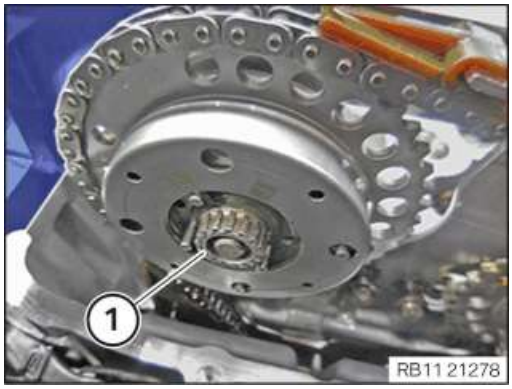
- Keep intake adjuster (1) marked IN ready.



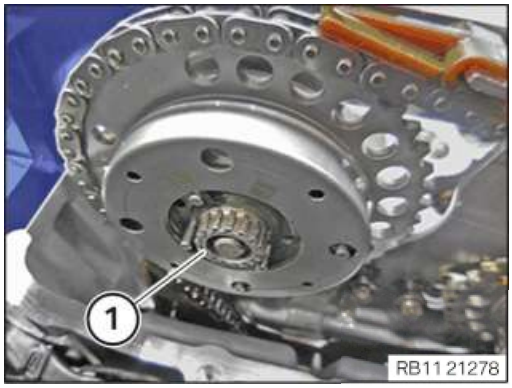
- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

46 – Install the VANOS central valve of the intake adjuster

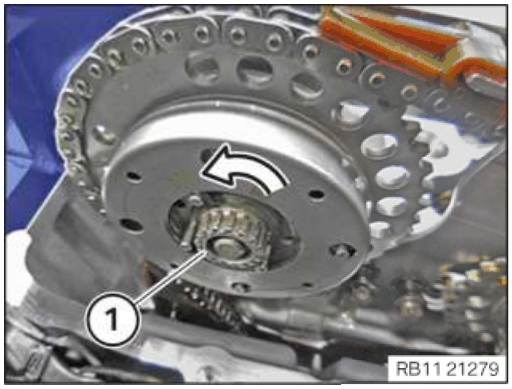
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- Guide in the VANOS central valve (1) of the intake adjuster and install.

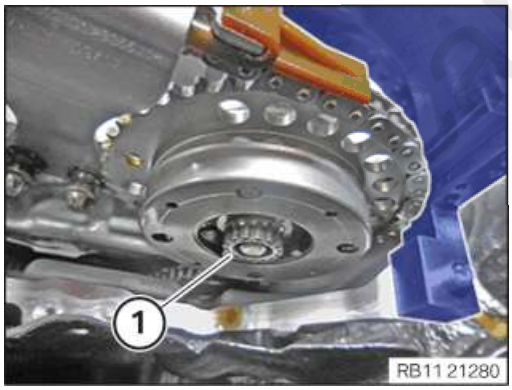


- Hand-tighten the VANOS central valve (1) of the intake adjuster.

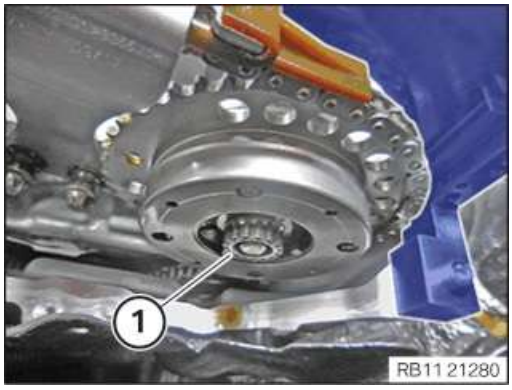


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

47 – Installing the VANOS central valve of the exhaust camshaft adjuster

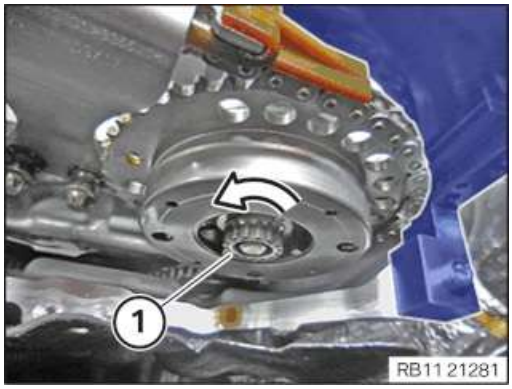


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



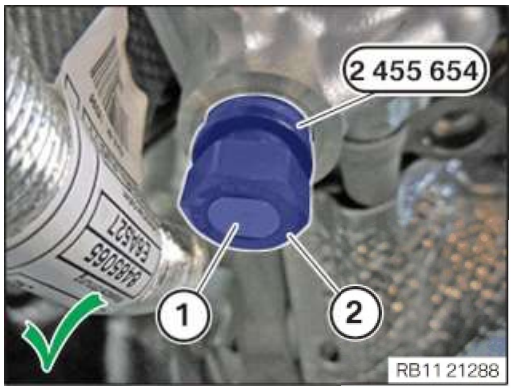
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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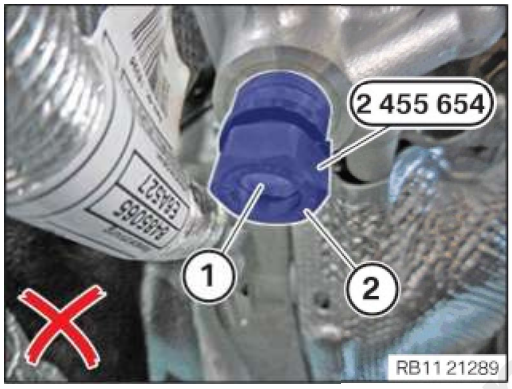
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

48 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

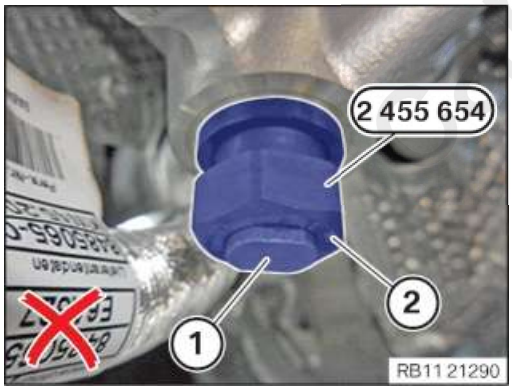
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

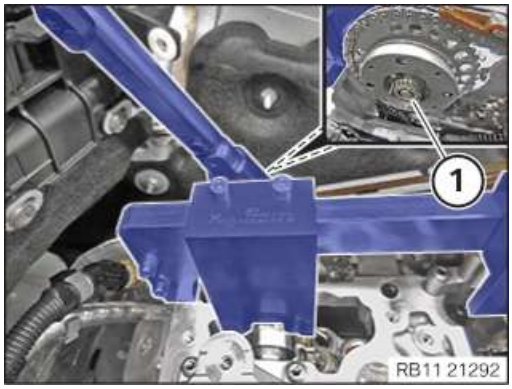
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

49 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

50 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

51 – Install chain tensioner

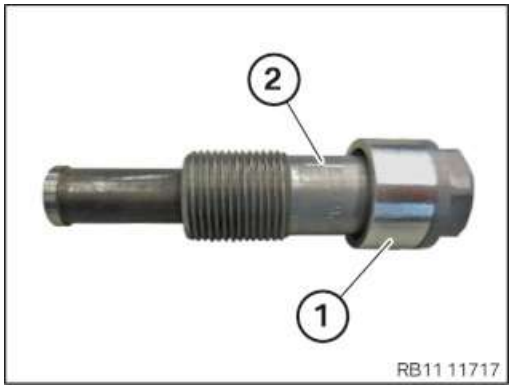
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

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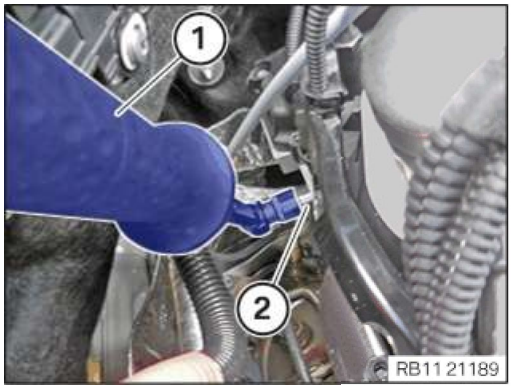


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

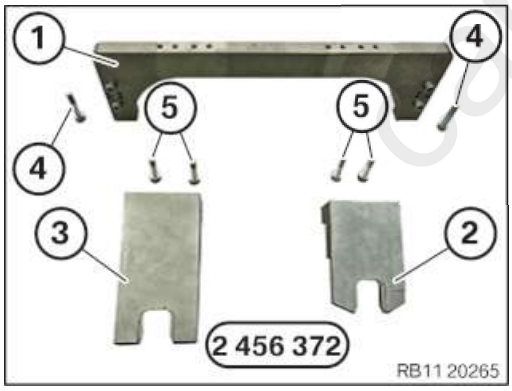


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

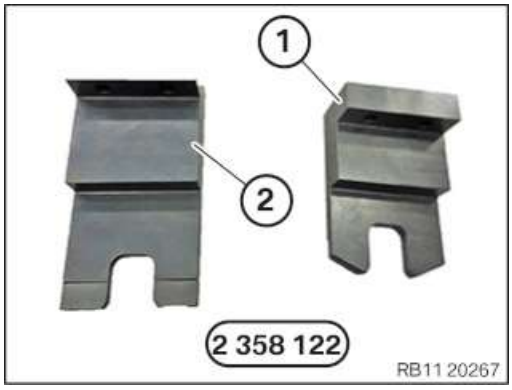
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

52 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft

cardiagn.com



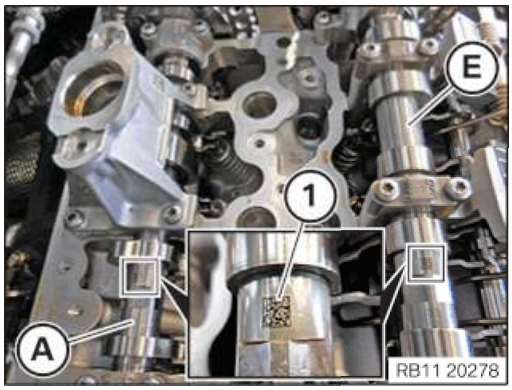
RISK OF DAMAGE

Damage to the engine.

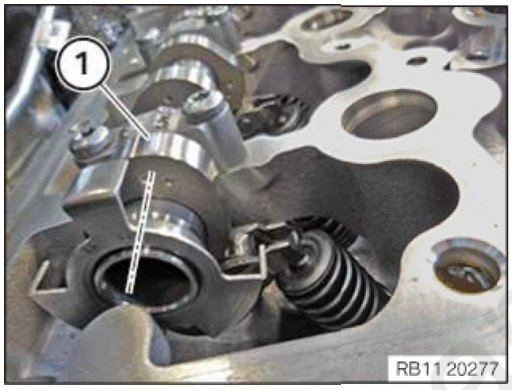
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

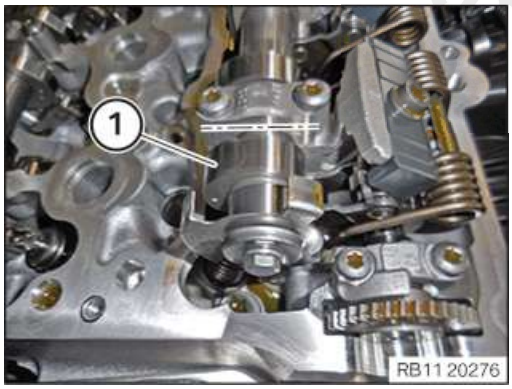
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



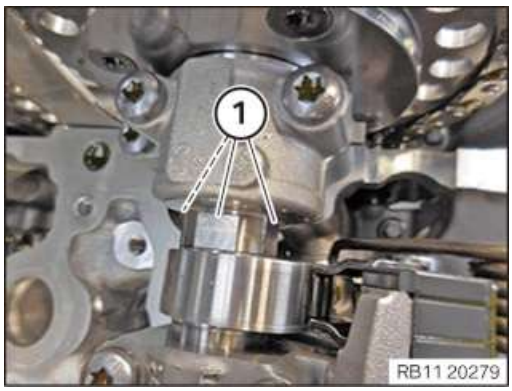
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

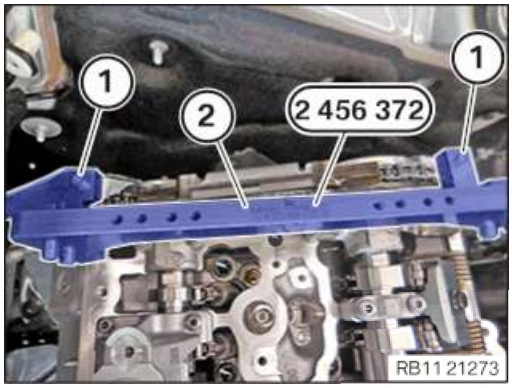


- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.

autodiagn.com



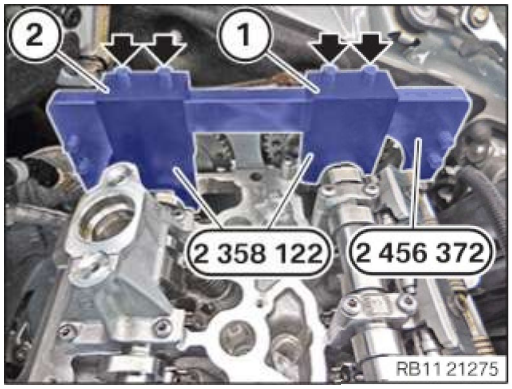
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



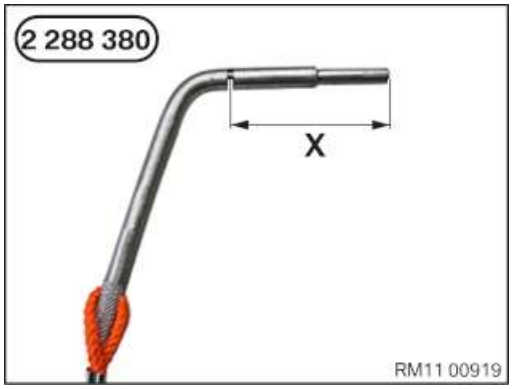
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).

rdiag.com



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

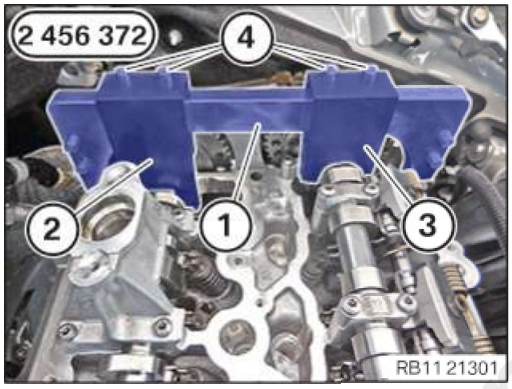


- **Vehicles with automatic transmission:**

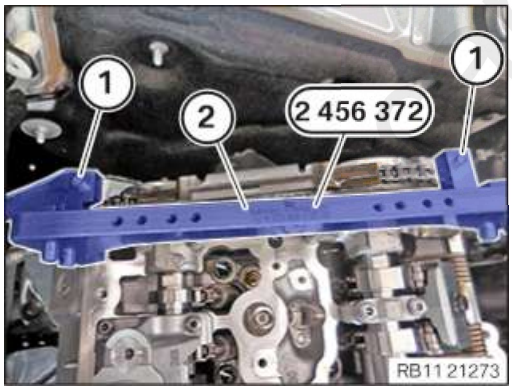
  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

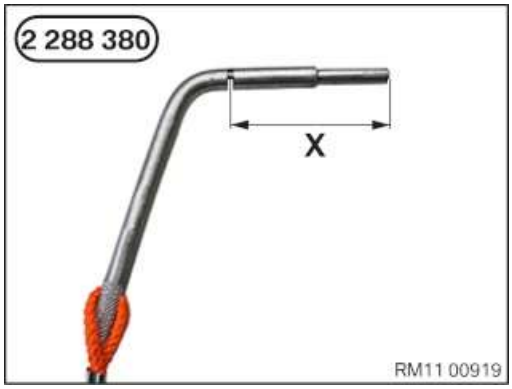
53 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



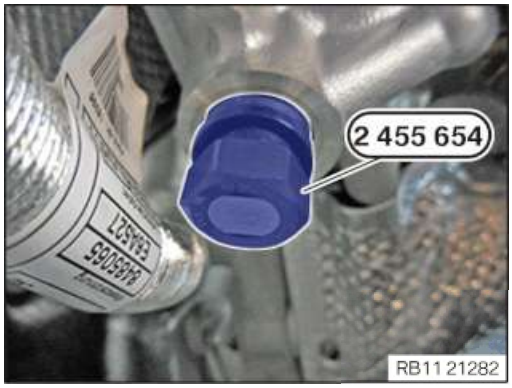
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.

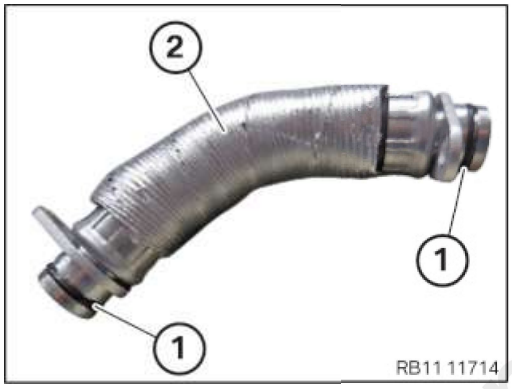


- Guide the special tool 0 493 380 (11 6 480) out and remove.



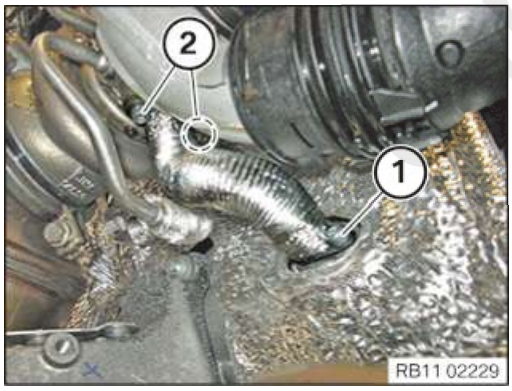
- Guide the special tool (1)2 455 654 out and remove.

54 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

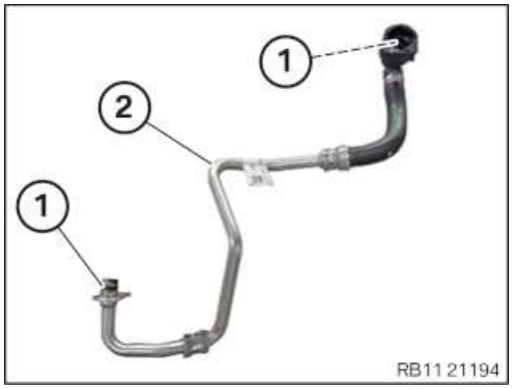
Oil return line to exhaust turbocharger/crankcase

M6x14		Tightening torque	8 Nm

55 – Install the coolant return line for the exhaust turbocharger

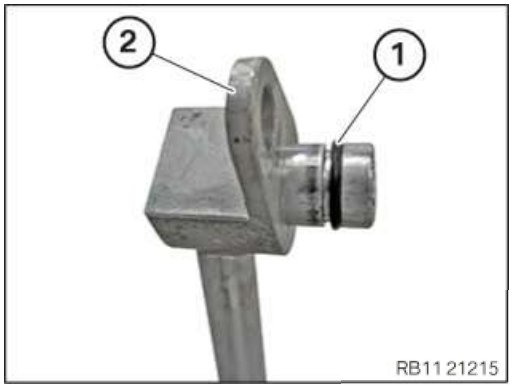
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



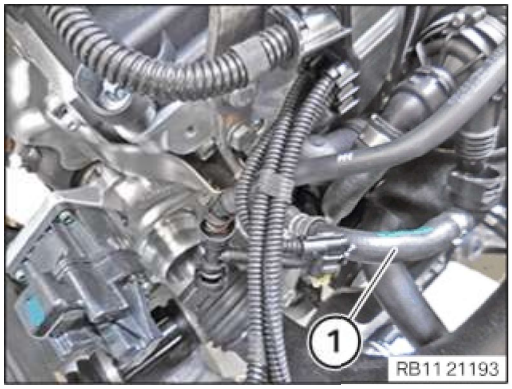
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

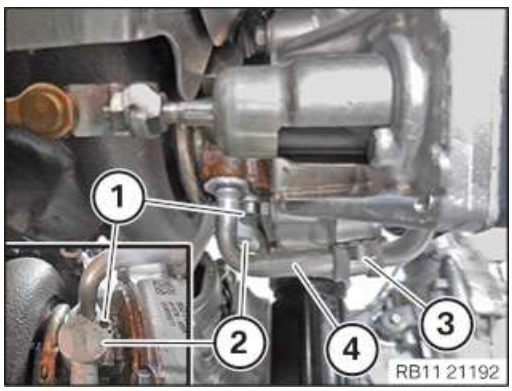
  Parts: O-ring



- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

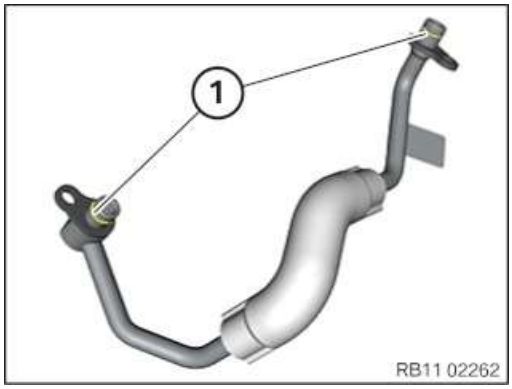
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

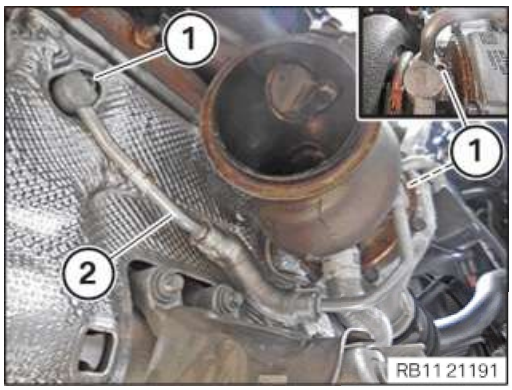
M6		Tightening torque	8 Nm

mbdiagn.com



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

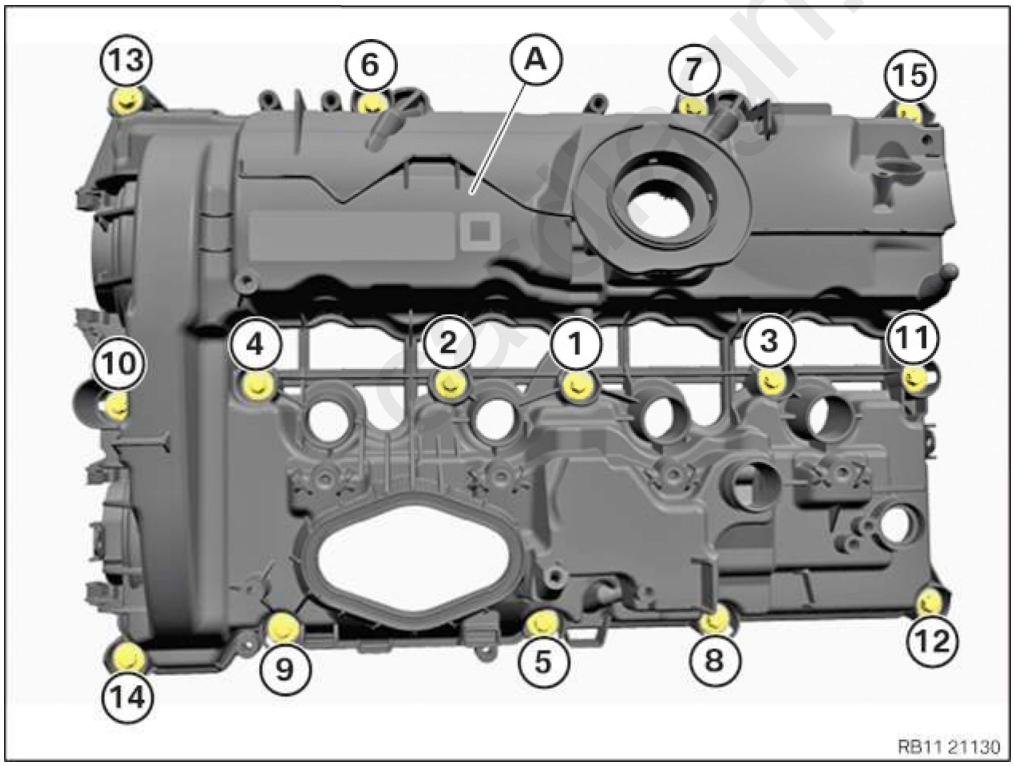
- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

57 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

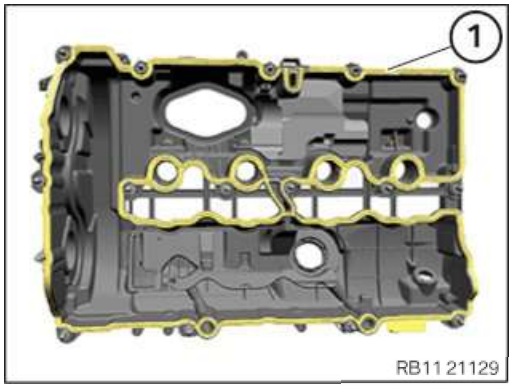
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

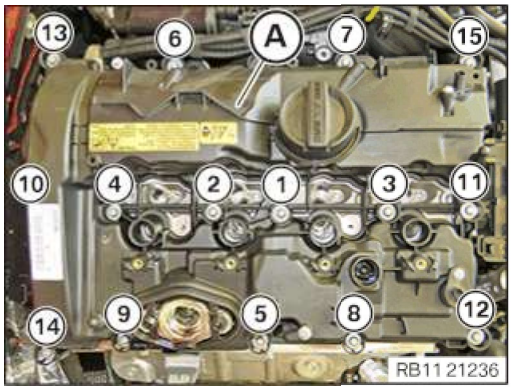
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal

- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

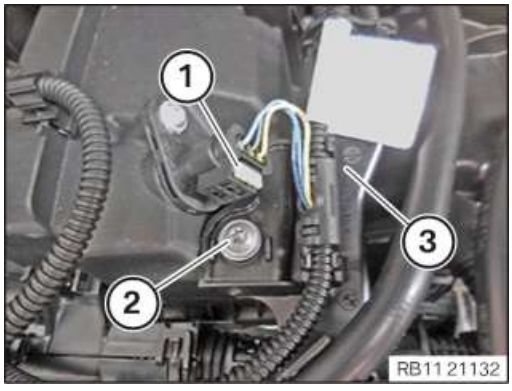
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

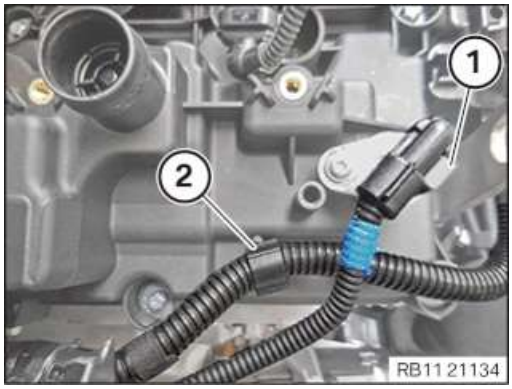


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

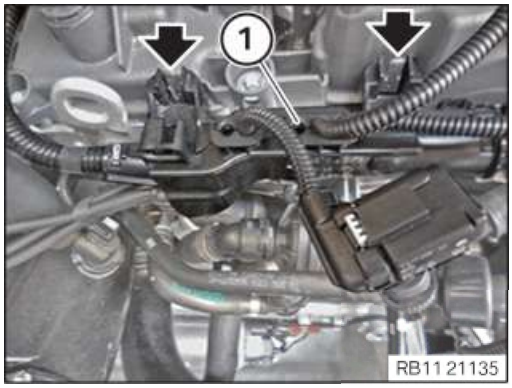
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

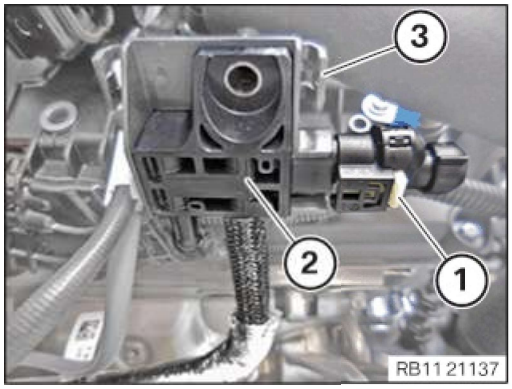
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



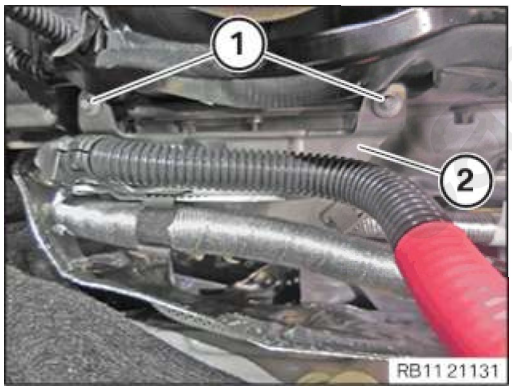
- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

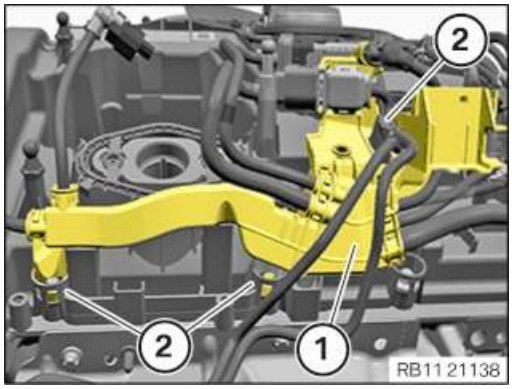
- Route the positive battery cable without abrasions and do not trap.

- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

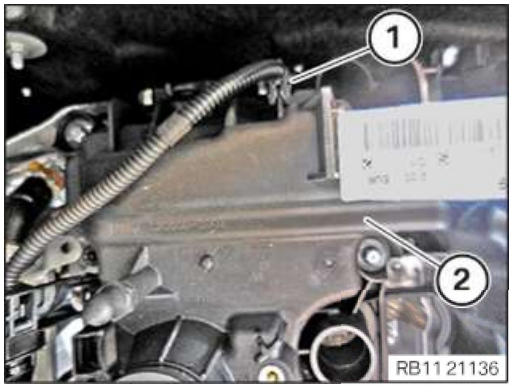
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

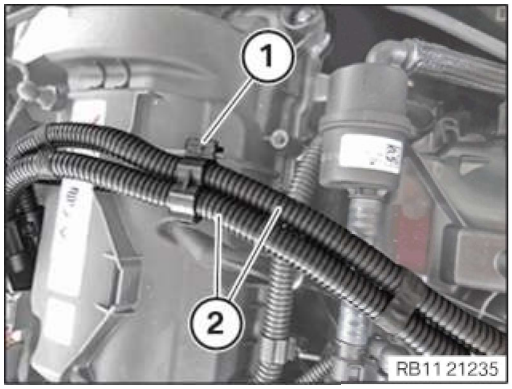
.com



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

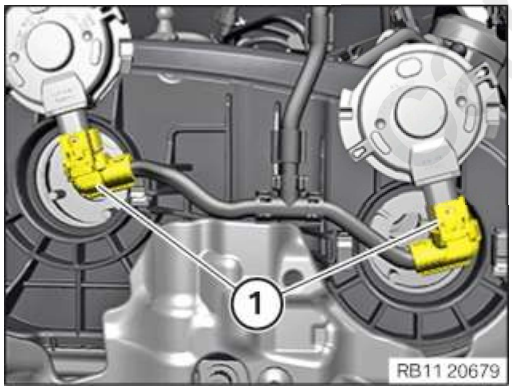


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

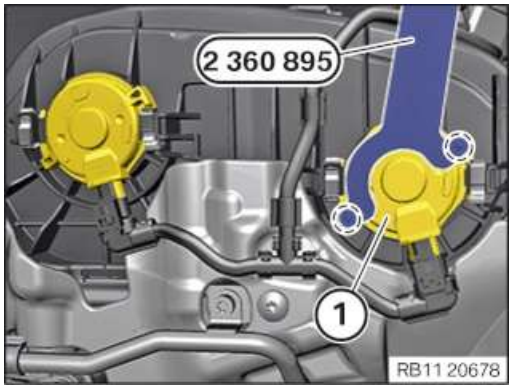
58 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

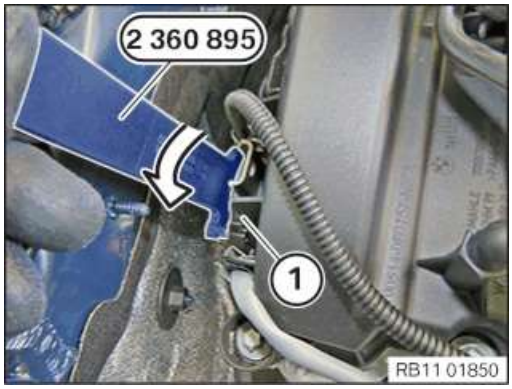


NOTICE

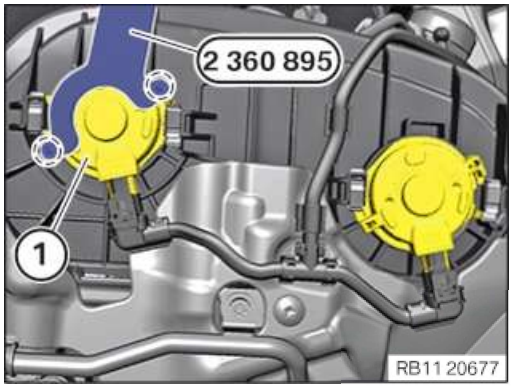
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.

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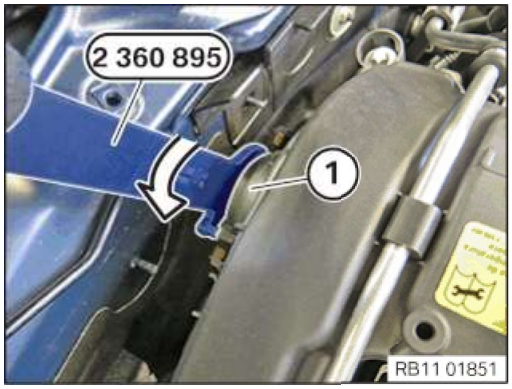
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

59 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

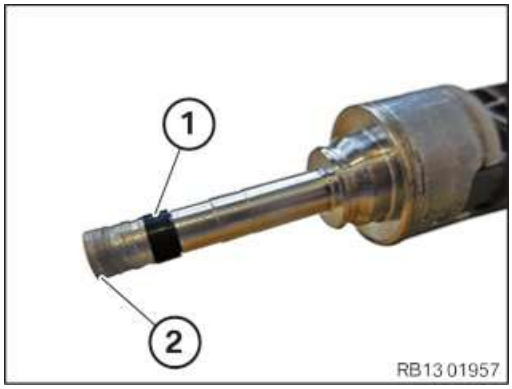
- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

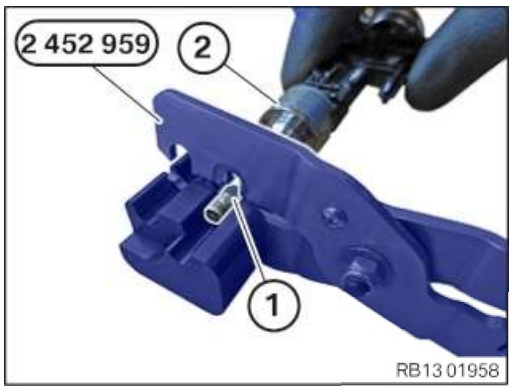
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.

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- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.



- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

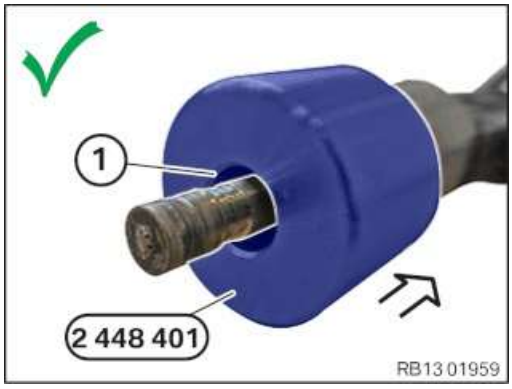
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

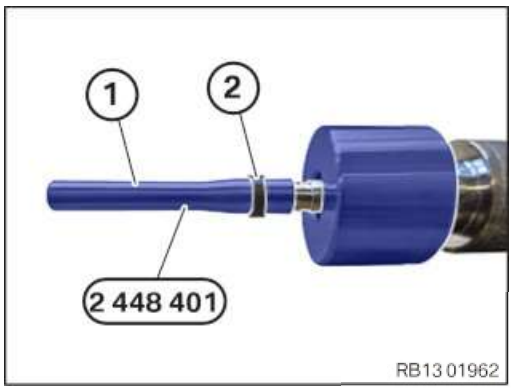
  The larger diameter of the assembly sleeve (1) must point to the injector tip.

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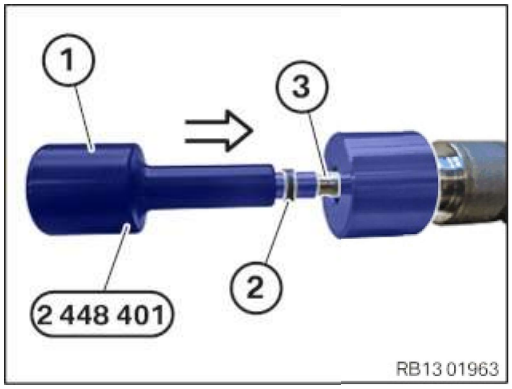


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

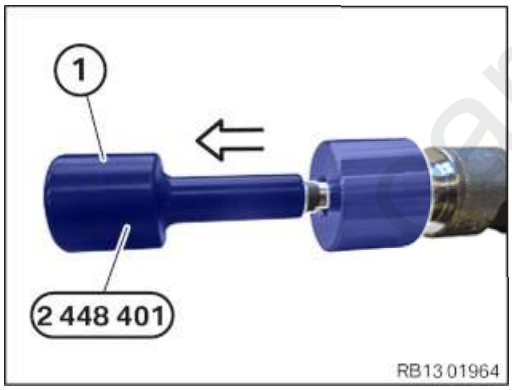
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



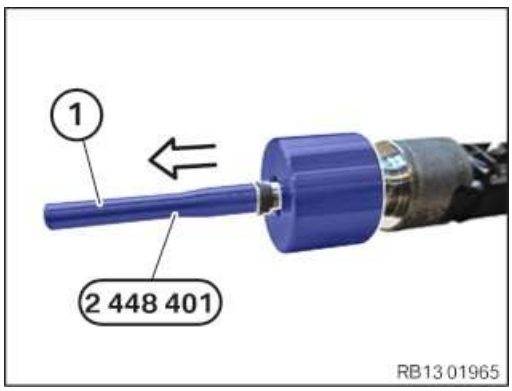
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

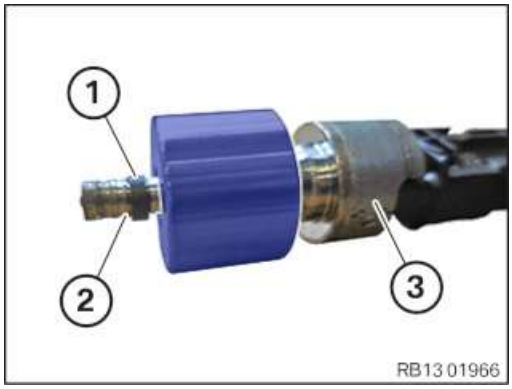


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

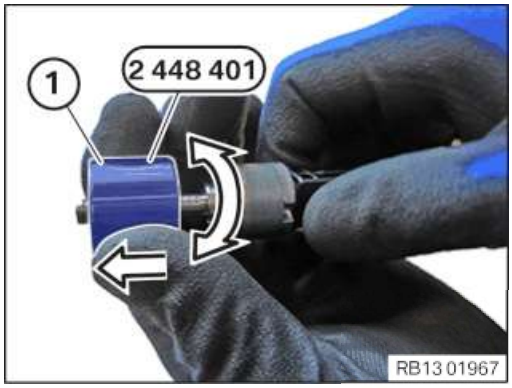


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

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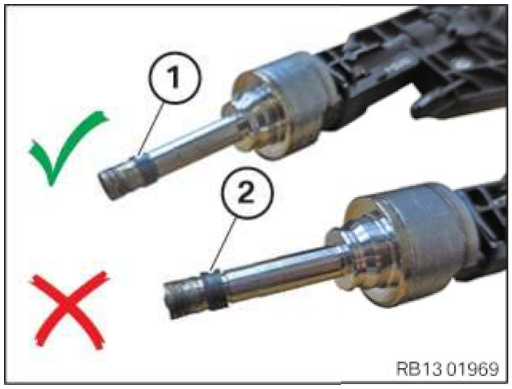


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

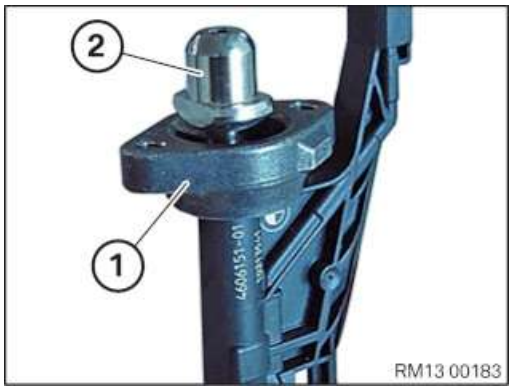


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

60 – Installing the rail with injectors

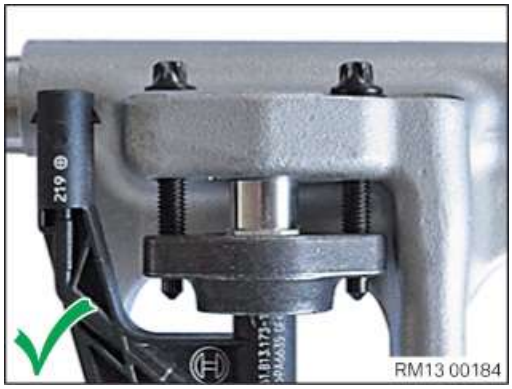
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



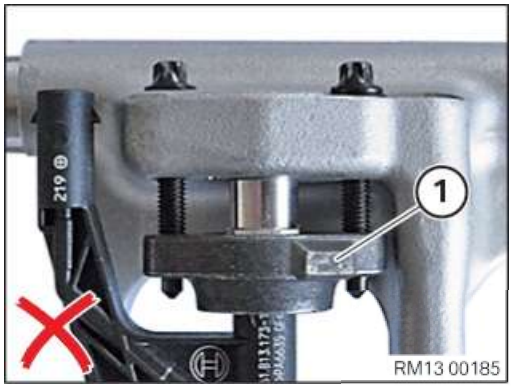
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.

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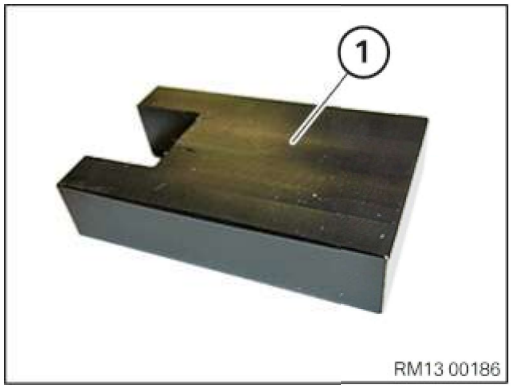
- If applicable, note the position of the cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



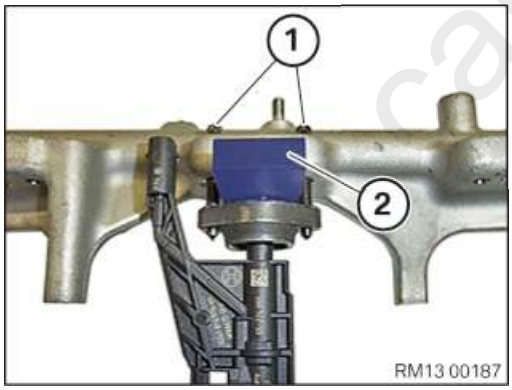
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



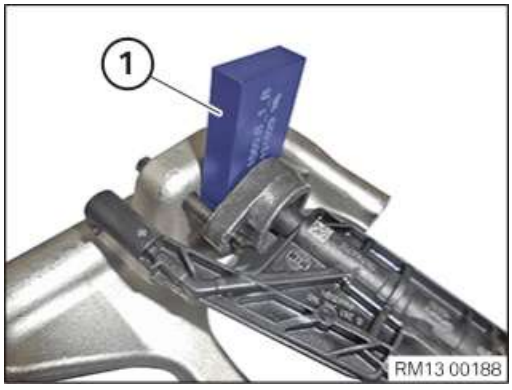
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)

- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

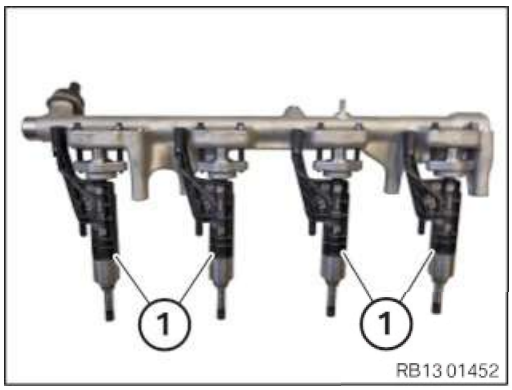
  The electrical injector connections must point to the fuel pressure sensor.

- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

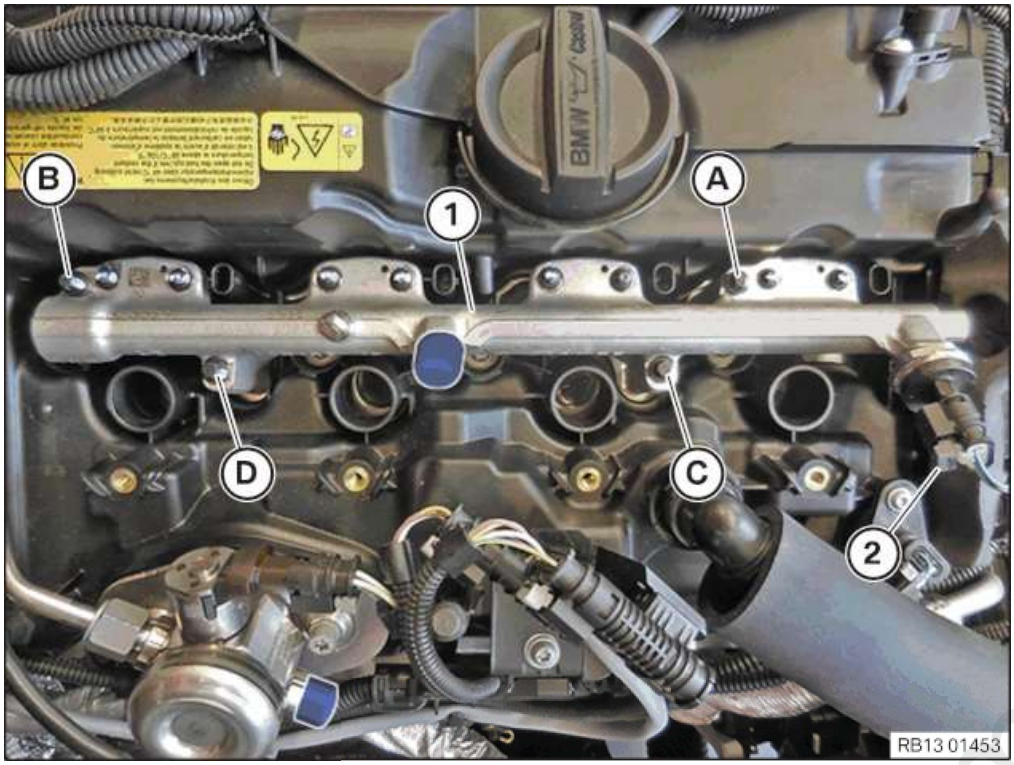
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- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

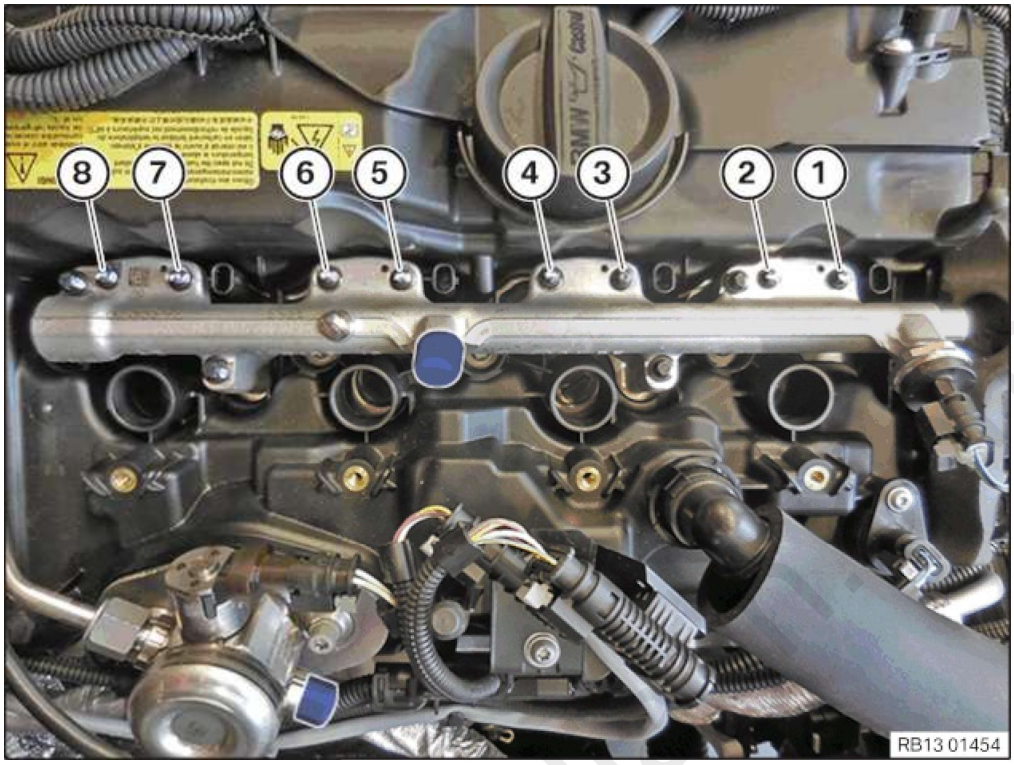
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.

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- Make sure that the rail (1) rests flat against the cylinder head.



- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

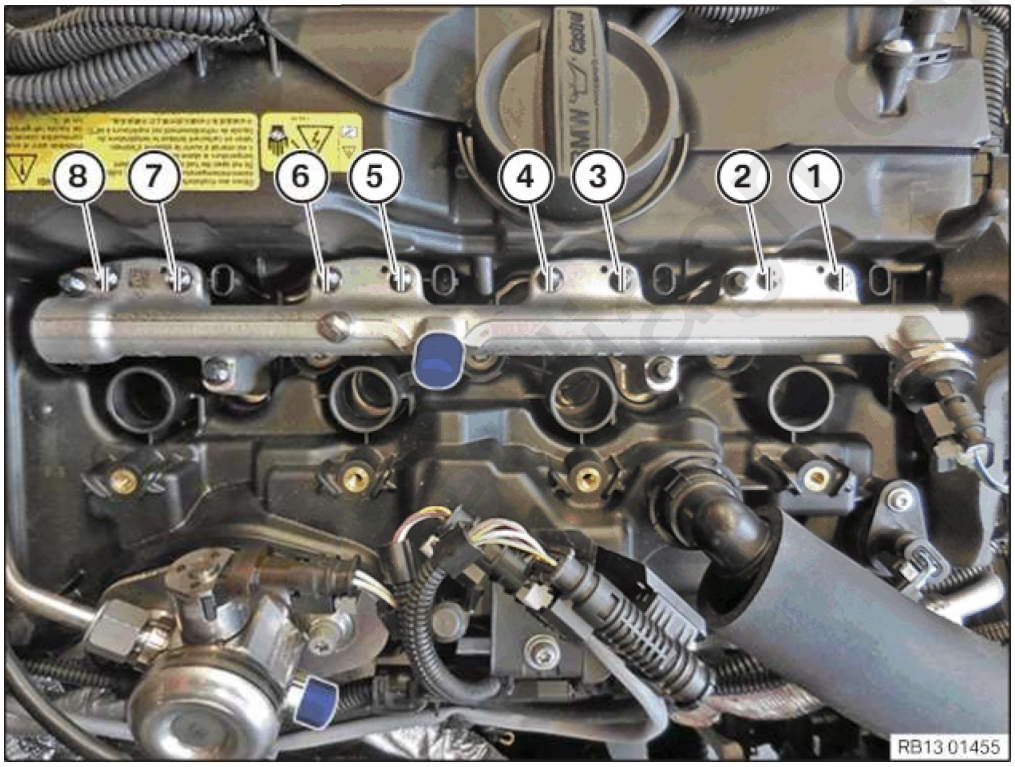
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

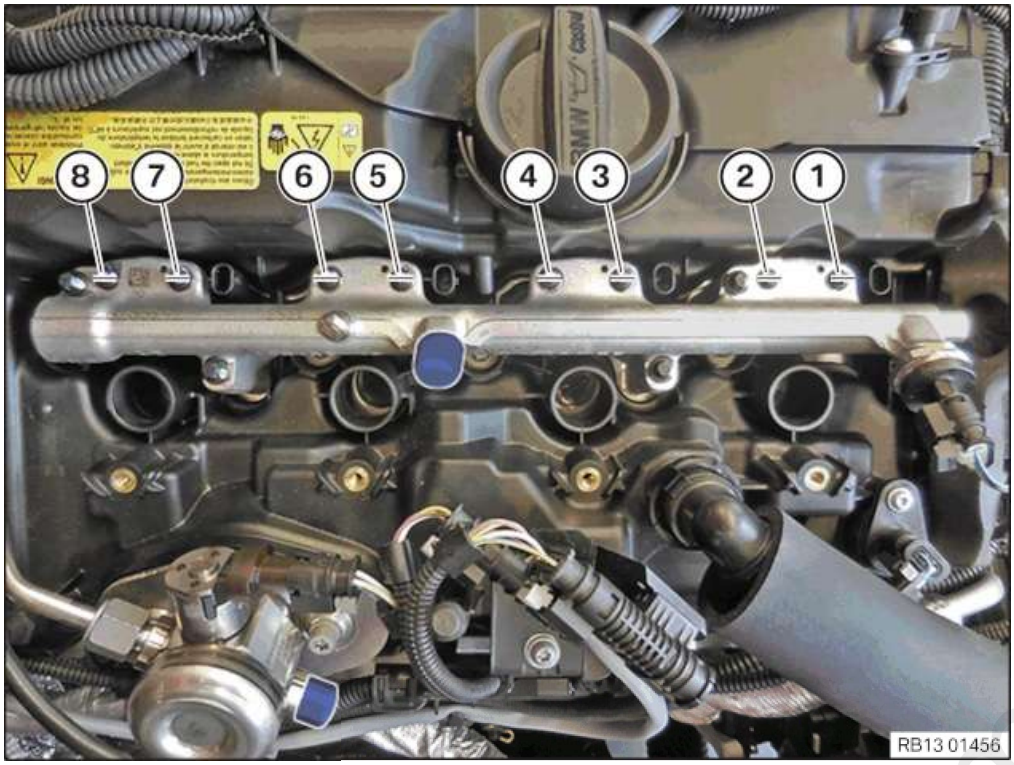
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.

- **Fuel injector 3:**
- Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
- **Fuel injector 4:**
- Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
- Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
- Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

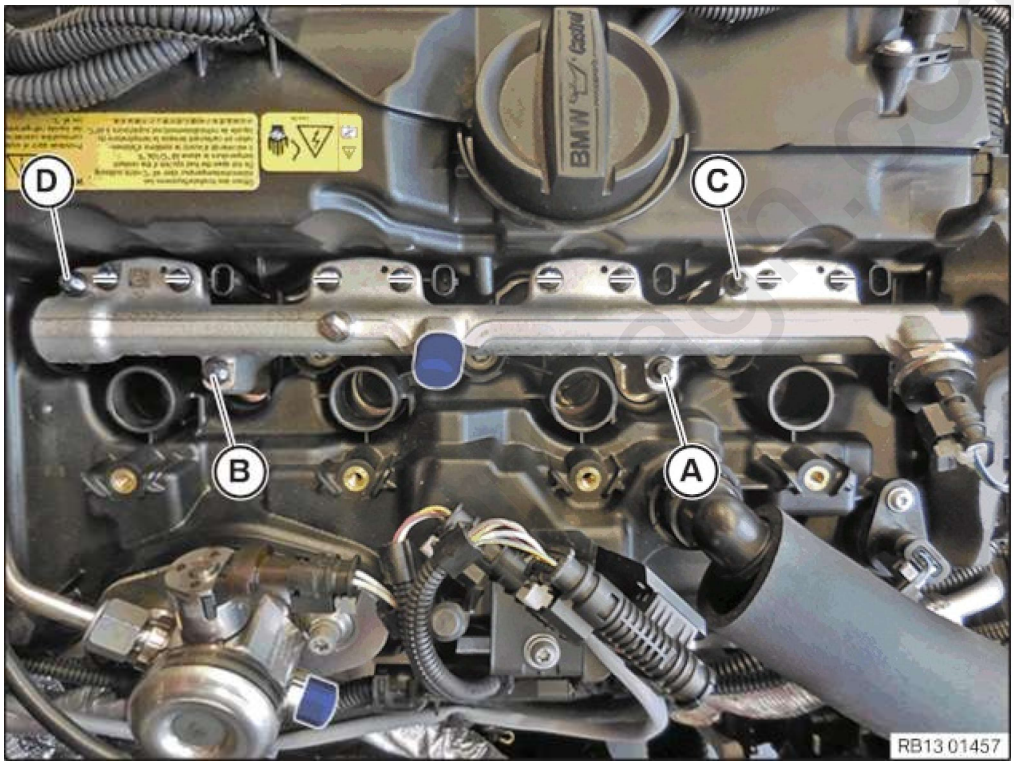


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

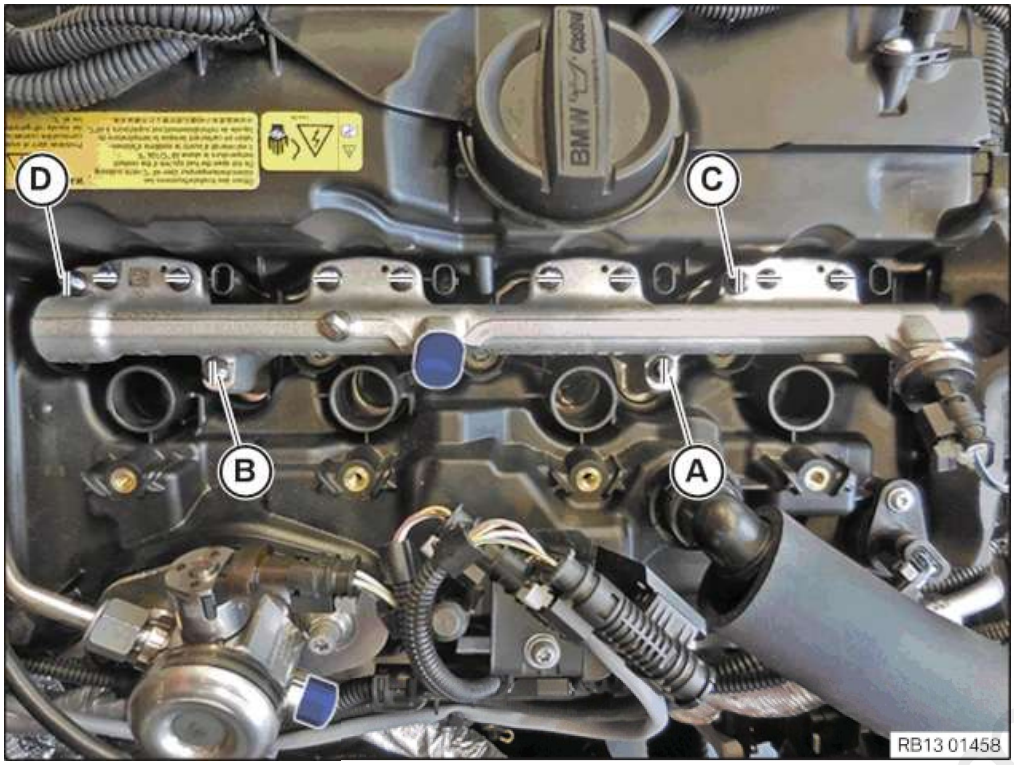
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

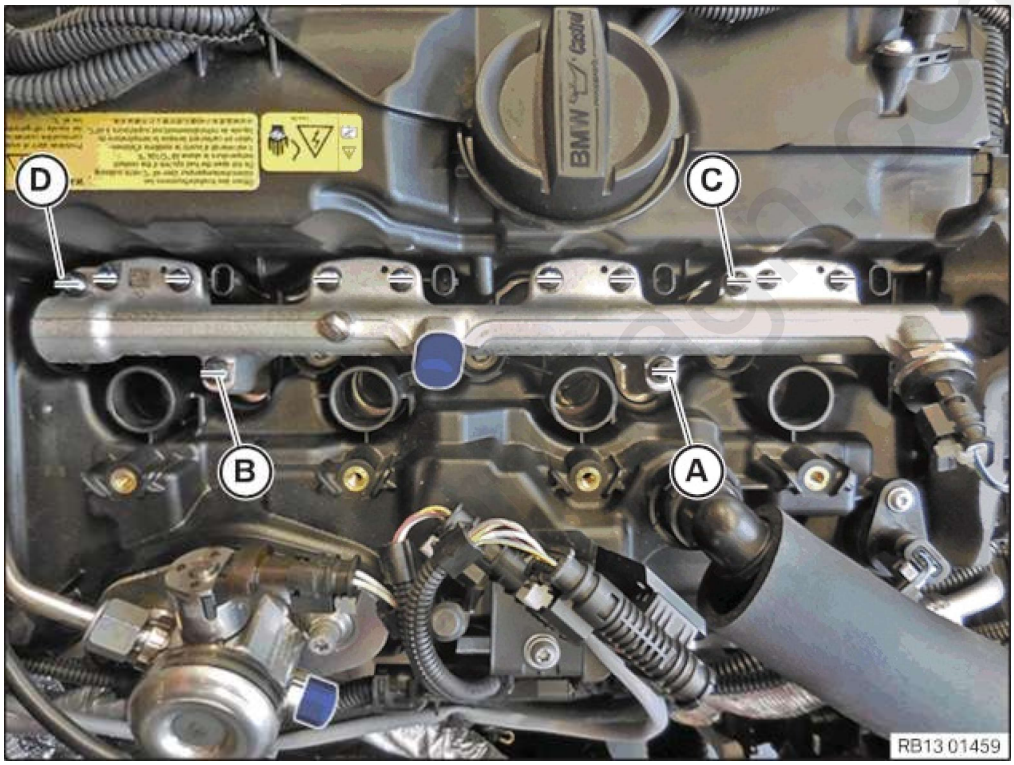
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

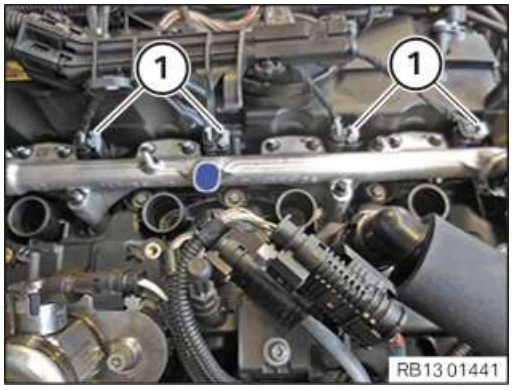


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



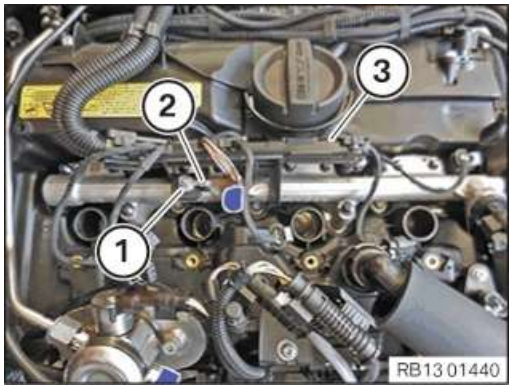
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

61 – Install high pressure pump

RISK OF DAMAGE

Damage to the engine.

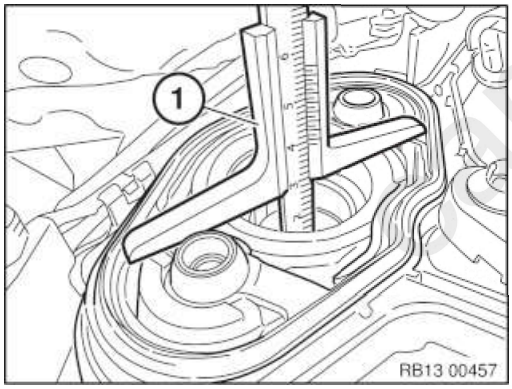
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

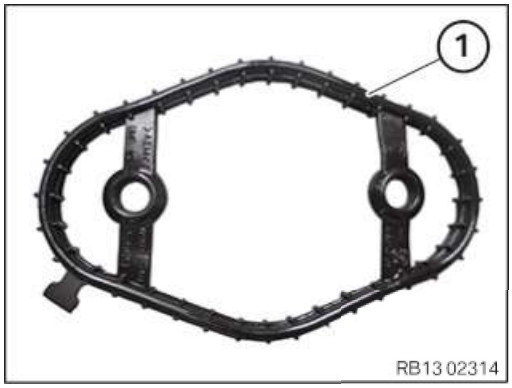
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



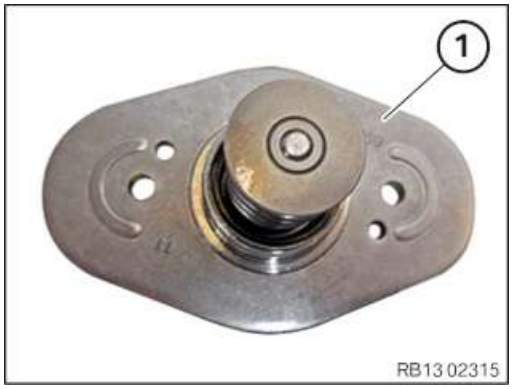
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

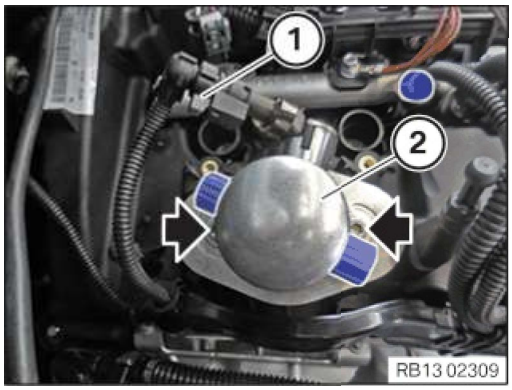
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

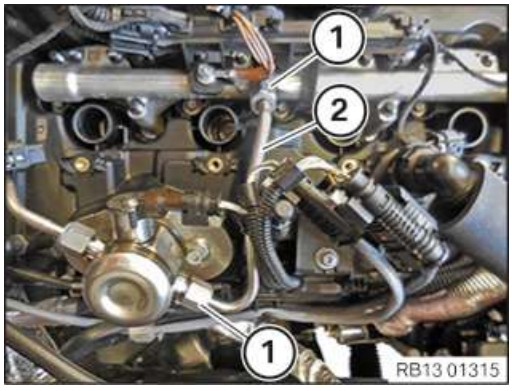
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

62 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

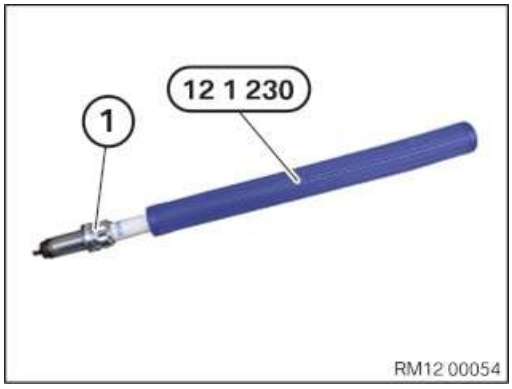
High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

63 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).



TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

M12x1.25		Tightening torque	23 Nm

64 – Installing the intake plenum

RISK OF DAMAGE

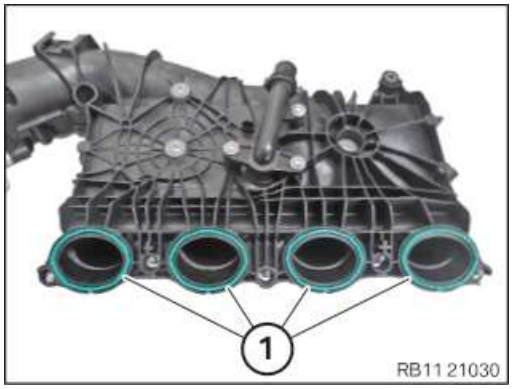
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

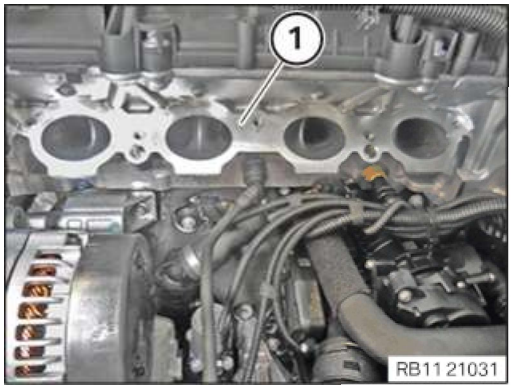
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

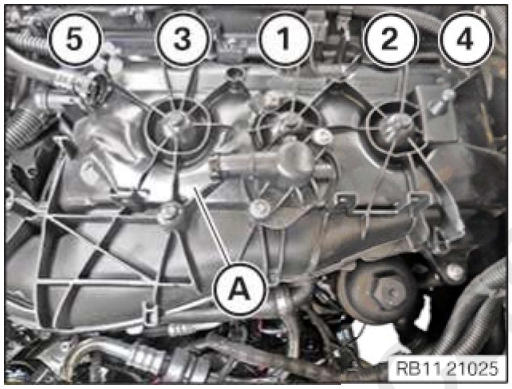


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

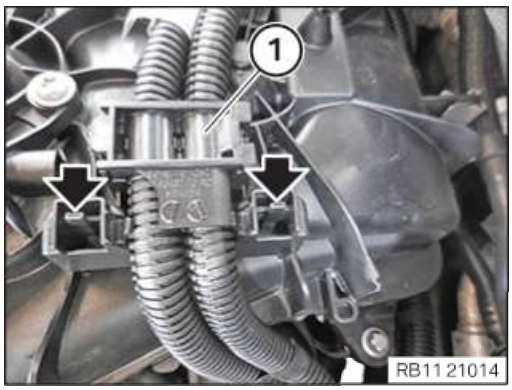
ertogen.com



- Tighten down screw (1).

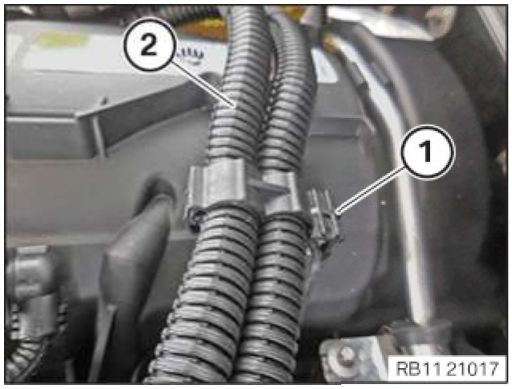
Intake plenum to support

M6X25		Tightening torque	8 Nm

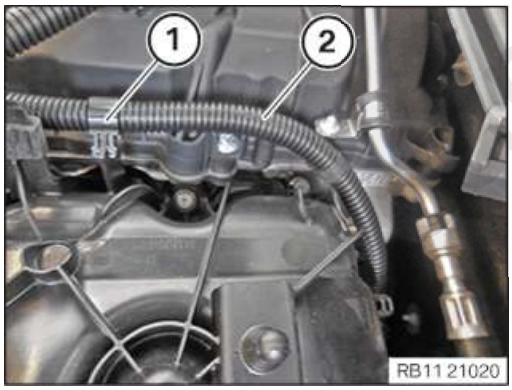


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

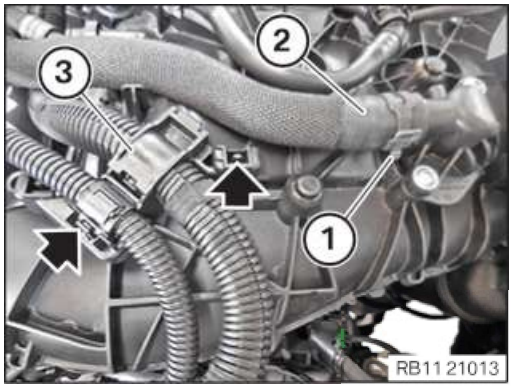
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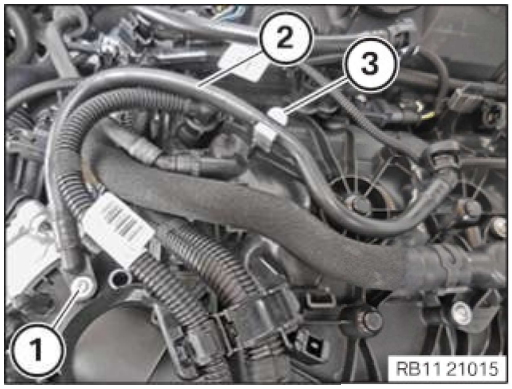
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



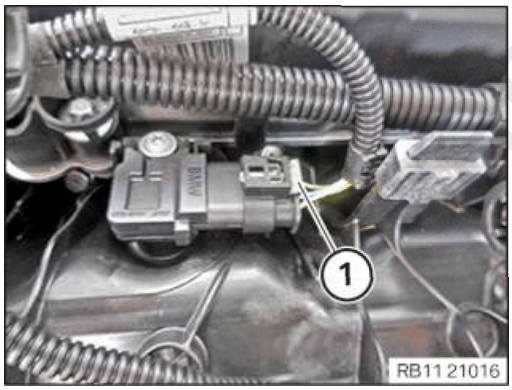
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

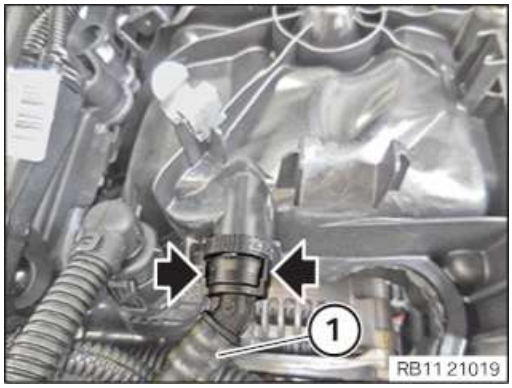
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

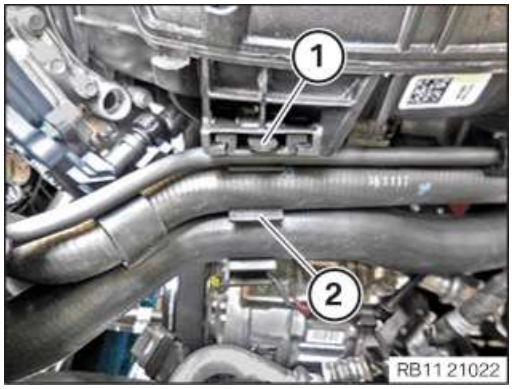
  The connector (1) must engage audibly.



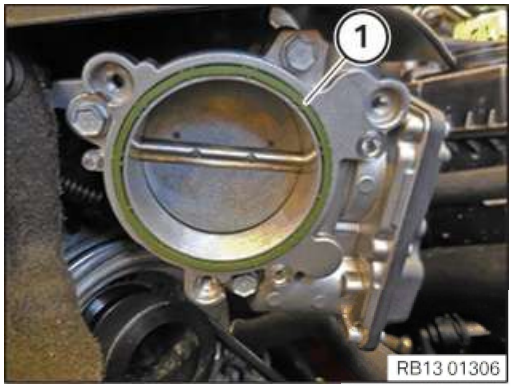
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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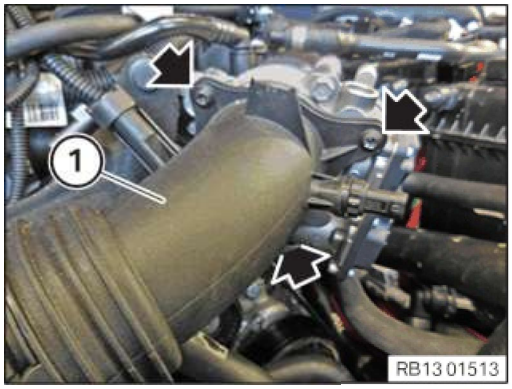


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

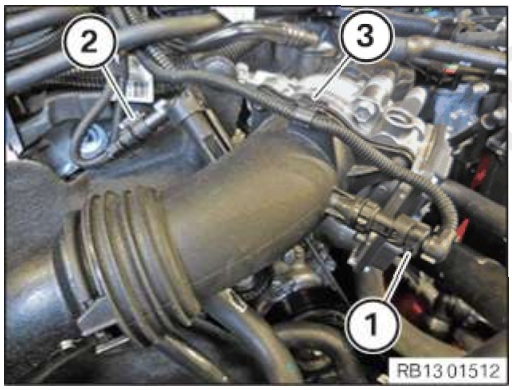
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

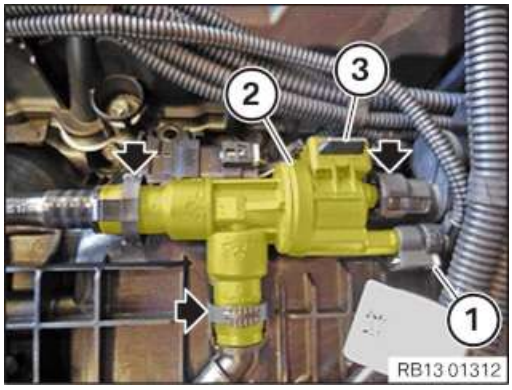
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

65 – Installing the tank vent valve



- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

66 – Topping up the engine oil

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RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

TECHNICAL INFORMATION

- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

- Fill in engine oil at the oil filler neck.

Engine oil

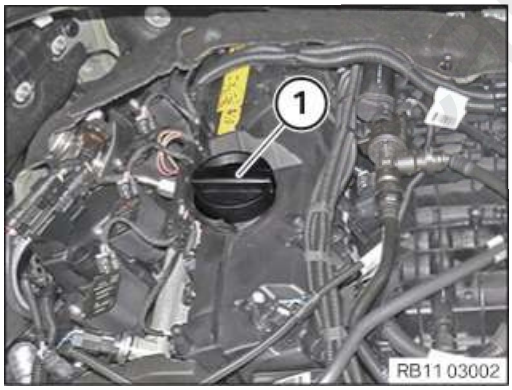
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

▸ **Installing the oil filler cap**

- Close oil filler cap (1).



67 – Remove the engine on an assembly stand

CAUTION

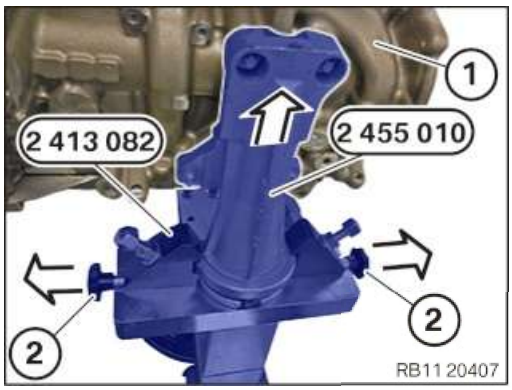
Heavy component.

Heavy components can lead to injury or damage.

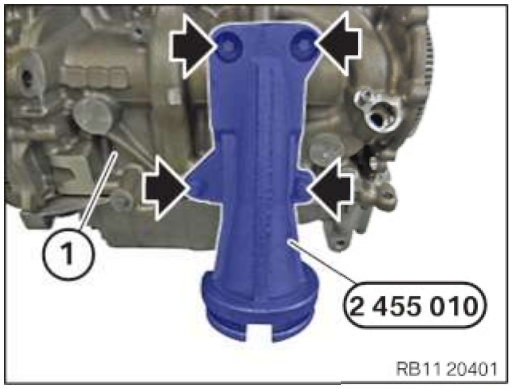
- Remove and install heavy components with the aid of another person/other persons.



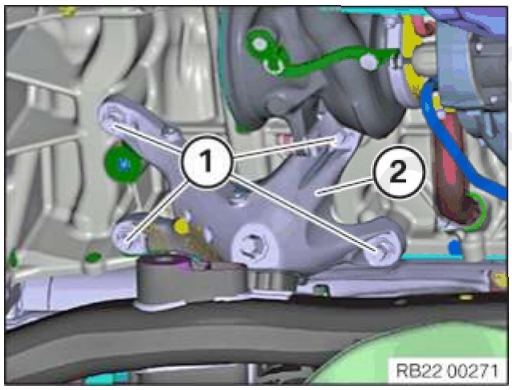
- Insert engine lifter with special tool and position engine (1).



- Unscrew the nuts on special tool .
- Detach the holder (2) in the direction of the arrow.
- Detach the engine (1) with special tool 2 455 010 out of the special tool in the direction of arrow.



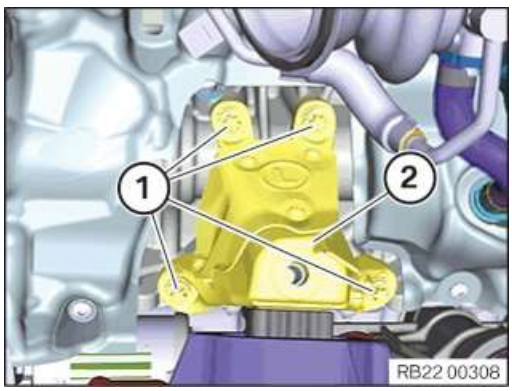
- Remove conventional screws (arrows).
- Feed out the special tool 2 455 010 on the engine (1) and remove.



- **Type: Rear-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm



- **Type: Four-wheel drive**
- Install engine mounting bracket (2).
- Tighten the screws (1).

Engine support arm to engine

M10		Tightening torque	38 Nm

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- See additional information.

Additional Information

Overview of Tightening Torques

Special tool 2 455 010 to crankcase			Used in step 2
M10x30		Tightening torque	38 Nm

Special tool 11 8 930 to special tool 00 2 320			Used in step 2
M14x35		Tightening torque	160 Nm

Oil drain plug			Used in step 4
M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Basic carrier to cylinder head			Used in step 174352
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 174352
M6		Tightening torque	8 Nm

Special tool to cylinder head			Used in step 26
M8		Tightening torque	21,5 Nm

Bearing journal to crankcase			Used in step 33
Bearing journal	Replace bearing journal.	Tightening torque	20 Nm

Rear timing case cover to crankcase			Used in step 34
M6 x 31	Renew screws.	Jointing torque	8 Nm
		Angle of rotation	90 °

Oil sump to crankcase			Used in step 35
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission)			Used in step 35
M8 x 50		Tightening torque	19 Nm

Flywheel to crankshaft			Used in step 36
M12x1.5	Renew screws.	Jointing torque	45 Nm
		Angle of rotation	40 °

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Battery positive lead to starter — Used in step 37

M8		Tightening torque	13,5 Nm

Cylinder head to crankcase — Used in step 42

M11	Observe tightening sequence. Fit new cylinder head bolts.	1. Jointing torque	30 Nm
		2. Angle of rotation	90 °
		3. Angle of rotation	180 °

Cylinder head bolt to timing case cover — Used in step 42

M8x40	Renew screws.	Tightening torque	19 Nm

Bearing journal to cylinder head — Used in step 42

Bearing journal	Renew the bearing journal!	Tightening torque	20 Nm

Sliding rail to cylinder head — Used in step 42

M6x16			8 Nm

Cable routing to cylinder head, rear — Used in step 42

M6 x 20		Tightening torque	8 Nm

Cover on rear cylinder head — Used in step 42

M6		Tightening torque	8 Nm

Camshaft sensor wheel to intake camshaft — Used in step 42

M6x16		Tightening torque	8 Nm

Manifold support for intake air to cylinder head — Used in step 42

M6X16		Tightening torque	8 Nm

Holder for electrical auxiliary coolant pump on cylinder head — Used in step 42

M6		Tightening torque	7 Nm

Standard screw connection M6 — Used in step 42

M6			8 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 42

M6x12		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4950

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 51

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Oil return line to exhaust turbocharger/crankcase — Used in step 54

M6x14		Tightening torque	8 Nm

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Coolant feed line/coolant return line to exhaust turbocharger — Used in step 5556

M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger — Used in step 55

M6		Tightening torque	8 Nm

Coolant feed line to crankcase — Used in step 56

M6 x 12		Tightening torque	8 Nm

Cylinder head cover to cylinder head — Used in step 57

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 57

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 57

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 60

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 61

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 62

M14		Tightening torque	33 Nm

Spark plugs — Used in step 63

M12x1.25		Tightening torque	23 Nm

Intake plenum to cylinder head — Used in step 64

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 64

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 64

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 64

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 64

M6		Tightening torque	8 Nm

Engine support arm to engine — Used in step 67

M10		Tightening torque	38 Nm

Overview of Special Tools

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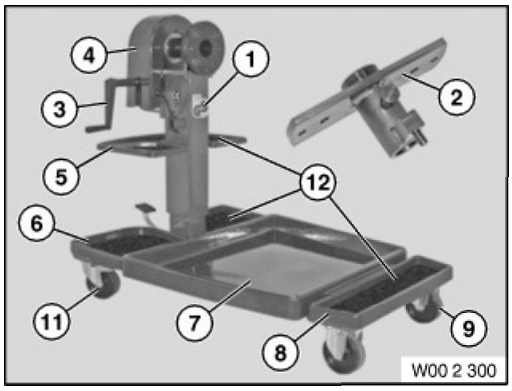
2 455 010 Engine support



Common Used in step 267

Usage	For accommodating engine on assembly stand. Engine: B3x, B4x, N47.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

0 495 187 (00 2 300) Assembly stand



Common Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	
2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	

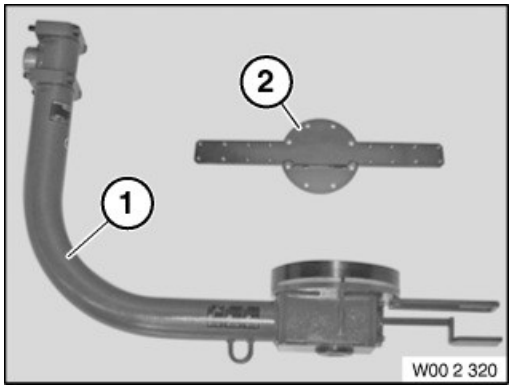
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7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

0 495 196 (00 2 320) Support arm

Used in step 2

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Common

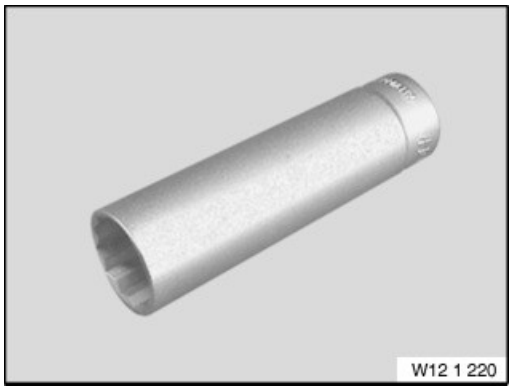
Usage	(Support arm with fixture) For mounting engines using the engine mounting bracket.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 25 04 (155)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 197 (00 2 321)		**Support arm**	
2	0 495 198 (00 2 322)		**Panel** (take-up plate)	
3	0 495 380 (00 2 323)		**Panel** (fixture) Engine N73	
6	0 496 287 (00 2 326)		**Panel** (fixture) Engine: M73	
5	0 496 288 (00 2 327)	0 496 373	**Panel** (fixture) Engine: S62 Replaced by 11 5 420 (0 496 373)	
8	0 496 533 (00 2 328)		**Support** (Engine mount) Engine: N57, N57Top	
9	0 496 579 (00 2 329)	0 496 680	**Support** (Engine mount) Engine: N74 Replaced by 116160 (0 496 680)	
4	0 495 379 (00 2 324)		**Panel** (fixture) Engine M67TU	
5	0 495 381 (00 2 325)		**Panel** (fixture) Engine N62, N62TU	

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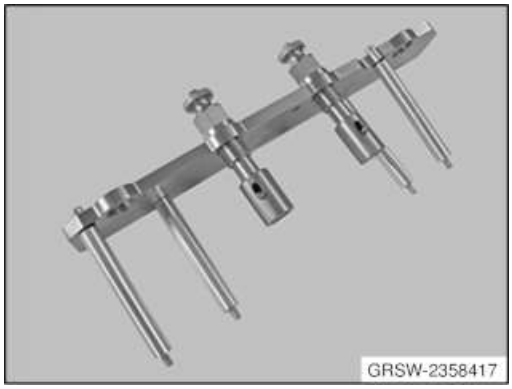
0 495 560 (12 1 220) Socket



Common Used in step 563

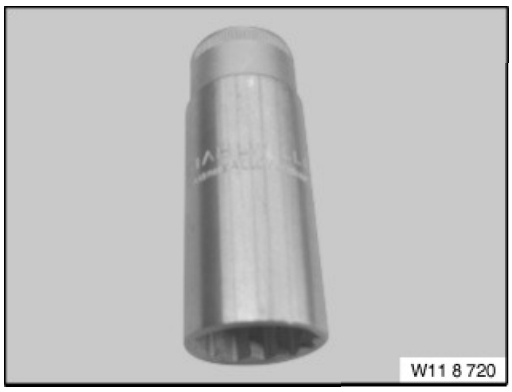
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

2 358 417 Device



Common	Used in step 8
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 8
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

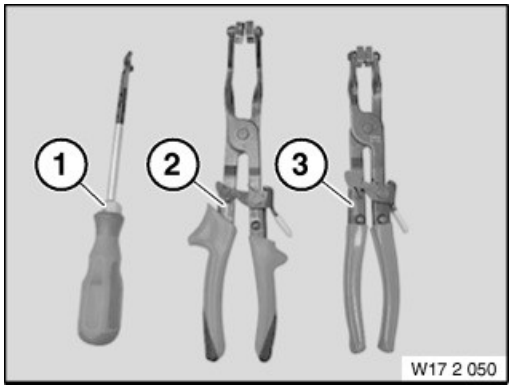
2 360 895 Pin wrench



Common	Used in step 958
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 794 (17 2 050) Pliers



Common Used in step 1264

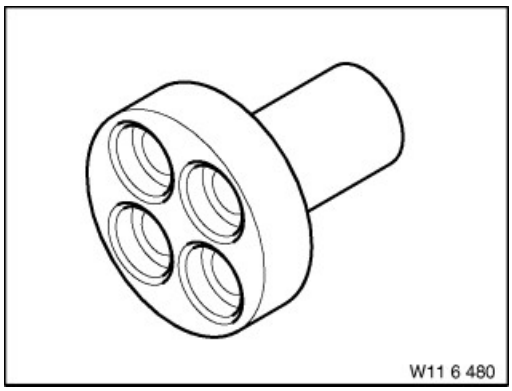
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

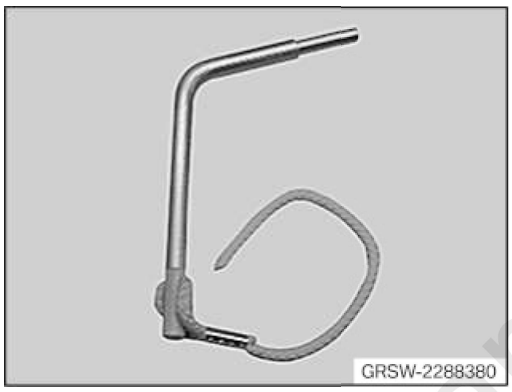
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0 493 380 (11 6 480) Connector



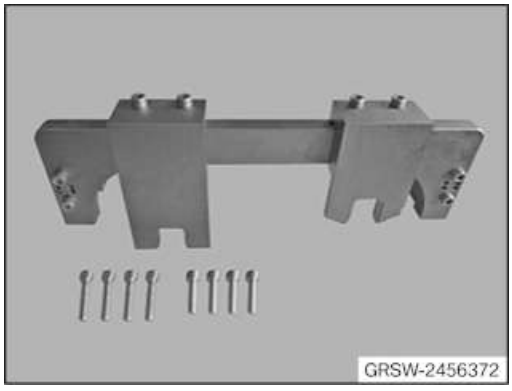
Common	Used in step 1738525361
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 17385253
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 1725435253
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 358 122 Gauge



Common	Used in step 172552
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



Common	Used in step 19204950
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

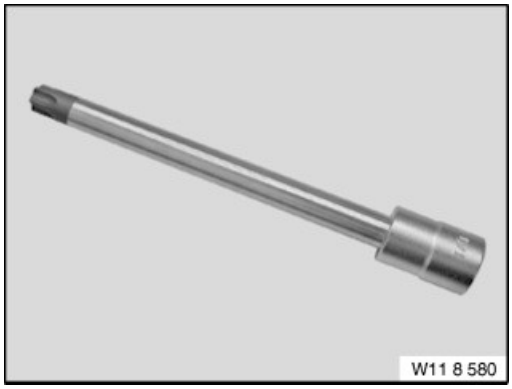
2 450 487 Socket



Common	Used in step 19204950
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

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0 495 747 (11 8 580) Socket wrench



Common	Used in step 2642
Usage	(wrench socket Torx T60) For removing and installing cylinder head (outside diameter 13.5 mm).
Included in the tool or work	
Storage location	A19
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

2 220 718 Workshop crane



Common	Used in step 26
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

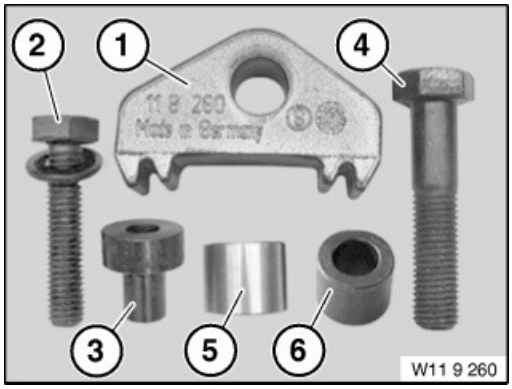
2 459 012 Holder



Common	Used in step 2642
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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0 493 938 (11 9 260) Holder



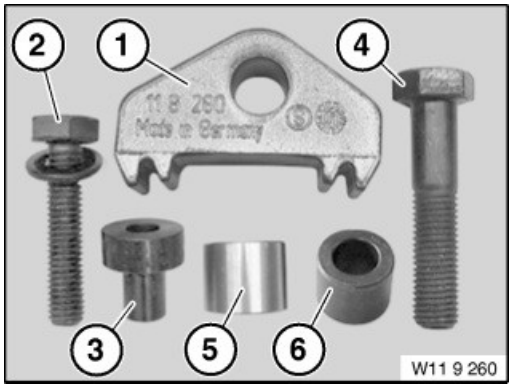
Common Used in step 2836

Usage	(Counter support with screw connection) For holding the flywheel when gearbox is removed
Included in the tool or work	
Storage location	A44
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 034 (11 9 261)		**Holder** (Individual counter support)	
2	0 494 035 (11 9 262)		**Screw** (Bolt (thread M10) with washer) For screwing counter support	
3	0 494 129 (11 9 263)		**Bush** (Bush for counter support) For counter support, for retaining flywheel when gearbox is removed Engine: N62, N73	
6	0 495 216 (11 9 266)		**Bush** For counter support, for retaining flywheel when gearbox is removed Engine: M57TU2	
4	0 494 130 (11 9 264)		**Screw** (Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed	
5	0 494 793 (11 9 265)		**Bush**	

0 494 130 (11 9 264) Screw

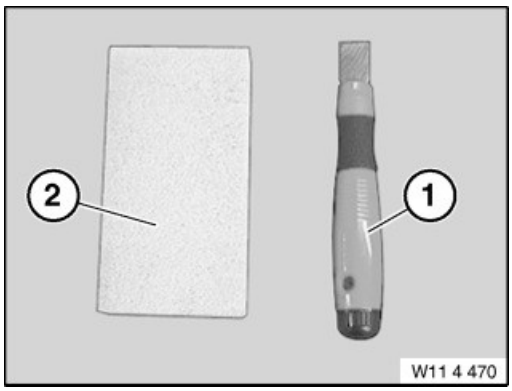


Common Used in step 2836

Usage	(Bolt (thread M12)) For counter support for retaining flywheel when gearbox is removed
Included in the tool or work	0 493 938
Storage location	A44
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool



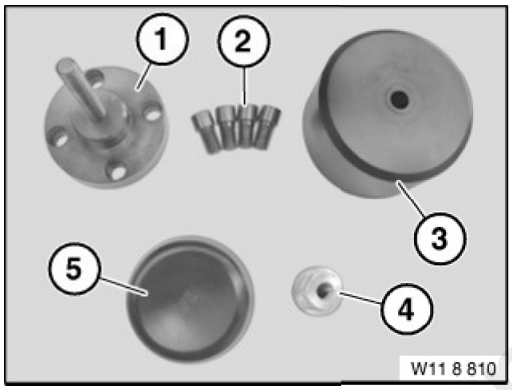
Common Used in step 3435

Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

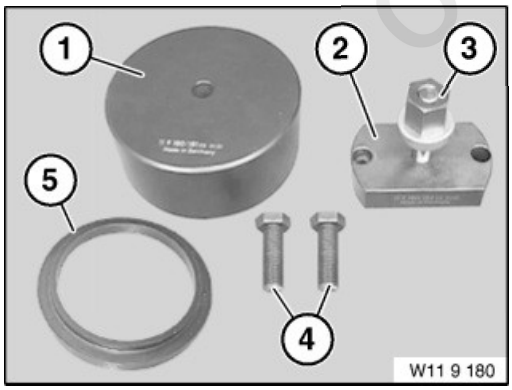
0 496 137 (11 8 815) Holding sleeve



Common Used in step 34

Usage	(Slip sleeve) Liquidation of existing inventory and then available only via complete tool set 11 8 810 = 83 30 0 496 132 - status 09.12.2011
Included in the tool or work	0 496 132
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 494 029 (11 9 182) Synchronising key

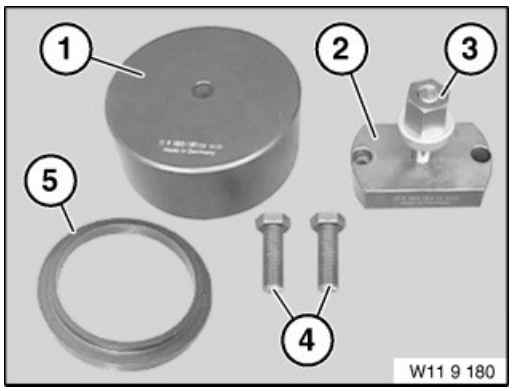


Common Used in step 34

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

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0 494 031 (11 9 184) Screw



Common	Used in step 34
Usage	(screws (2 x))
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

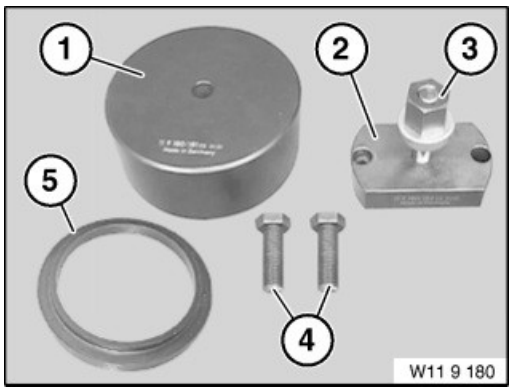
2 360 215 Adapter



Common	Used in step 34
Usage	For installing the rear radial shaft seal. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B56
Replaced by	
In connection with	11 9 180 = 0493881
SI-Number	01 13 14 (098)

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0 493 881 (11 9 180) Tool



Common Used in step 34

Usage	(pulling tool) For pulling radial shaft seal into engine block, rear
Included in the tool or work	
Storage location	C26
Replaced by	
In connection with	
SI-Number	01 01 01 (662)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 028 (11 9 181)		**Bush**	
2	0 494 029 (11 9 182)		**Synchronising key**	
3	0 494 030 (11 9 183)		**Nut**	
4	0 494 031 (11 9 184)		**Screw** (screws (2 x))	
5	0 496 660 (11 9 185)		**Ring** For installation shaft seal - rim offset 6.6 mm (N55).	

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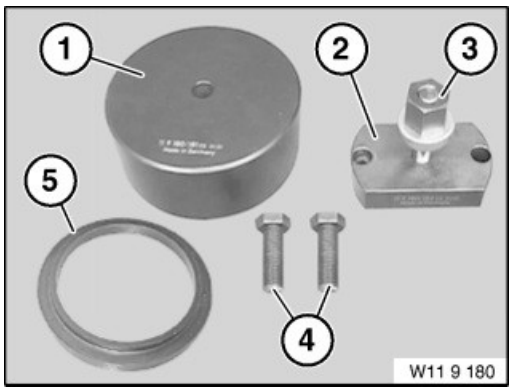
0 494 028 (11 9 181) Bush



Common Used in step 34

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

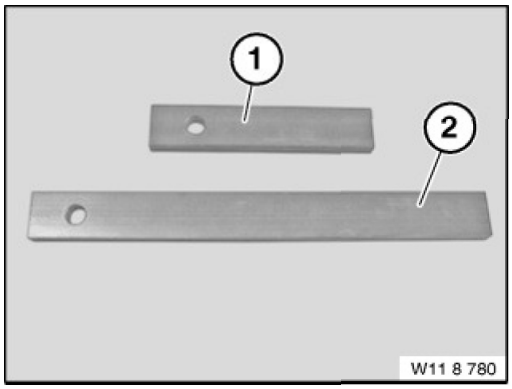
0 494 030 (11 9 183) Nut



Common Used in step 34

Usage	
Included in the tool or work	0 493 881
Storage location	C26
Replaced by	
In connection with	
SI-Number	

0 496 120 (11 8 780) Plate



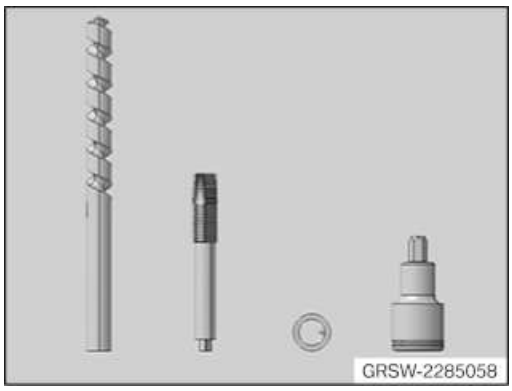
Common Used in step 35

Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

2 285 058 Tool set

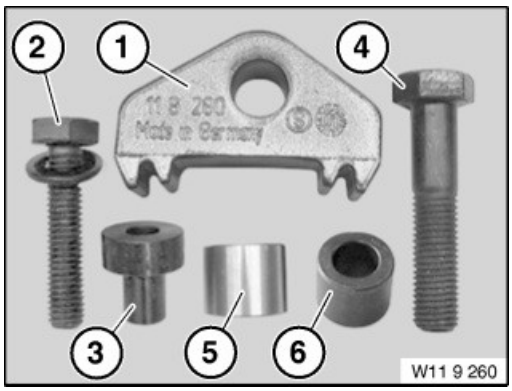


Common Used in step 36

Usage	
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 02 14 (069)

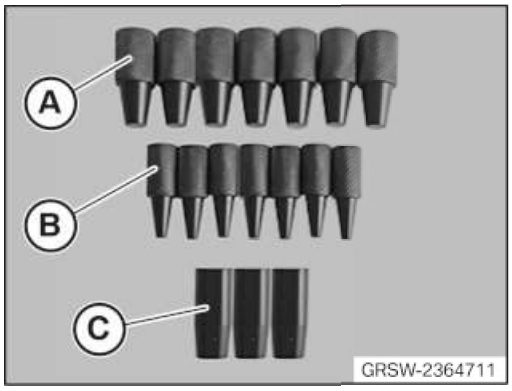
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0 494 034 (11 9 261) Holder



Common	Used in step 36
Usage	(Individual counter support)
Included in the tool or work	0 493 938
Storage location	
Replaced by	
In connection with	
SI-Number	

2 364 711 Plug



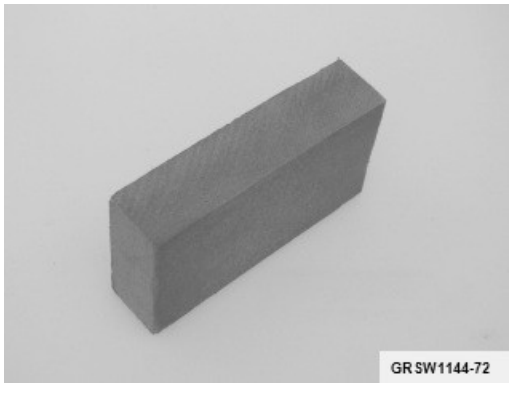
Common	Used in step 3940
Usage	For closing the pressure oil holes for cleaning the cylinder head sealing surfaces.
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 50 14 (203)

0 495 103 (11 4 471) Scraper



Common	Used in step 40
Usage	
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

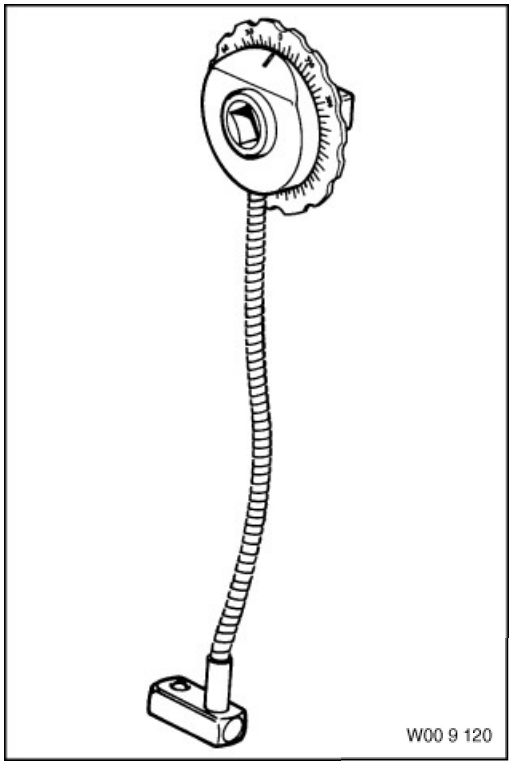
0 495 104 (11 4 472) Extractor



Common	Used in step 40
Usage	(grindstone)
Included in the tool or work	0 495 102
Storage location	C52
Replaced by	
In connection with	
SI-Number	

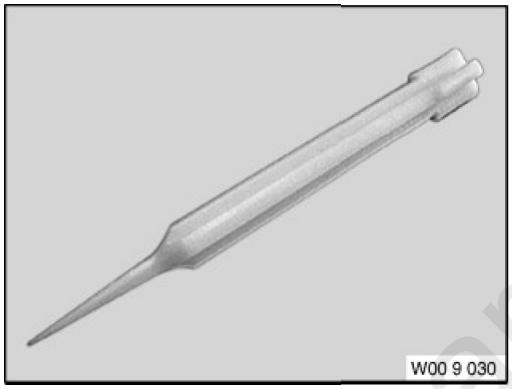
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0 490 504 (00 9 120) Torque angle measuring dial



Common	Used in step 42
Usage	For torsion angle adjustment of cylinder head bolts (all engines) And reinforcement plate front axle support E46
Included in the tool or work	
Storage location	A4
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common	Used in step 425556
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

2 455 654 Tensioning tool



Common	Used in step 4853
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 452 959 Pliers



Common	Used in step 59
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 59
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

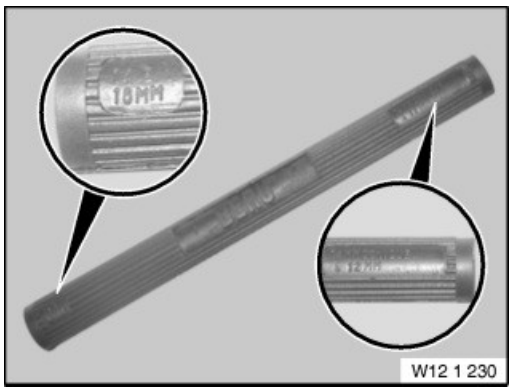
2 358 022 Gauge



Common	Used in step 60
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 065 (12 1 230) Fitting aid



Common	Used in step 63
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

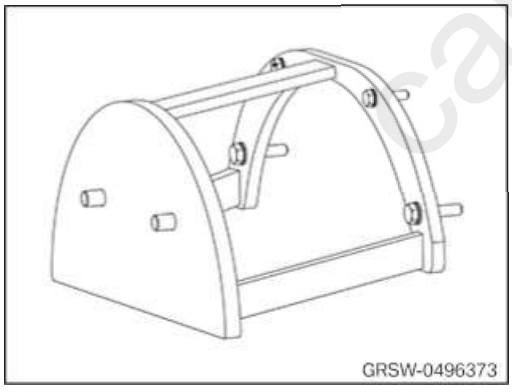
Replacement tools:

2 299 563 Adapter



Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

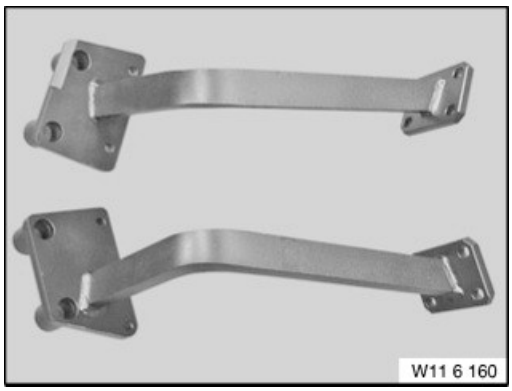
0 496 373 (11 5 420) Plate



Common	Used in step 2
Usage	(Fixture) Engine S62
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

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0 496 680 (11 6 160) Support



Common	Used in step 2
Usage	For mounting N74 engine on the assembly stand. In combination with 00 2 300, 00 2 320
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	00 2 300; 00 2 320 = 0495196
SI-Number	01 31 09 (604)

Overview Technical Data

Height of the sealing bead	Used in step 34
	2,0 mm ... 2,5 mm

Engine oil	Used in step 66
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil B48B20O1/B46B20O1	Used in step 66
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Screw-in depth of thread cutter	Used in step 36
Screw-in depth	18 mm

Links

Functional descriptions	Used in step
Petrol particulate filter	66

General repair instructions	Used in step
11 00 ... Overview of consumables (Electronic Parts Catalogue)	3435

Repair instructions	Used in step
11 00 050 Removing and installing engine	168
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11 00 050 Removing and installing engine	168
31 10 001 Completely removing and installing front axle with engine and transmission	168
11 00 050 Removing and installing engine	168
11 00 050 Removing and installing engine	168
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11 00 050 Removing and installing engine	168
11 00 050 Remove and install engine	168
11 00 050 Remove and install engine	168
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11 00 050 Remove and install engine	168
11 00 050 Removing and installing the engine (manual gearbox)	168
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11 00 050 Remove and install engine	168
11 00 050 Remove and install engine (Automatic)	168
11 00 050 Remove and install engine (Automatic)	168
11 00 050 Remove and install engine	168
11 00 050 Remove and install engine	168
11 00 050 Remove and install engine (Automatic)	168
11 00 050 Remove and install engine (Automatic)	168
11 00 050 Remove and install engine	168
11 00 050 Remove and install engine	168
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11 00 050 Remove and install engine	168
11 00 050 Removing and installing the engine with a double-clutch transmission (DKG)	168
11 00 050 Remove and install engine	168
13 53 ... Clean the cylinder head around the injectors due to grit / dust	8
61 13 ... Unlocking and disconnecting different plug connections	81057
61 35 ... Notes on ESD protection (Electro Static Discharge)	8911
61 35 ... Notes on ESD protection (Electro Static Discharge)	911

Operating materials	**Used in step**
3.0 Technically appropriate engine oils for BMW Group engines	66

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11 33 050 Removing and installing/replacing all rocker arms

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

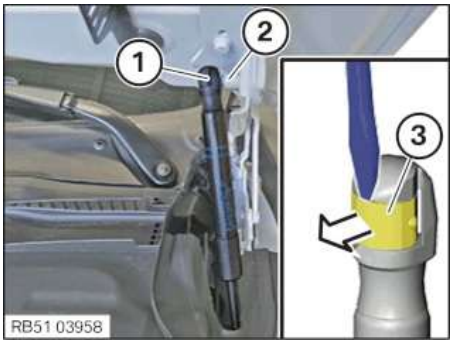
Engine compartment lid is open.

CAUTION

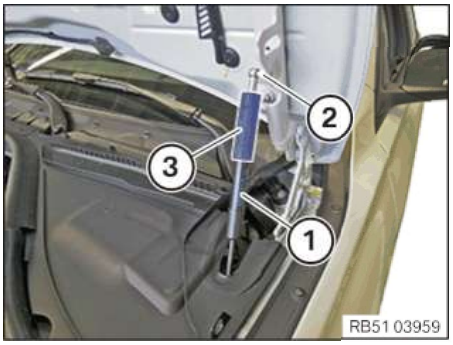
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

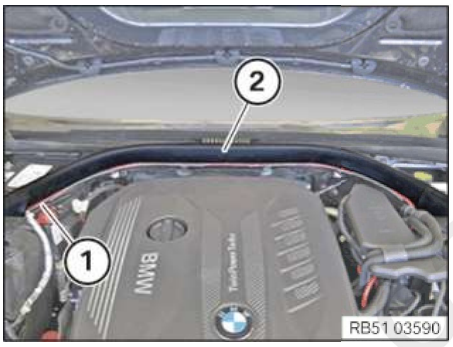


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

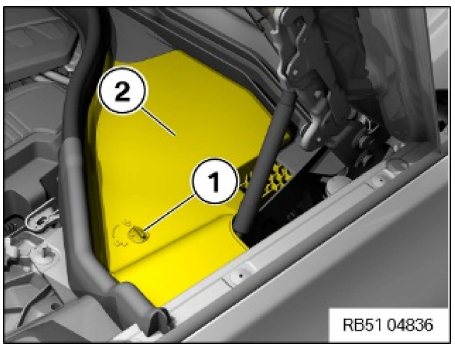
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

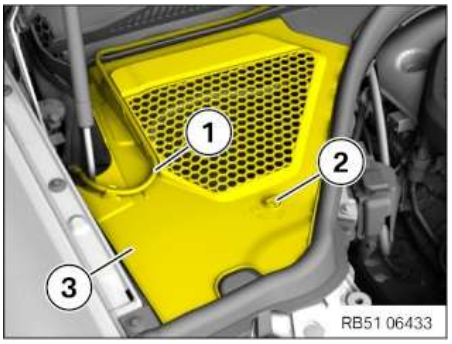
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

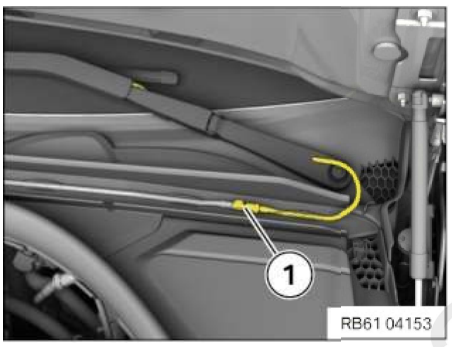
▶ **Remove the wiper arm**

RISK OF DAMAGE

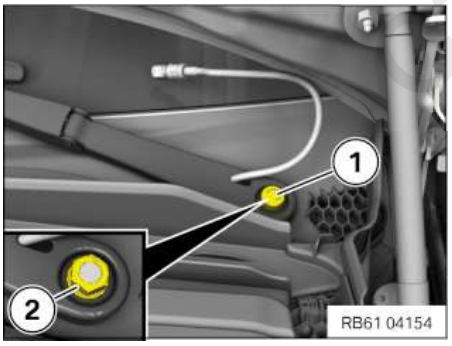
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

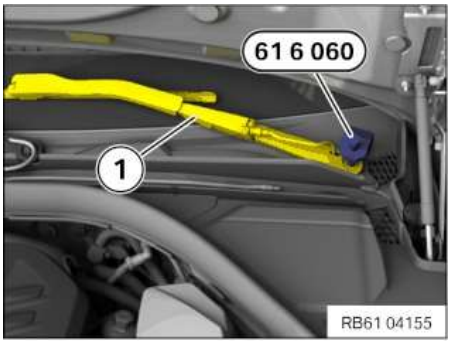
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



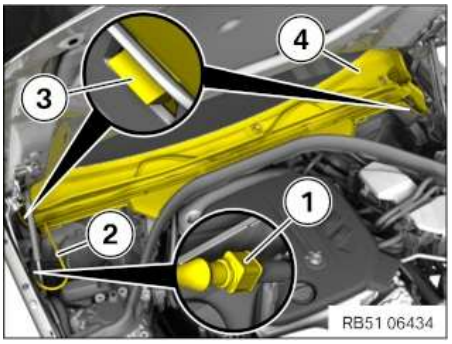
- Remove the protective cap (1).
- Loosen nut (2).



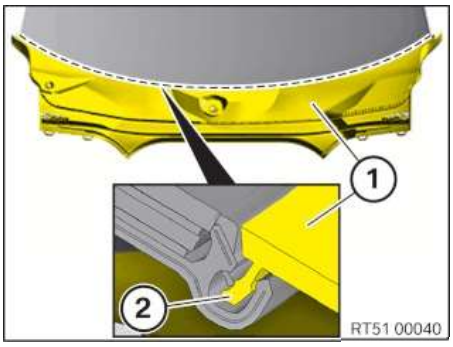
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

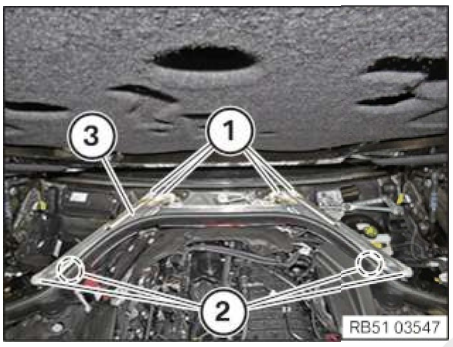


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

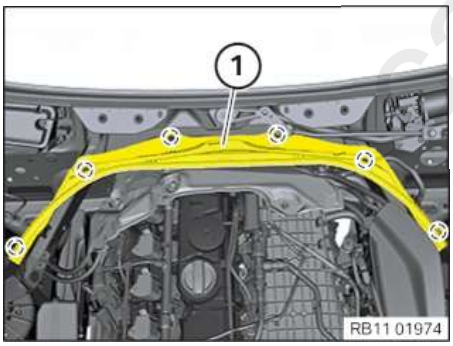
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

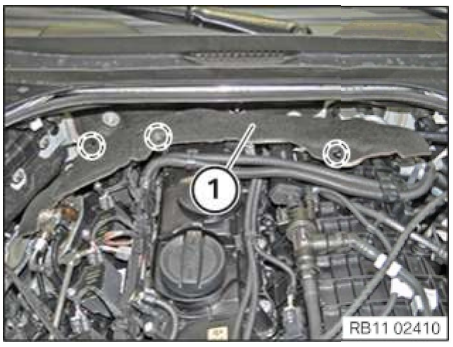
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



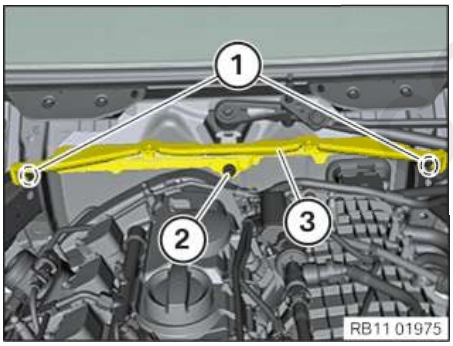
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

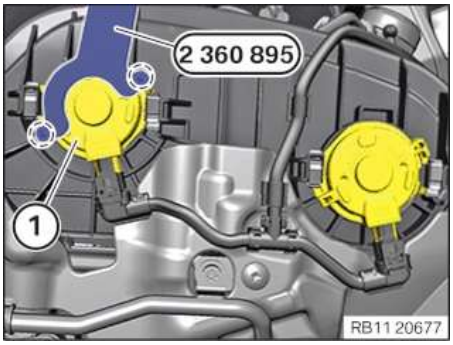
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

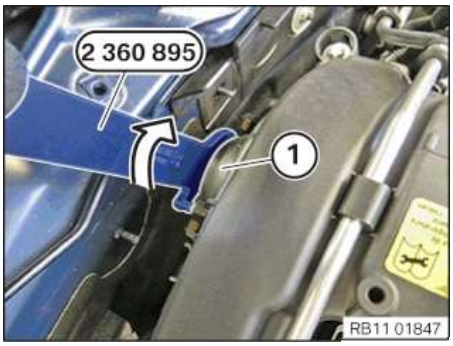
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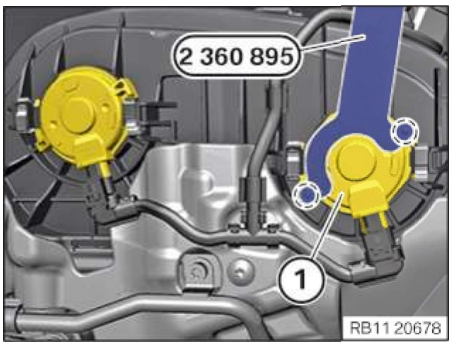
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



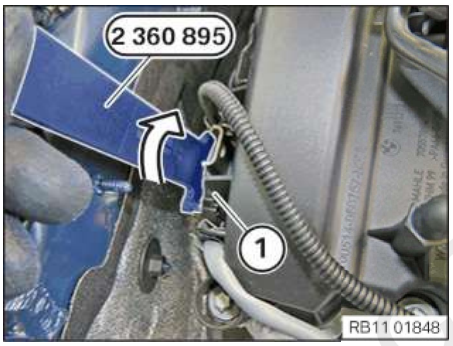
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



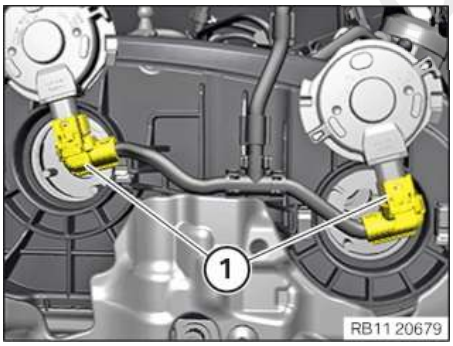
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

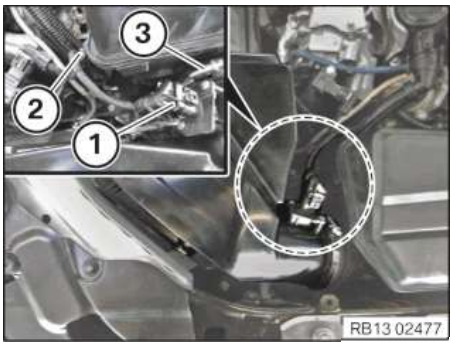
Risk of burning!

- Perform all work only on components that have cooled down.

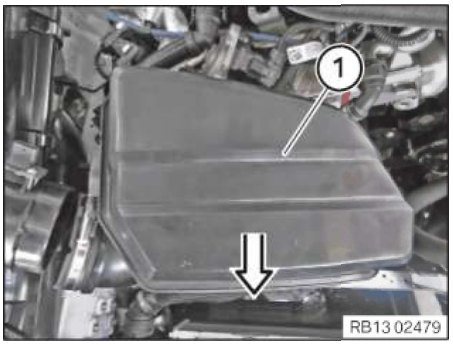
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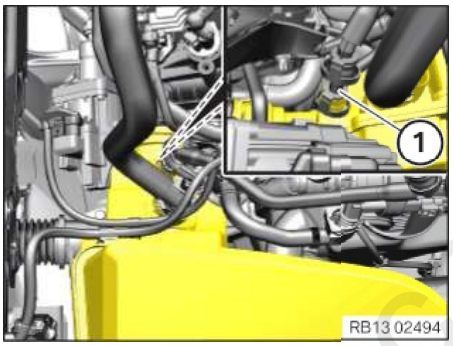
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



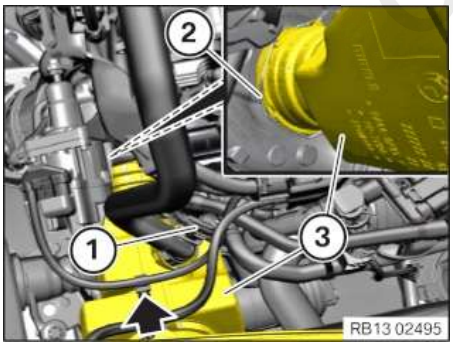
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



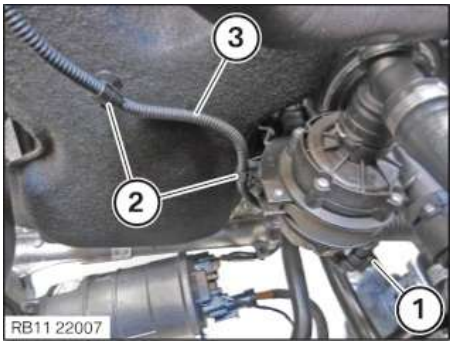
- Unlock and disconnect the tank ventilation line (1).



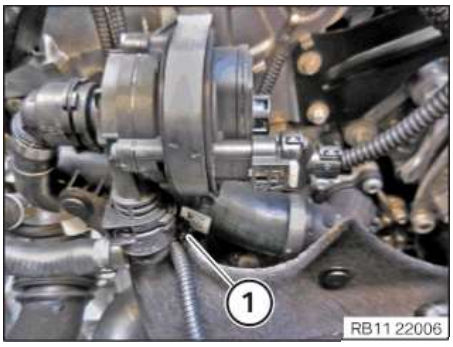
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

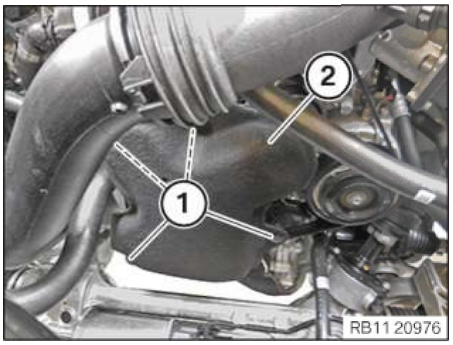
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

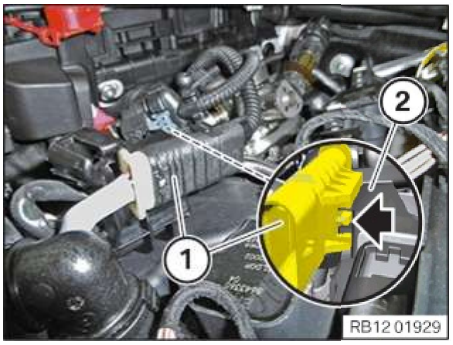
Electrostatic discharge.

Damage to or destruction of electrical components.

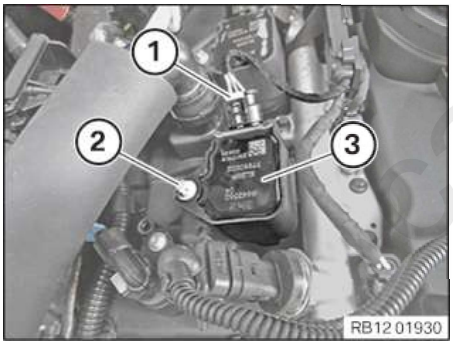
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

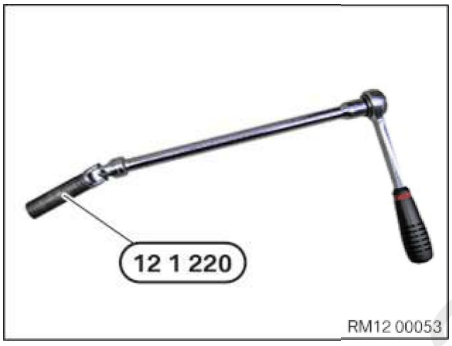
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

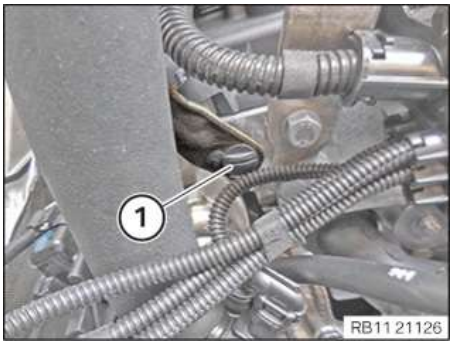
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

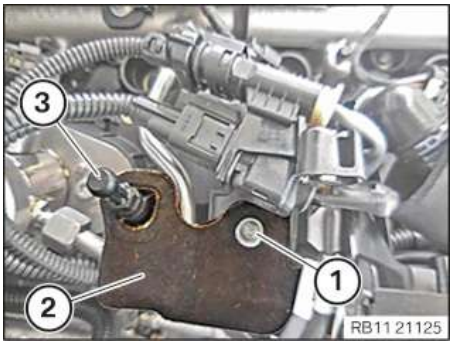


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

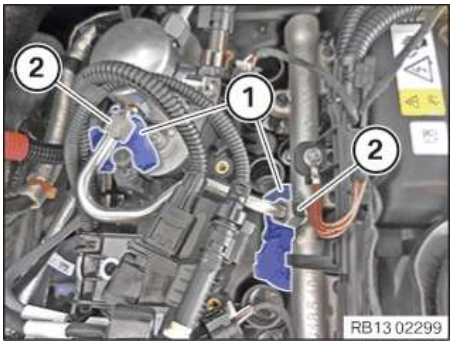
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

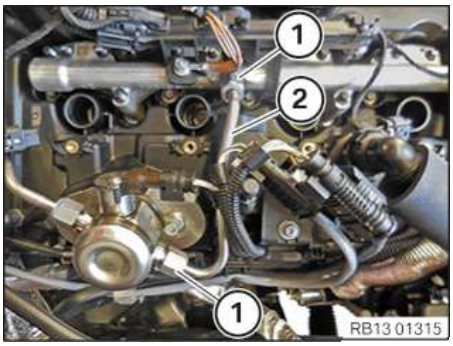


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

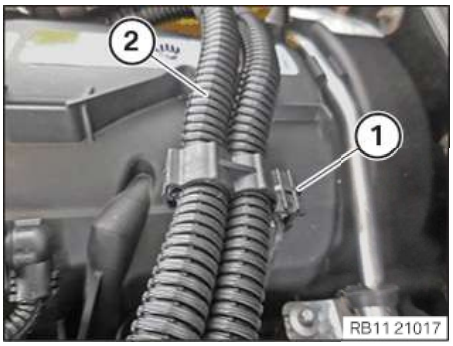
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

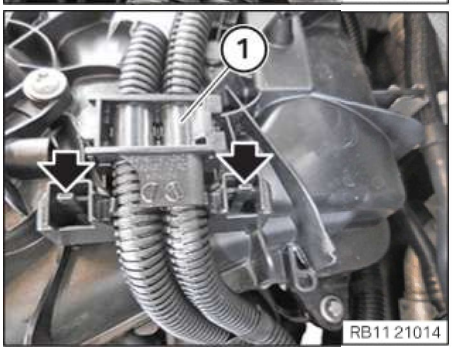
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

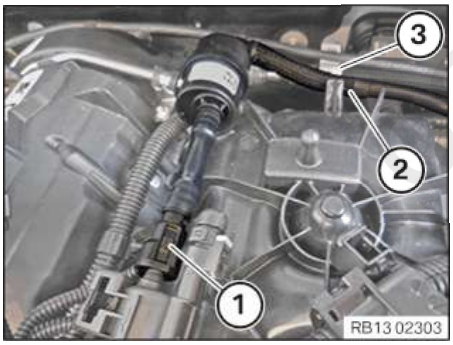
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



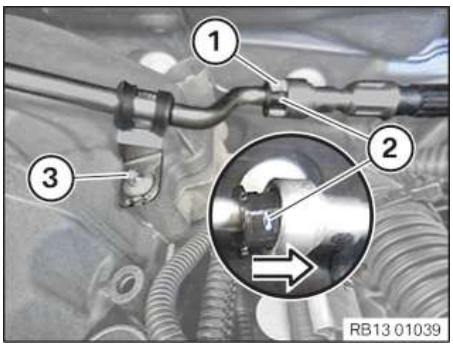
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

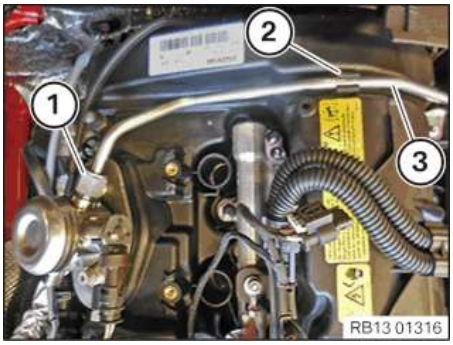


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

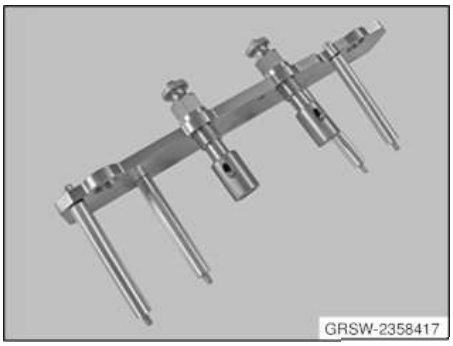
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



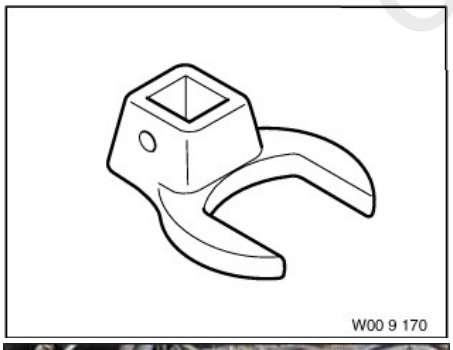
- Prepare special tool 2 358 417.



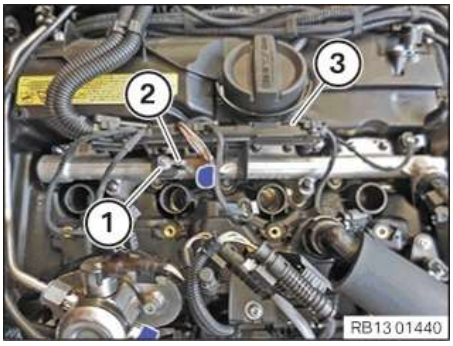
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

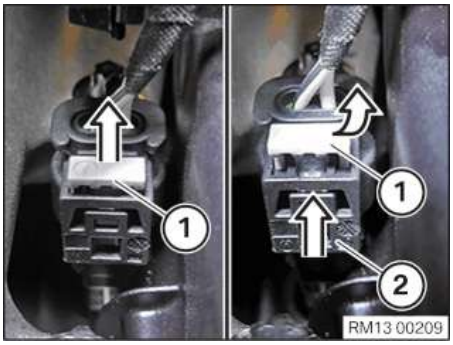


- Prepare special tool .

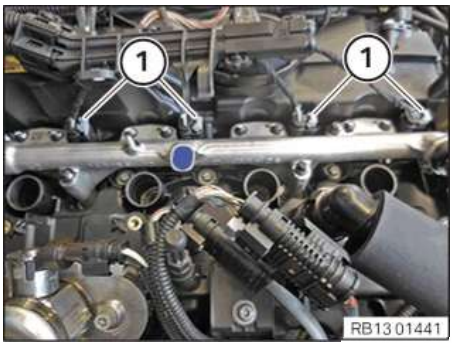


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



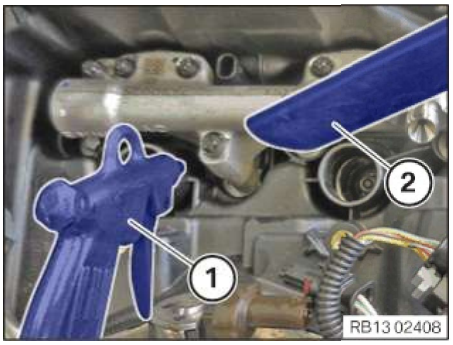
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

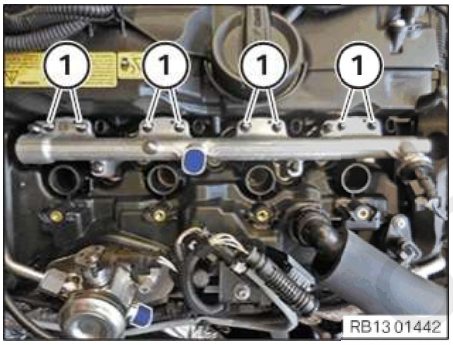


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

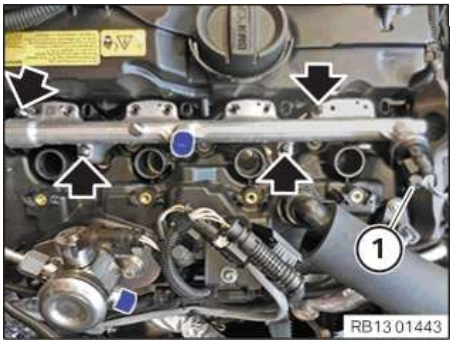
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



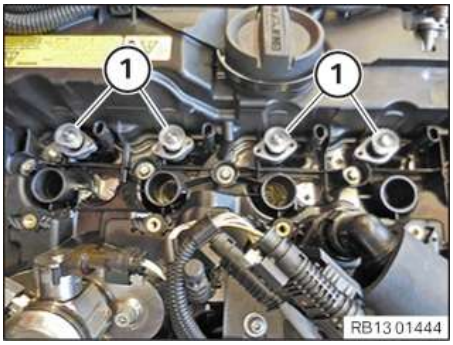
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

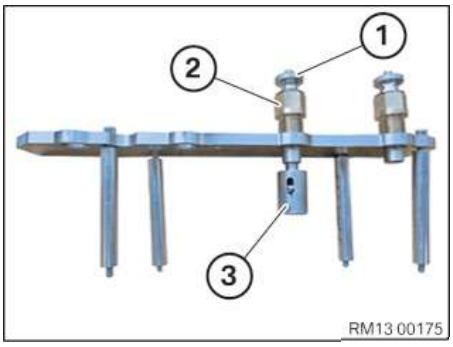
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

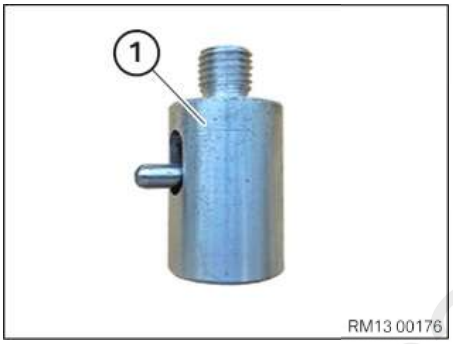
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

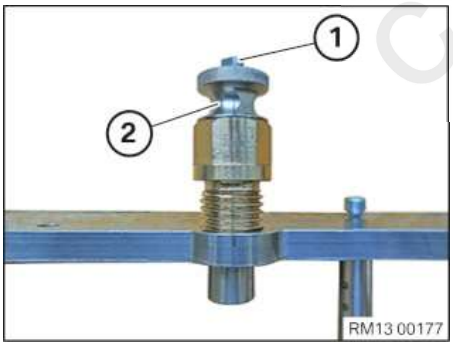
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

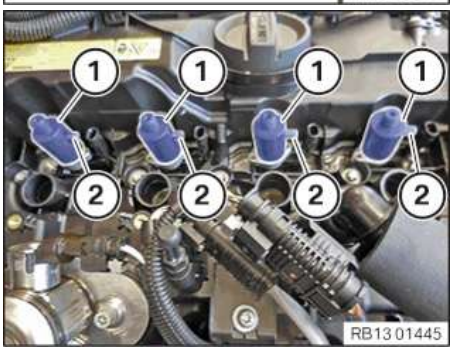
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



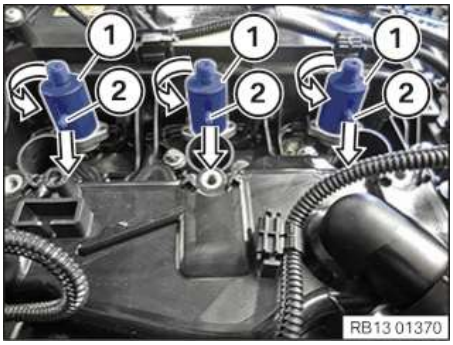
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



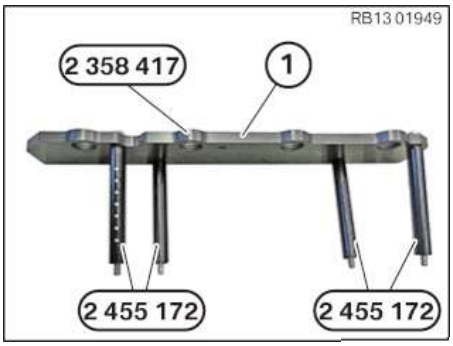
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

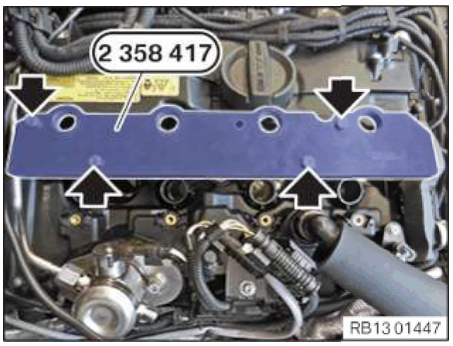
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



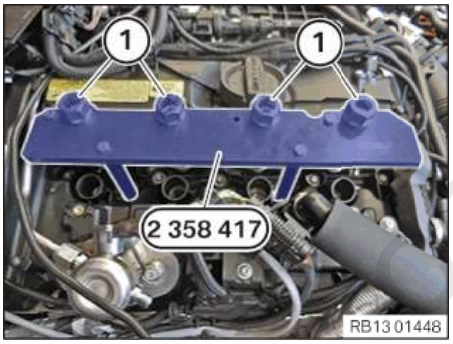
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

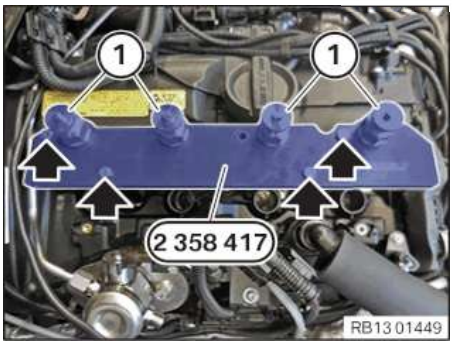
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

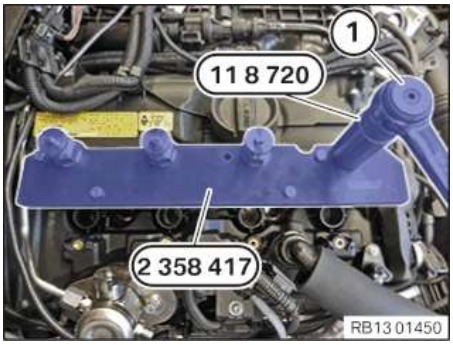
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

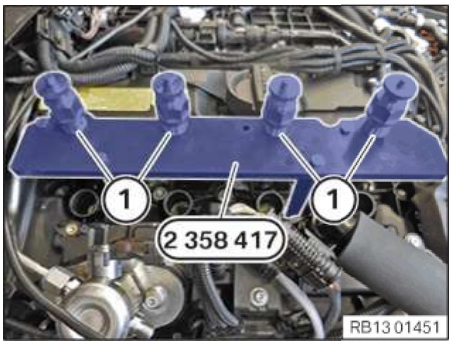


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

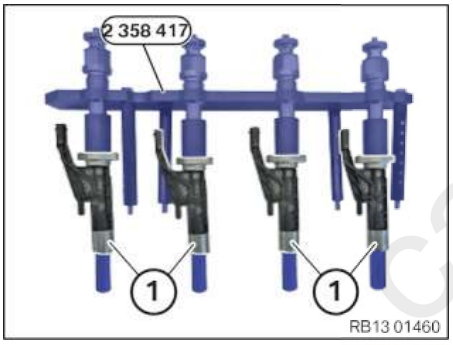
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

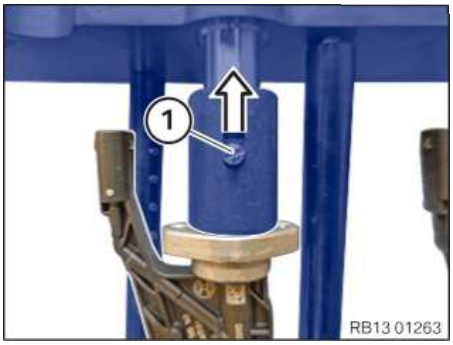


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

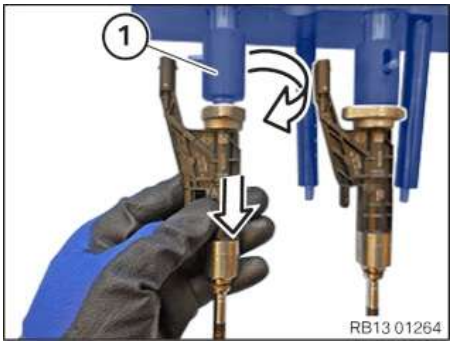


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

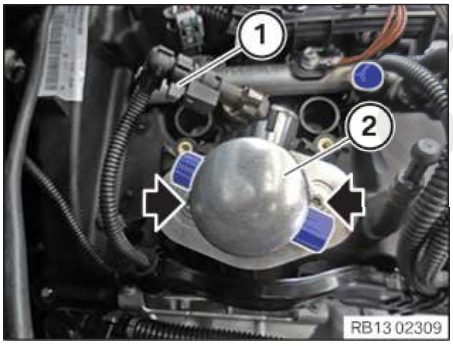
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

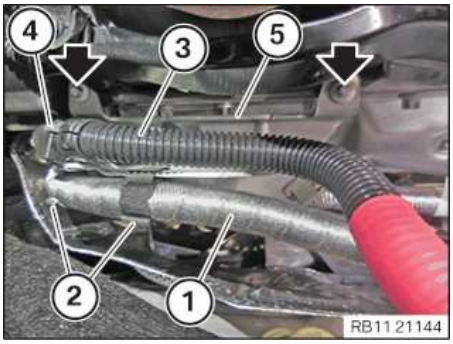
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

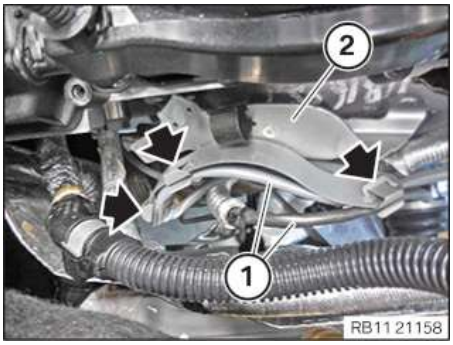


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

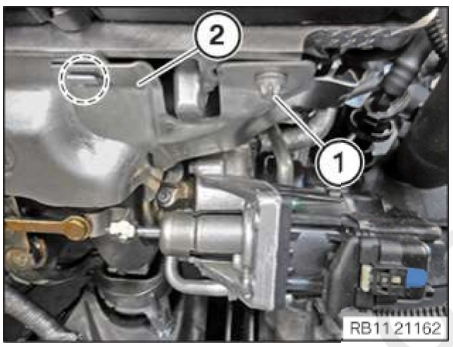
Hot surfaces.

Risk of burning!

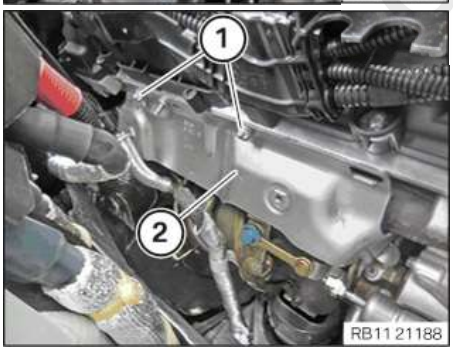
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

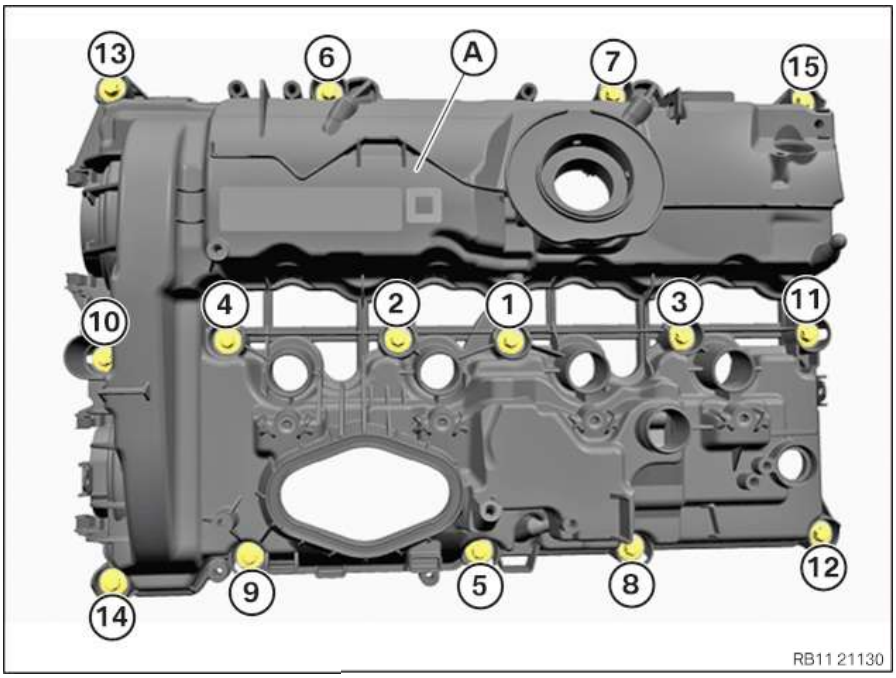


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

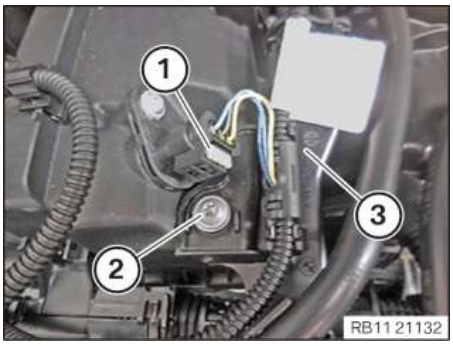
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

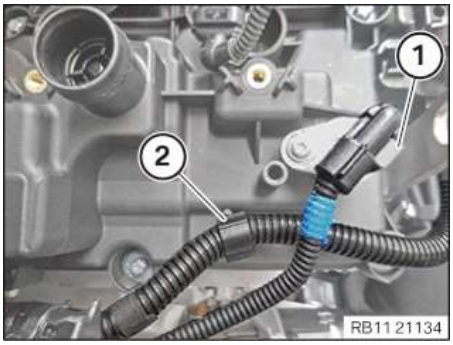
- Do not pull on the wires when disconnecting connectors and plug connections.



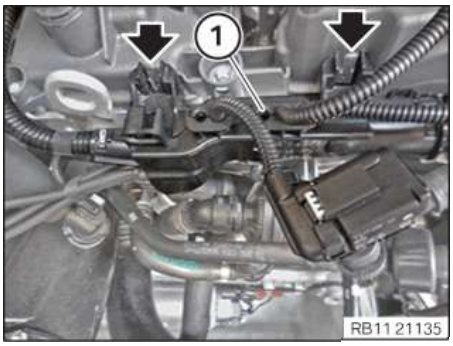
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



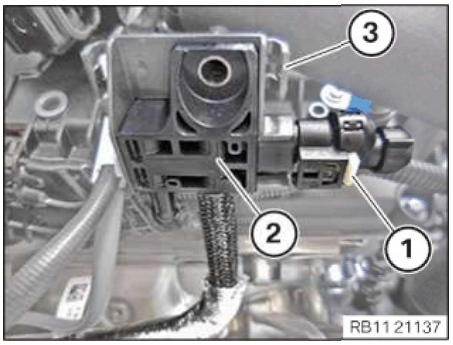
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



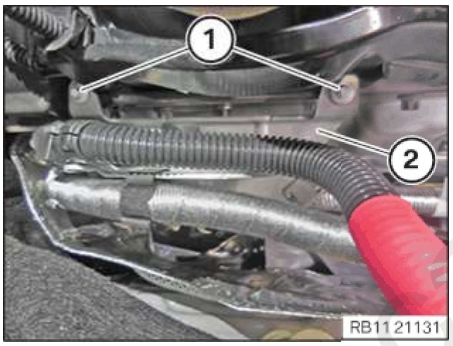
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



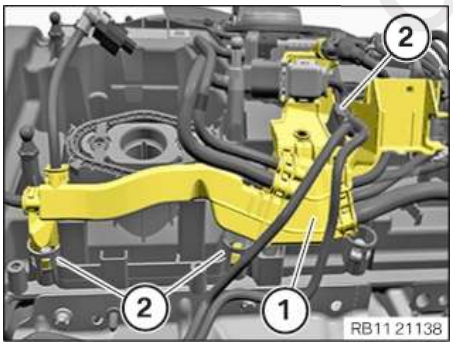
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



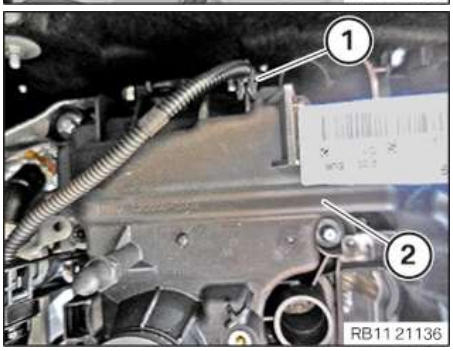
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

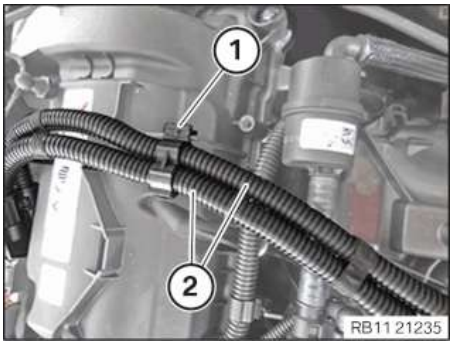


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

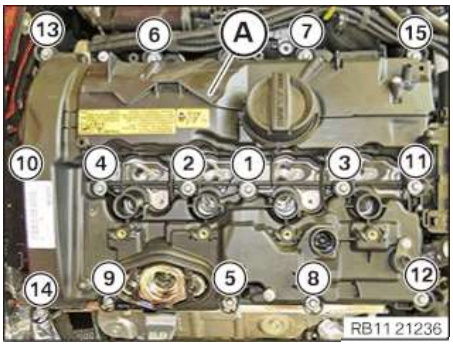


- Loosen clamp (1).

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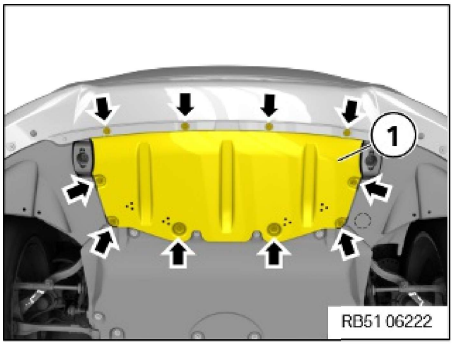


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

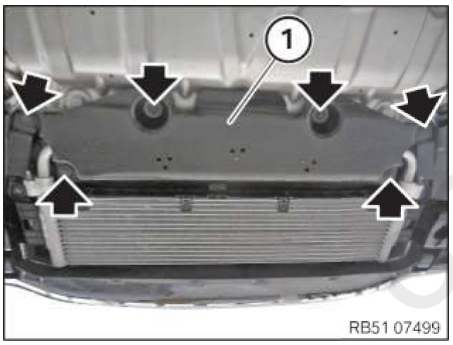
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

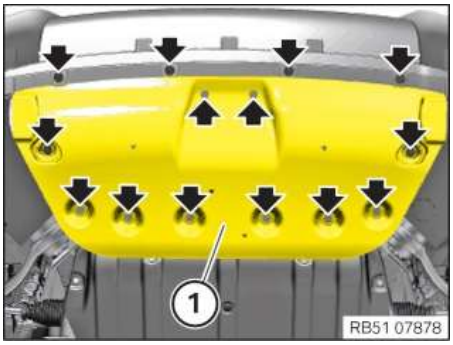
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

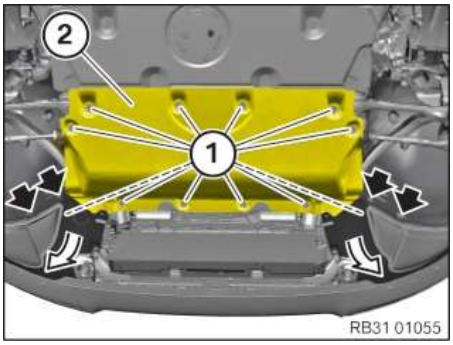


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



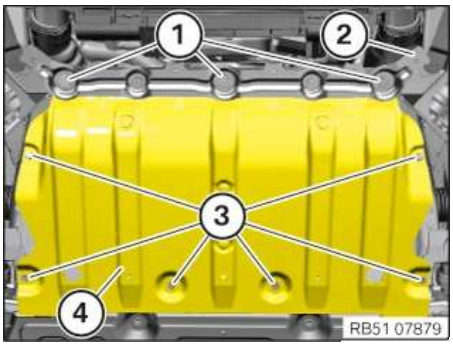
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

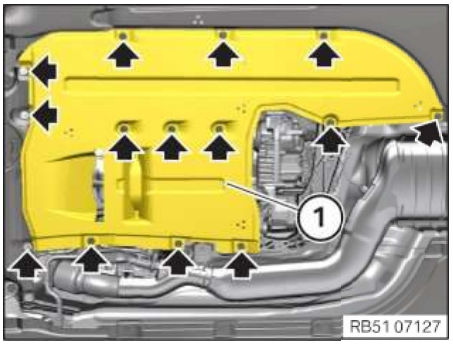
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

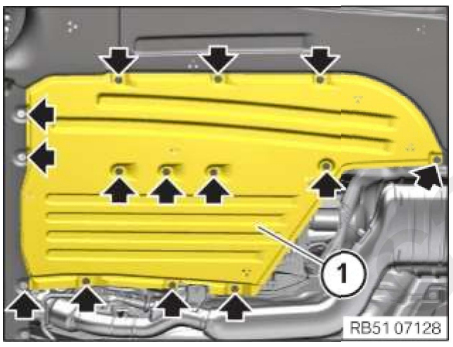
27 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

28 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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TECHNICAL INFORMATION

Life-long fill of coolant!

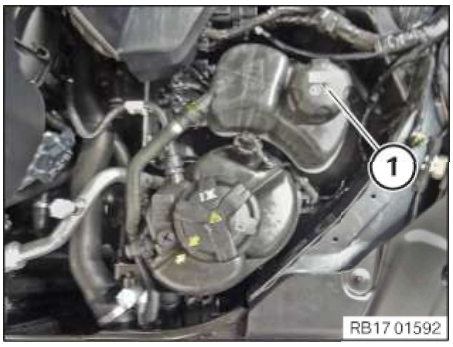
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

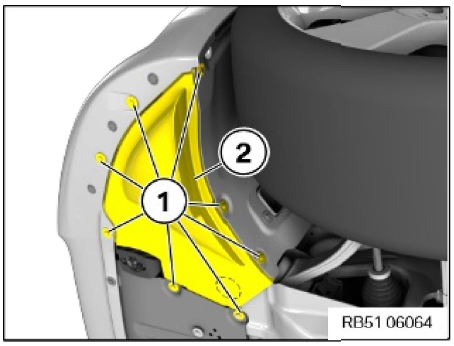
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

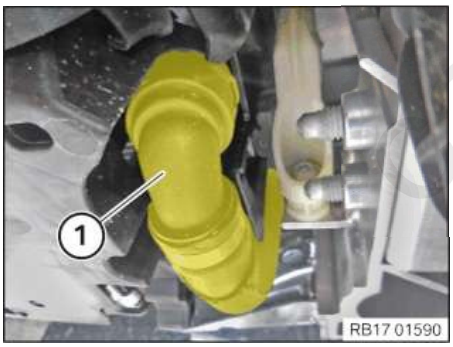
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.



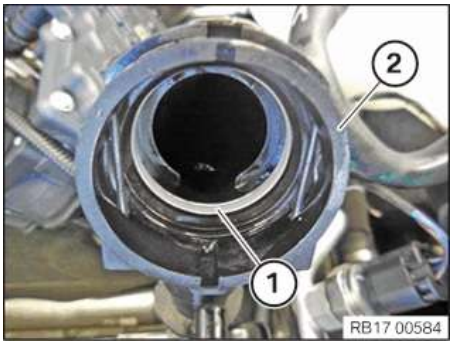
- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

29 – Connecting the coolant lines for the low-temperature coolant circuit

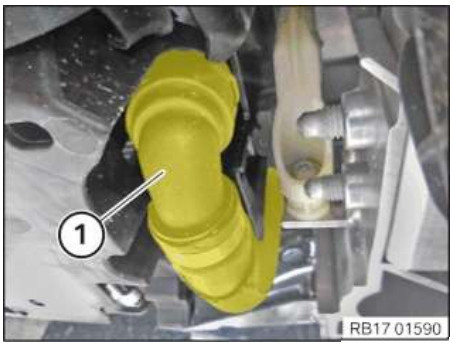
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

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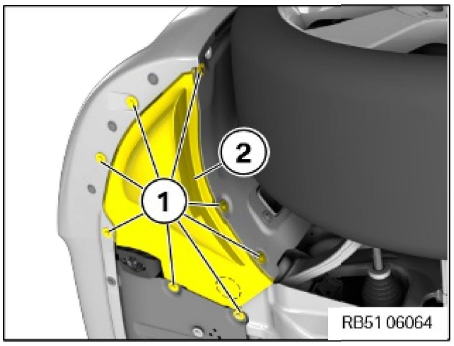


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

30 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

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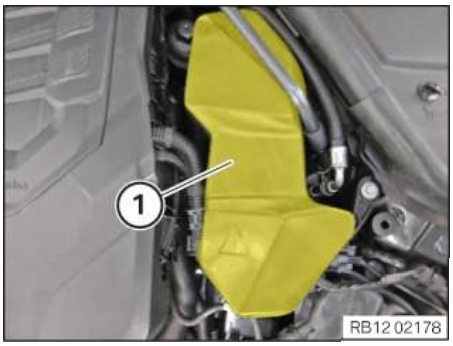
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

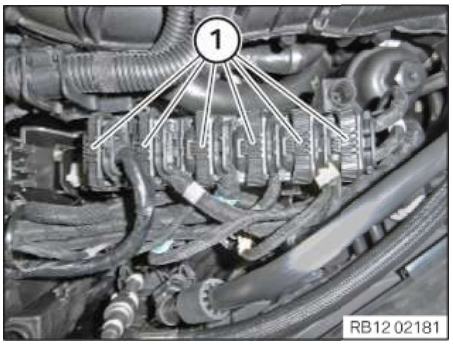
For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

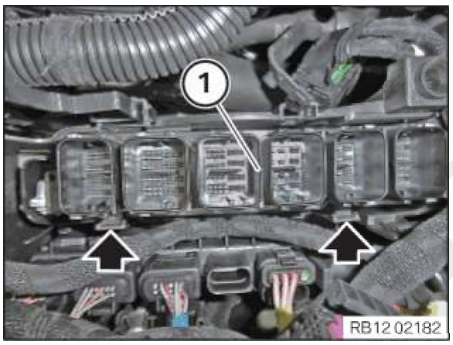
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.



- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

31 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

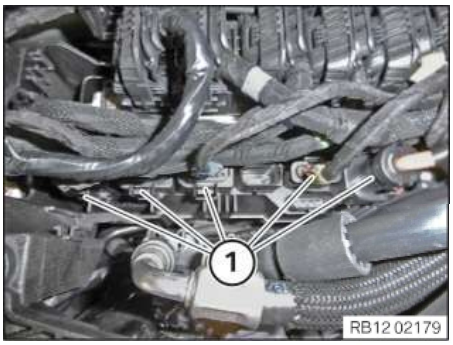
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RISK OF DAMAGE

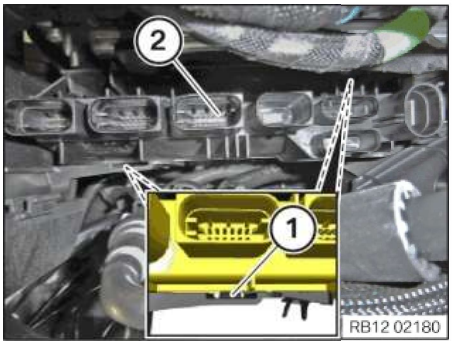
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

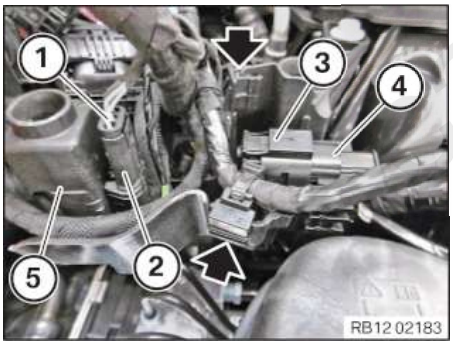


- Unlock and disconnect plug connections (1).

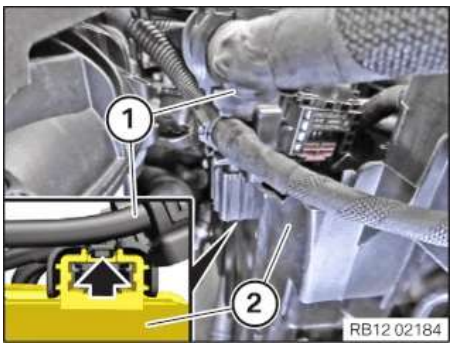


- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

32 – Removing the control unit holder

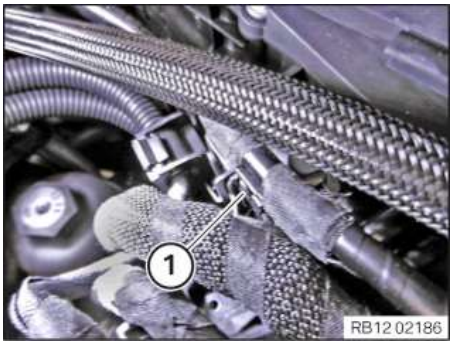


- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).

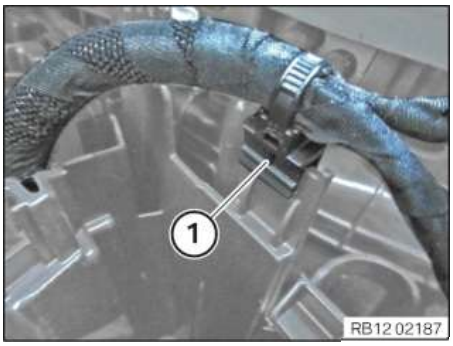


- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).

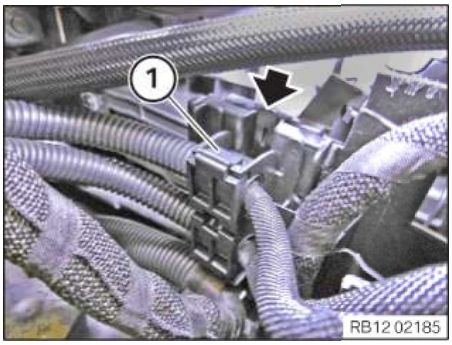
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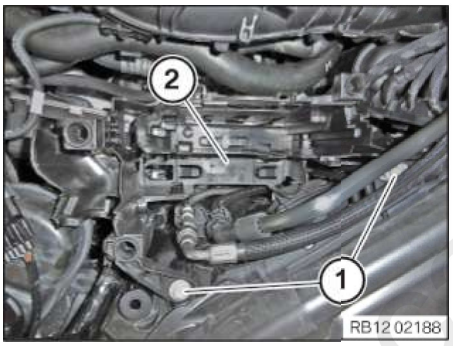
- Loosen clamp (1).



- Loosen clamp (1).



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

33 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

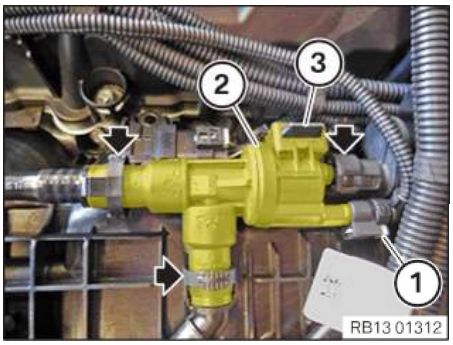
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

34 – Removing the intake plenum

RISK OF DAMAGE

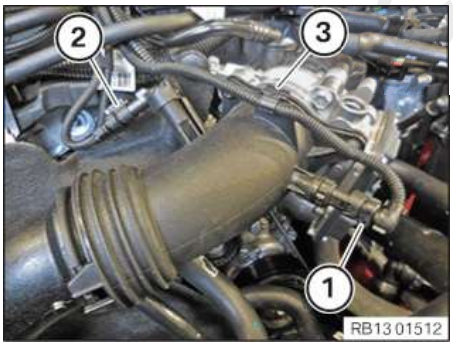
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

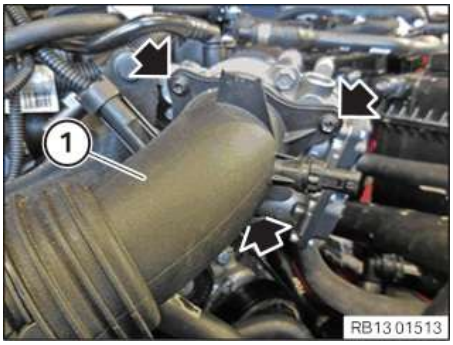
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

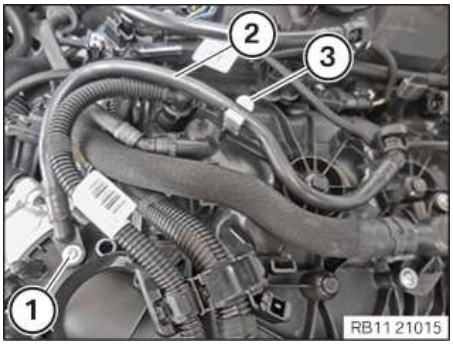


- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).

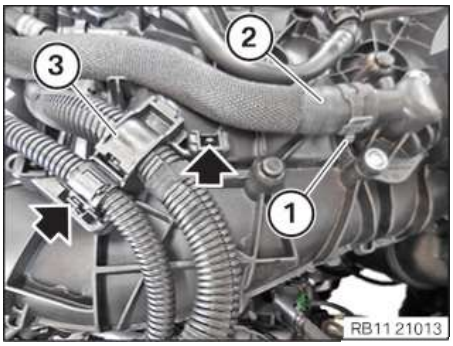


- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.

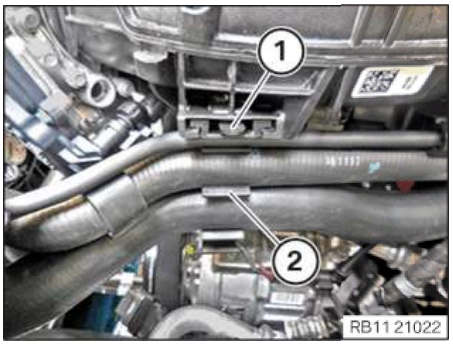
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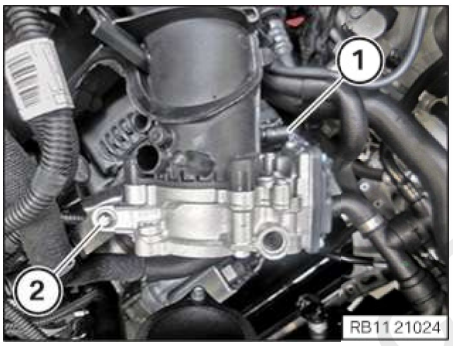
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



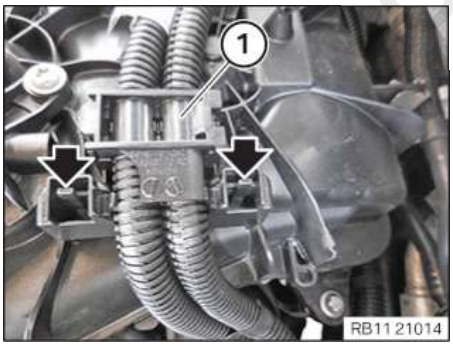
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



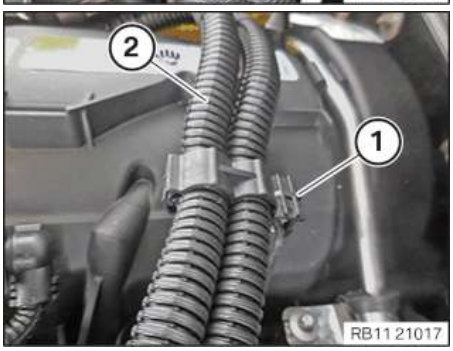
- Unlock the lock (1).
- Thread out holder (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

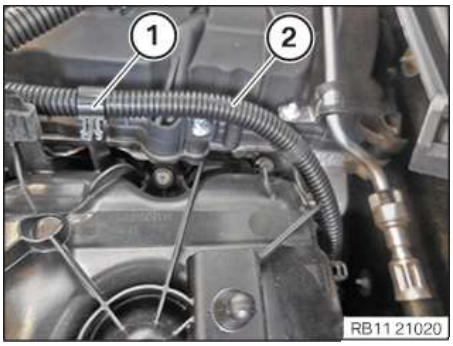


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.

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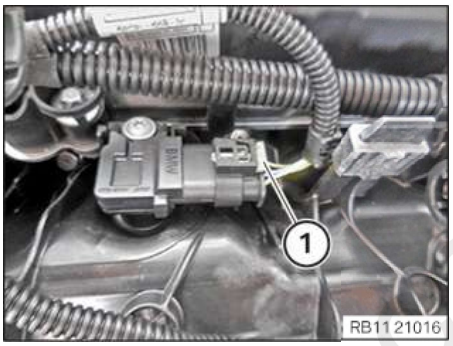
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



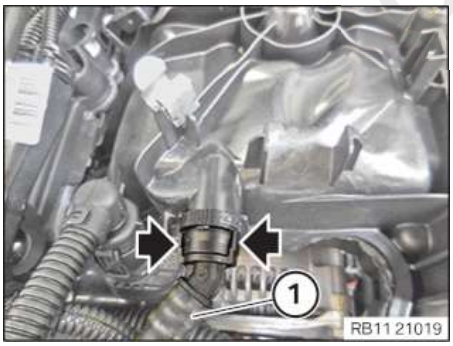
- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.



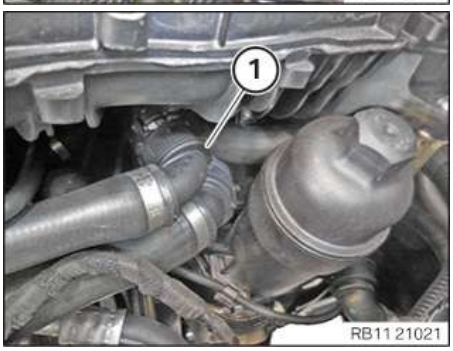
- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

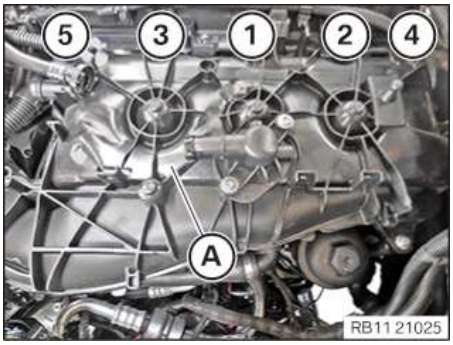


- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.

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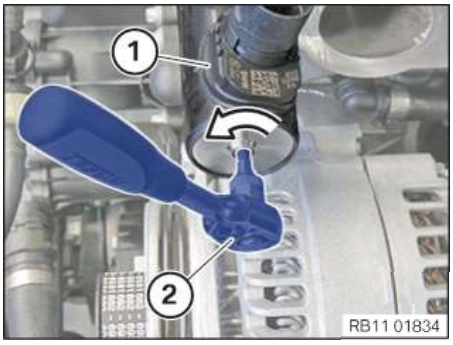


TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

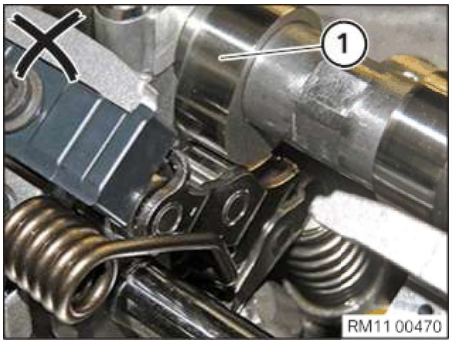
- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

35 – Adjusting the servomotor to minimum lift



- Slowly adjust the eccentric shaft with the servomotor (1) to the minimum lift using the tool (2).

36 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

37 – Remove all torsion springs

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION



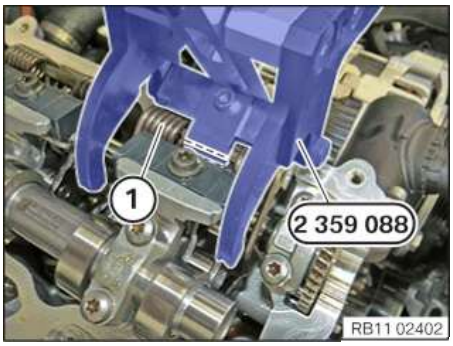
- Wear safety goggles.

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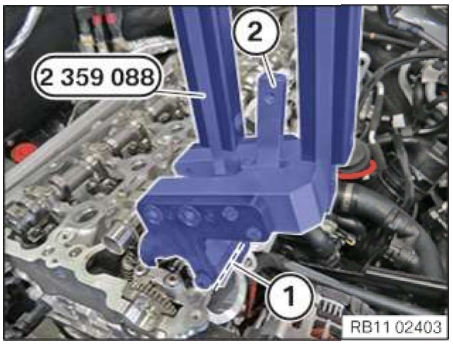


- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)

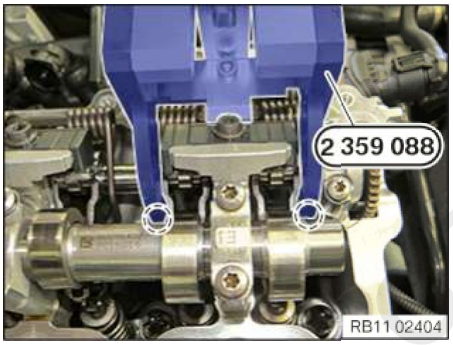


- Open the special tool 2 359 088 and position it at the torsion spring (1).



- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.

Check



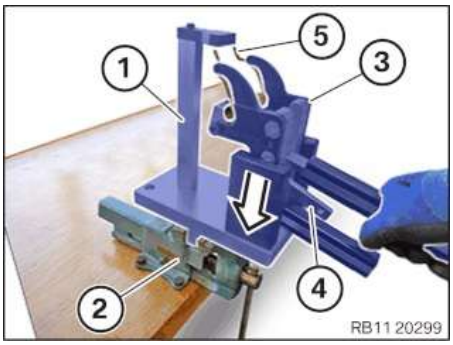
- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.

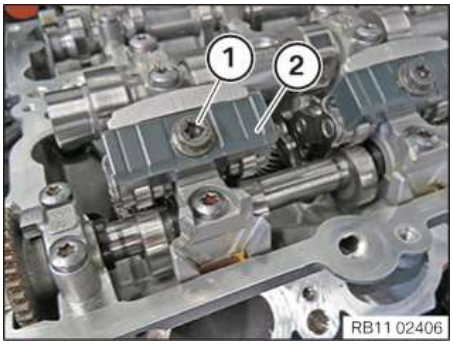


- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).

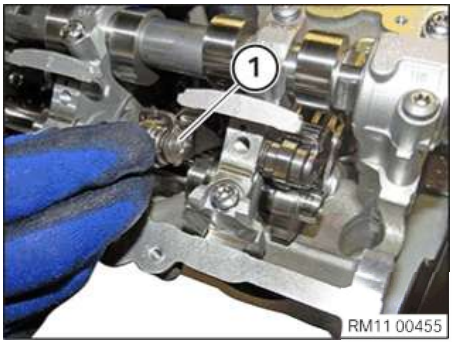
- Repeat the operations for the remaining torsion springs.

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- Loosen screw (1).
- Remove the gate (2) and place it arranged in order into 0 495 105 (11 4 480).
- Repeat the step for all the gates.

39 – Removing all intermediate levers



- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

40 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



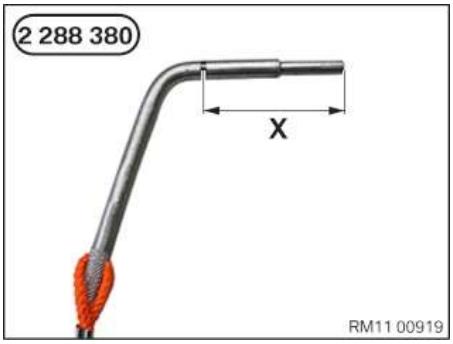
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).

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- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

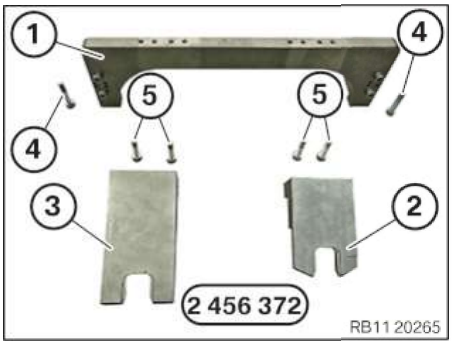
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

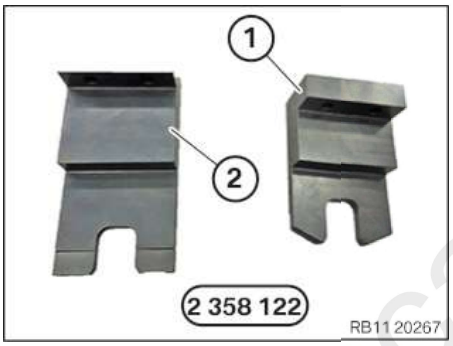
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



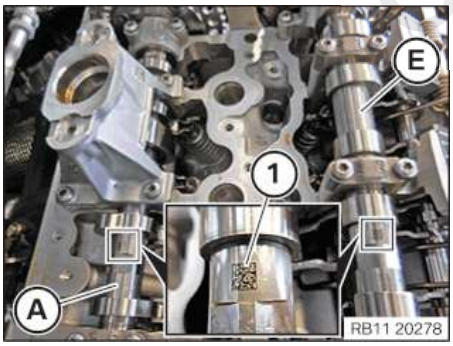
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

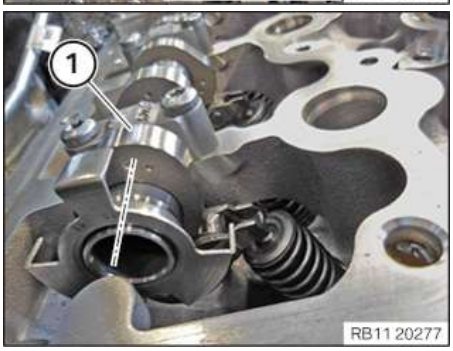


- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft

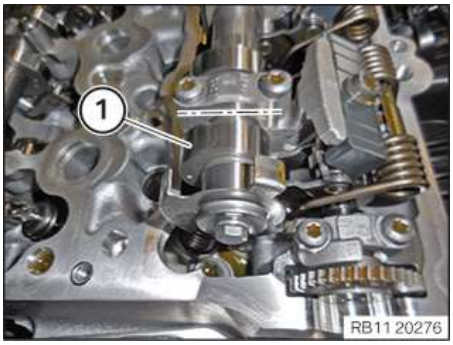


- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

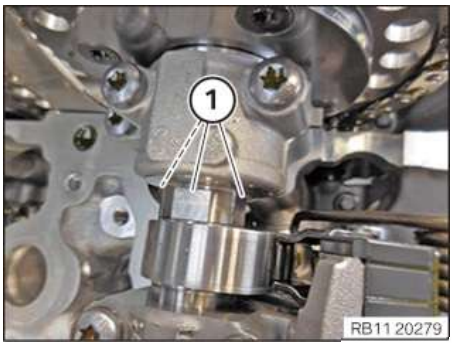


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

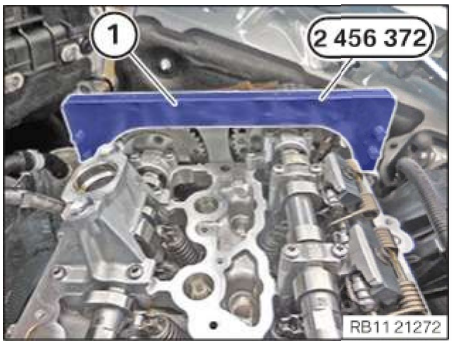
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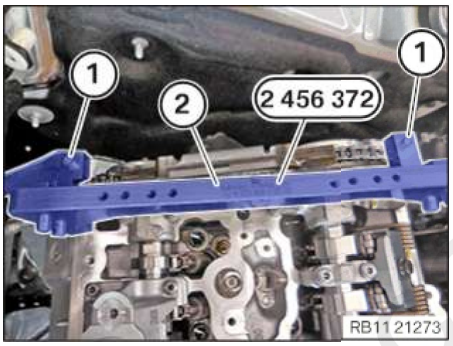
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



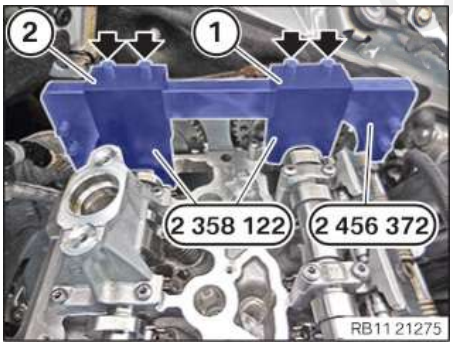
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

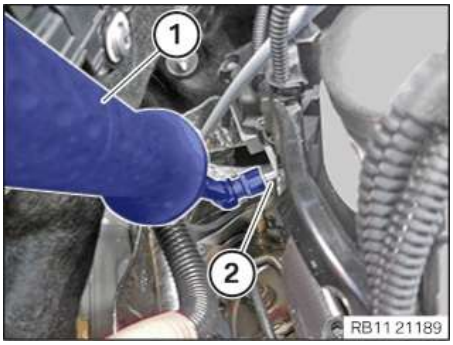
M6		Tightening torque	8 Nm

41 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

42 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

The figure shows the rear side of the engine.

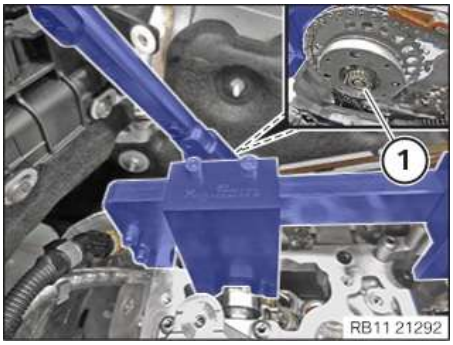
- Release the VANOS central valve (1) of the intake adjuster.

43 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

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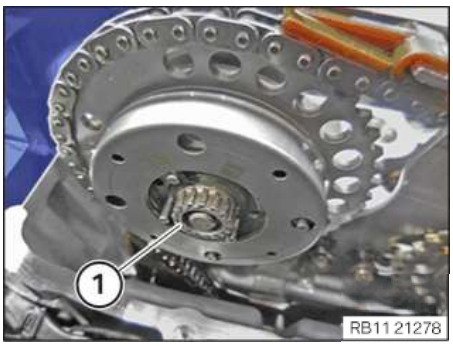


NOTICE

The figure shows the rear side of the engine.

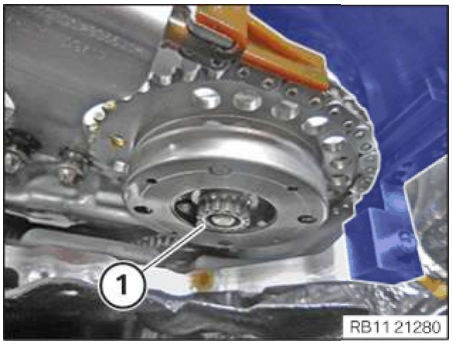
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

44 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

45 – Remove the VANOS central valve of the exhaust camshaft adjuster



- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

46 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.



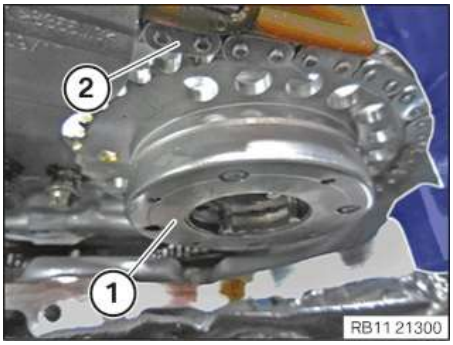
- Guide out the intake adjuster (1) from the timing chain (2) and remove.

47 – Remove exhaust camshaft adjuster

NOTICE

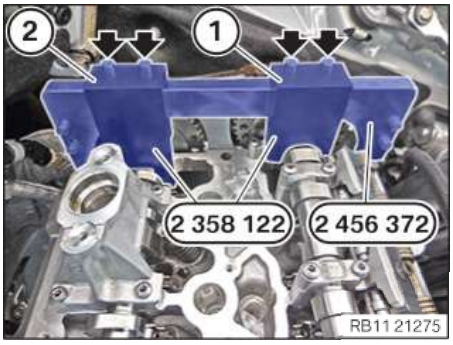
The figure shows the rear side of the engine.

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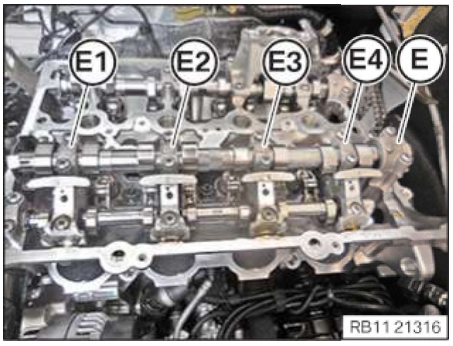
- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

48 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

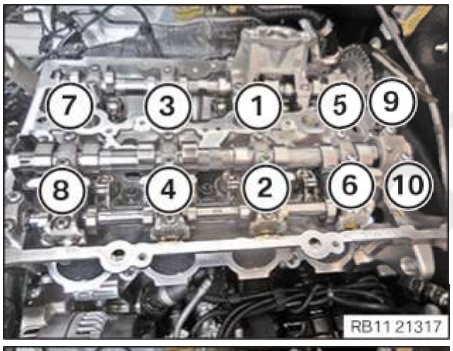
49 – Remove intake camshaft



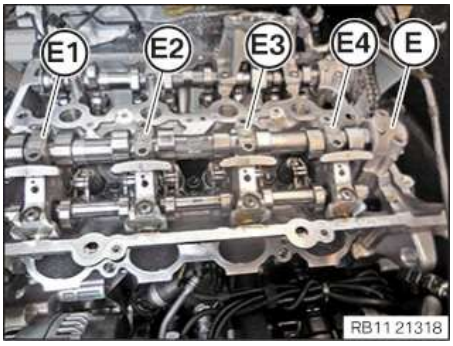
- Make sure that the exhaust camshaft bearing cap is placed in the correct position in the special tool 0 495 105 (11 4 480).

Note: The intake camshaft bearing caps can be read from the intake side and are identified by **E1**, **E2**, **E3 E4** and **E**.

Note: Intake camshaft bearing cap **E** is a thrust bearing.

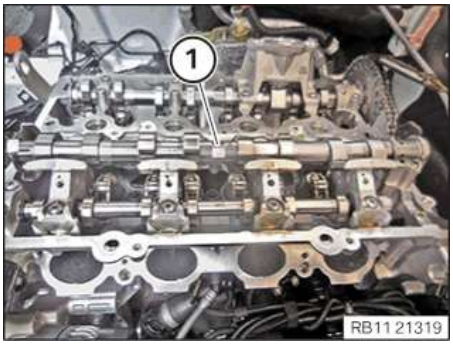


- Loosen all screws on the intake camshaft bearing caps in sequence from (10) to (1).



- Remove the intake camshaft bearing caps (E1), (E2), (E3), (E4), (E) place them in order in the special tool 0 495 105 (11 4 480).

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- Guide out the intake camshaft (1) in the direction of arrow and remove it.

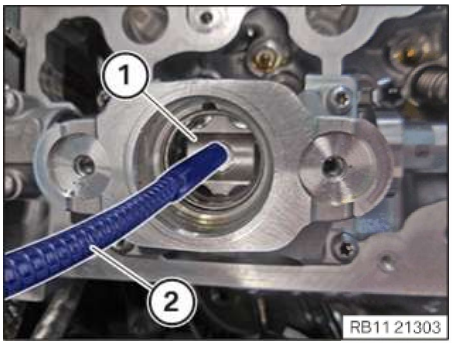
50 – Remove exhaust camshaft.

RISK OF DAMAGE

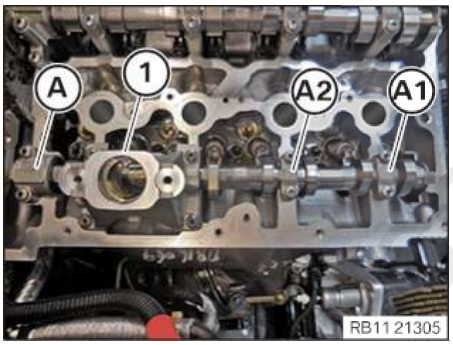
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Feed out and remove roller tappet (1) with commonly available tools (2).

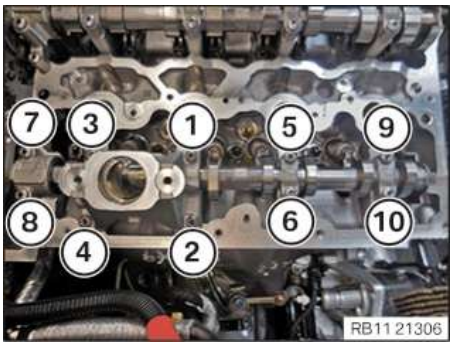


- Ensure that the exhaust camshaft bearing caps (A1) (A2) and (A) are placed in the right position 0 495 105 (11 4 480) in the special tool.

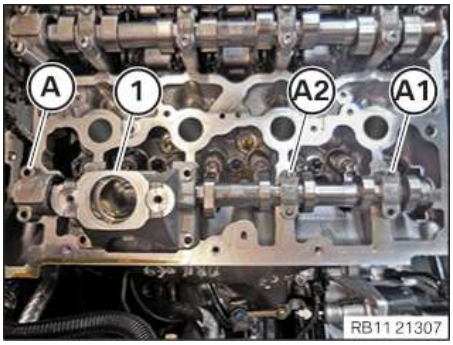
Note: The exhaust camshaft bearing caps can be read from the intake side and are identified by **A1**, **A2** and **A**.

Note: Exhaust camshaft bearing cap **A** is a thrust bearing.

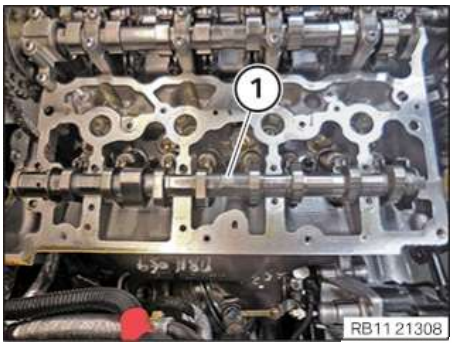
Note: Bearing cap **1** is the high pressure pump bracket.



- Loosen all screws on the exhaust camshaft bearing cap in **sequence** from (10) to (1) in **half** turn.



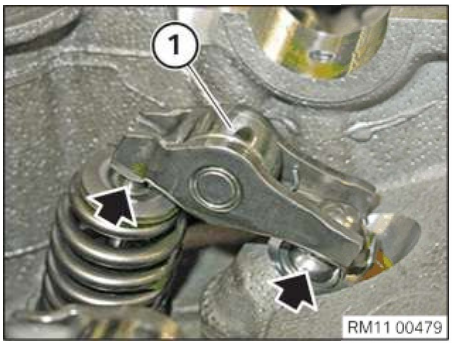
- Remove the exhaust camshaft bearing cap (A1) (A2) and (A) and store it properly in the special tool 0 495 105 (11 4 480).
- Remove high pressure pump bracket (1) and place in order in special tool 0 495 105 (11 4 480).



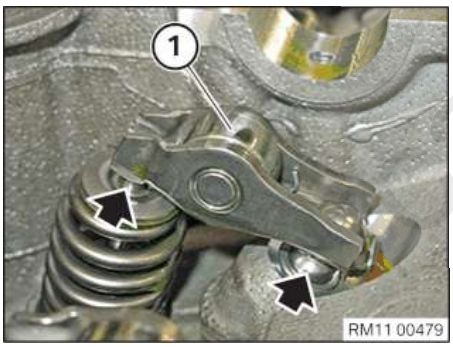
- Feed out and remove exhaust camshaft (1).

MAIN WORK

51 – Remove all roller cam followers



- Detach and remove the roller cam followers (1) on the intake side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).



- Detach and remove the roller cam followers (1) on the output side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).

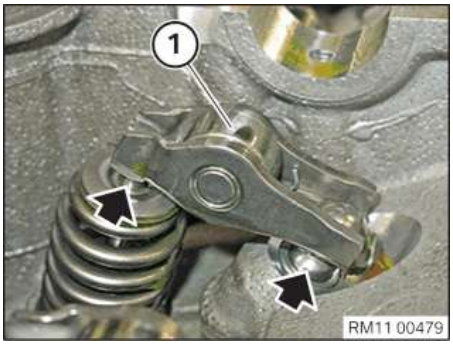
52 – Install all roller cam followers



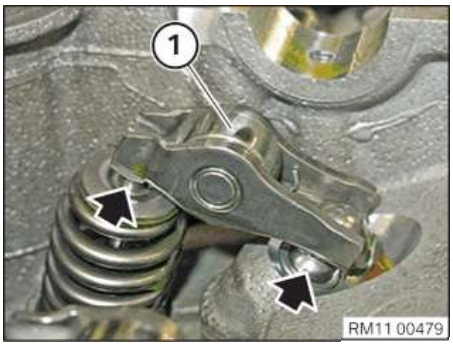
- The classification in digits from 1 to 5 has been printed on the roller cam follower.

Classification	Idle speed
1	Repair case - slow engine speed when idling
2	Installed as standard/initial installation
3	Installed as standard/initial installation
4	Installed as standard/initial installation
5	Repair case - high engine speed when idling

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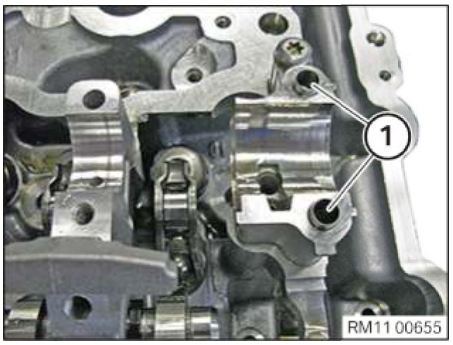
- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.



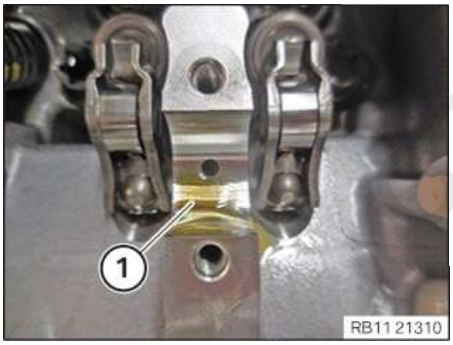
- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

POSTPROCESSES

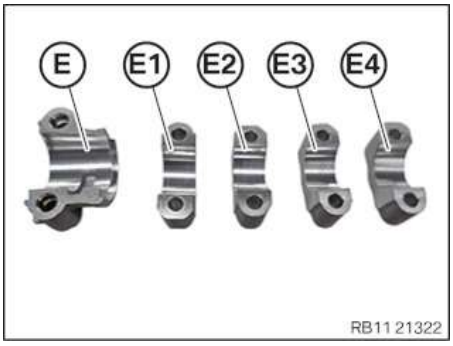
53 – Install intake camshaft



- Check the fitting sleeves (1) for correct fit and damage and replace where required.

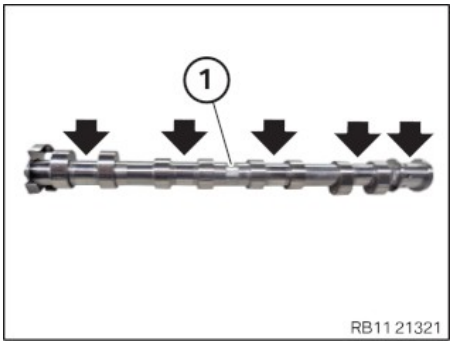


- Coat all bearing positions (1) with fresh engine oil.

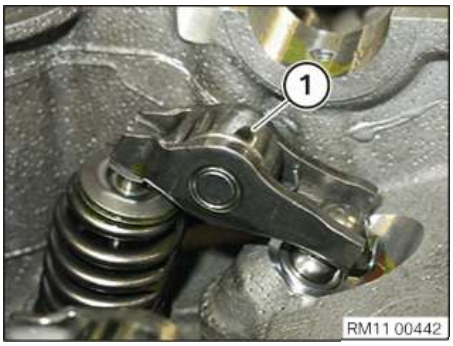


- Clean all the bearing positions of the intake camshaft bearing caps (E1), (E2), (E3), (E4) and (E) and coat with engine oil.

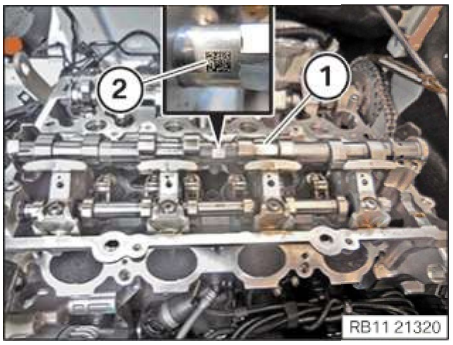
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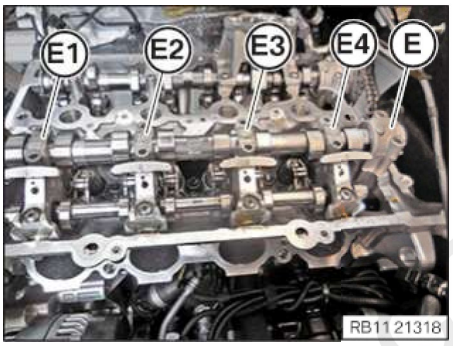
- Clean all bearing positions (arrows) of the intake camshaft (1) and coat with engine oil.



- Ensure the **correct** fit of the roller cam followers (1) before mounting the intake camshaft.
- Coat roller cam follower (1) with **new** engine oil.



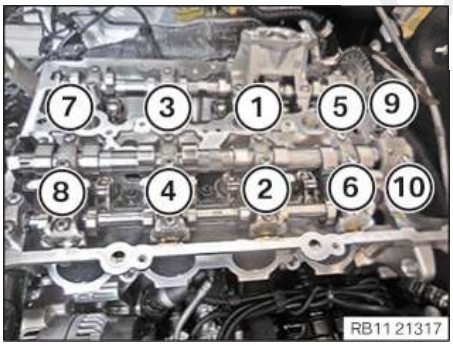
- Insert the intake camshaft (1) into the cylinder head so that the mark (2) points up.



- Position the intake camshaft bearing cap on the cylinder head.

Note: The intake camshaft bearing caps can be read from the intake side and are identified by **E1**, **E2**, **E3** **E4** and **E**.

Note: Intake camshaft bearing cap **E** is a thrust bearing.

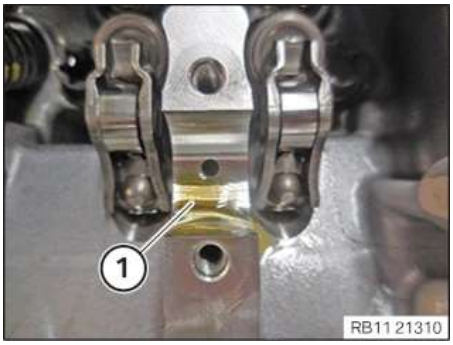


- Press intake camshaft bearing cap down and hand-tighten the bolts incrementally in sequence (1) to (10).
- Join bolts in sequence (1) to (10) **in half turns**.
- **Observe jointing torque.**
- **Tighten** all bolts in sequence from (1) to (10).

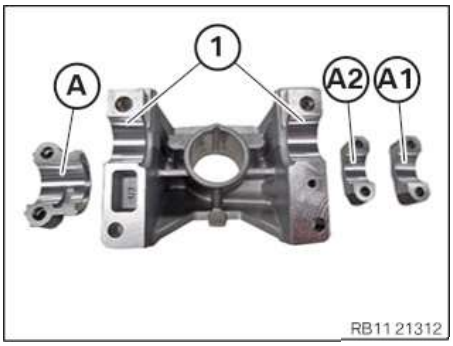
Intake camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

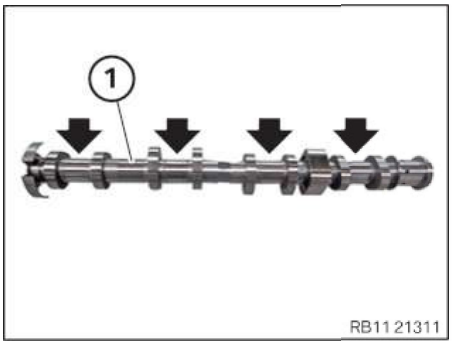
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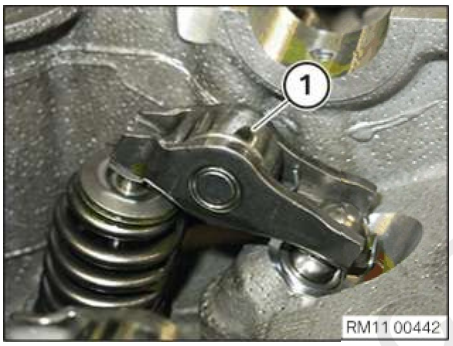
- Coat all bearing positions (1) with **fresh** engine oil.



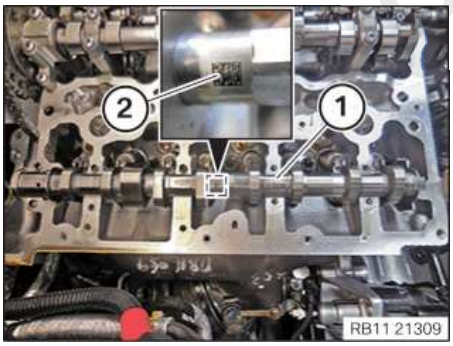
- Clean all the bearing positions of exhaust camshaft bearing caps (A1), (A2) and (A) and coat them with engine oil.
- Clean bearing positions (1) of the high pressure pump bracket and coat with engine oil.



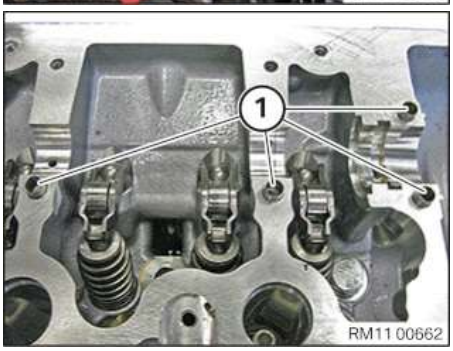
- Clean all the bearing positions (arrows) of exhaust camshaft (1) and coat with engine oil.



- Ensure the **correct** fit of the roller cam followers (1) before mounting the exhaust camshaft.
- Coat roller cam follower (1) with **new** engine oil.

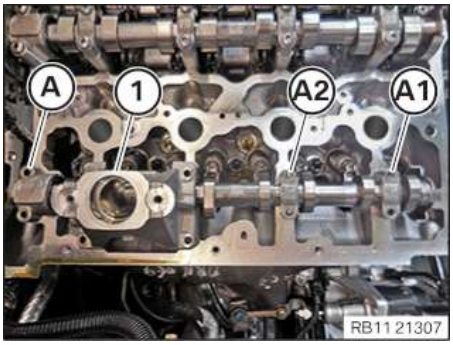


- Insert exhaust camshaft (1) in the cylinder head, such that the mark (2) points **upwards**.



- Check the fitting sleeves (1) for **correct** fit and damage and replace where required.

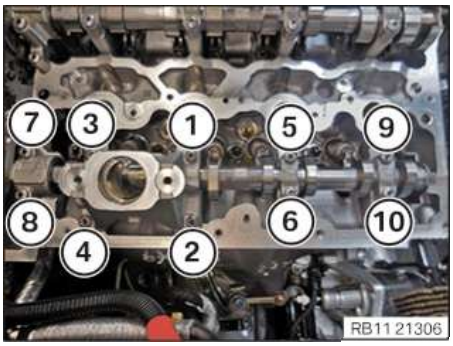
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- Position all exhaust camshaft bearing caps (A1) (A2) (A) and high pressure pump bracket (1) on the cylinder head and press down.

Note: The exhaust camshaft bearing caps can be read from the intake side and are identified by **A1**, **A2** and **A**.

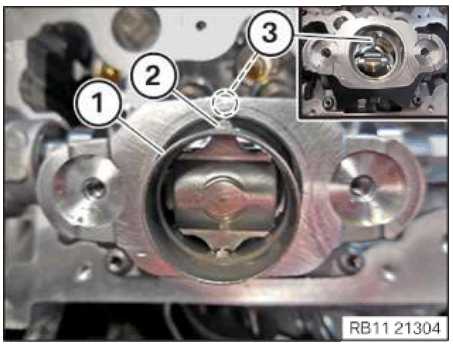
Note: Exhaust camshaft bearing cap **A** is a thrust bearing.



- Join all the screws in the **sequence** (1) to (10) **in half turns**.
- **Adhere to** the **jointing torque**.
- **Tighten** all bolts in sequence (1) to (10).

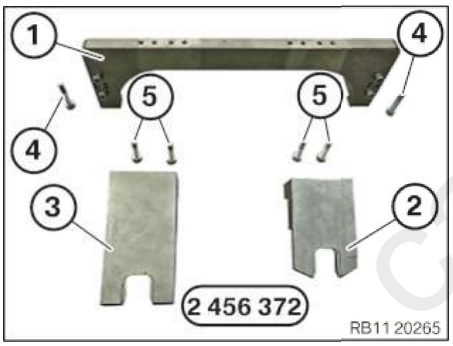
Exhaust camshaft to cylinder head

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm



- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

55 – Adjust the camshafts with the special tool



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

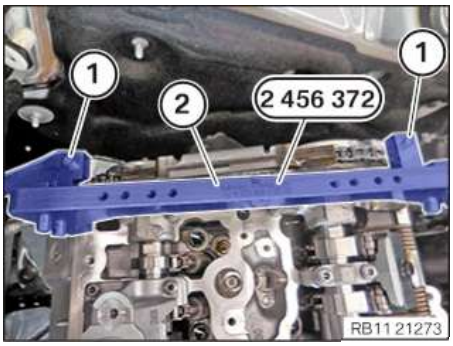


- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.

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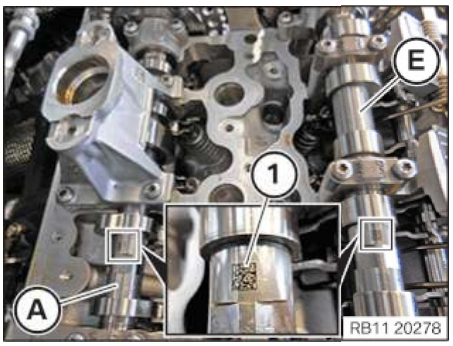
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



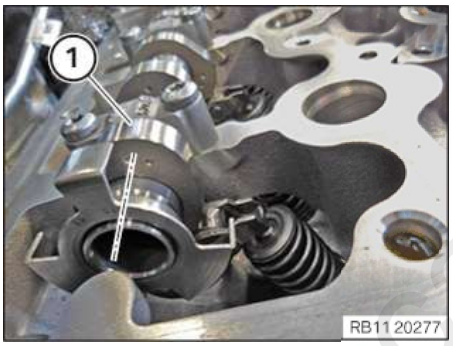
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

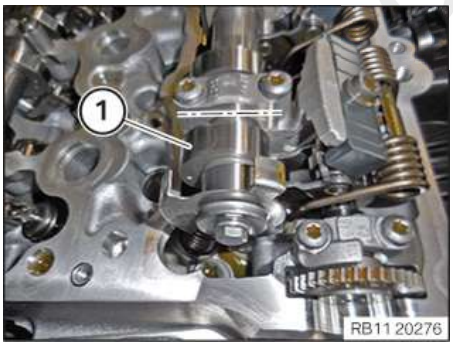
M6		Tightening torque	8 Nm



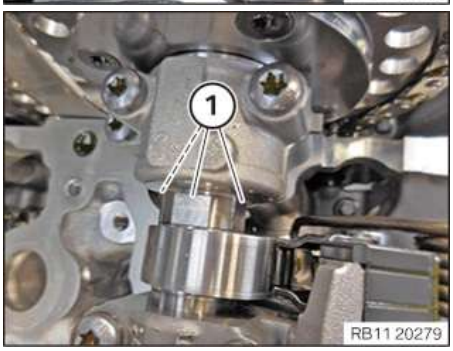
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

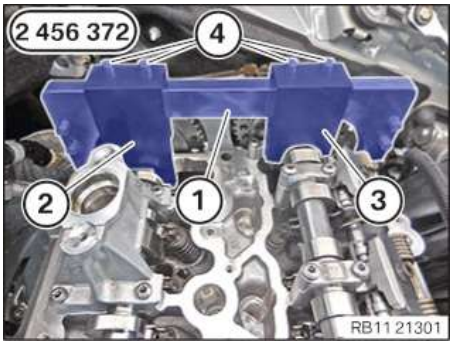


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

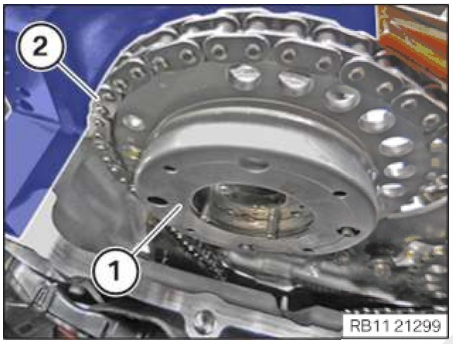
56 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

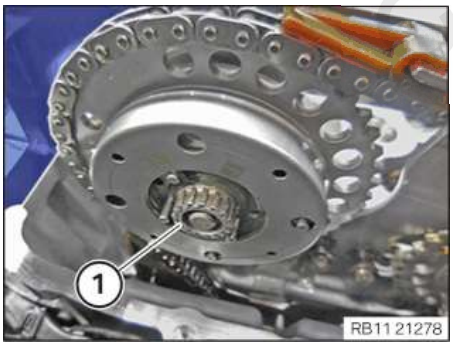


- Keep intake adjuster (1) marked IN ready.

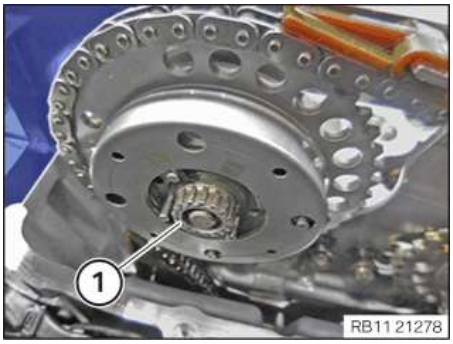


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

57 – Install the VANOS central valve of the intake adjuster

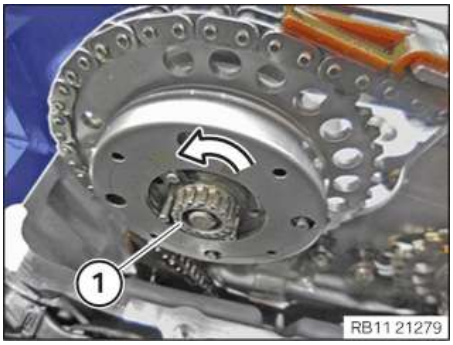


- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.

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- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

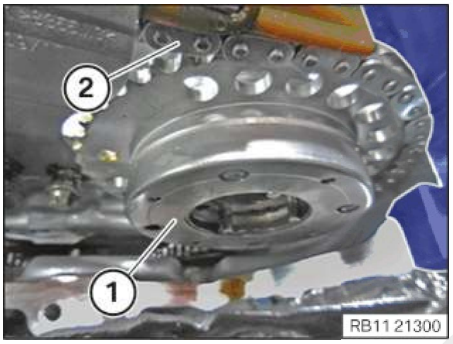
58 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

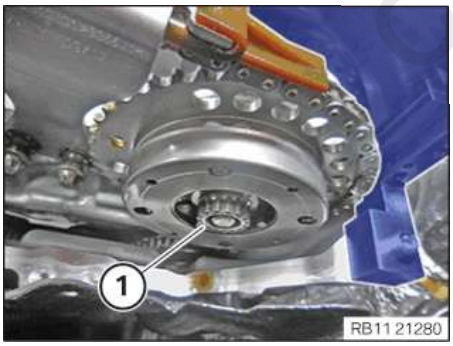


- Keep exhaust camshaft adjuster (1) marked EX ready.

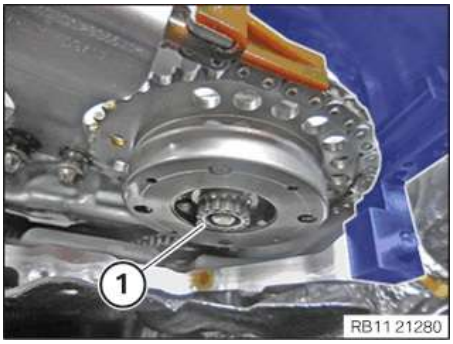


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

59 – Installing the VANOS central valve of the exhaust camshaft adjuster

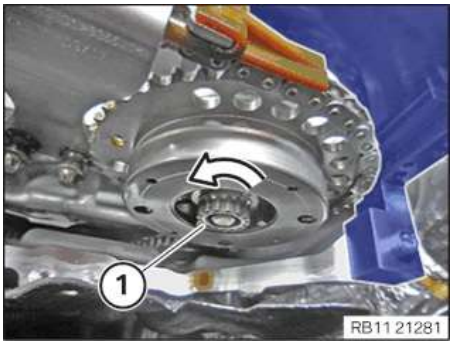


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



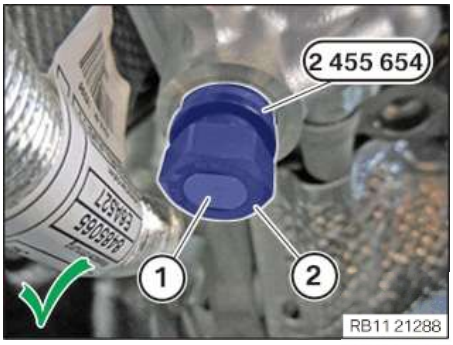
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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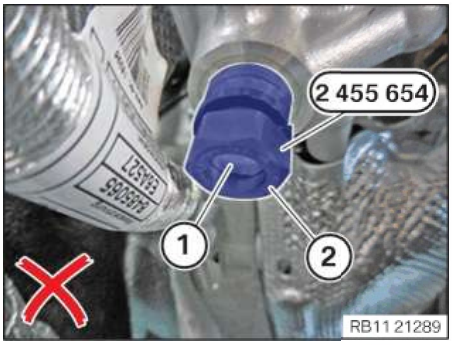
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

60 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

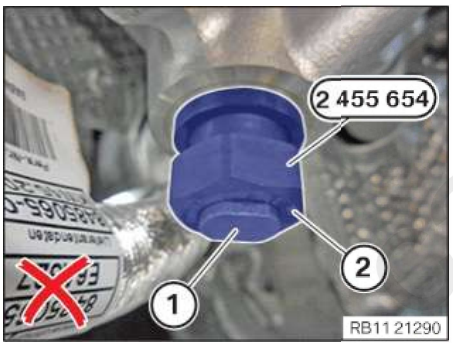
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

61 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the intake adjuster.

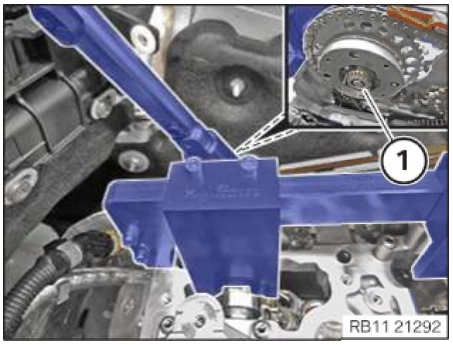
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

62 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

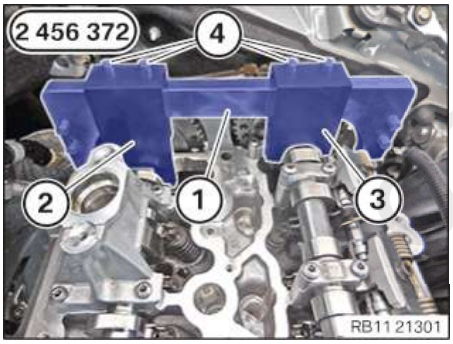


- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

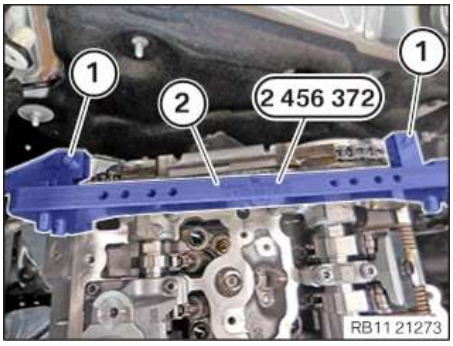
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

63 – Disassembling all special tools

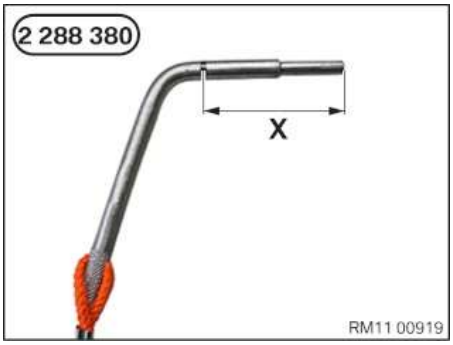


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.

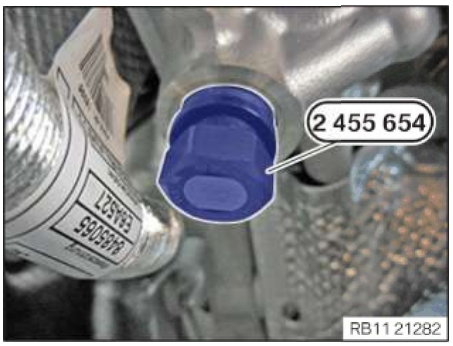
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- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

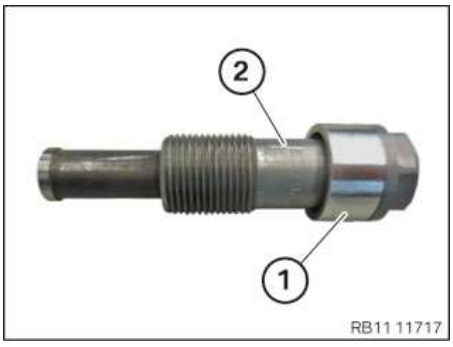
64 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



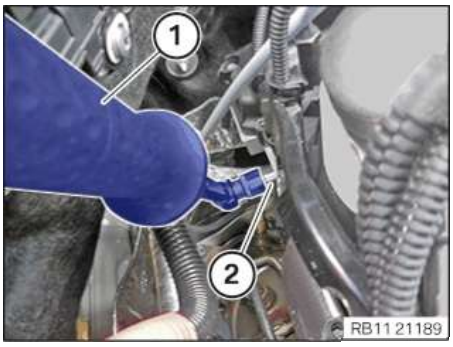
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.

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- Insert and install the chain tensioner (1).

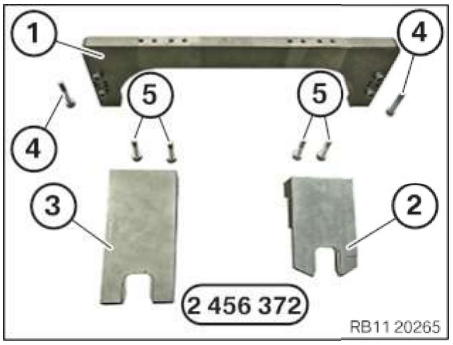


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

65 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



RISK OF DAMAGE

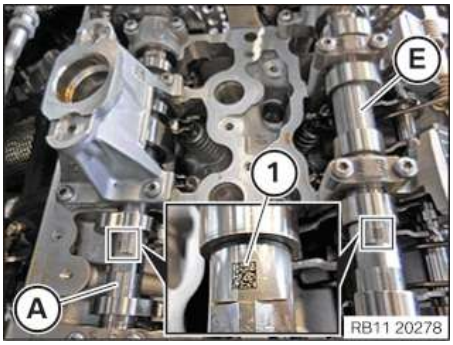
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

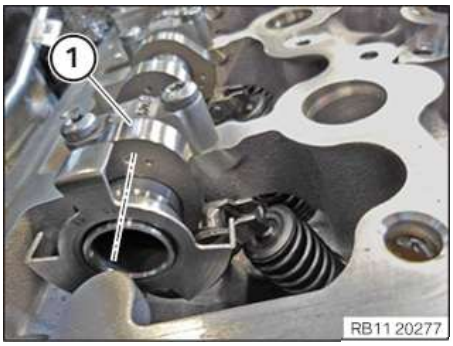
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

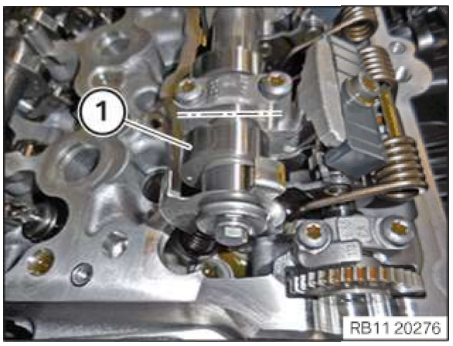
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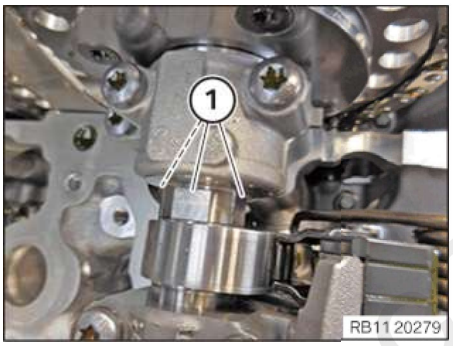
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



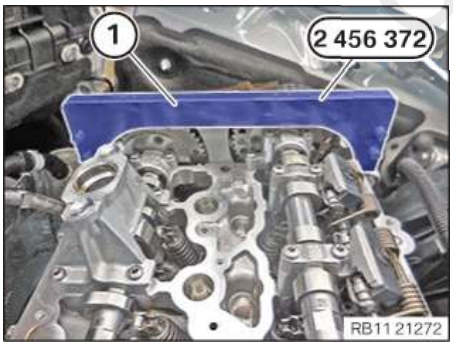
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



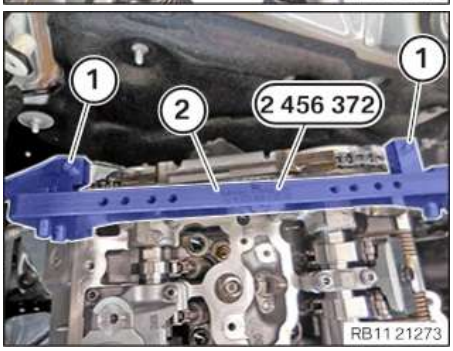
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

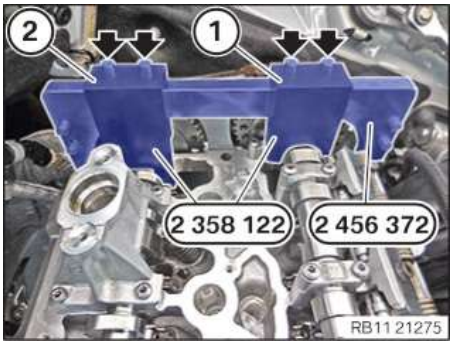


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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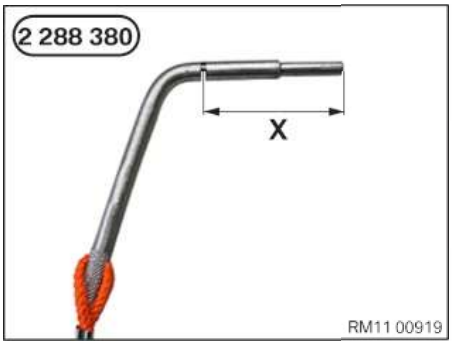
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

66 – Checking the intermediate lever classification

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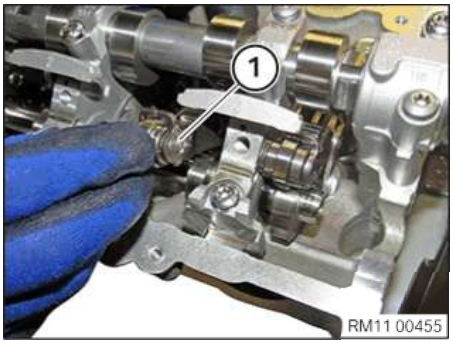
TECHNICAL INFORMATION

All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

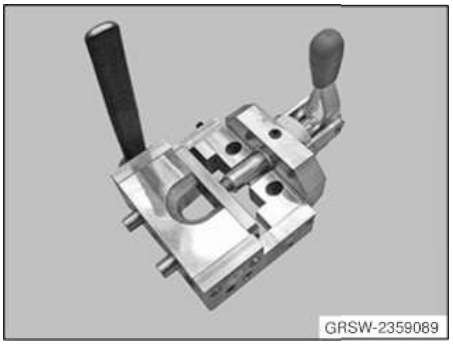
- Check classification (arrow) of intermediate lever.

67 – Installing all intermediate levers

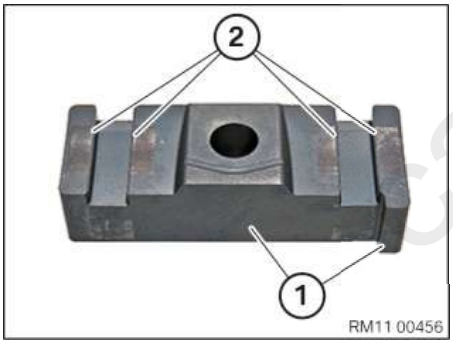


- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

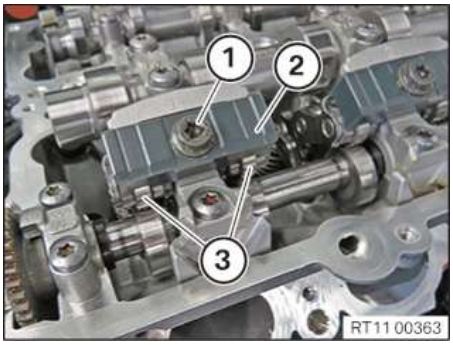
68 – Installing all gates



- Have the special tool 2 359 089 ready.

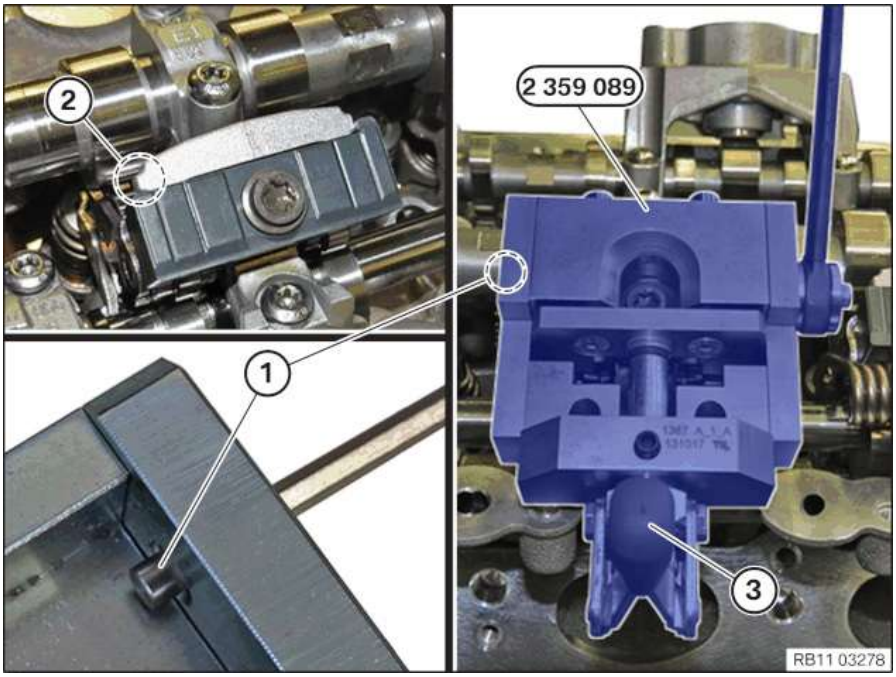


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

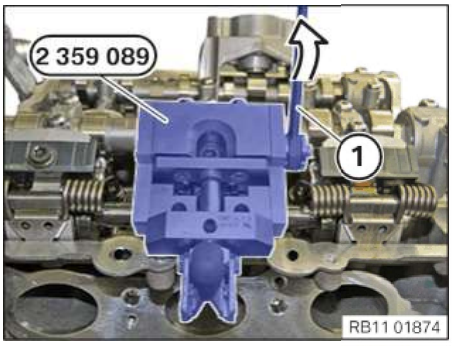


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.

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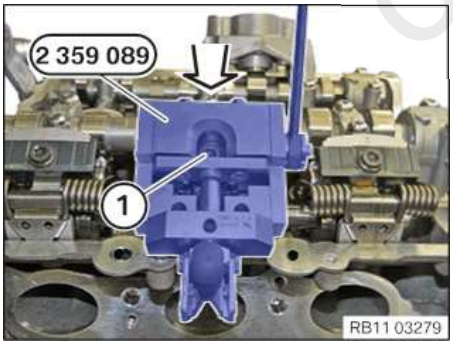
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1) in the direction of the arrow.



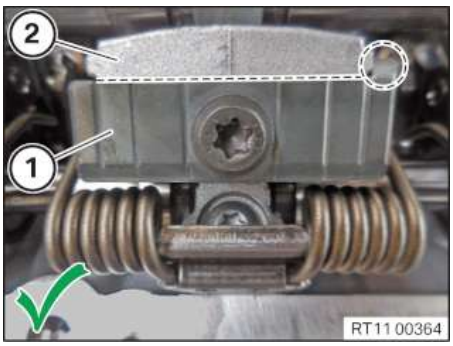
- Make sure that the special tool 2 359 089 rests flat against the cylinder head (arrows).



- Press the special tool 2 359 089 onto the cylinder head in the direction of the arrow.
- Tighten the bolt (1) at the same time.

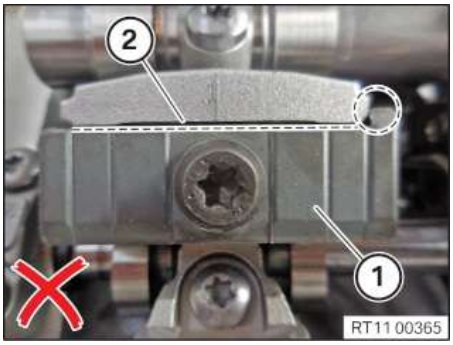
Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).
  Gate (1) is installed correctly in the marked area.

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- Ensure that gate (1) rests **correctly** against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area.

- Repeat the step for all the gates.

69 – Install all torsion springs

CAUTION

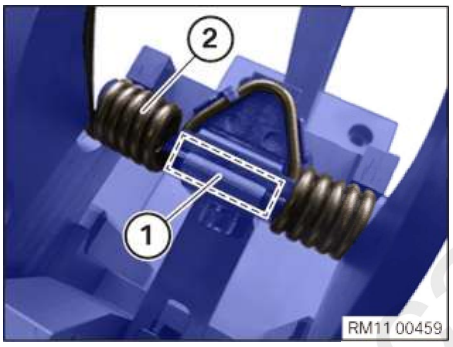
Spring preload.

Danger of injury!

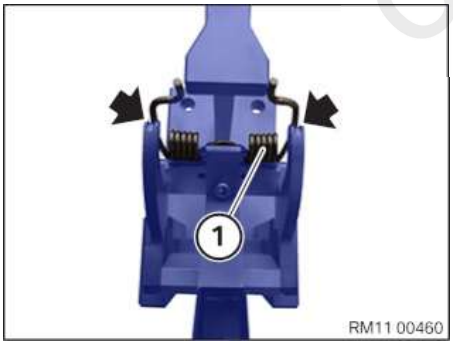
- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

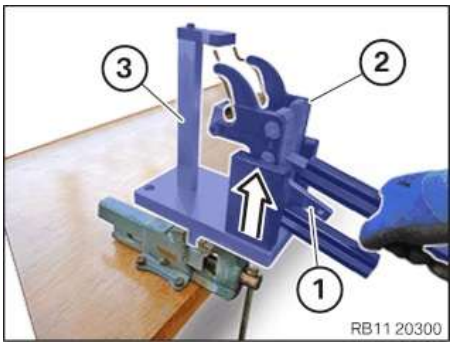
- Wear safety goggles.



- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.



- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

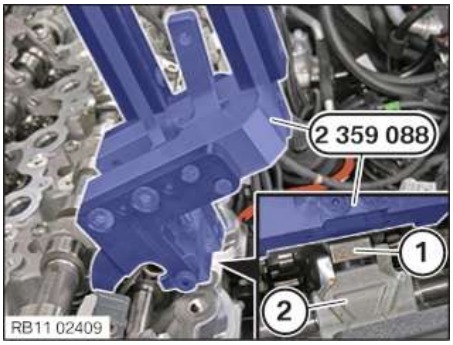


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the lever (1) audibly engages.

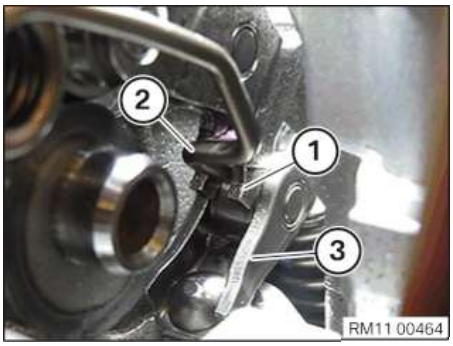
  The torsion spring is tensioned.

- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.

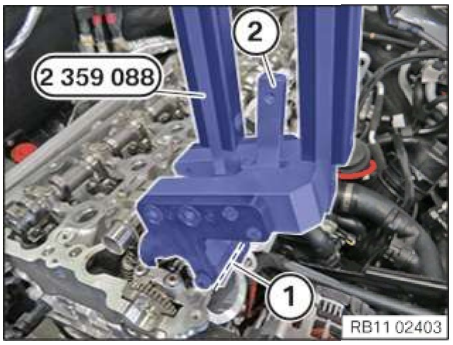
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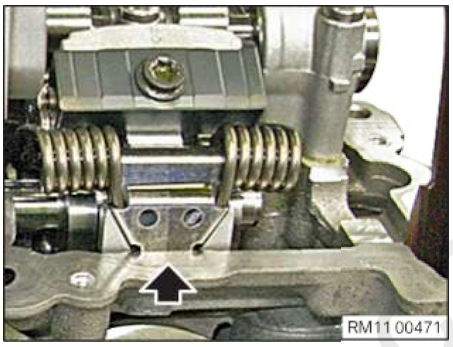
- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).



- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).
- Repeat the operations for the remaining torsion springs.

70 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

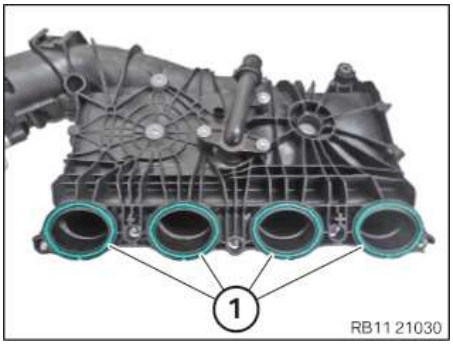
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

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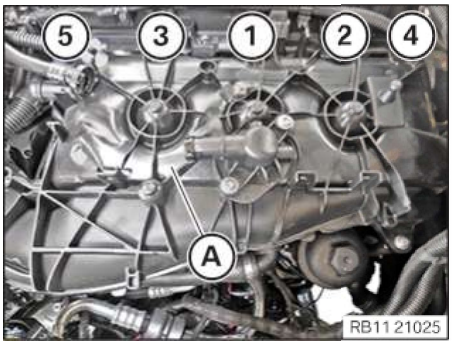


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6	Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

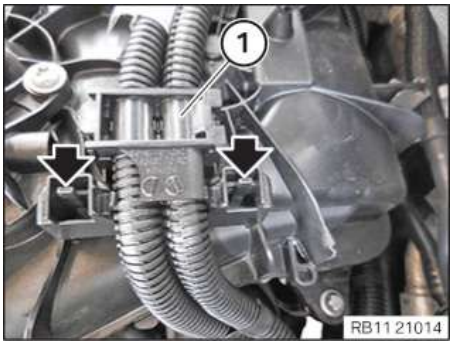


- Tighten down screw (1).

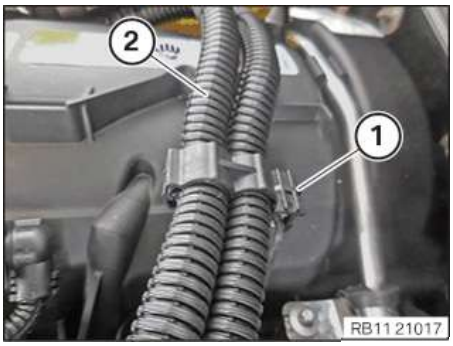
Intake plenum to support

M6X25		Tightening torque	8 Nm

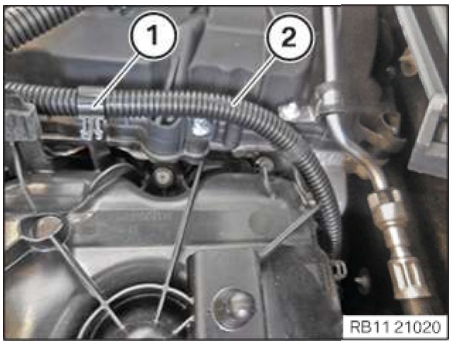
cardiagn.com



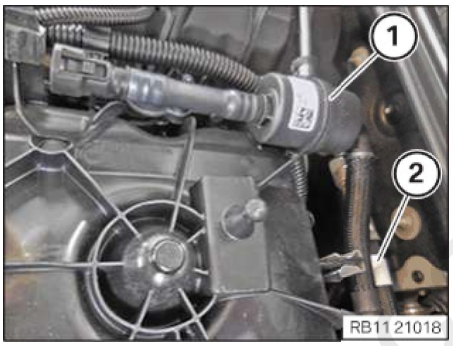
- Insert and install the wiring harness section (1) for the injectors and ignition coils.
  The locks (arrows) must engage audibly.



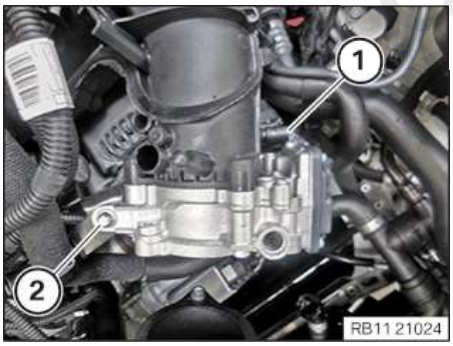
- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



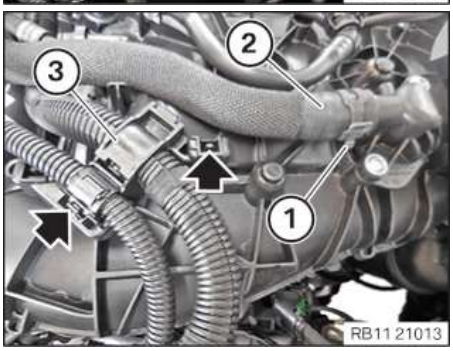
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

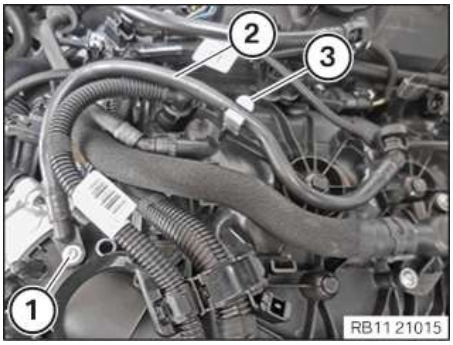
Throttle body to holder

M6X25		Tightening torque	8 Nm



- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

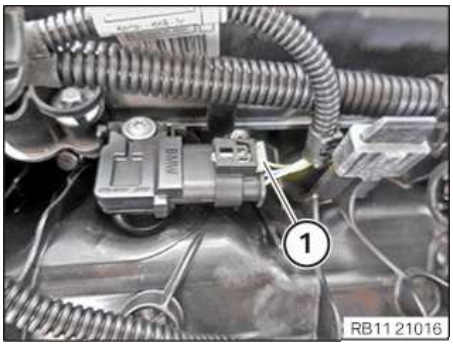
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- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

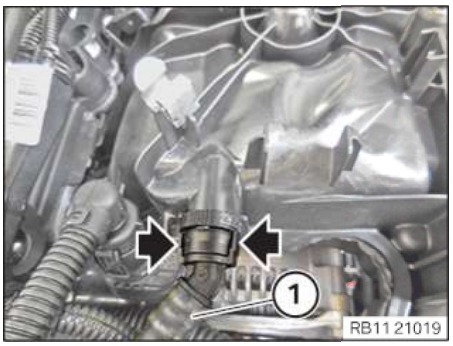
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



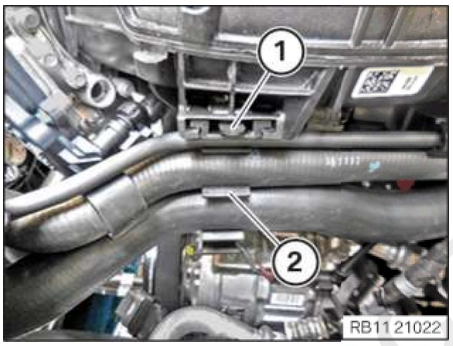
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

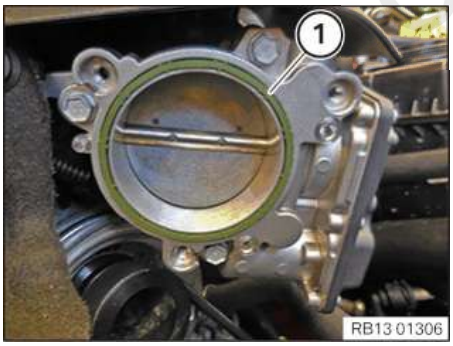


- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

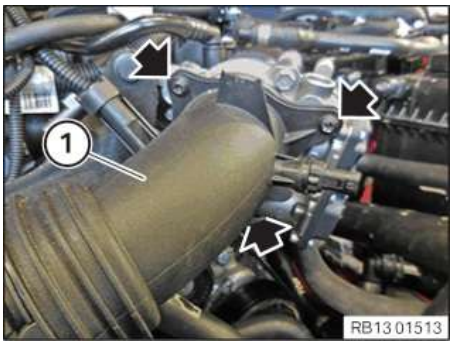


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

  Parts: Gasket

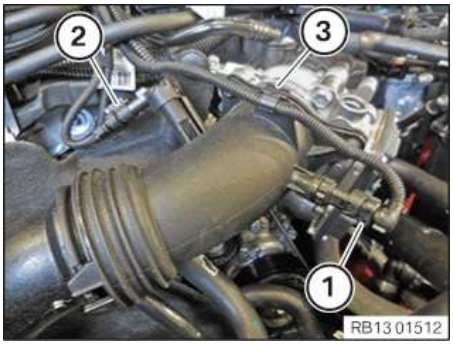


- Insert and install charge air line (1).
- Tighten screws (arrows).

Charge air line to throttle body

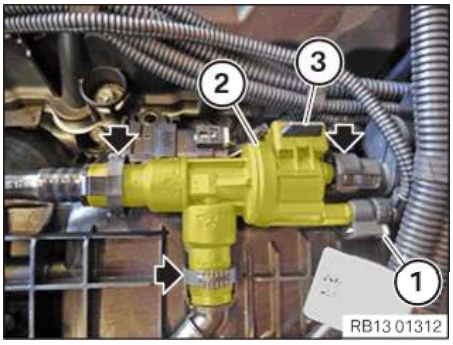
M6		Tightening torque	8 Nm

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- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

71 – Installing the tank vent valve

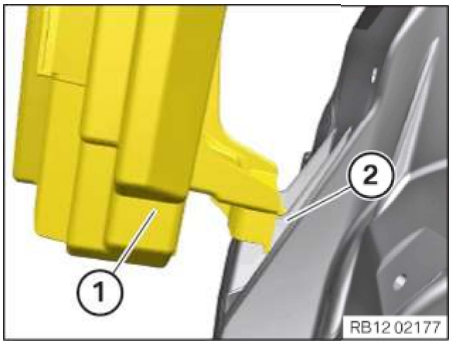


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

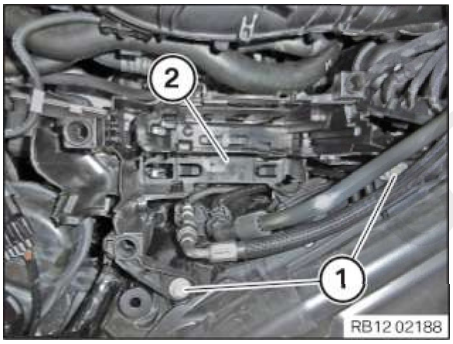
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

72 – Installing the control unit holder



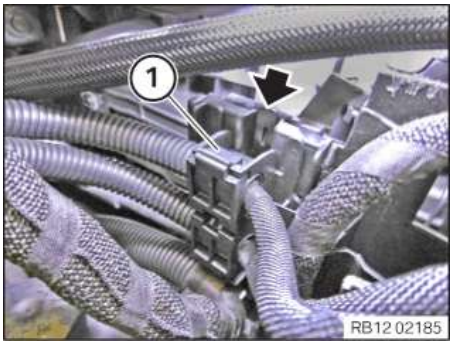
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

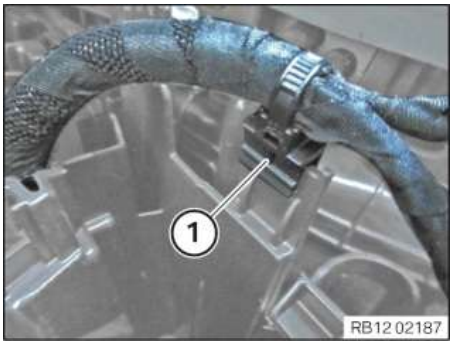
Hexagon screw		Tightening torque	8 Nm



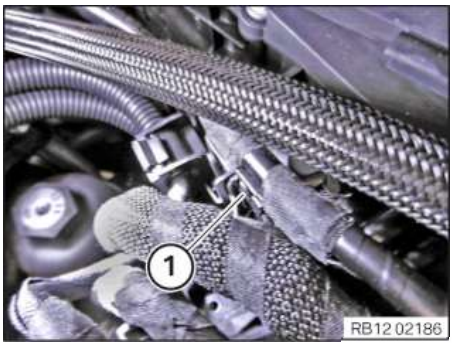
- Feed in and install the cable clip (1).

  Lock (arrow) must audibly engage.

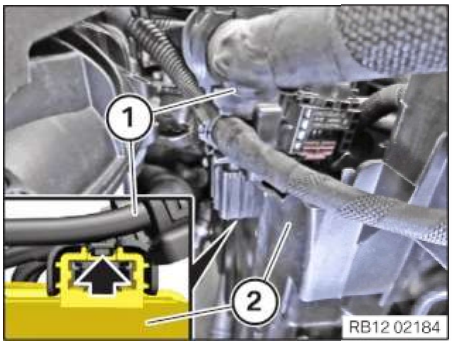
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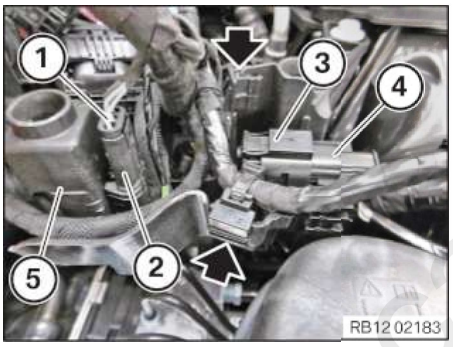
- Secure clamps (1).



- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

73 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

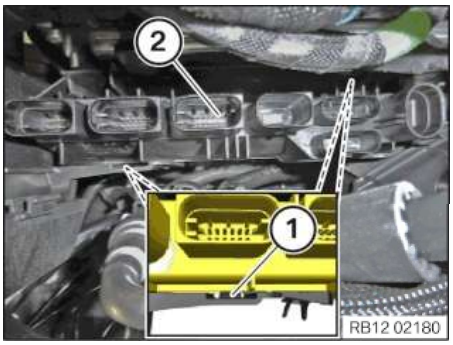
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Insert and install the integrated supply module (PDM) (2).

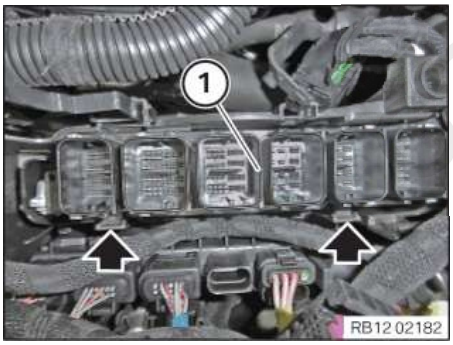
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



- Connect connectors (1) and lock.

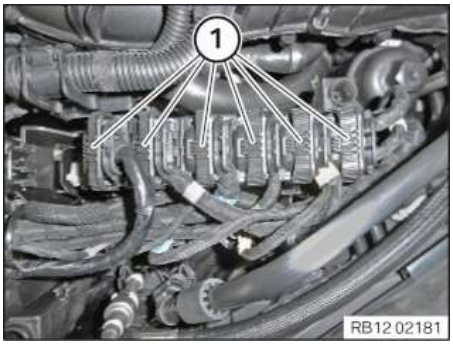
  The connectors (1) must engage audibly.

74 – Installing the DME control unit



- Feed in and install DME control unit (1).

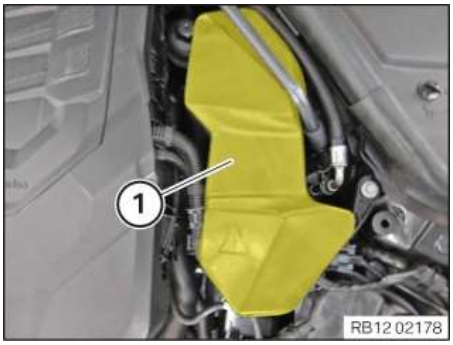
  The locks (arrows) must engage audibly.



- Connect connectors (1) and lock.

  All connectors (1) must engage audibly.

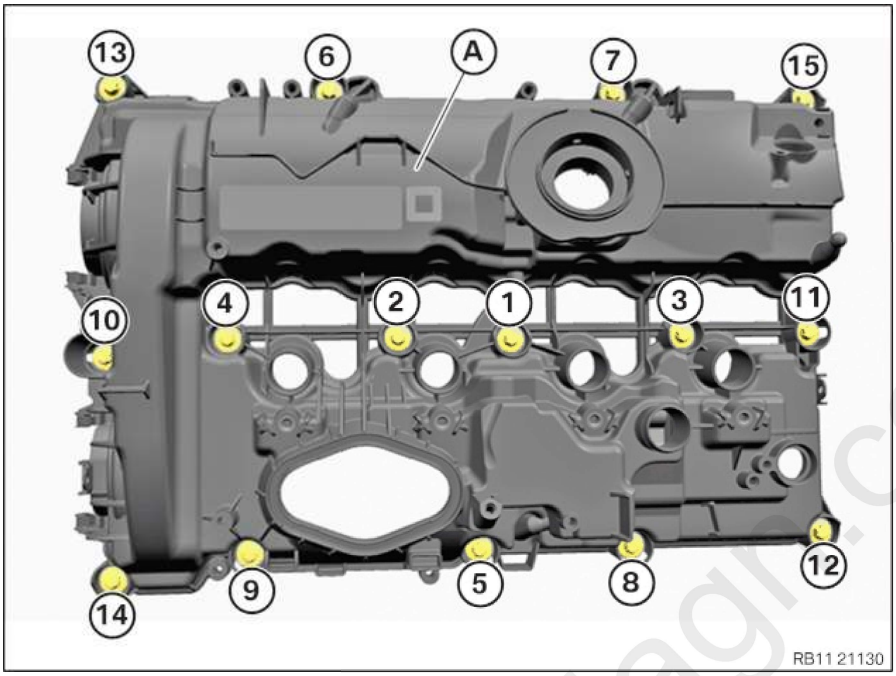
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- Insert and install cover (1) into guides.

75 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

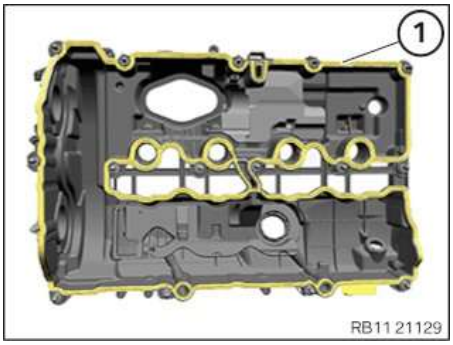
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

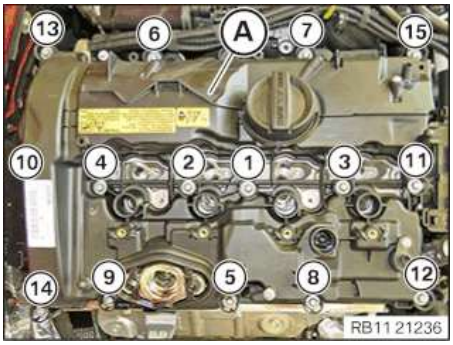
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

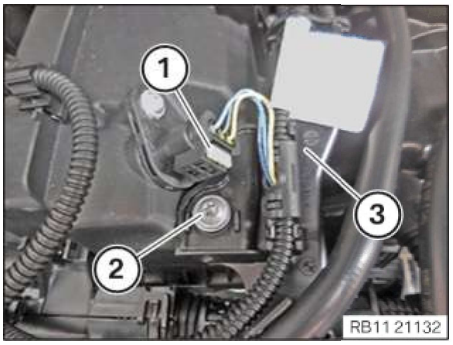
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

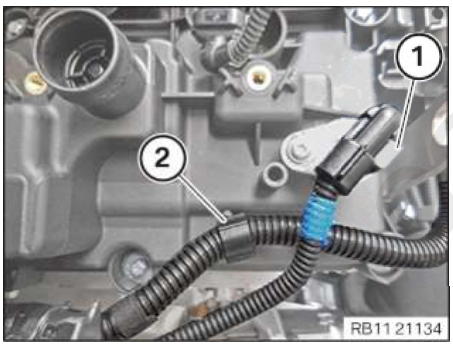


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

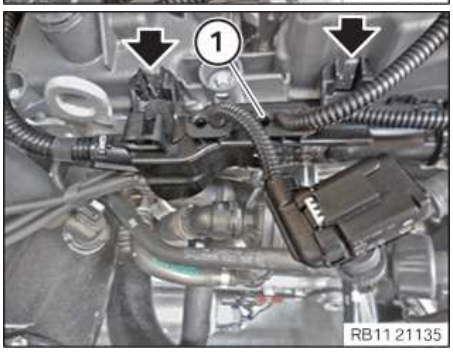
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

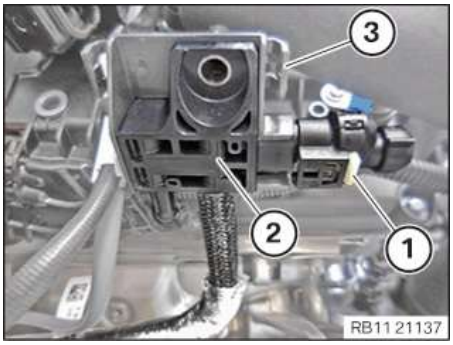


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

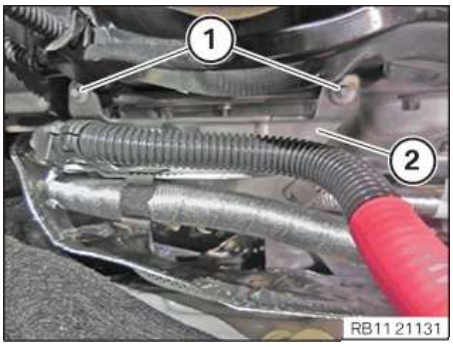


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

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- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

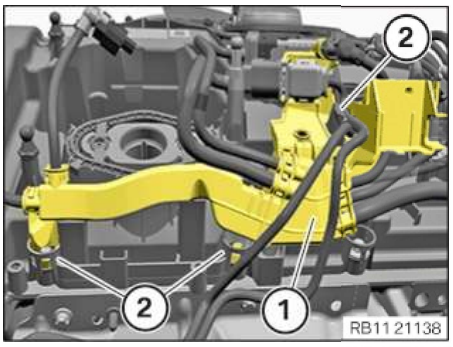
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

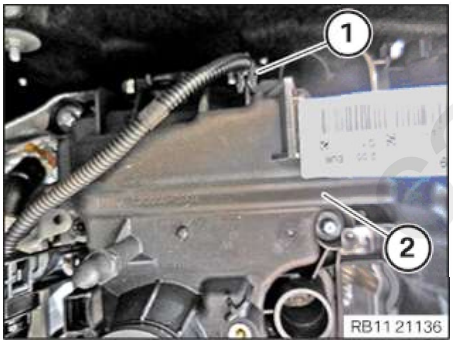
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

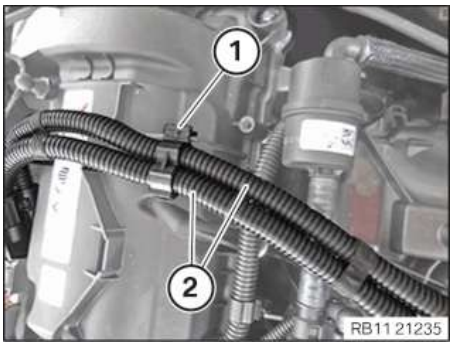
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.



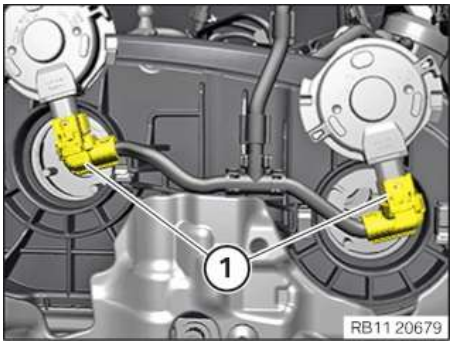
- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

76 – Installing both actuators

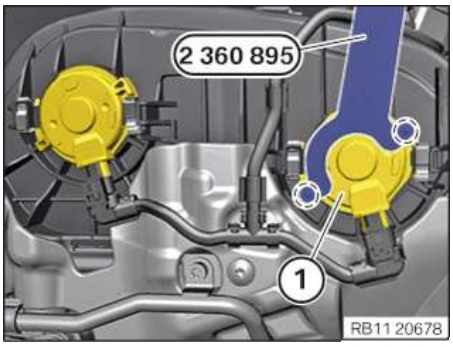
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NOTICE

The figure shows the rear side of the engine.

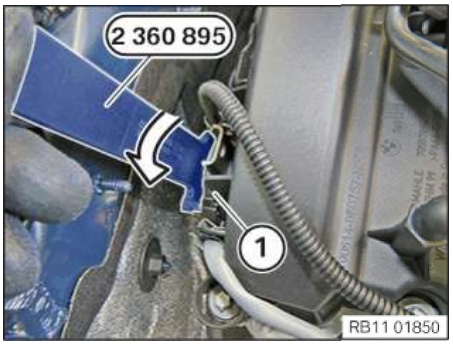
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



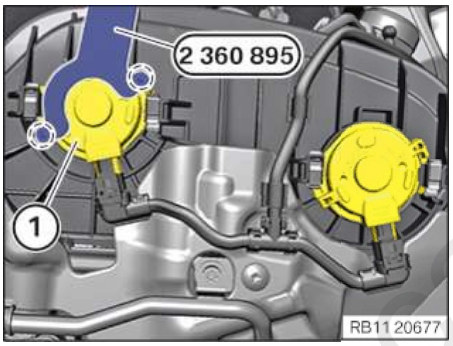
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



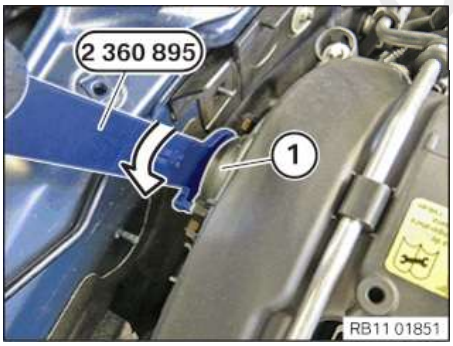
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

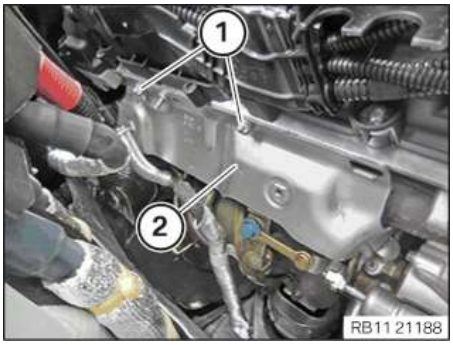
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

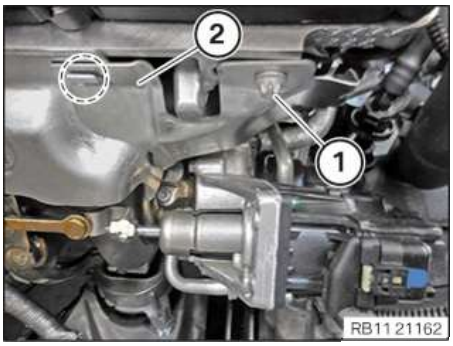
77 – Installing the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

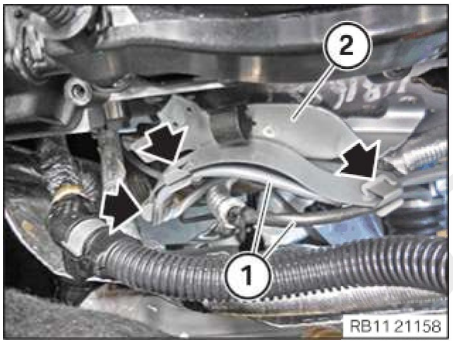


- Tighten down screw (1).

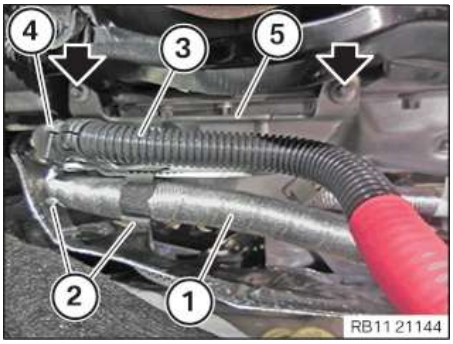
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

78 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

79 – Prepare the injectors for installation

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RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

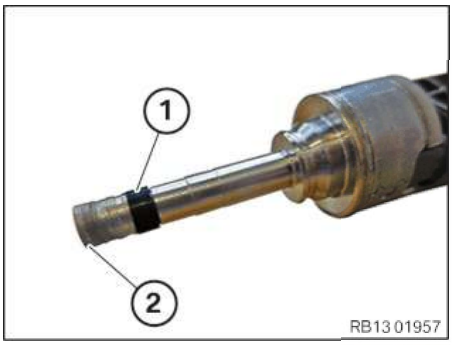
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

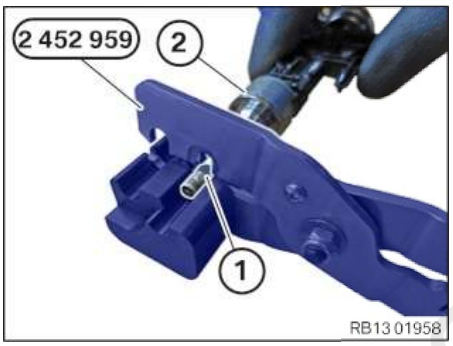
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

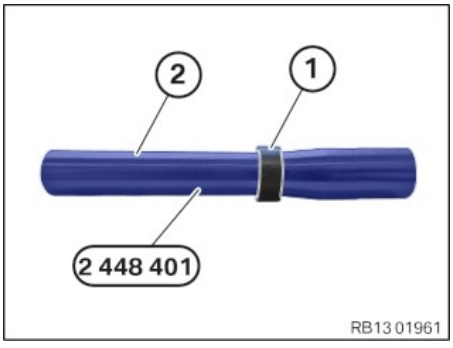


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

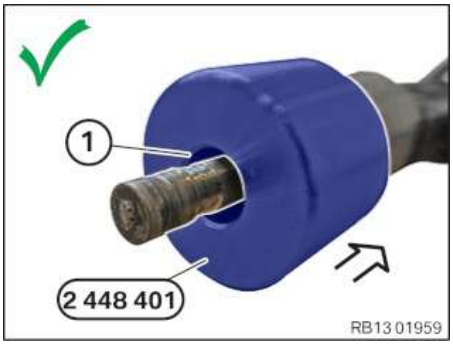
  (2) Sliding sleeve

  (3) Assembly sleeve



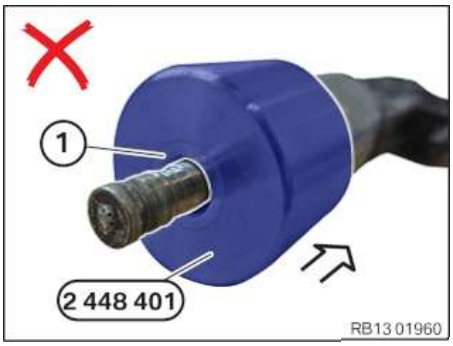
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.

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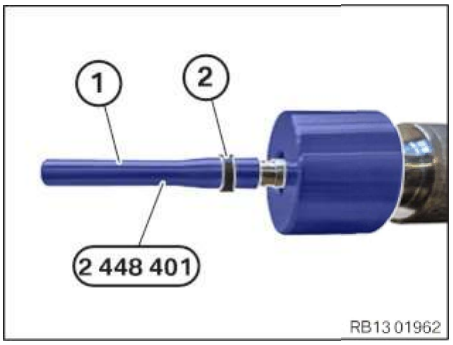
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

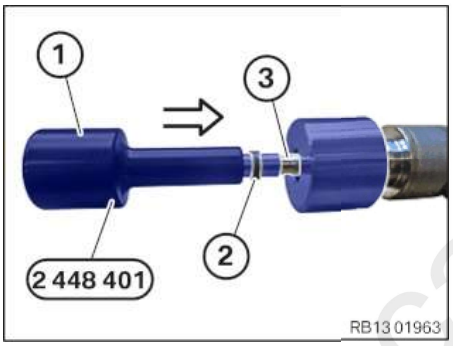


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

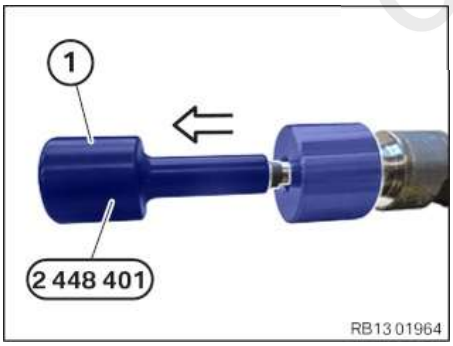
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



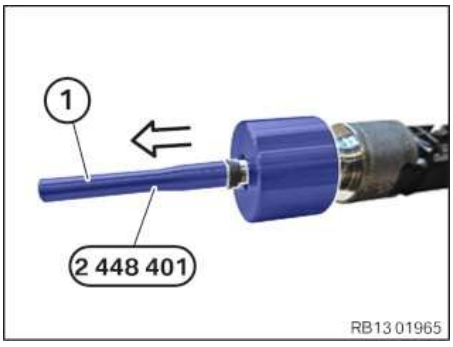
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

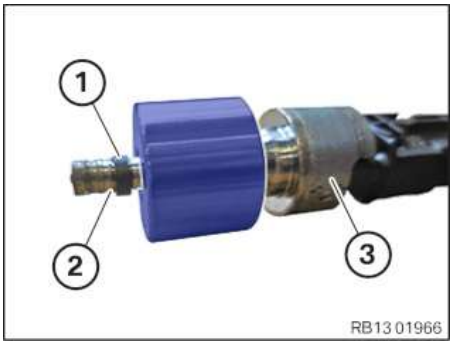


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

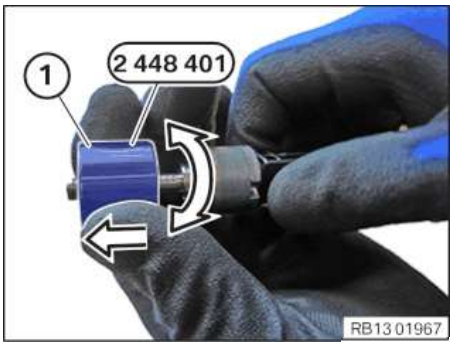


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

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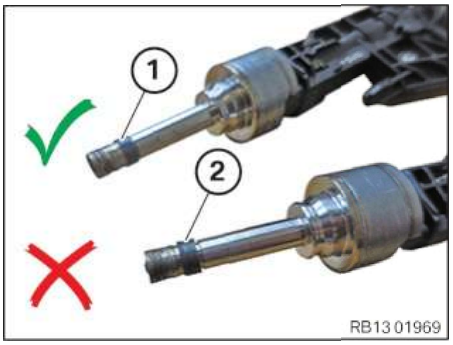


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

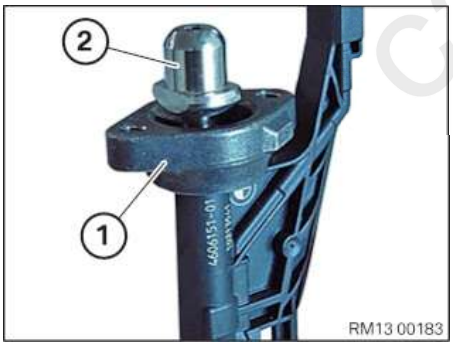


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

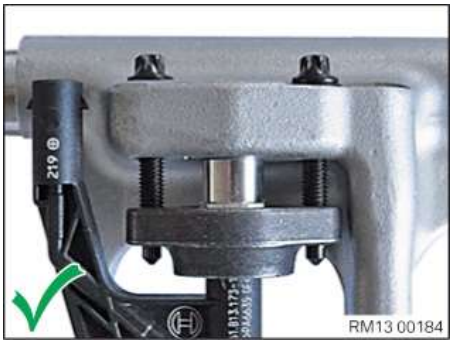
80 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



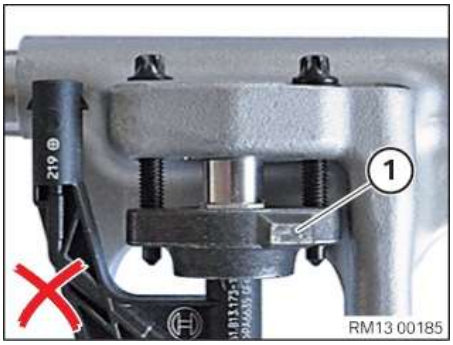
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

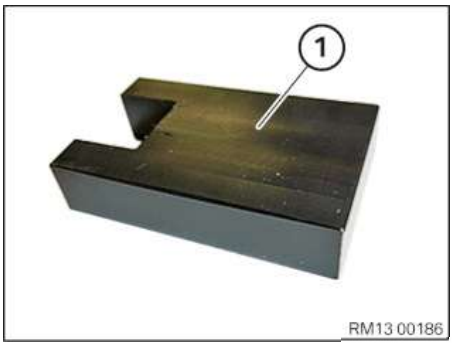
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



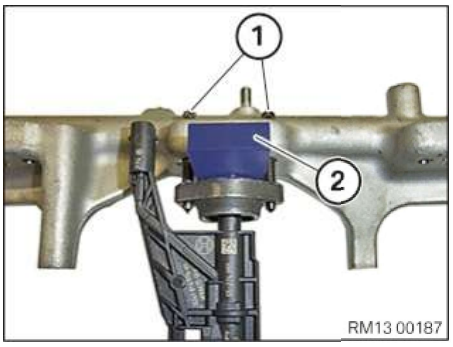
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



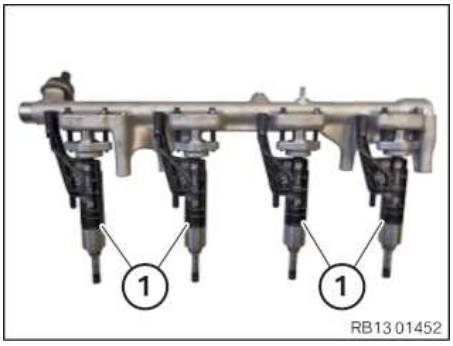
- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



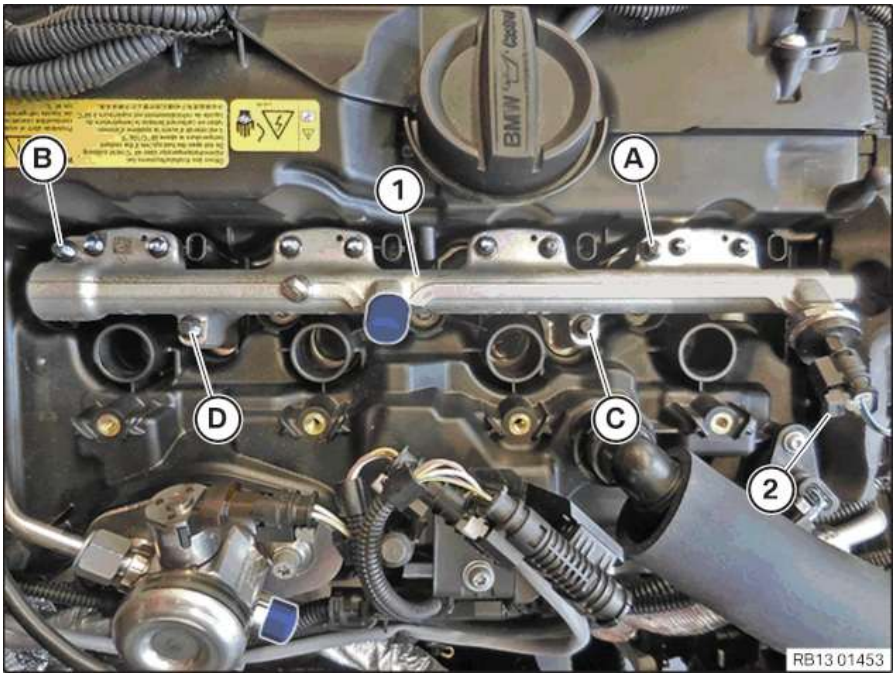
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

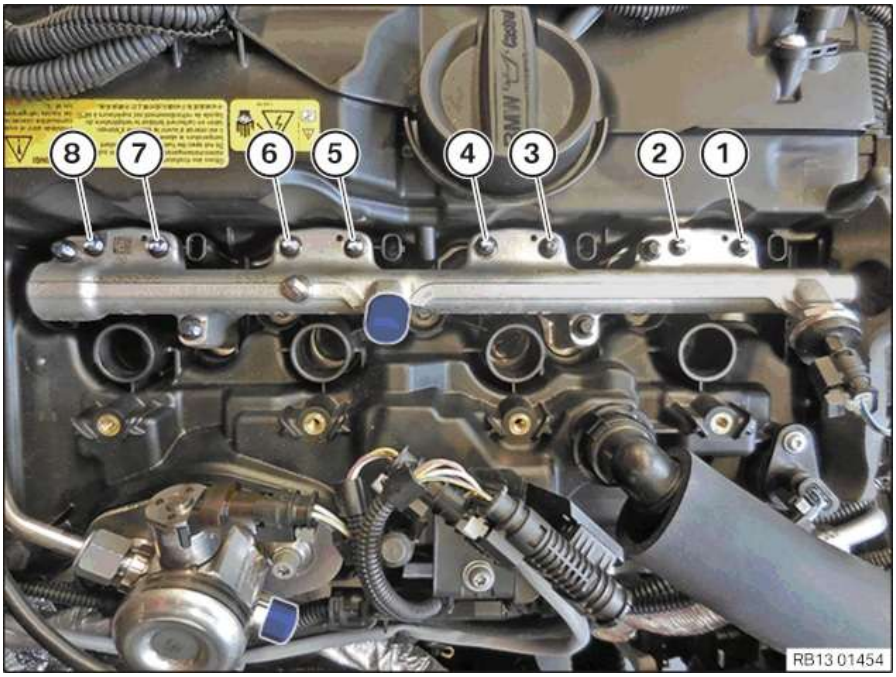
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

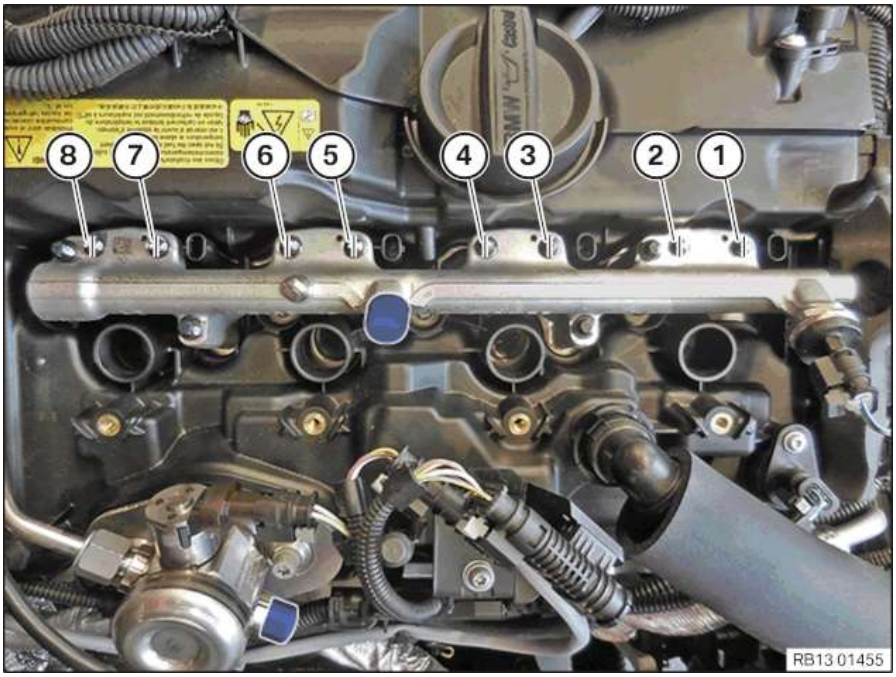
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

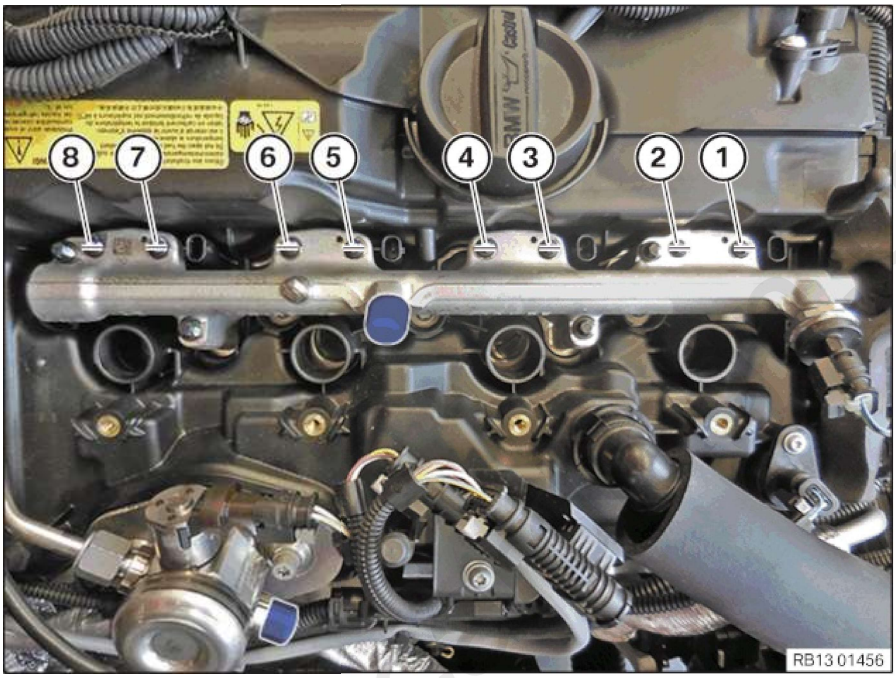
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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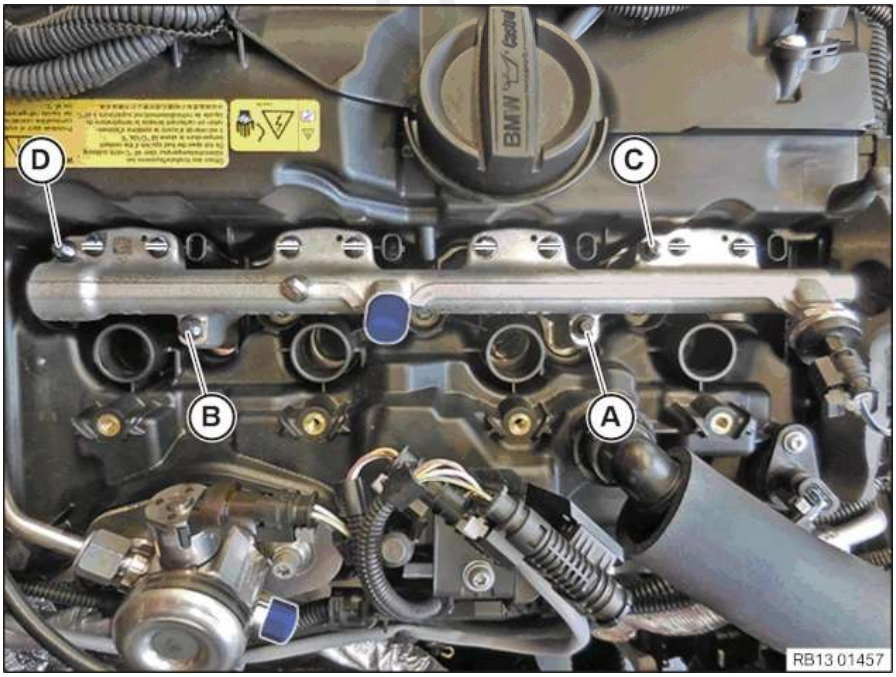


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

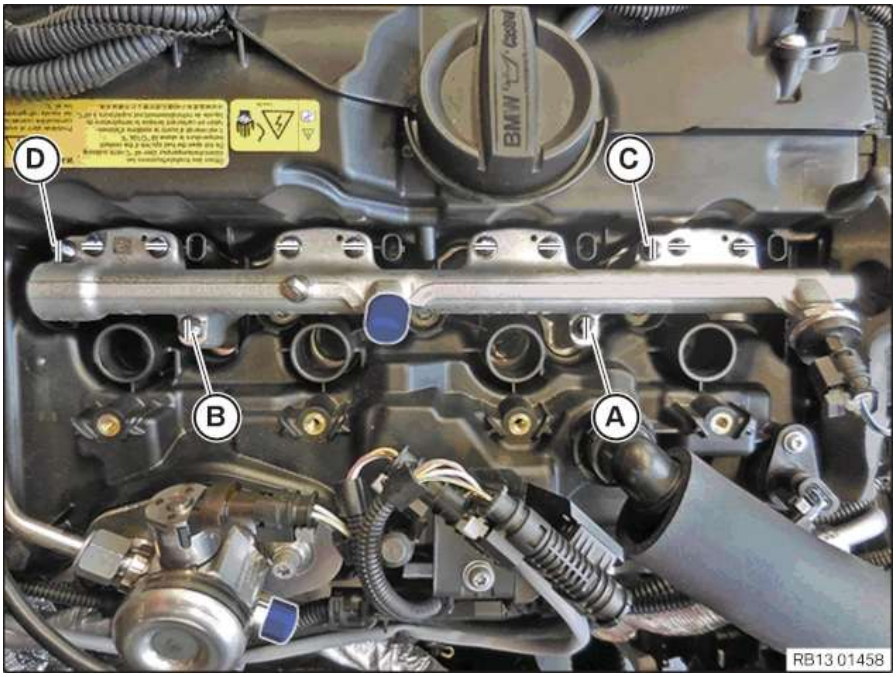
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

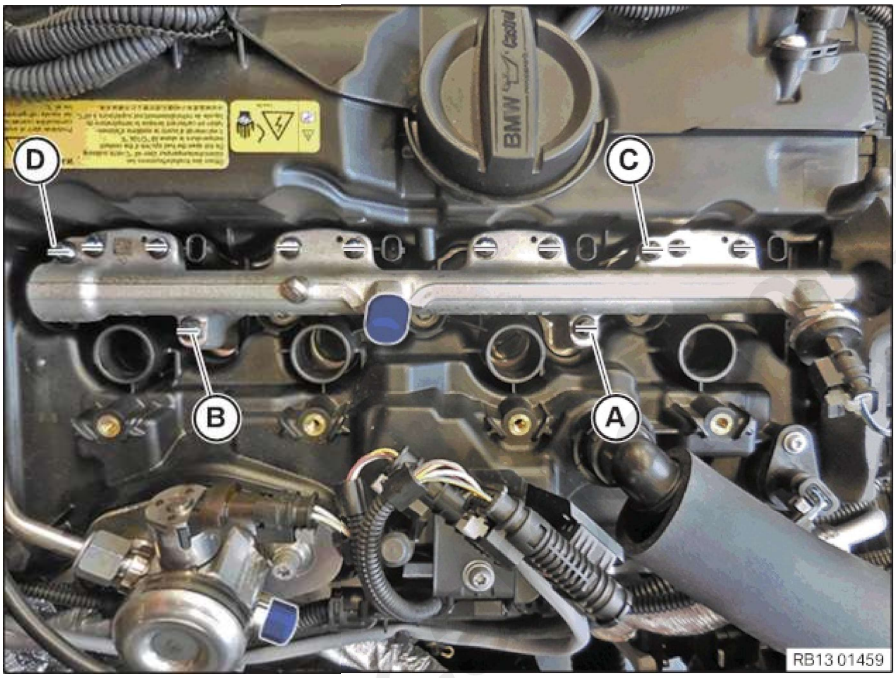
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

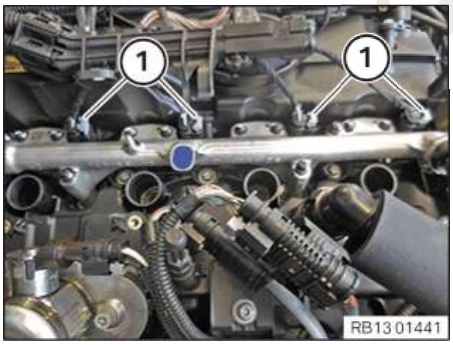


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



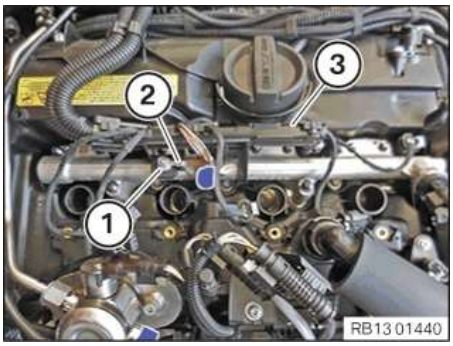
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

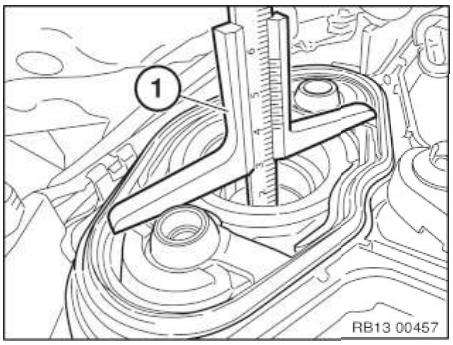
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

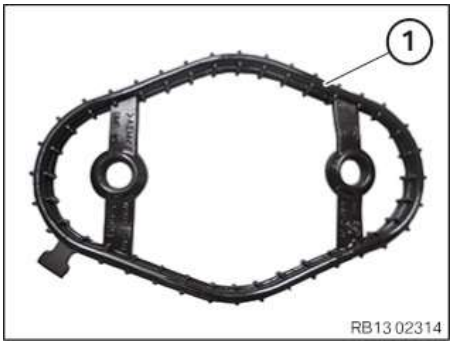
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

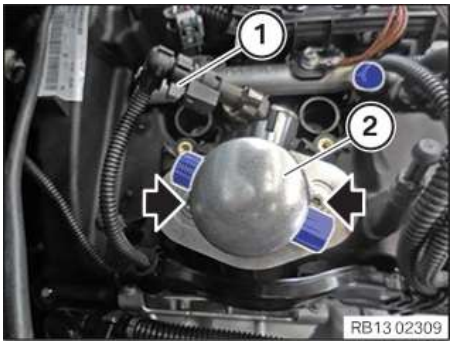
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

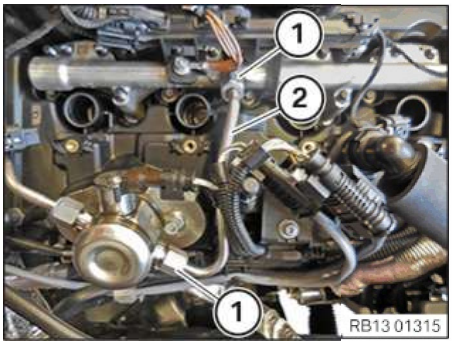
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

82 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

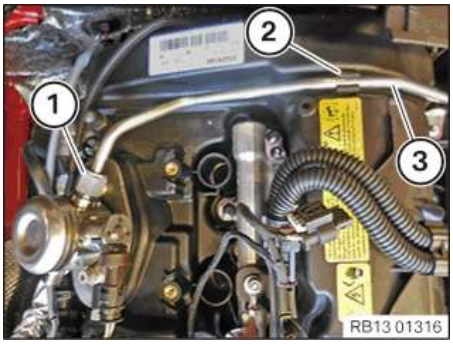
83 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

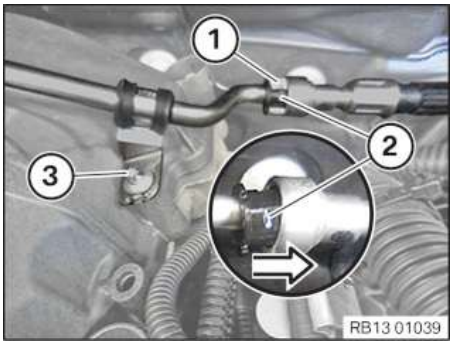


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

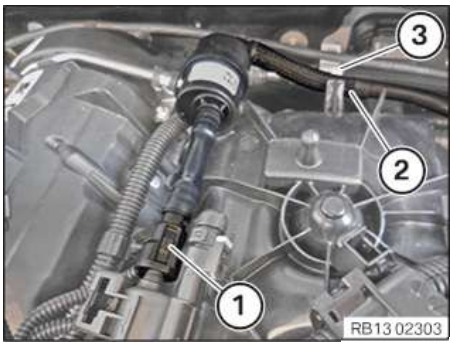
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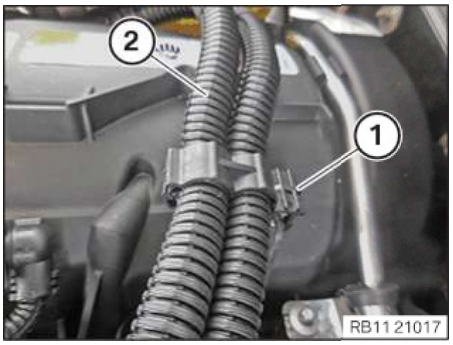
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

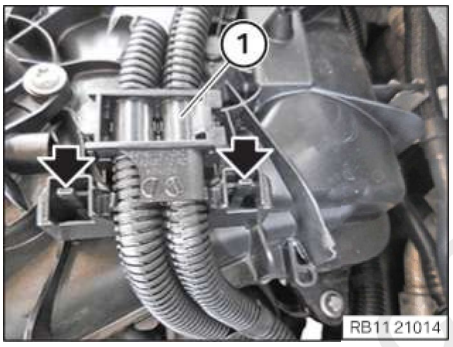
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

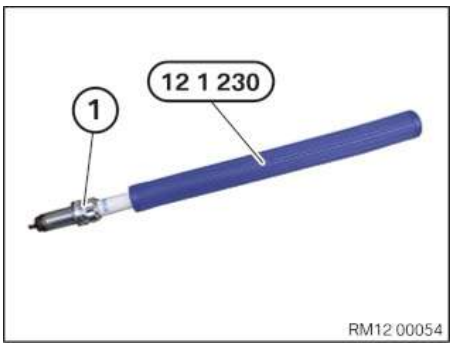


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

84 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

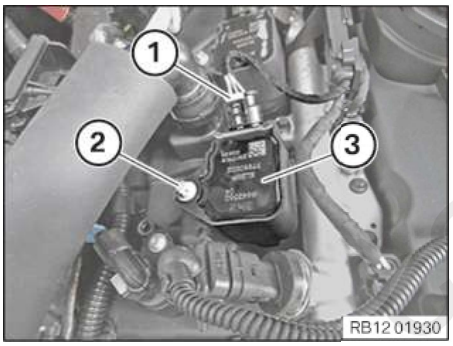
M12x1.25		Tightening torque	23 Nm

85 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



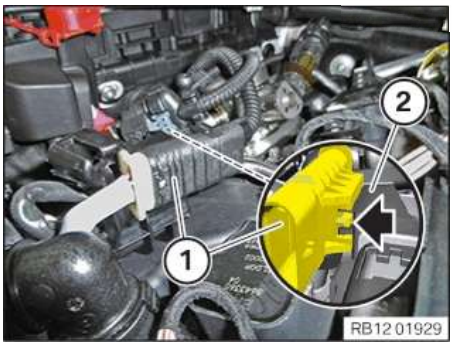
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

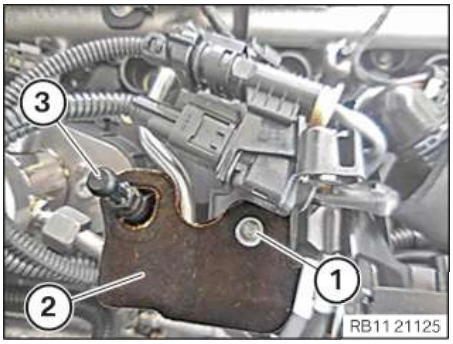
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

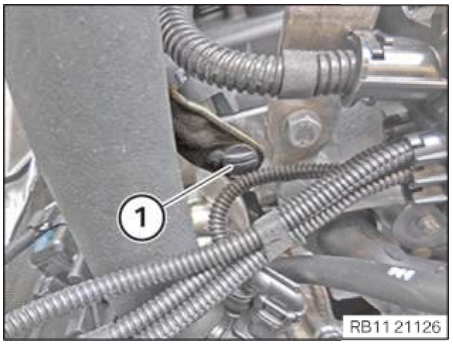
86 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

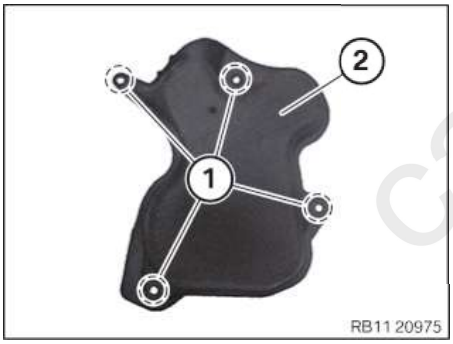
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



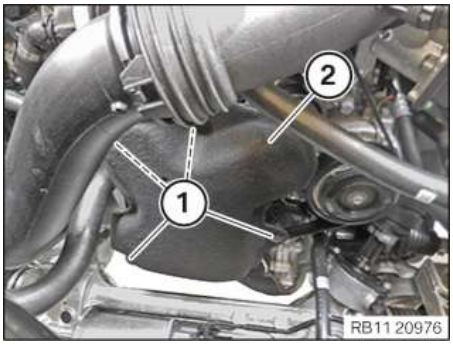
- Secure the clip (1).

87 – Install the acoustic cover for the engine at the front



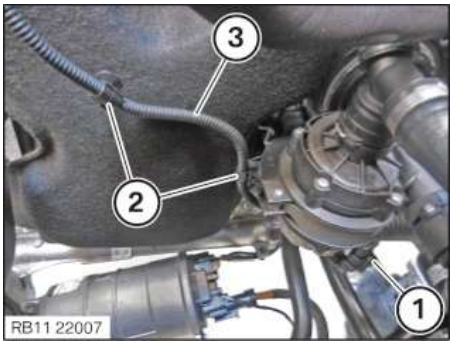
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



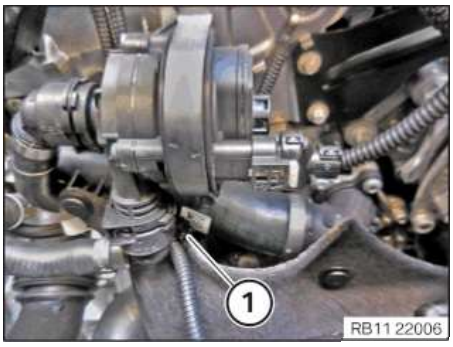
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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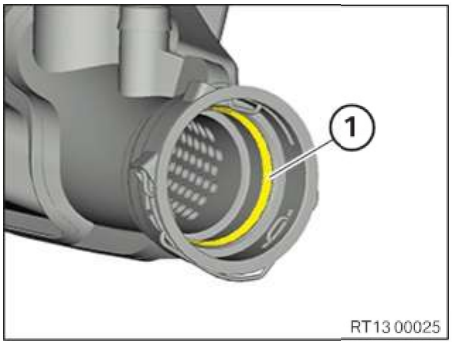
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

88 – Installing the clean air pipe with resonator

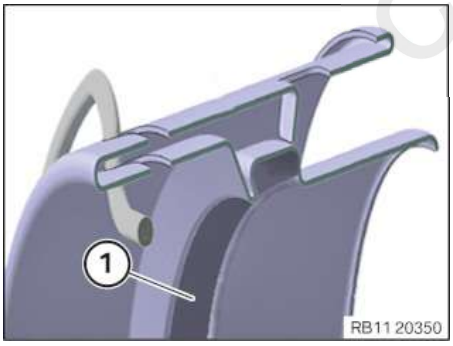


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

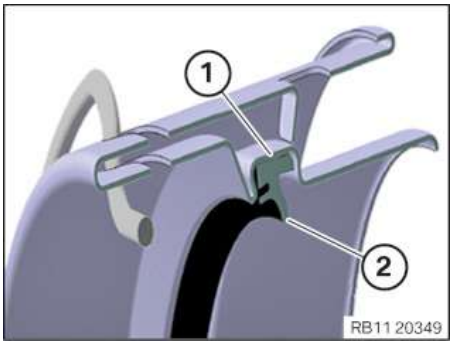
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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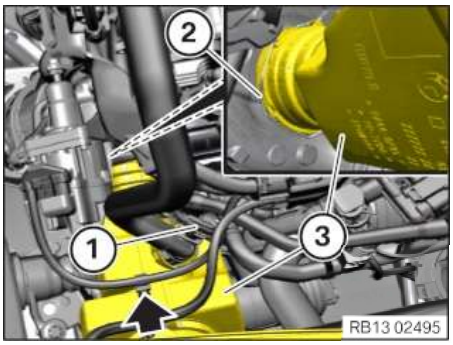
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

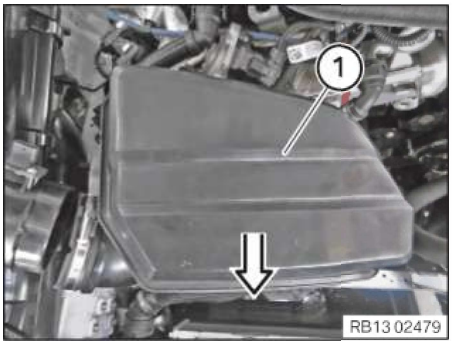
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



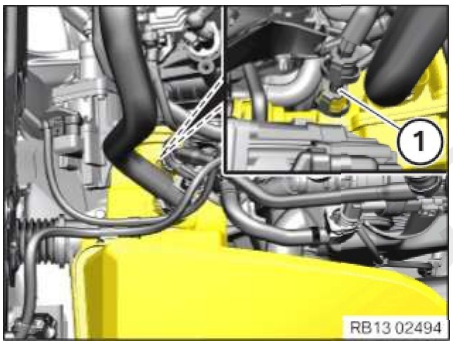
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

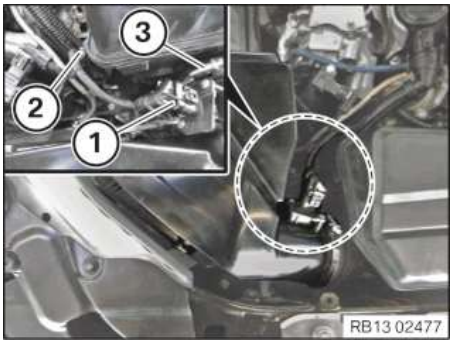
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

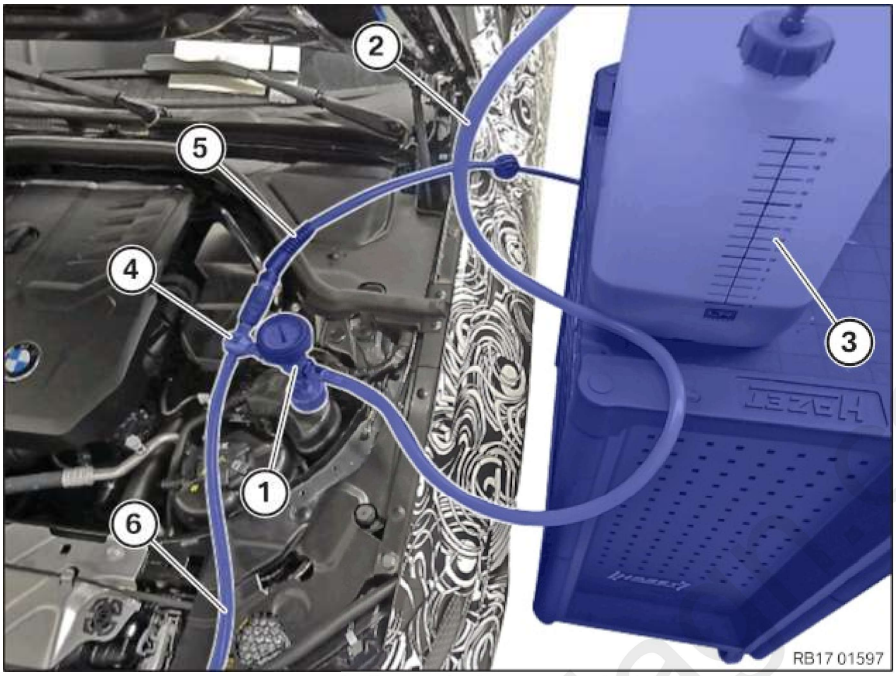
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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

89 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

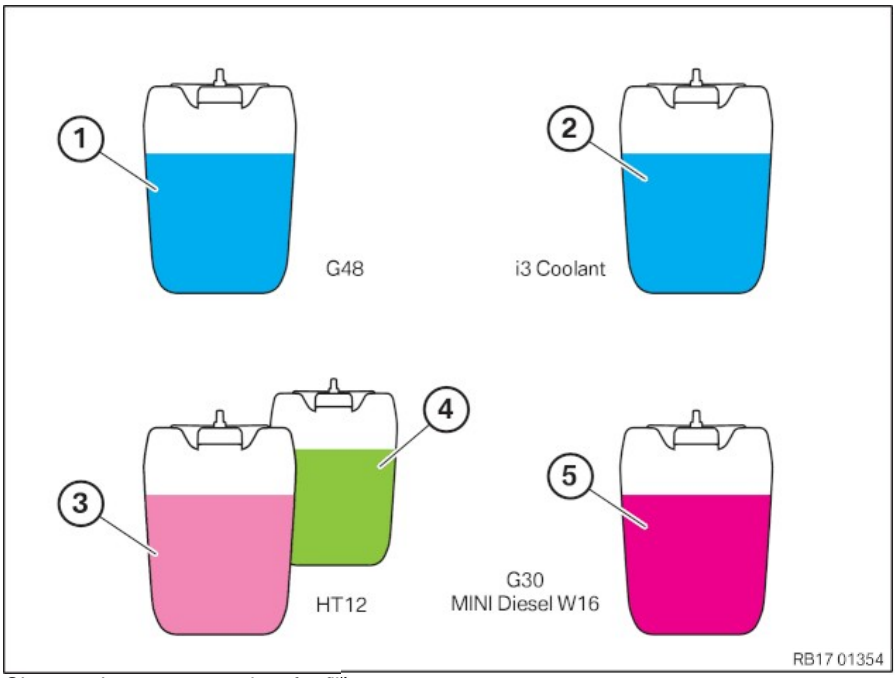
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

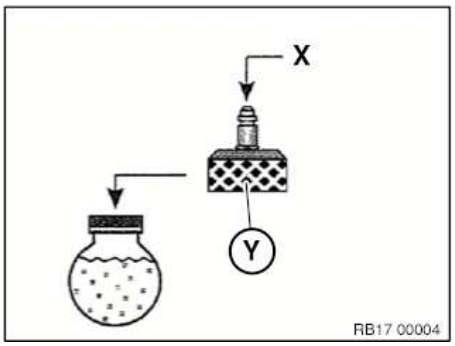
- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

Capacity of low-temperature coolant circuit G20

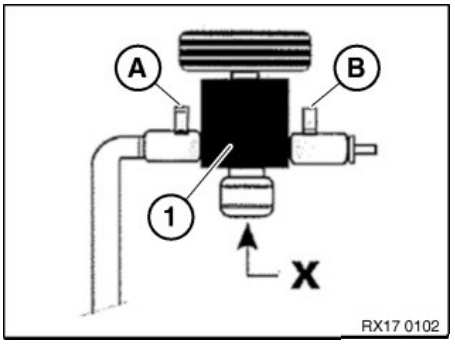
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

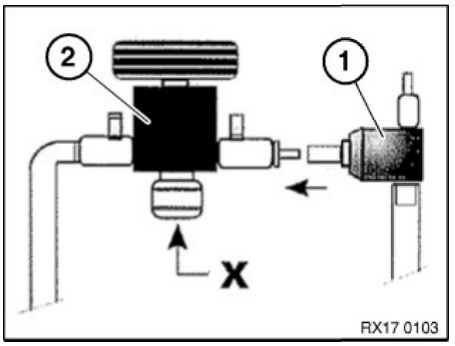
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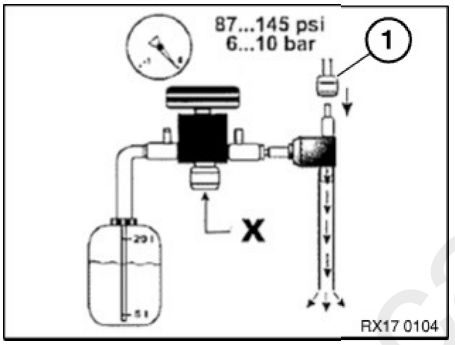
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



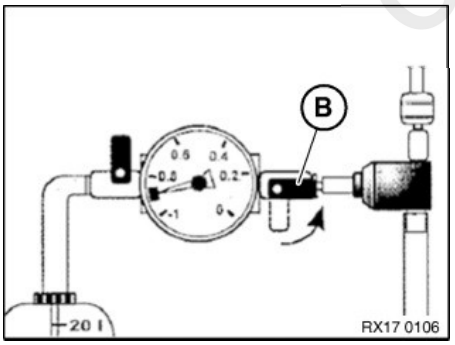
- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



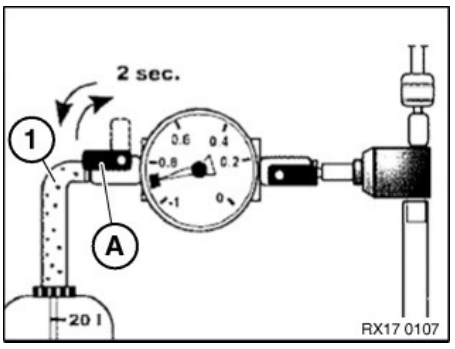
- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.



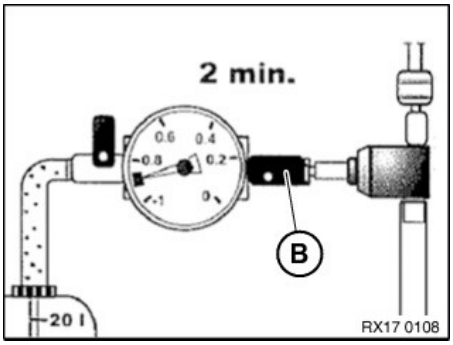
- Open shut-off valve (B).
  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

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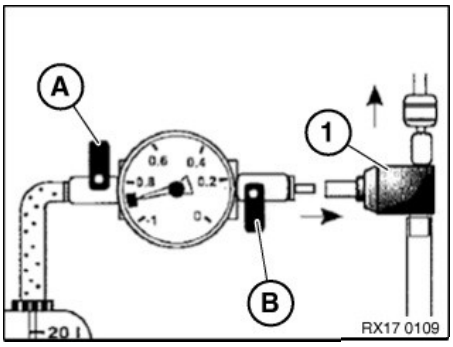


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

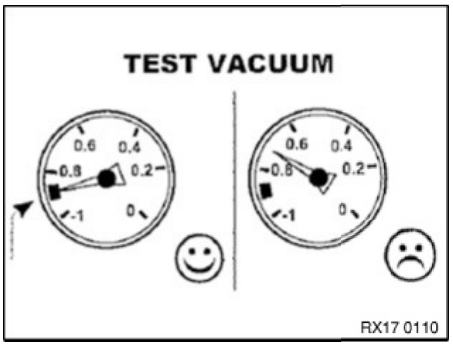
- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.



Result

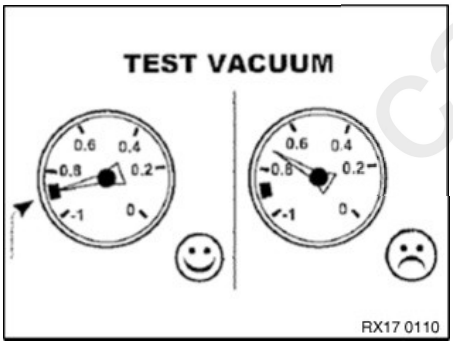
» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

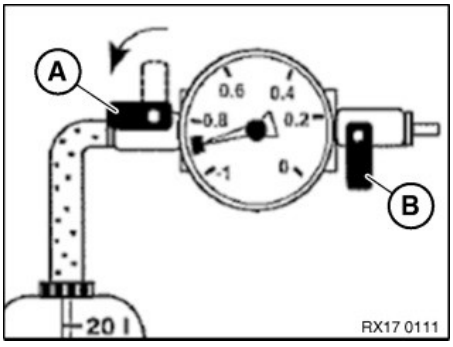


Result

» Vacuum remains constant.

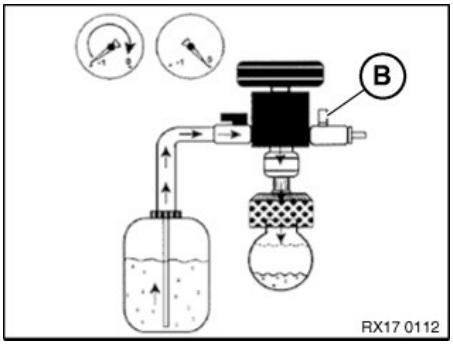
Measure

- Continue with filling.

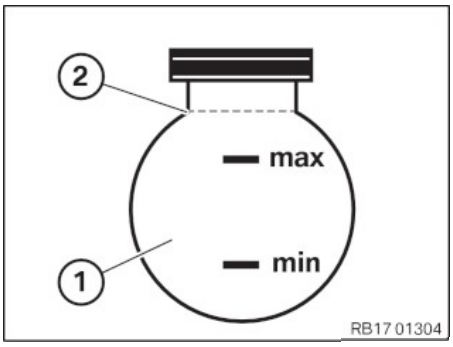


- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.

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- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

90 – Disconnecting all battery earth leads



- See additional information.

91 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

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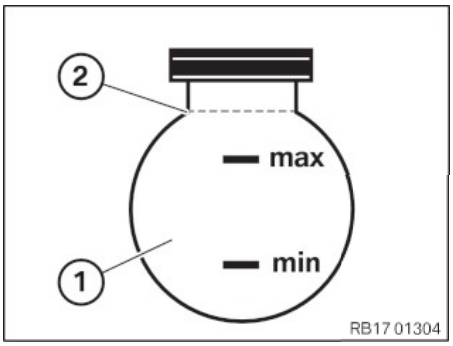
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

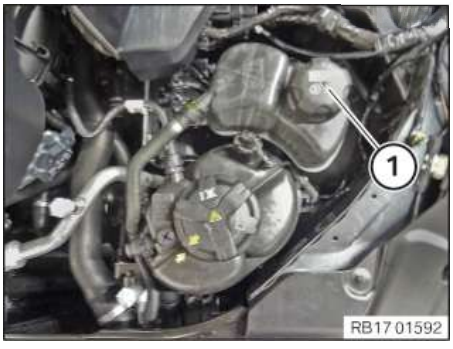
  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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TECHNICAL INFORMATION

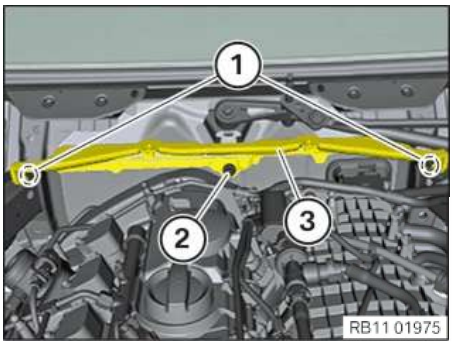
After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

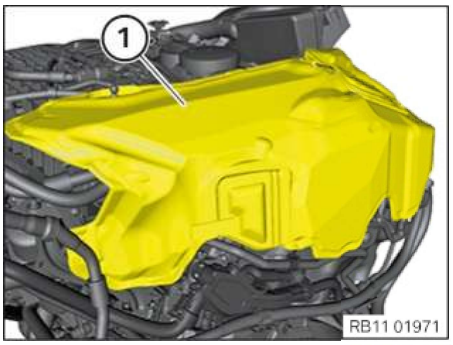
- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

92 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

93 – Installing acoustic cover at rear

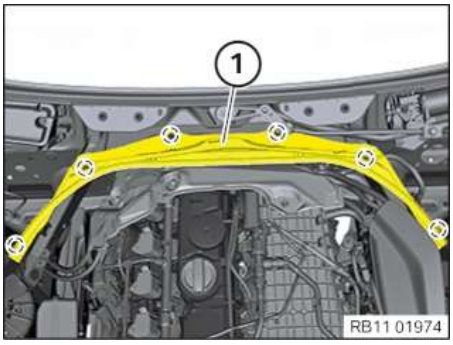


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

94 – Installing the centre bulkhead upper part

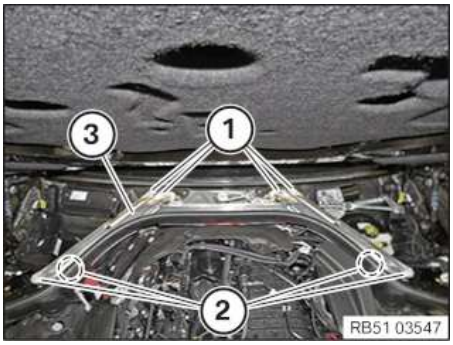


- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

	Tightening torque	3 Nm

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- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

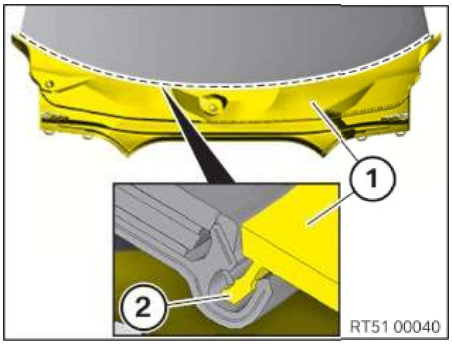
95 – Installing cowl panel cover

RISK OF DAMAGE

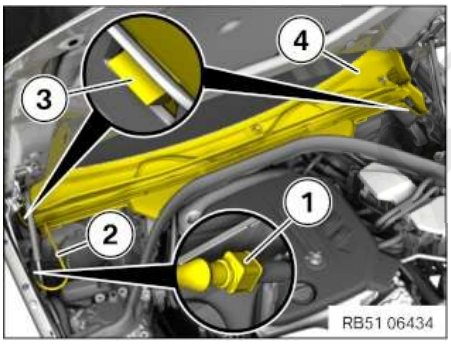
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

96 – Installing both wiper arms

NOTICE

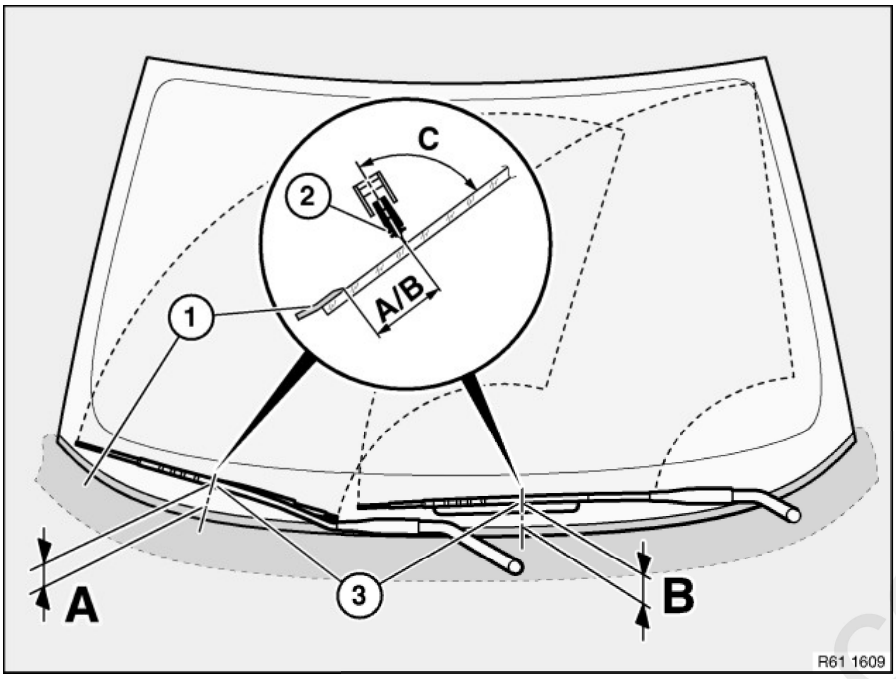
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

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TECHNICAL INFORMATION

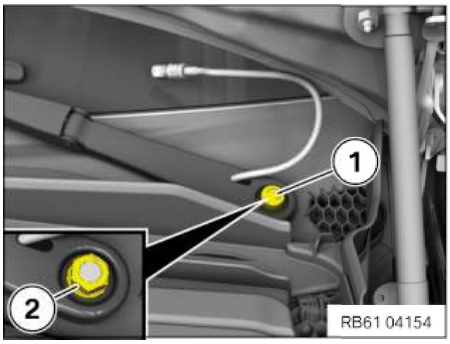
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

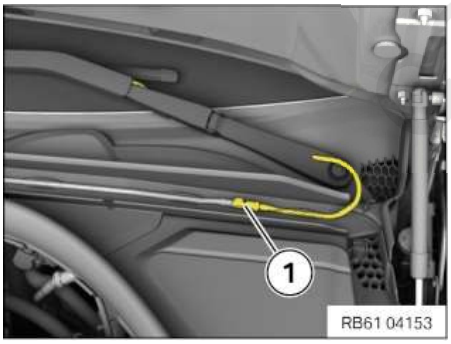


- Tighten nut (2).

Windscreen wiper arm

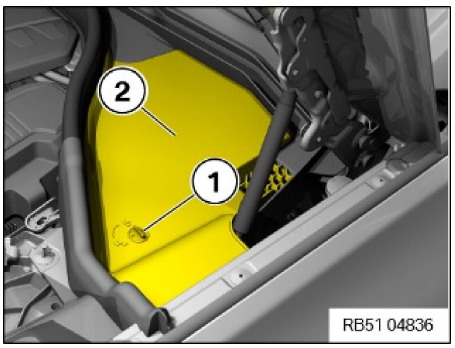
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

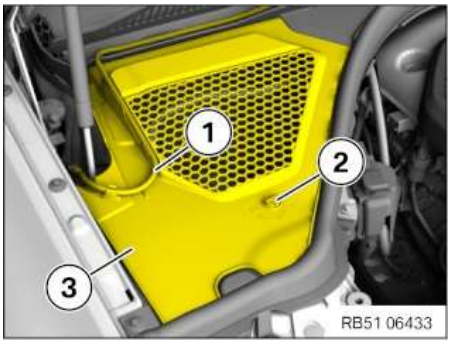
97 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

98 – Install the rear right engine compartment cover

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- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

99 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

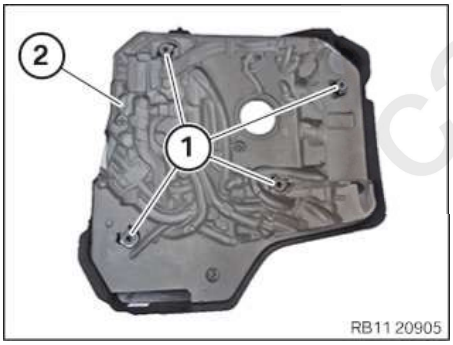
100 – Install acoustic cover

RISK OF DAMAGE

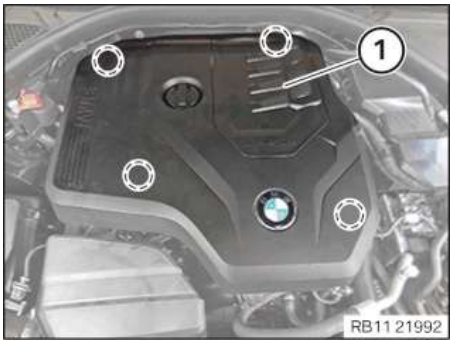
Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

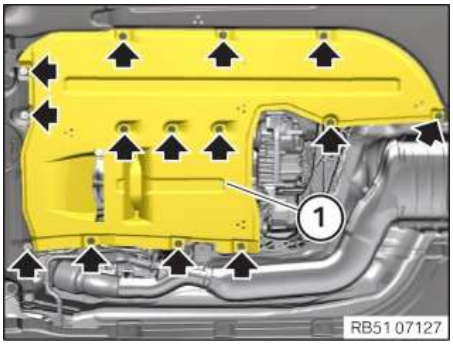


- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

101 – Installing underbody protection at rear

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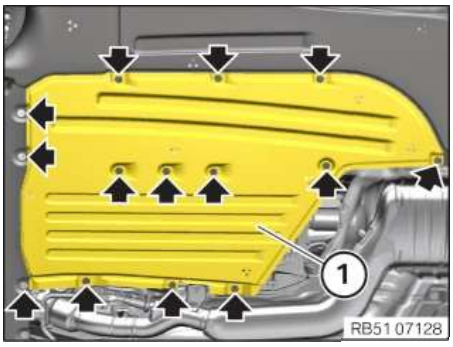
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

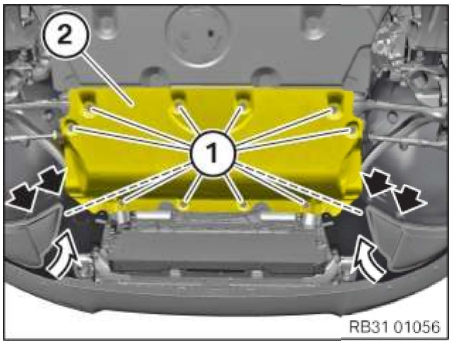
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

102 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

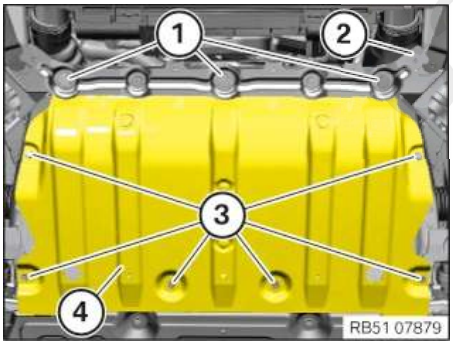
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

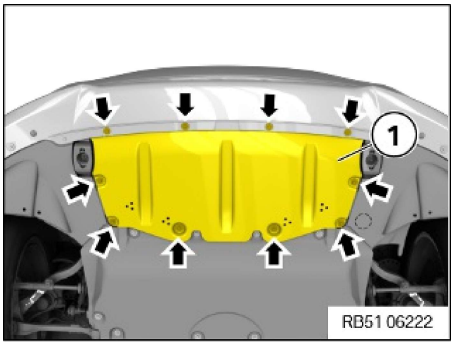
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

103 – Installing the front underbody protection



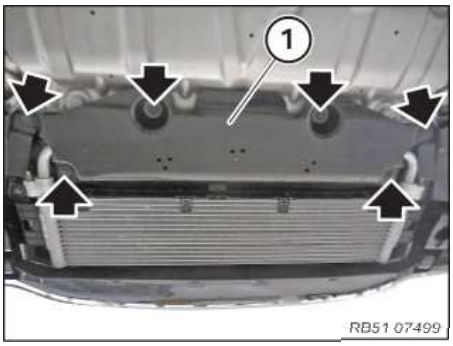
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



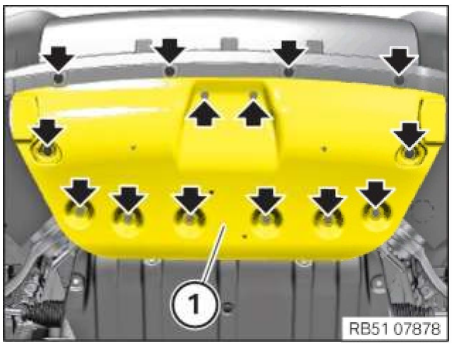
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

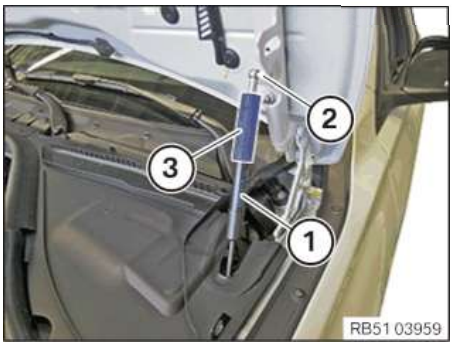
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

104 – Check engine oil level

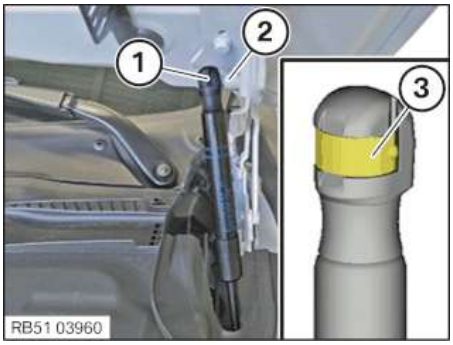
- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

105 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 29

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head — Used in step 405565

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 405565

M6		Tightening torque	8 Nm

Intake camshaft to cylinder head — Used in step 53

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Exhaust camshaft to cylinder head — Used in step 54

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

VANOS central valve to camshaft — Used in step 6162

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 64

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Gate to bearing bracket — Used in step 68

M8			20 Nm

Intake plenum to cylinder head — Used in step 70

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 70

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 70

M6X25		Tightening torque	8 Nm

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Tank ventilation line to intake plenum			Used in step 70
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body			Used in step 70
M6		Tightening torque	8 Nm

Control unit holder on spring strut dome			Used in step 72
Hexagon screw		Tightening torque	8 Nm

Cylinder head cover to cylinder head			Used in step 75
M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover			Used in step 75
M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover			Used in step 7578
6X18		Tightening torque	6 Nm

Heat shield to cylinder head			Used in step 77
M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip			Used in step 77
M6 x 12		Tightening torque	8 Nm

Ground cable to rail			Used in step 80
M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange			Used in step 81
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail			Used in step 82
M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump			Used in step 83
M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover			Used in step 83
M6 screw		Tightening torque	6,5 Nm

Spark plugs			Used in step 84
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 85
Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover			Used in step 86
TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 88
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 94
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 94
M10x25 screw		Tightening torque	56 Nm

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Tension strut to spring strut dome — Used in step 94

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 96

Combination hexagon nut		Tightening torque	35 Nm

Underbody protection — Used in step 101

Hexagon screw		Tightening torque	3 Nm

Underbody protection of the steering gear — Used in step 102

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 102

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 102

M10		Tightening torque	56 Nm

Underbody protection front — Used in step 103

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

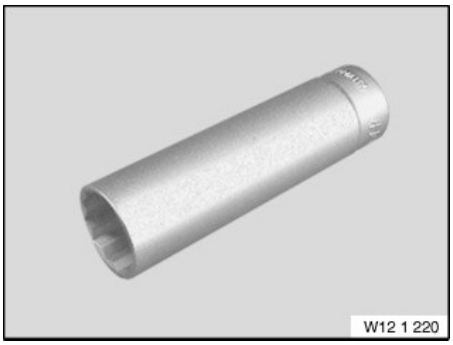
2 360 895 Pin wrench



Common — Used in step 1276

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 560 (12 1 220) Socket

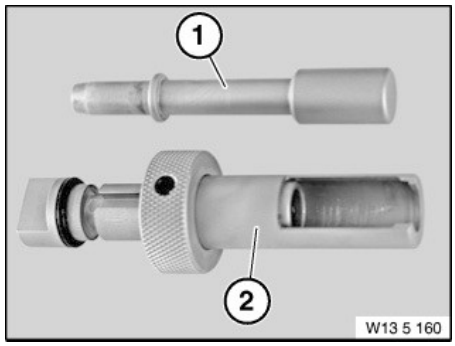


Common — Used in step 1684

Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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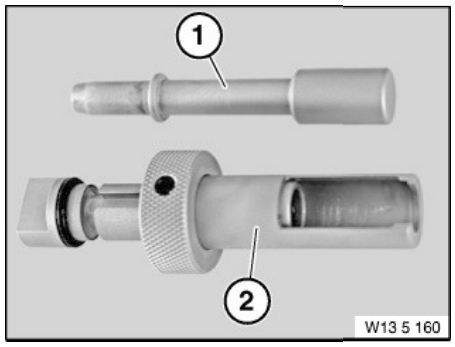
0 496 567 (13 5 161) Fastener



Common Used in step 19

Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

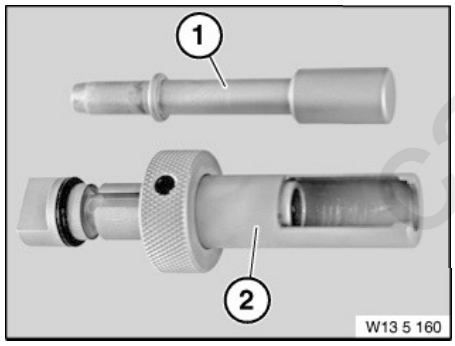
0 496 568 (13 5 162) Fastener



Common Used in step 19

Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener



Common Used in step 19

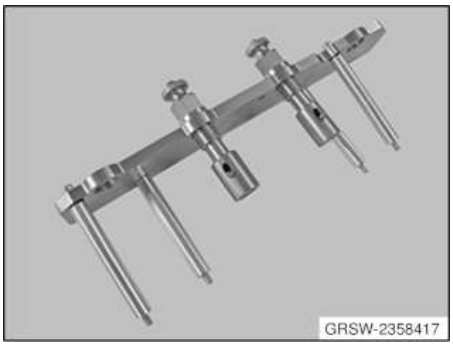
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

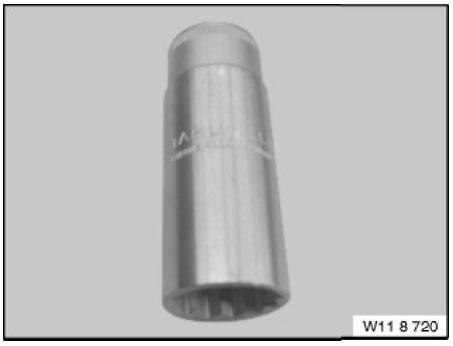
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2 358 417 Device



Common	Used in step 20
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

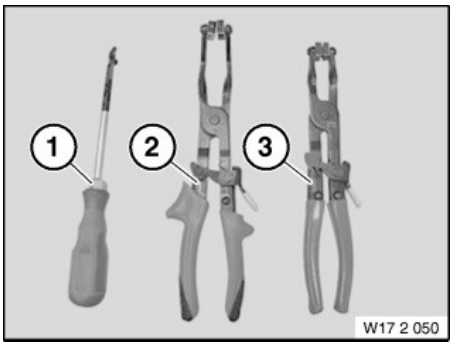
0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 20
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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0 495 794 (17 2 050) Pliers



Common Used in step 3470

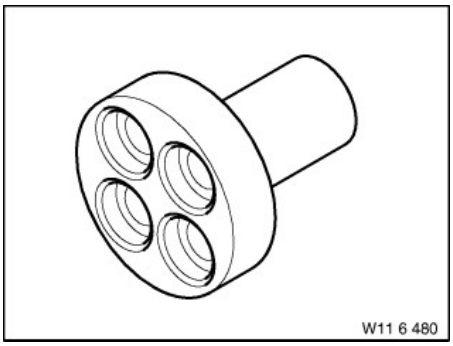
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 493 380 (11 6 480) Connector



Common Used in step 3640636581

Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

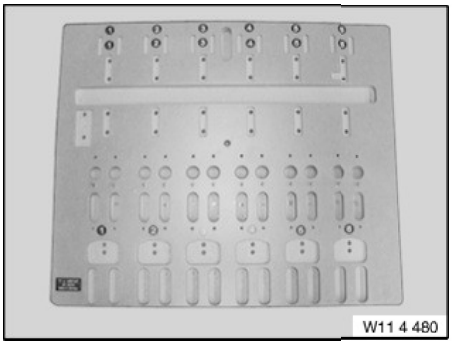
2 359 088 Device



Common Used in step 3769

Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 105 (11 4 480) oddments tray



Common Used in step 373839495051

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

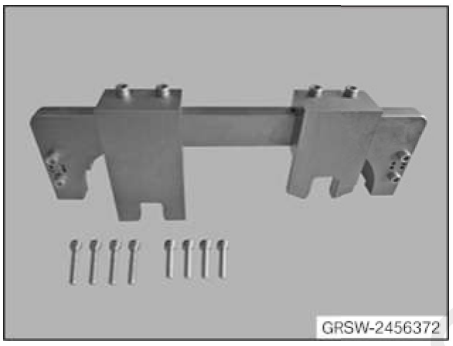
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2 288 380 Locating stud



Common	Used in step 406365
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 4048556365
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 404865
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



Common	Used in step 42436162
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 42436162
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

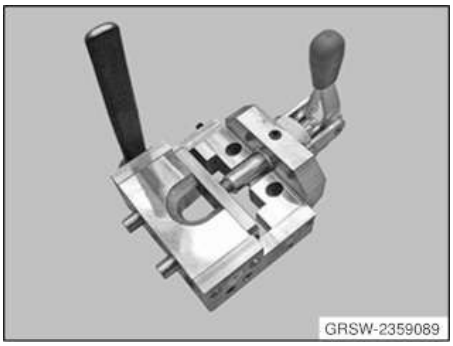
2 455 654 Tensioning tool



Common	Used in step 6063
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

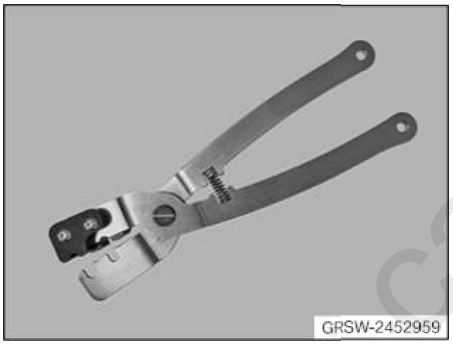
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2 359 089 Device



Common	Used in step 68
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

2 452 959 Pliers



Common	Used in step 79
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 79
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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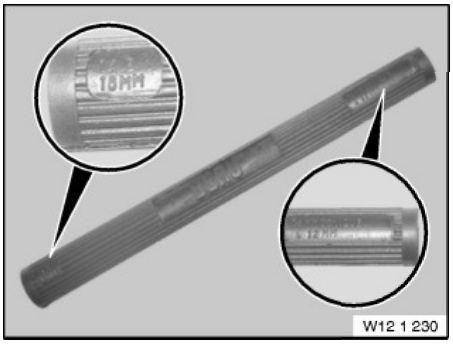
2 358 022 Gauge



Common Used in step 80

Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



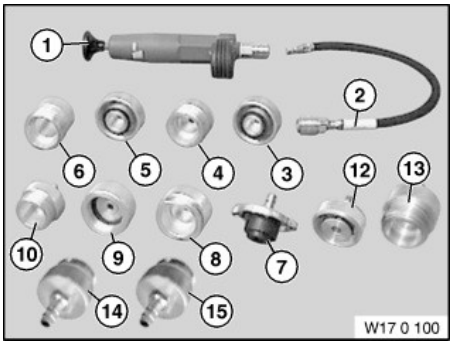
Common Used in step 84

Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 494 417 (17 0 100) Tester

Used in step 89

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Common

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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Overview Technical Data

Distance from window pane edge to wiper blade Used in step 96

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Capacity of low-temperature coolant circuit G20	Used in step 89
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

General repair instructions	**Used in step**
12 00 ... Instructions for removal and replacement of control units	3074

Repair instructions	**Used in step**
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	190
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	190
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
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61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 20 900 Disconnecting and connecting battery earth lead	190
61 35 ... Notes on ESD protection (Electro Static Discharge)	1233
61 35 ... Notes on ESD protection (Electro Static Discharge)	12152030313373
13 53 ... Clean the cylinder head around the injectors due to grit / dust	20
61 13 ... Unlocking and disconnecting different plug connections	202475
61 00 730 Encode/program control unit(s) (after vehicle test)	74
17 00 ... Notes for working on cooling system.	89

Operating materials	**Used in step**

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11 33 062 Replacing all hydraulic valve clearance compensating elements

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

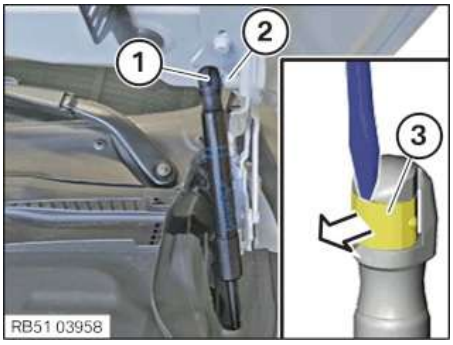
Engine compartment lid is open.

CAUTION

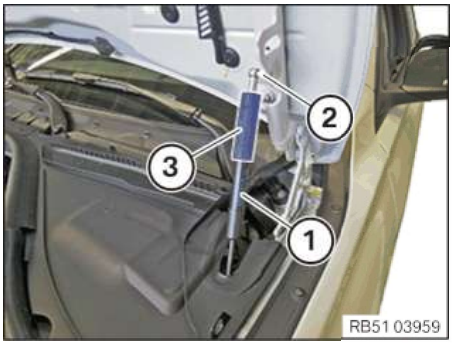
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

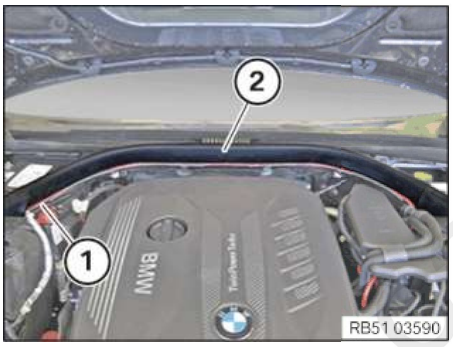


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

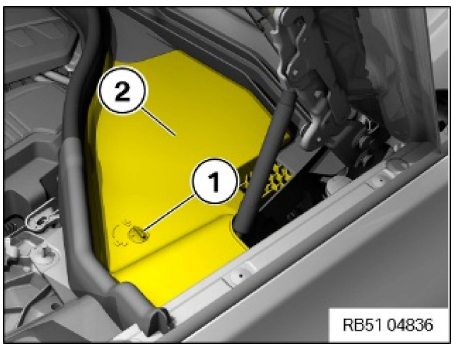
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

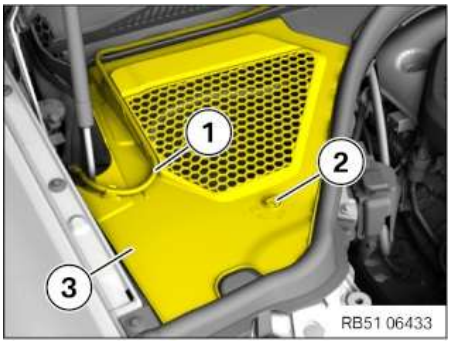
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

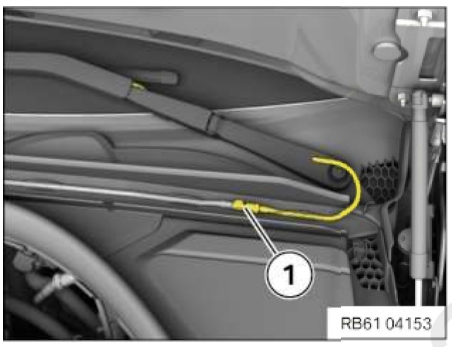
▶ **Remove the wiper arm**

RISK OF DAMAGE

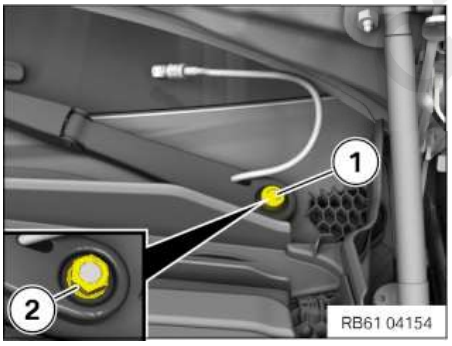
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

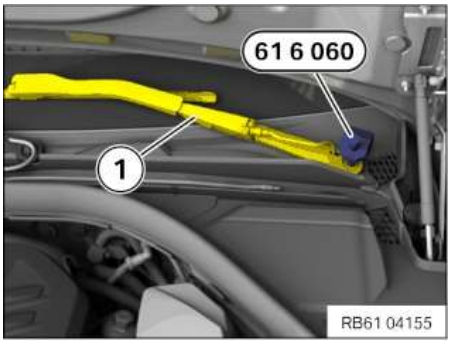
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



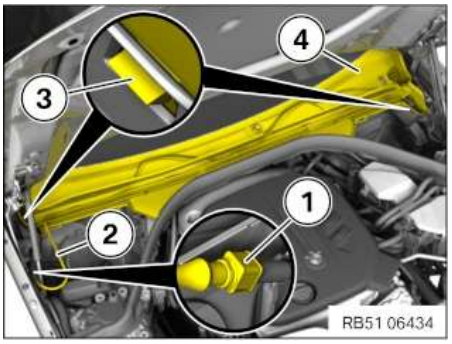
- Remove the protective cap (1).
- Loosen nut (2).



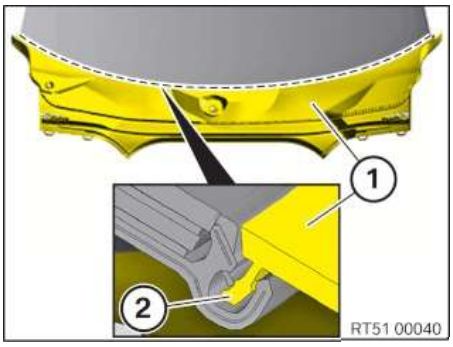
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

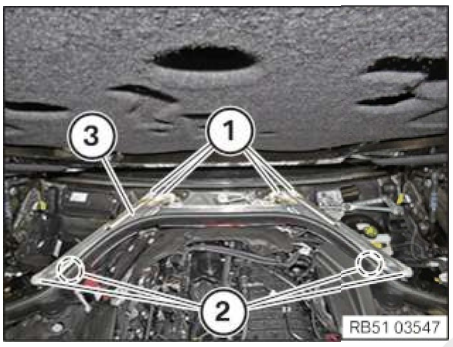


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

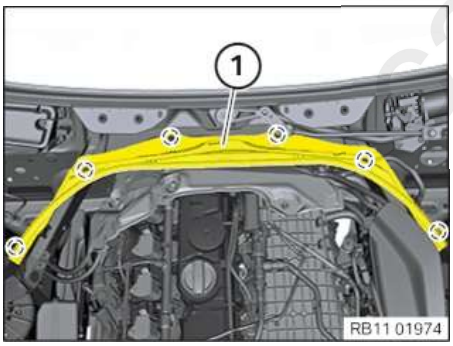
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

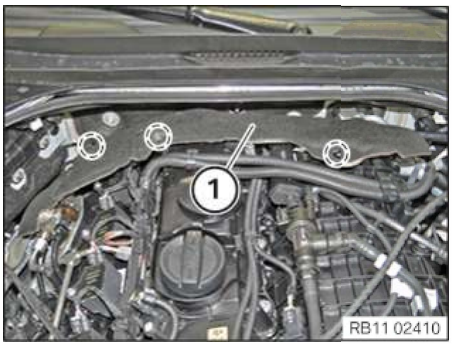
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



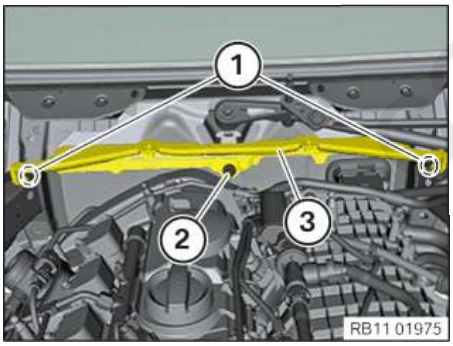
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

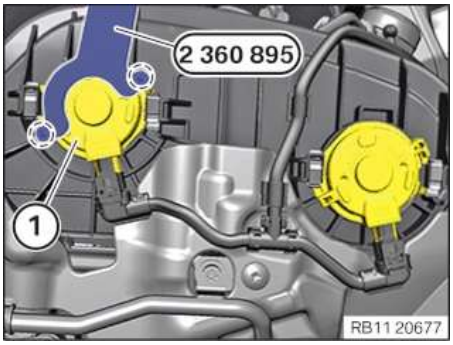
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

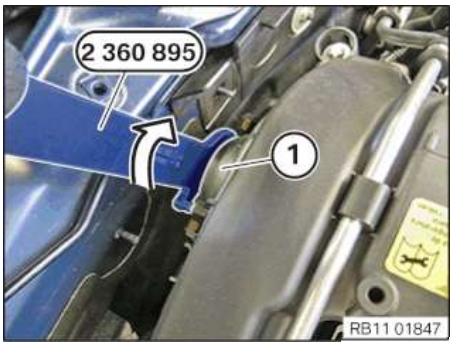
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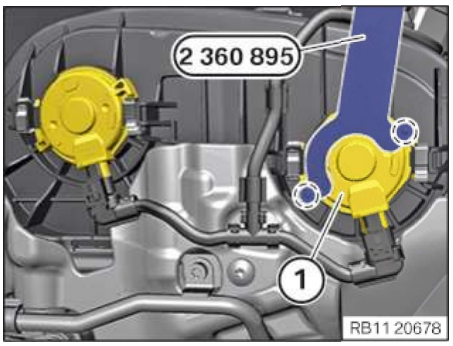
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



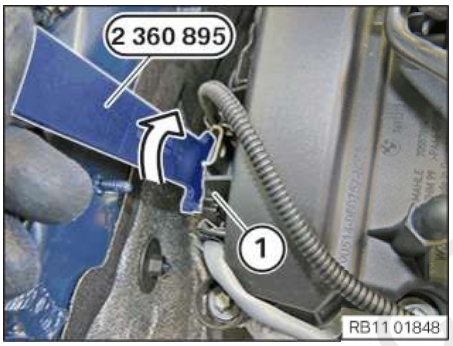
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



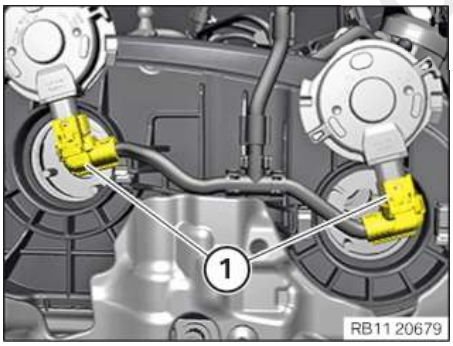
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

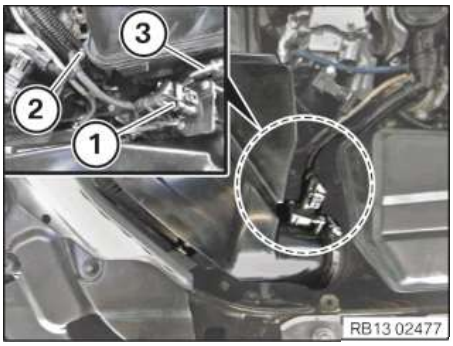
Risk of burning!

- Perform all work only on components that have cooled down.

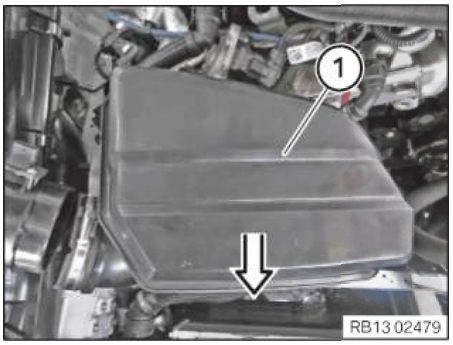
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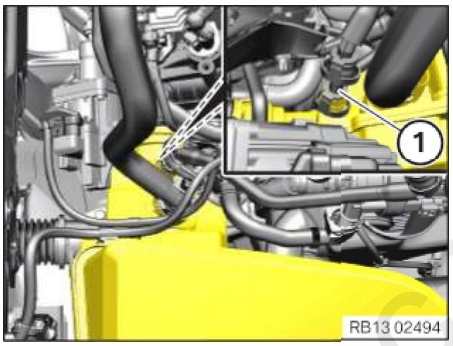
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



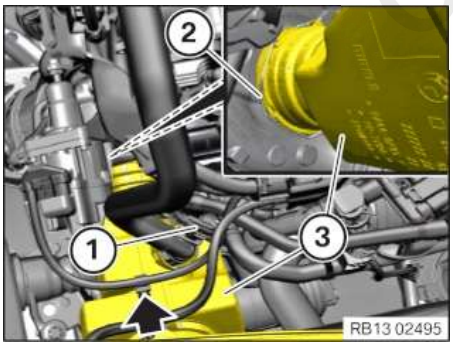
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



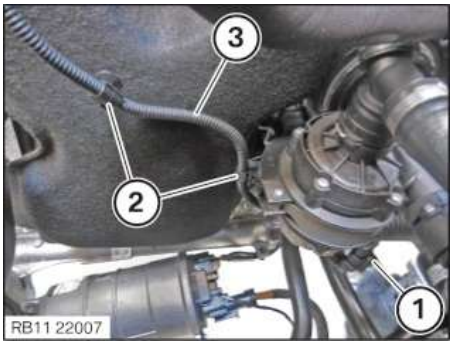
- Unlock and disconnect the tank ventilation line (1).



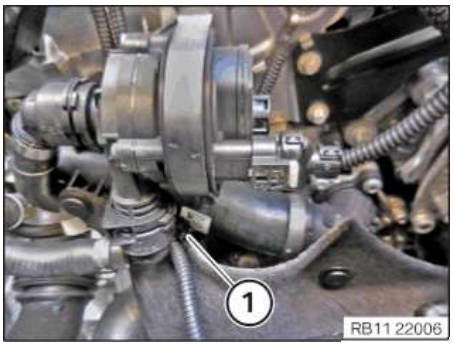
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

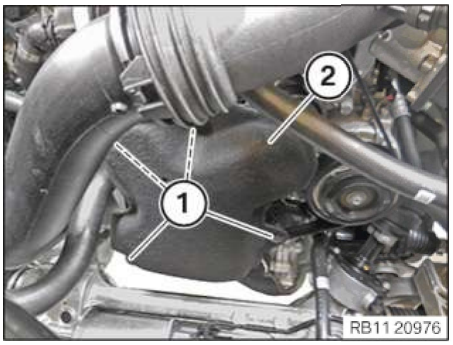
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

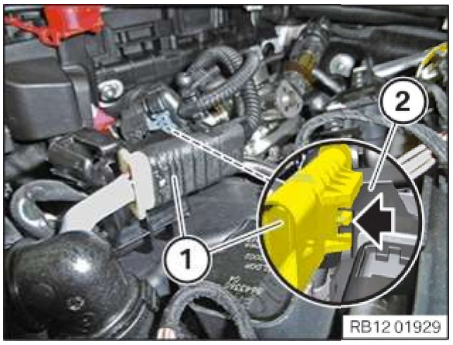
Electrostatic discharge.

Damage to or destruction of electrical components.

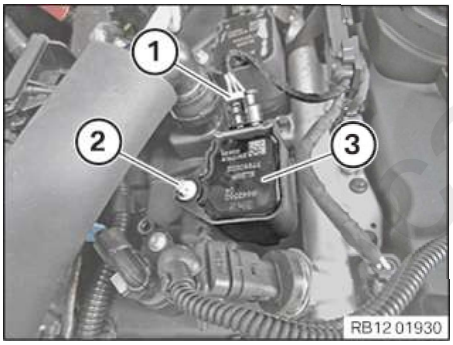
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

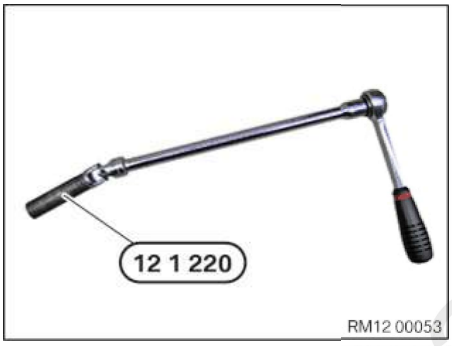
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

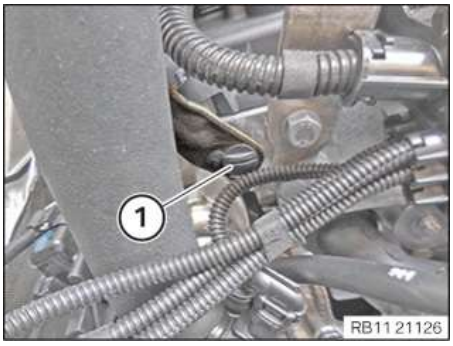
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

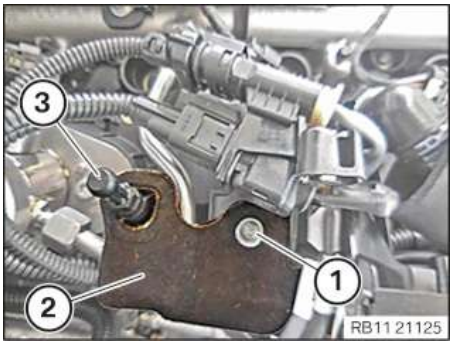


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

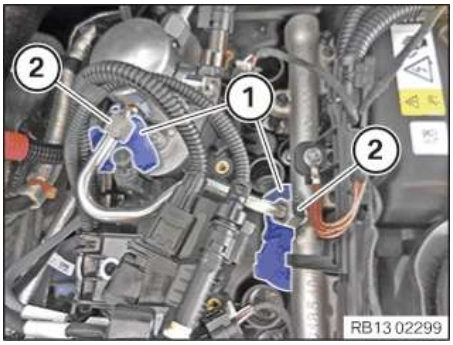
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

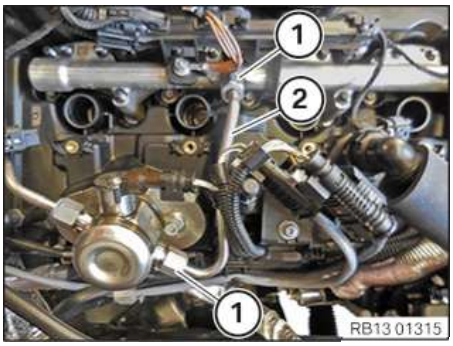


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

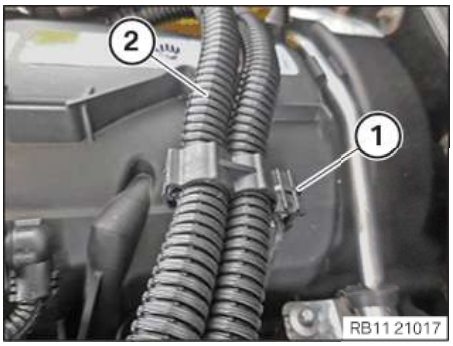
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

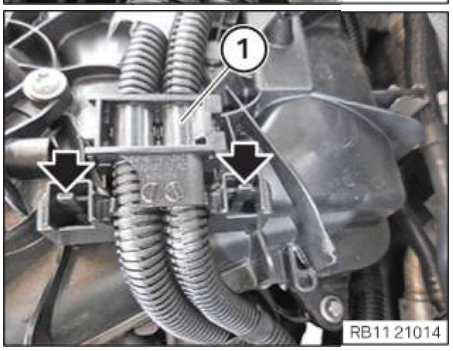
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

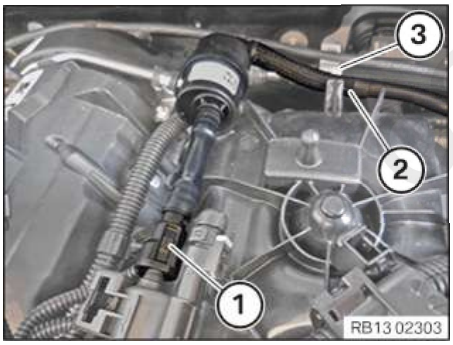
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



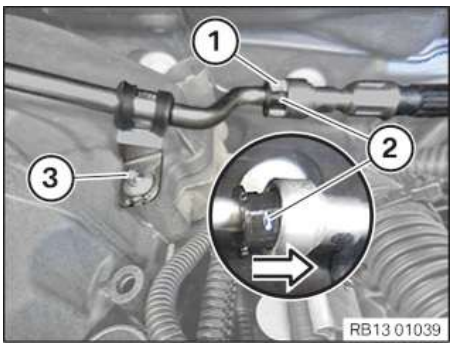
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

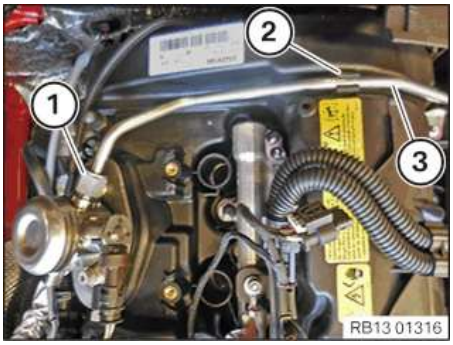


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

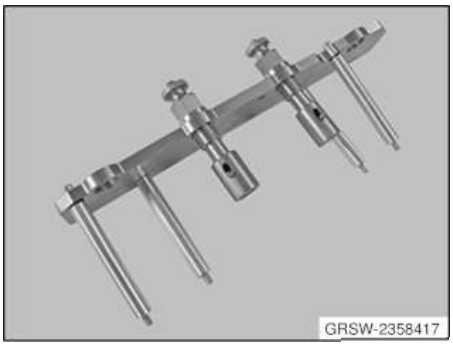
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



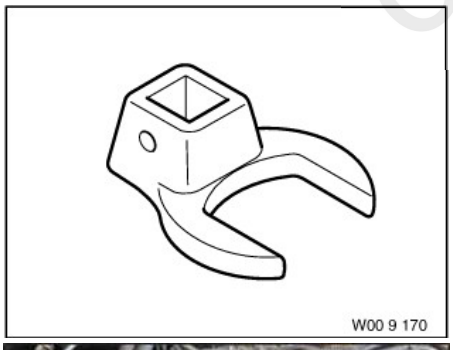
- Prepare special tool 2 358 417.



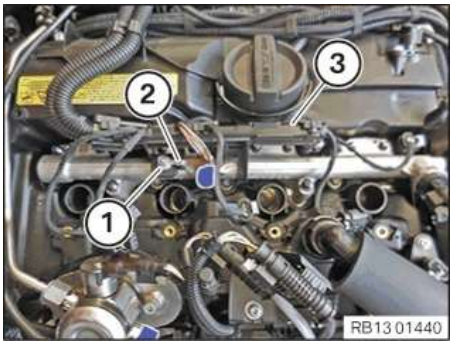
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

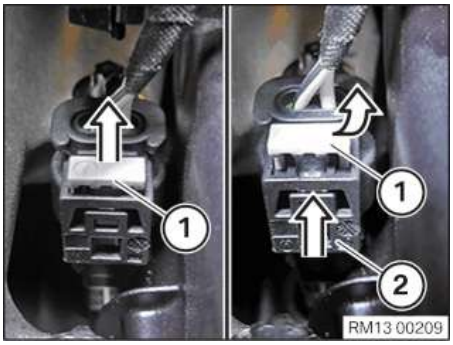


- Prepare special tool .

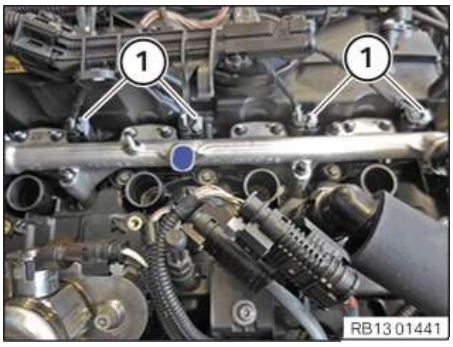


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



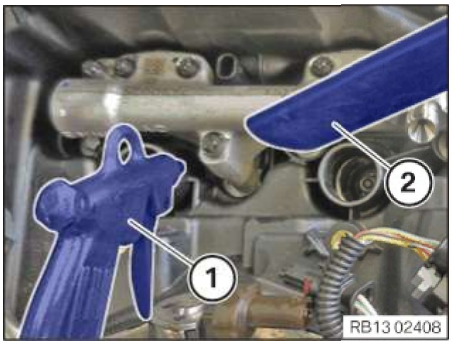
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

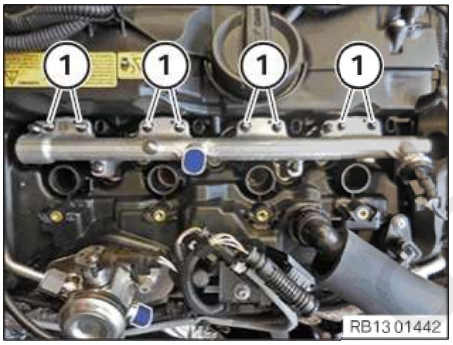


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

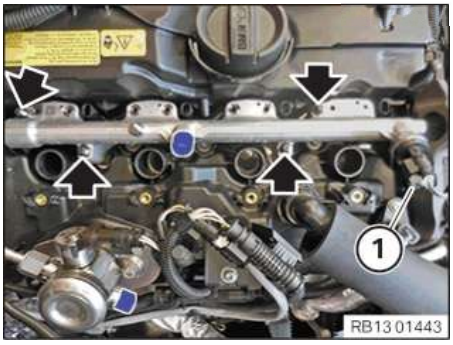
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



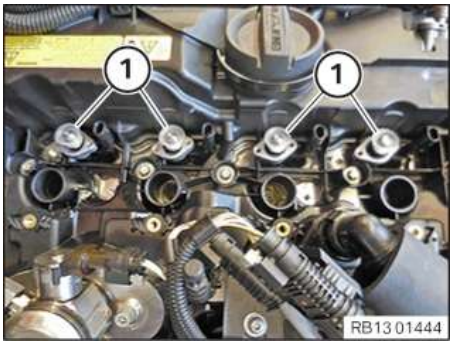
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

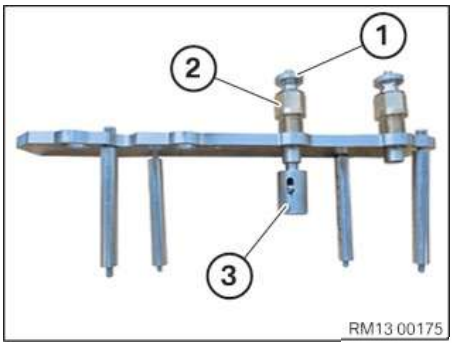
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

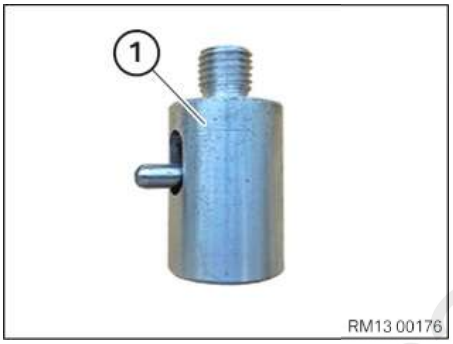
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

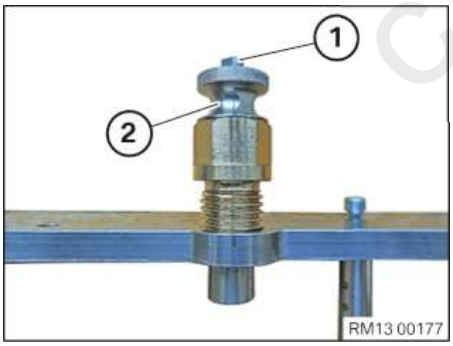
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

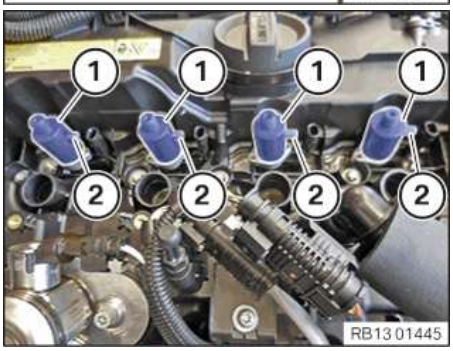
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



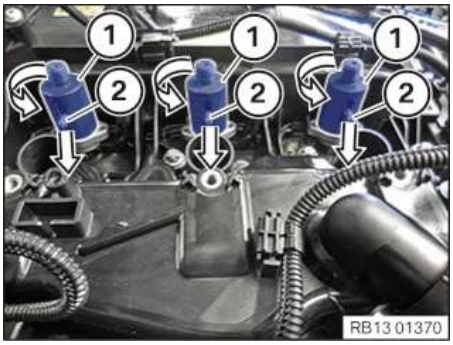
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



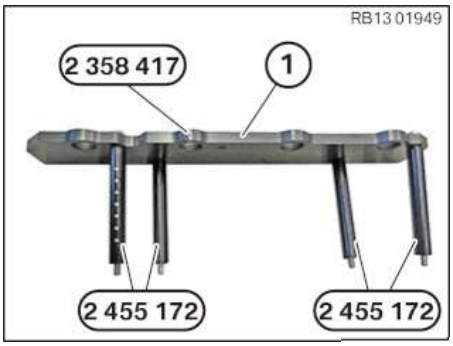
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

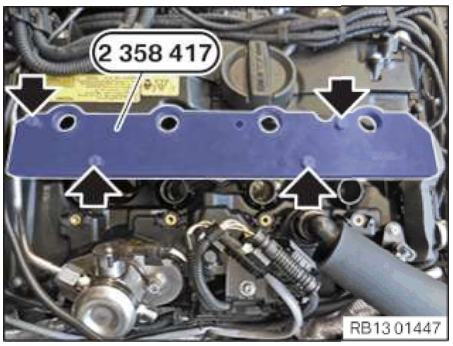
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



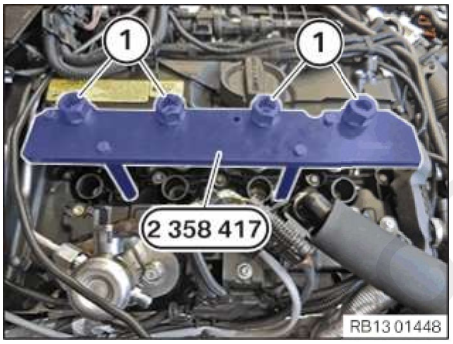
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

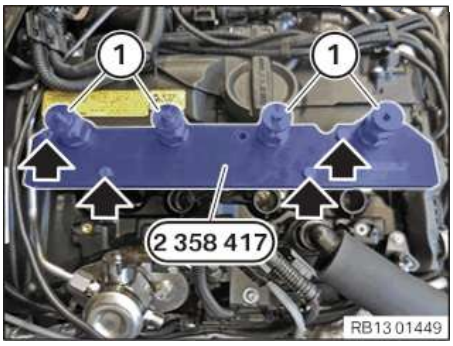
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

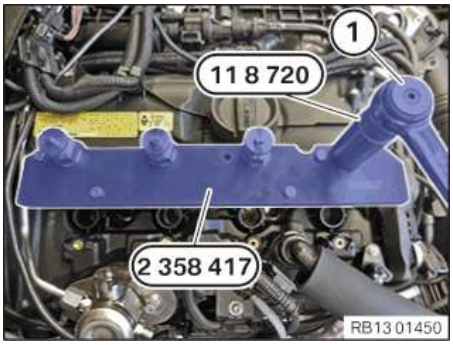
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

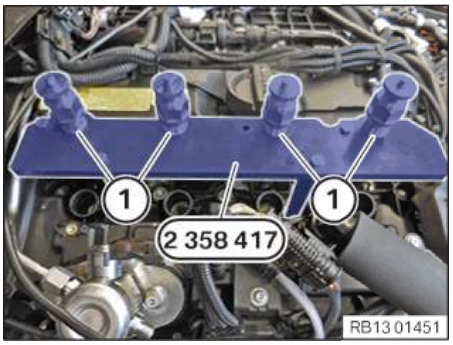


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

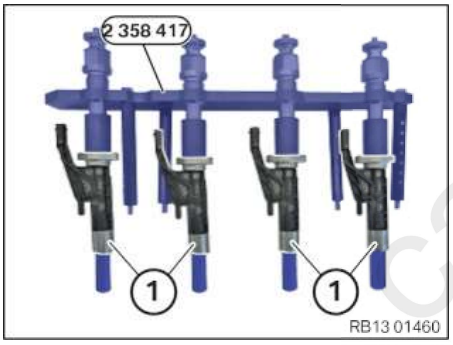
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

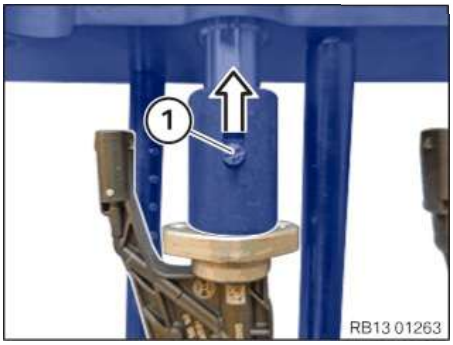


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

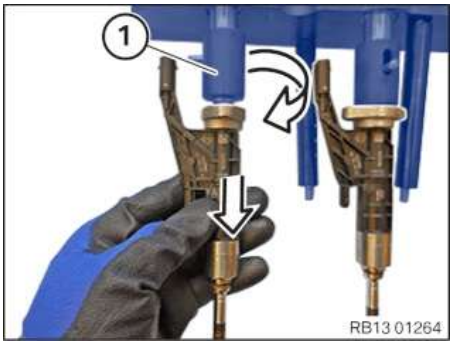


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

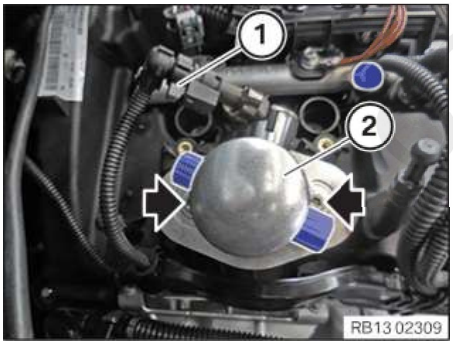
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

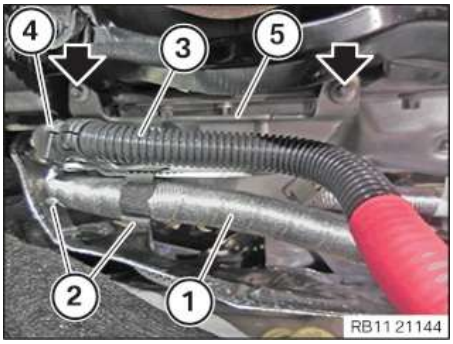
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

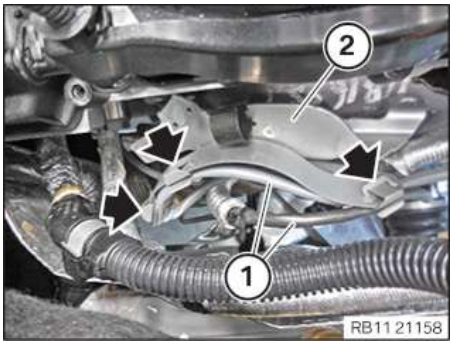


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

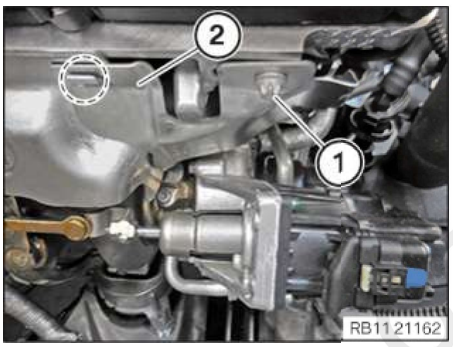
Hot surfaces.

Risk of burning!

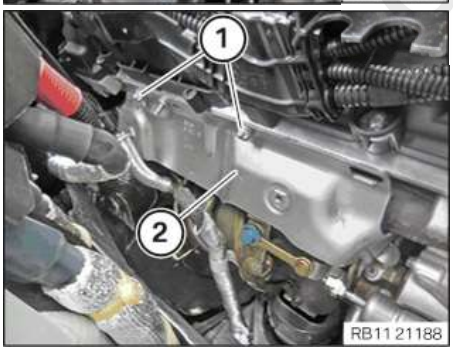
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

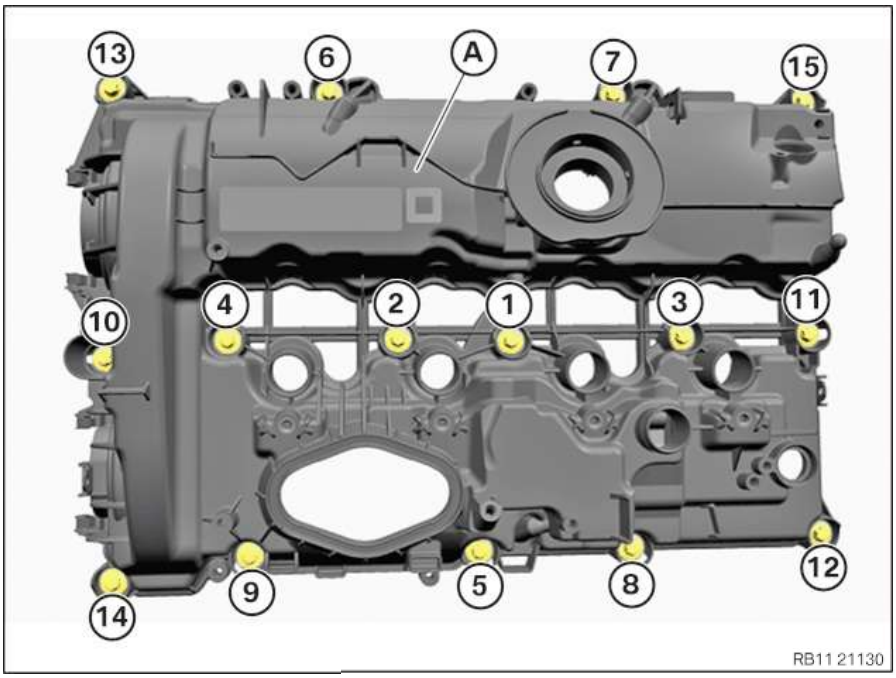


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

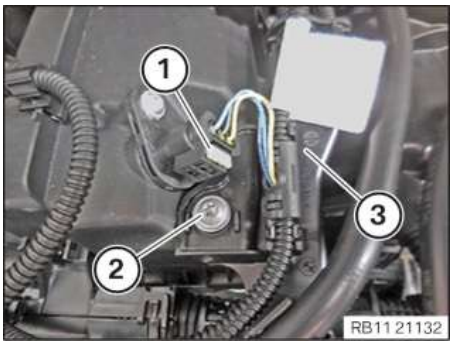
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

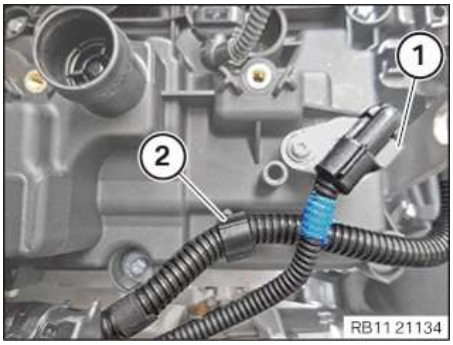
- Do not pull on the wires when disconnecting connectors and plug connections.



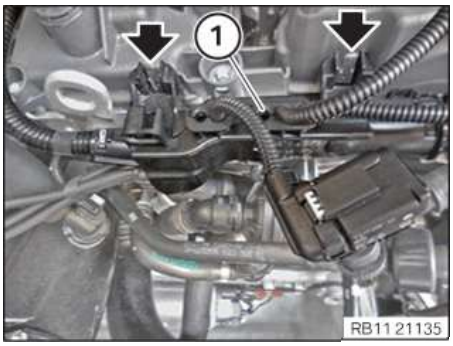
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



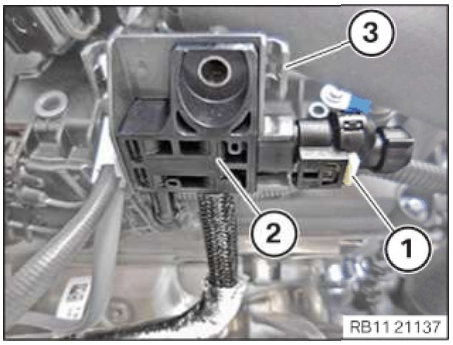
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



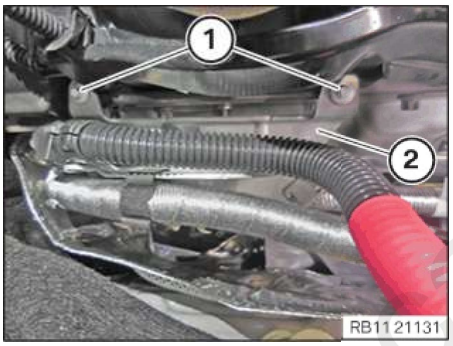
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



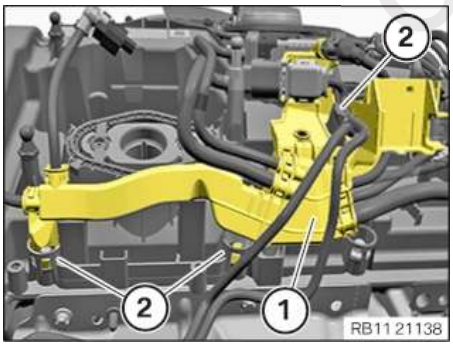
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



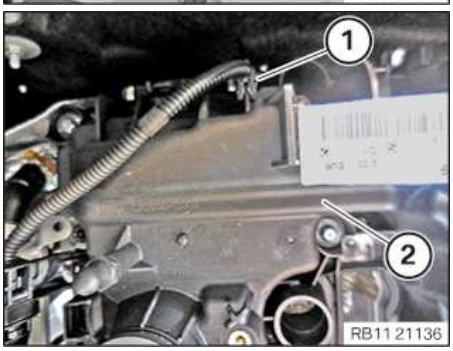
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

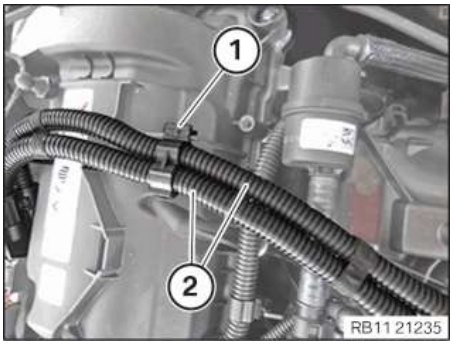


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

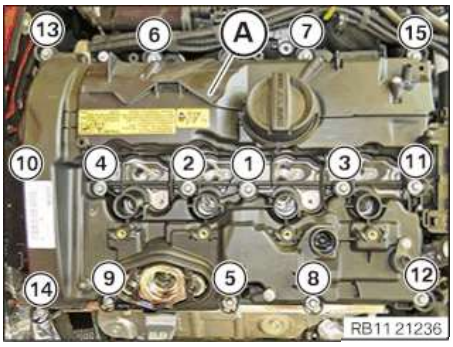


- Loosen clamp (1).

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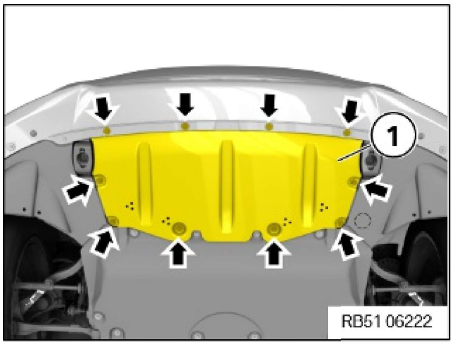


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

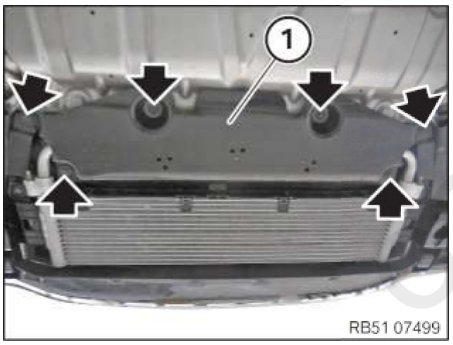
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

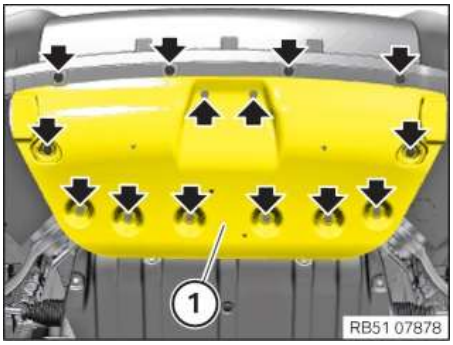
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

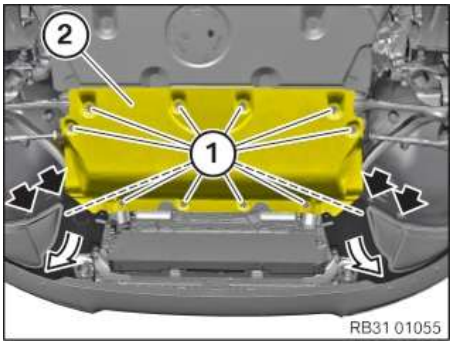


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



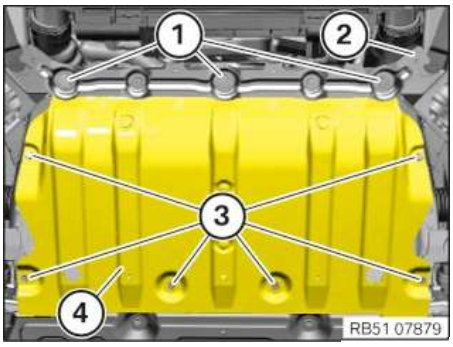
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

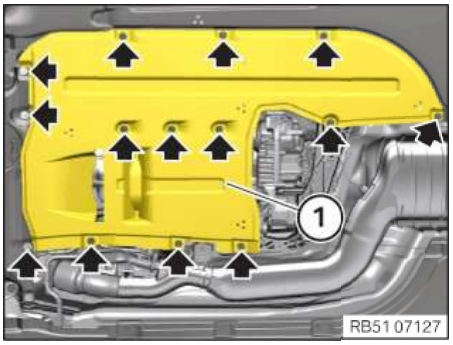
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

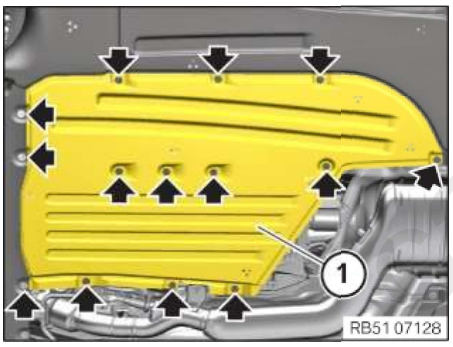
27 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

28 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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TECHNICAL INFORMATION

Life-long fill of coolant!

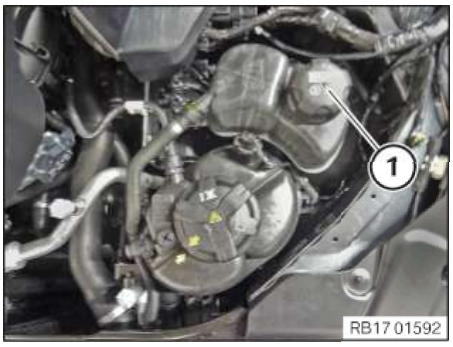
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

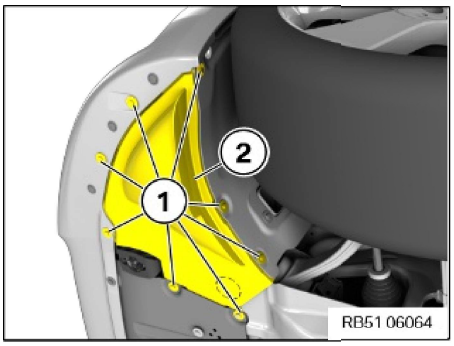
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

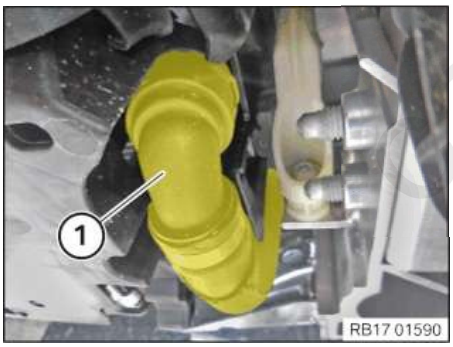
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.



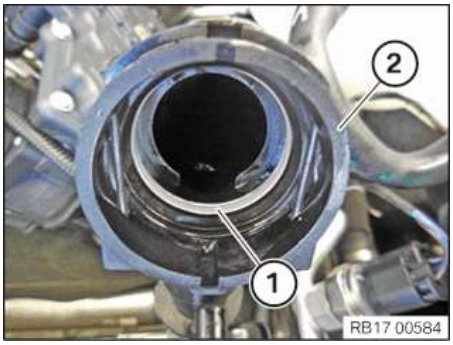
- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

29 – Connecting the coolant lines for the low-temperature coolant circuit

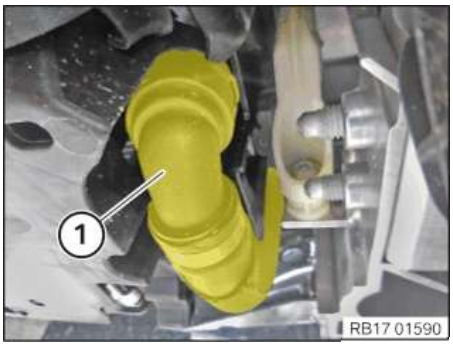
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

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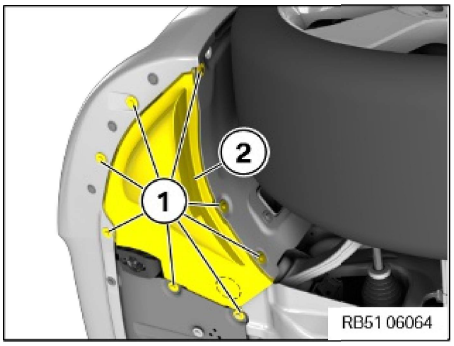


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

30 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

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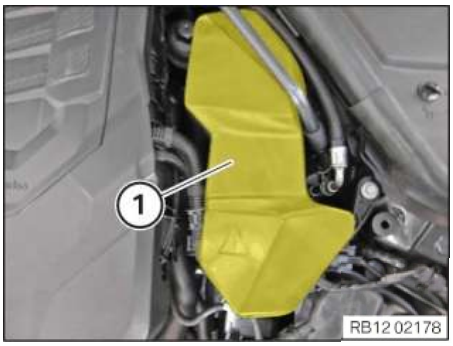
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

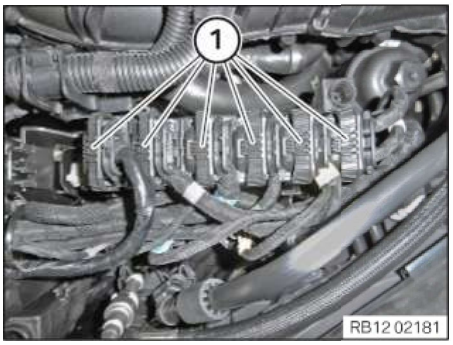
For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

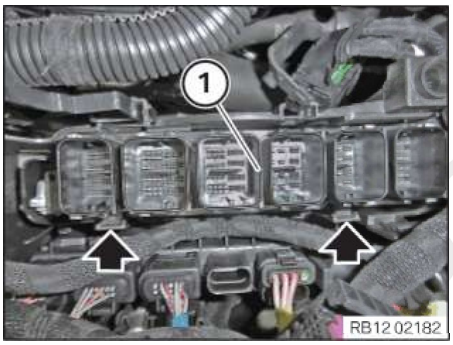
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.



- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

31 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

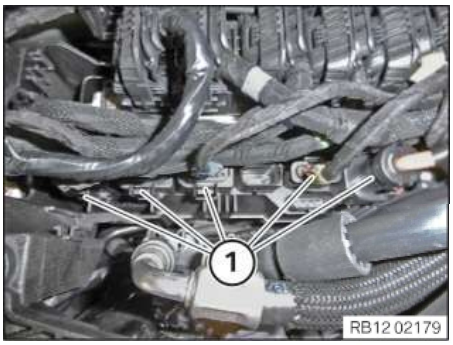
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RISK OF DAMAGE

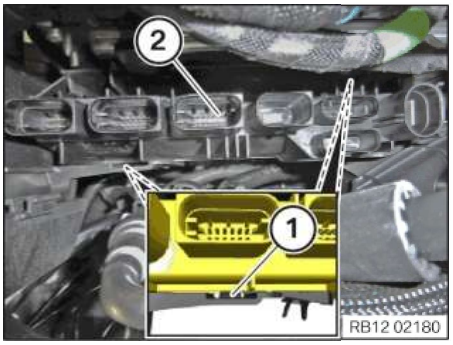
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

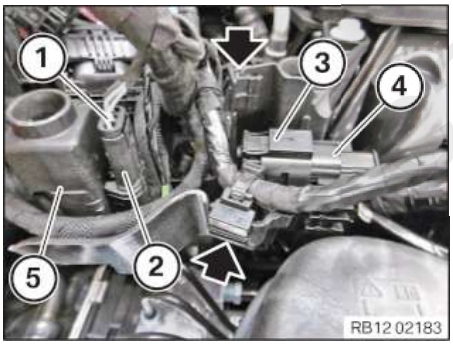


- Unlock and disconnect plug connections (1).

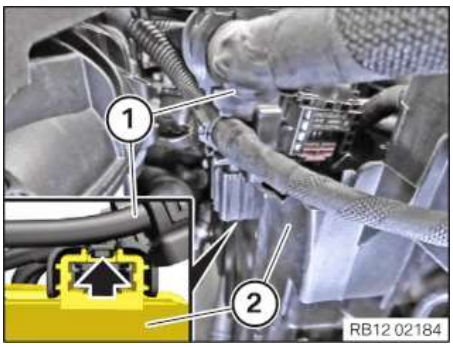


- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

32 – Removing the control unit holder

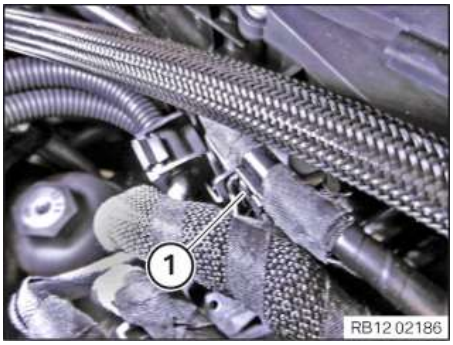


- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).

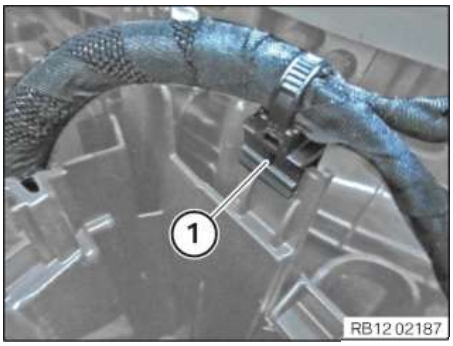


- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).

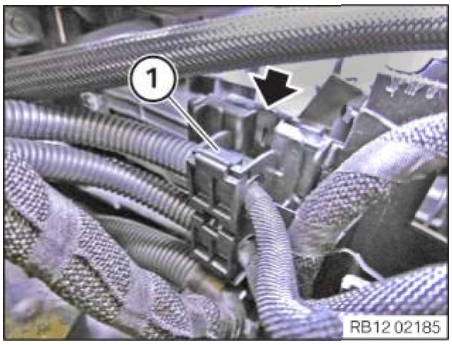
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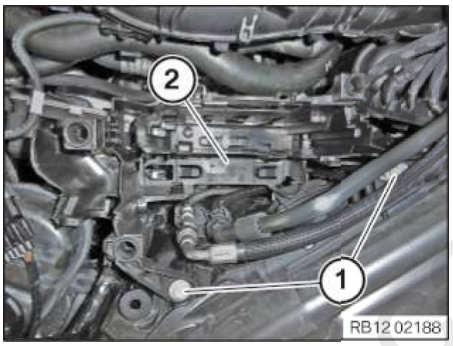
- Loosen clamp (1).



- Loosen clamp (1).



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

33 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

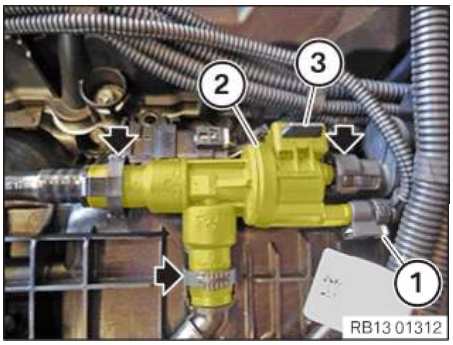
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

34 – Removing the intake plenum

RISK OF DAMAGE

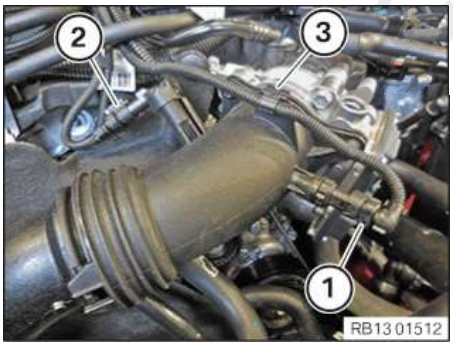
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

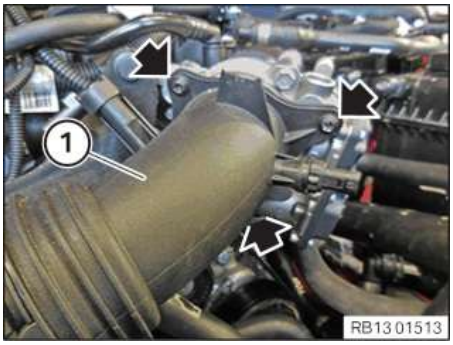
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

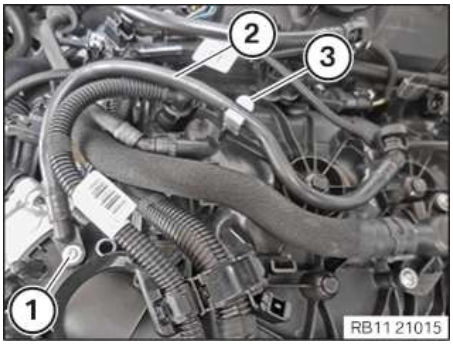


- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).

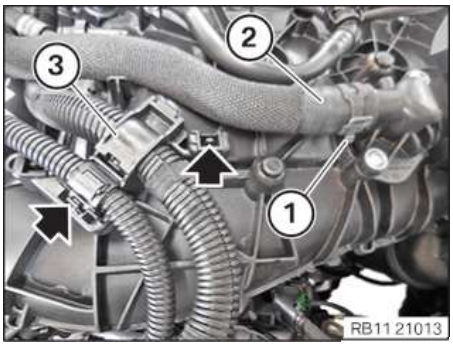


- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.

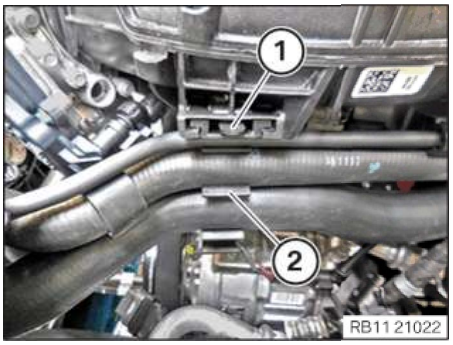
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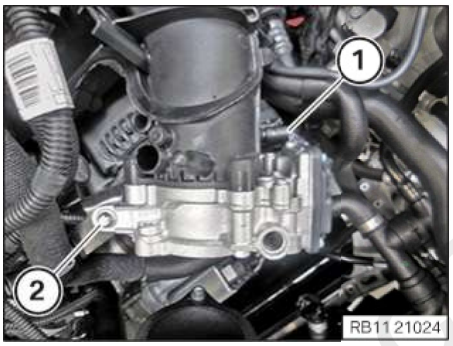
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



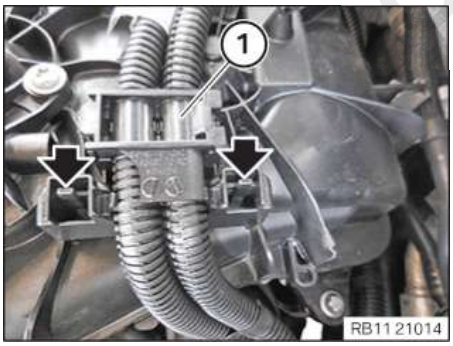
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



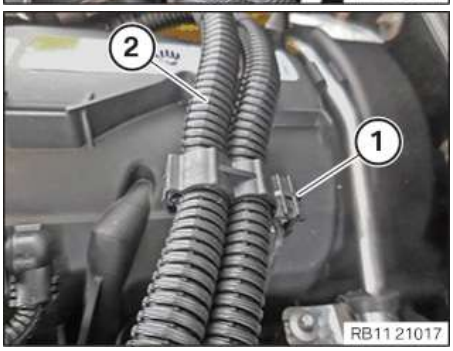
- Unlock the lock (1).
- Thread out holder (2) and set aside.



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

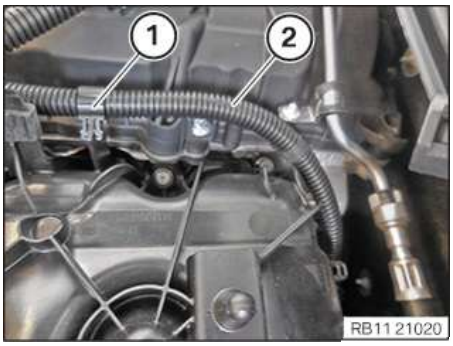


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.

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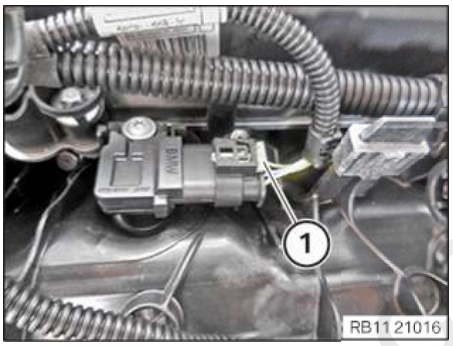
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



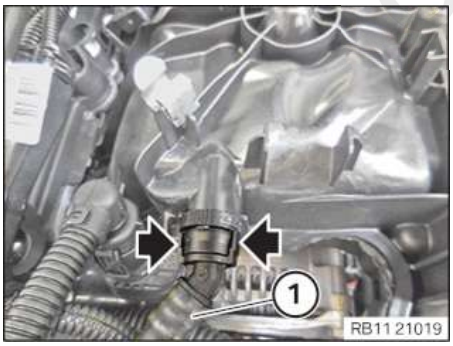
- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.



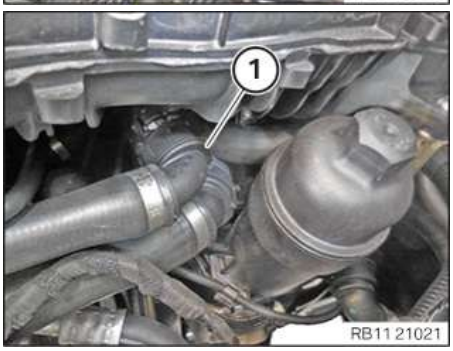
- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

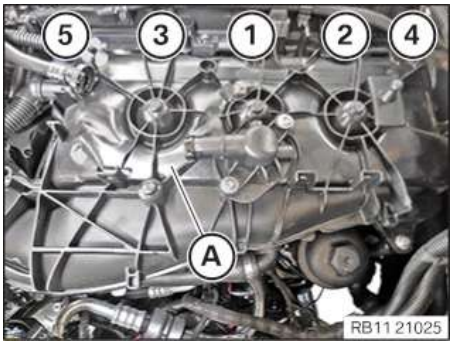


- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.

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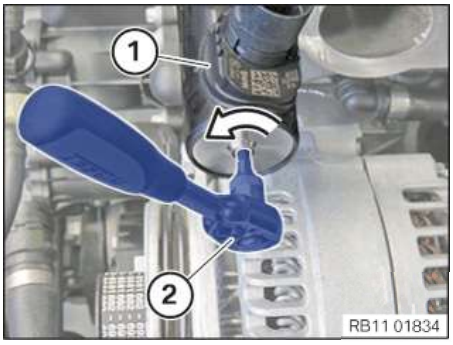


TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

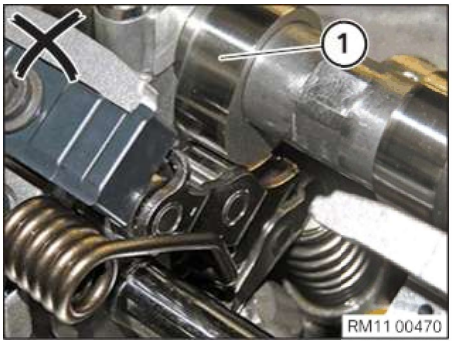
- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

35 – Adjusting the servomotor to minimum lift



- Slowly adjust the eccentric shaft with the servomotor (1) to the minimum lift using the tool (2).

36 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

37 – Remove all torsion springs

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION



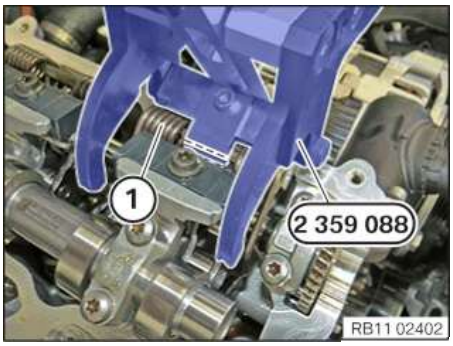
- Wear safety goggles.

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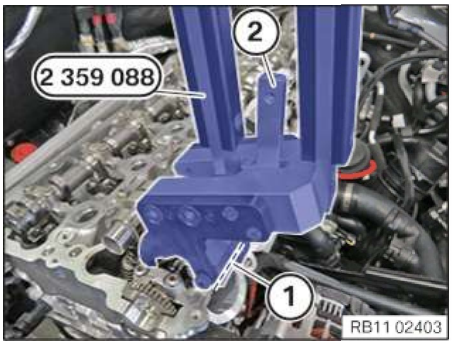


- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)

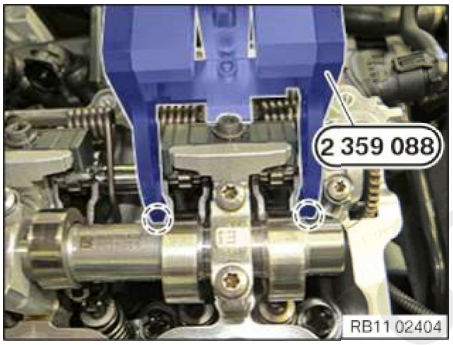


- Open the special tool 2 359 088 and position it at the torsion spring (1).



- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.

Check



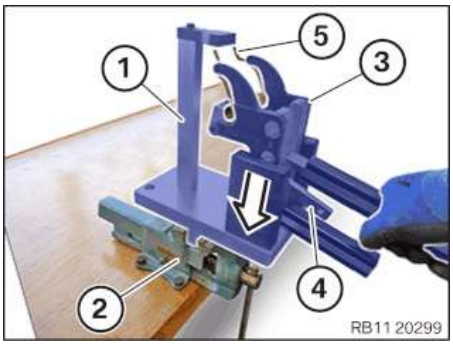
- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.

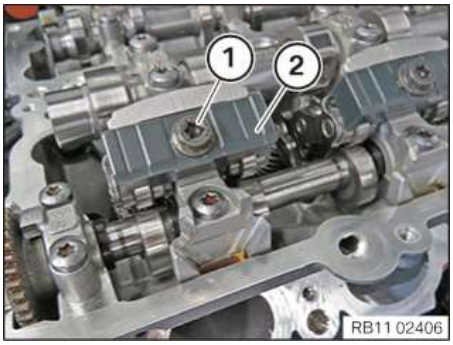


- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).

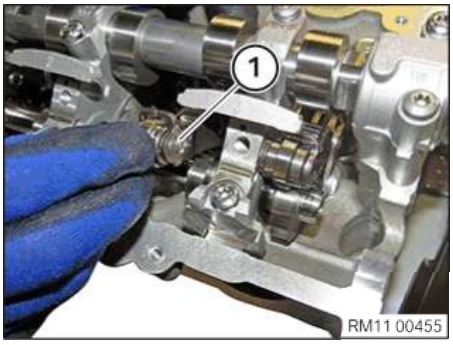
- Repeat the operations for the remaining torsion springs.

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- Loosen screw (1).
- Remove the gate (2) and place it arranged in order into 0 495 105 (11 4 480).
- Repeat the step for all the gates.

39 – Removing all intermediate levers



- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

40 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



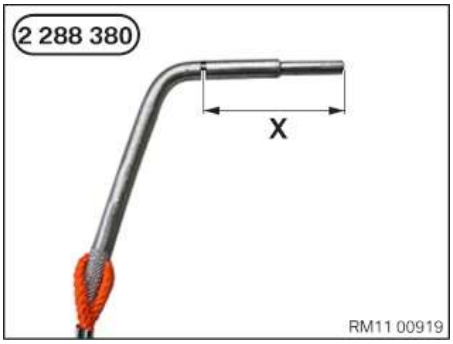
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).

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- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

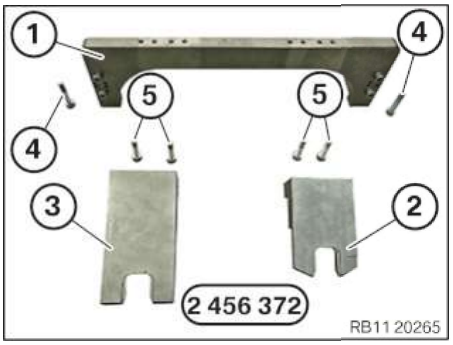
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

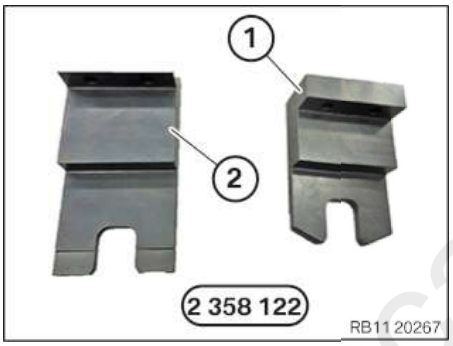
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



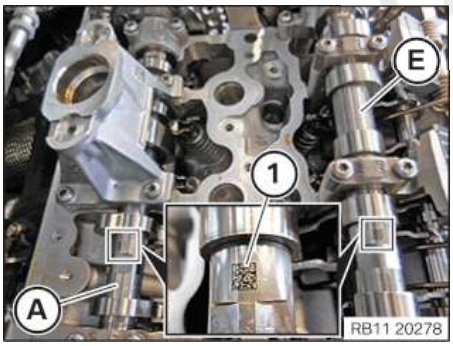
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

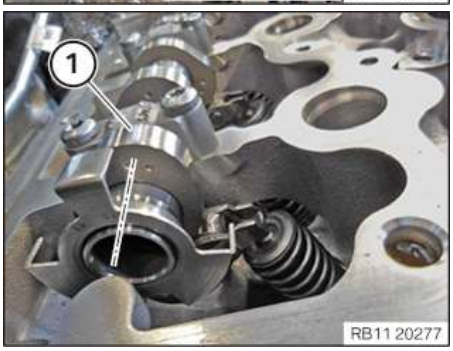


- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft

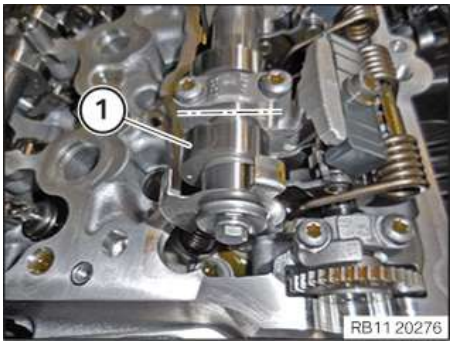


- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

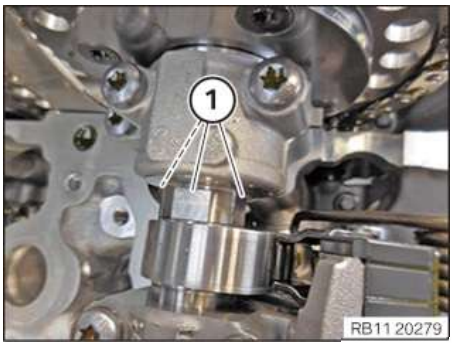


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

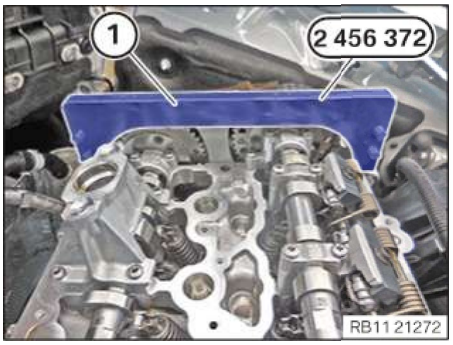
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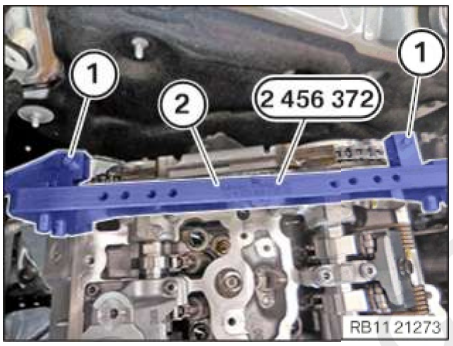
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



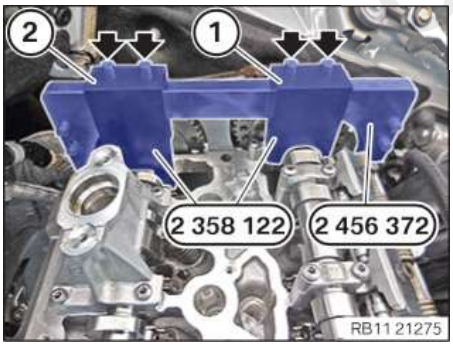
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

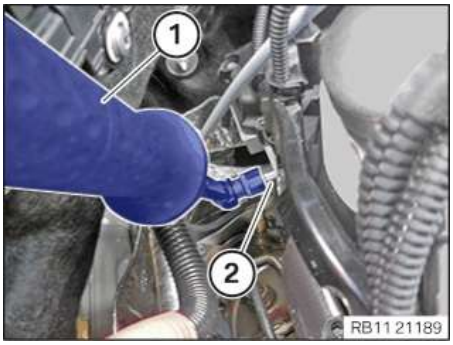
M6		Tightening torque	8 Nm

41 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

42 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

The figure shows the rear side of the engine.

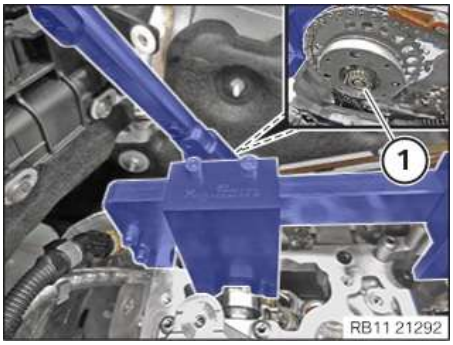
- Release the VANOS central valve (1) of the intake adjuster.

43 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

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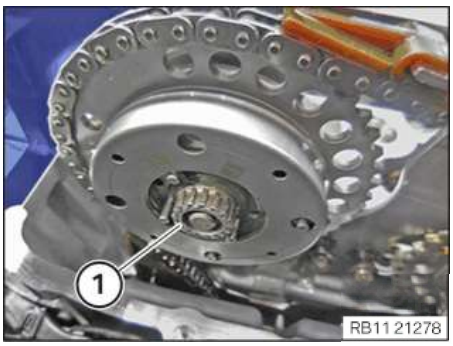


NOTICE

The figure shows the rear side of the engine.

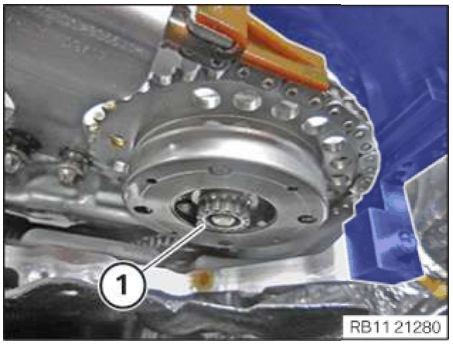
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

44 – Removing the VANOS central valve of the intake adjuster



- Guide out and remove the VANOS central valve (1) of the intake adjuster.

45 – Remove the VANOS central valve of the exhaust camshaft adjuster



- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

46 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.



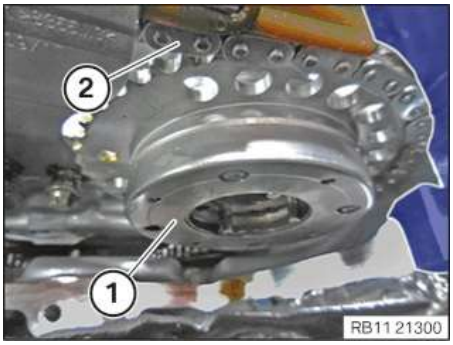
- Guide out the intake adjuster (1) from the timing chain (2) and remove.

47 – Remove exhaust camshaft adjuster

NOTICE

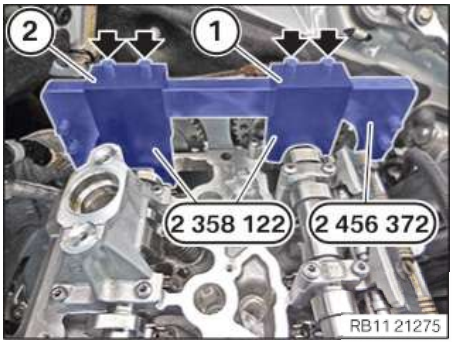
The figure shows the rear side of the engine.

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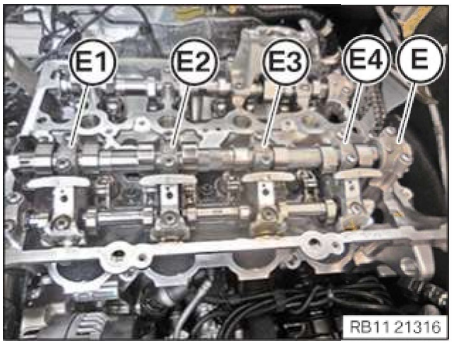
- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

48 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

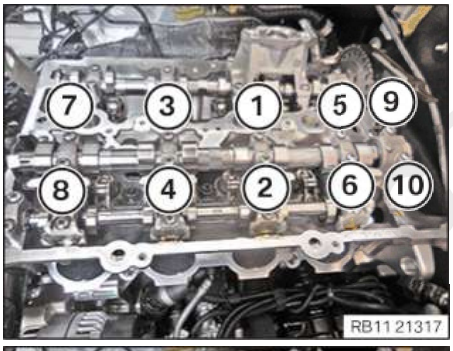
49 – Remove intake camshaft



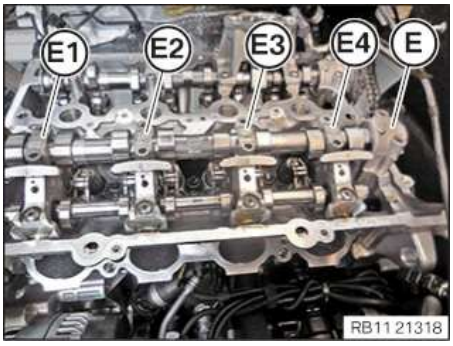
- Make sure that the exhaust camshaft bearing cap is placed in the correct position in the special tool 0 495 105 (11 4 480).

Note: The intake camshaft bearing caps can be read from the intake side and are identified by **E1**, **E2**, **E3 E4** and **E**.

Note: Intake camshaft bearing cap **E** is a thrust bearing.

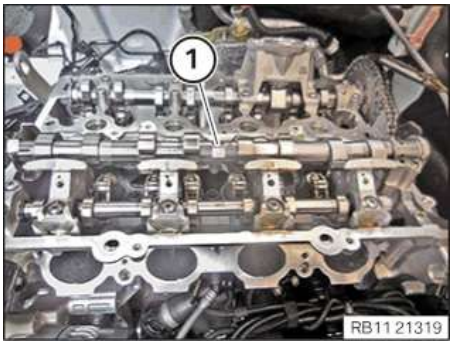


- Loosen all screws on the intake camshaft bearing caps in sequence from (10) to (1).



- Remove the intake camshaft bearing caps (E1), (E2), (E3), (E4), (E) place them in order in the special tool 0 495 105 (11 4 480).

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- Guide out the intake camshaft (1) in the direction of arrow and remove it.

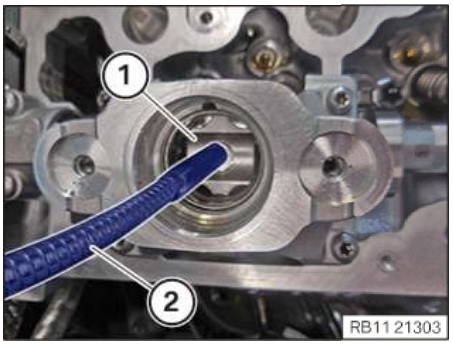
50 – Remove exhaust camshaft.

RISK OF DAMAGE

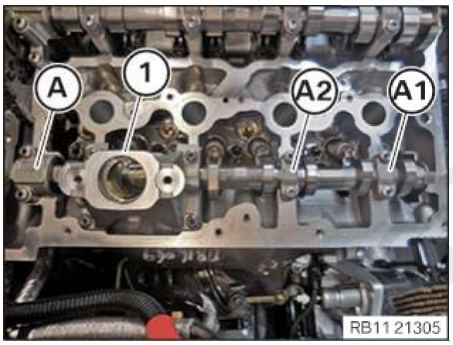
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Feed out and remove roller tappet (1) with commonly available tools (2).

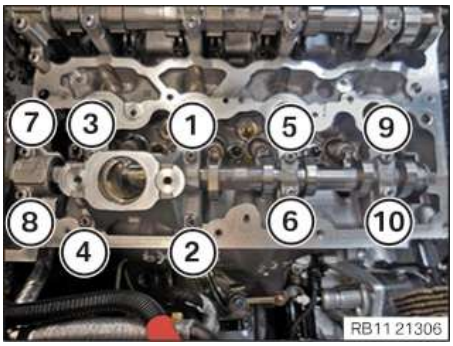


- Ensure that the exhaust camshaft bearing caps (A1) (A2) and (A) are placed in the right position 0 495 105 (11 4 480) in the special tool.

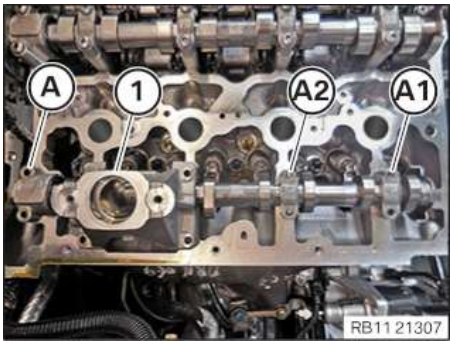
Note: The exhaust camshaft bearing caps can be read from the intake side and are identified by **A1**, **A2** and **A**.

Note: Exhaust camshaft bearing cap **A** is a thrust bearing.

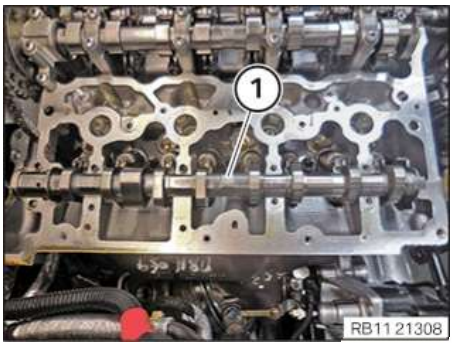
Note: Bearing cap **1** is the high pressure pump bracket.



- Loosen all screws on the exhaust camshaft bearing cap in **sequence** from (10) to (1) in **half** turn.

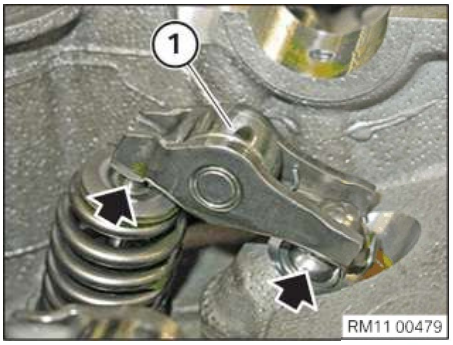


- Remove the exhaust camshaft bearing cap (A1) (A2) and (A) and store it properly in the special tool 0 495 105 (11 4 480).
- Remove high pressure pump bracket (1) and place in order in special tool 0 495 105 (11 4 480).

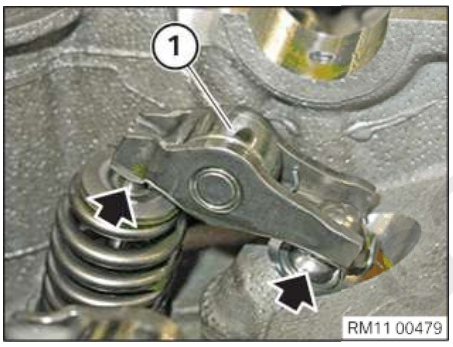


- Feed out and remove exhaust camshaft (1).

51 – Remove all roller cam followers



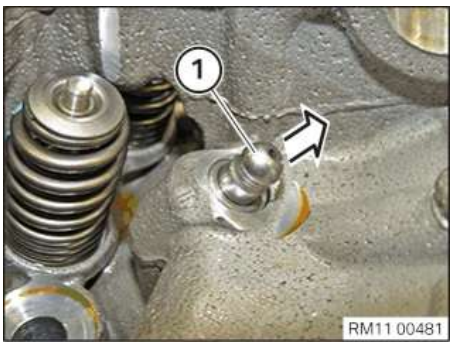
- Detach and remove the roller cam followers (1) on the intake side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).



- Detach and remove the roller cam followers (1) on the output side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).

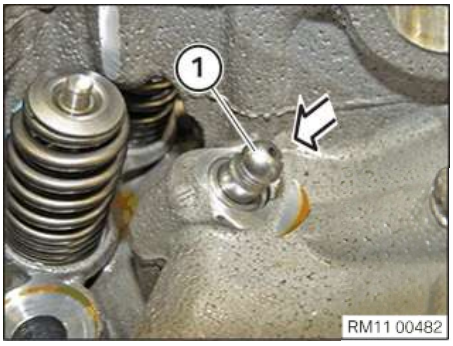
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52 – Removing all hydraulic valve clearance compensating elements



- Remove all hydraulic valve clearance compensating elements (1) to the top.
- Lay the hydraulic valve clearance compensating elements, together with the rocker arms, orderly in the special tool 0 495 105 (11 4 480).

53 – Installing all hydraulic valve clearance compensating elements



TECHNICAL INFORMATION

If the hydraulic valve clearance compensating elements are reused, they must be reinstalled at the same position.

- Install all hydraulic valve clearance compensating elements (1).

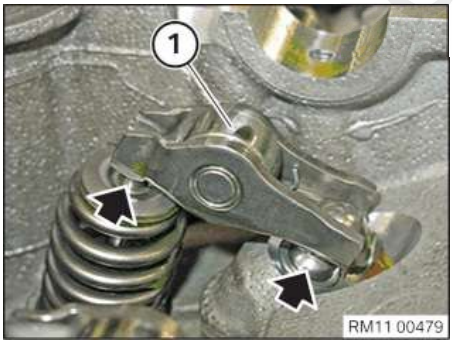
POSTPROCESSES

54 – Install all roller cam followers

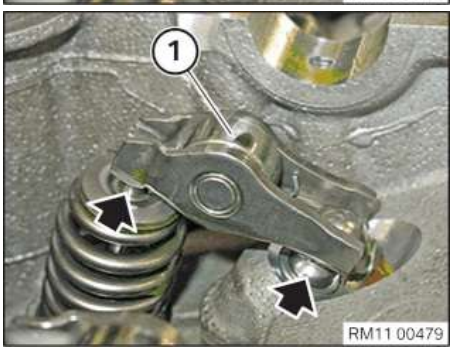


- The classification in digits from 1 to 5 has been printed on the roller cam follower.

Classification	Idle speed
1	Repair case - slow engine speed when idling
2	Installed as standard/initial installation
3	Installed as standard/initial installation
4	Installed as standard/initial installation
5	Repair case - high engine speed when idling



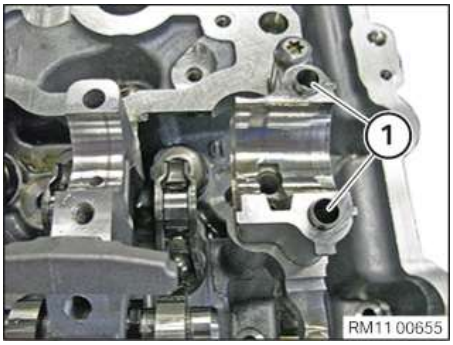
- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.



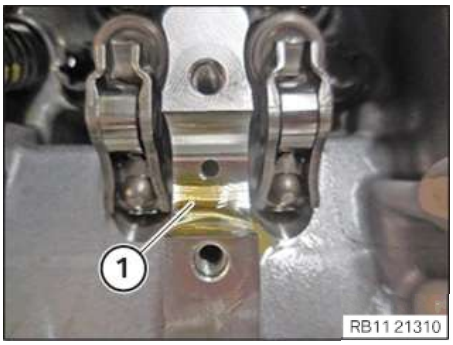
- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

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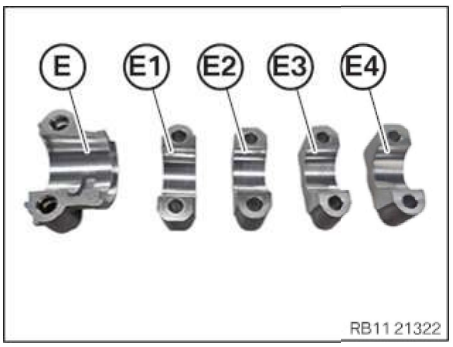
55 – Install intake camshaft



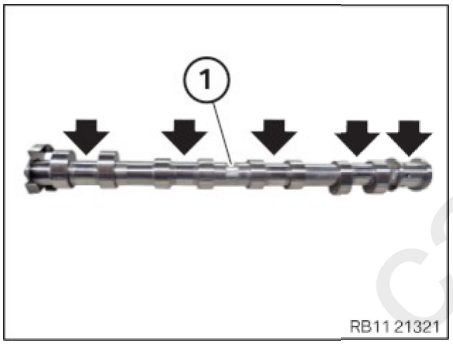
- Check the fitting sleeves (1) for correct fit and damage and replace where required.



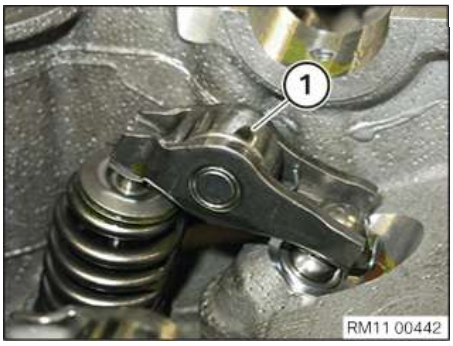
- Coat all bearing positions (1) with fresh engine oil.



- Clean all the bearing positions of the intake camshaft bearing caps (E1), (E2), (E3), (E4) and (E) and coat with engine oil.

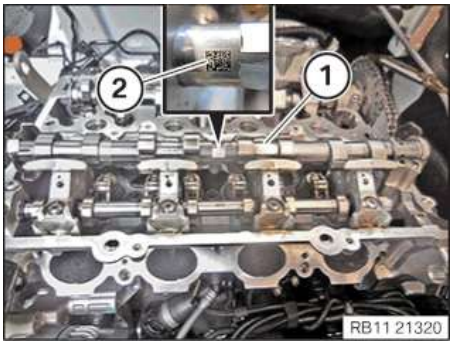


- Clean all bearing positions (arrows) of the intake camshaft (1) and coat with engine oil.

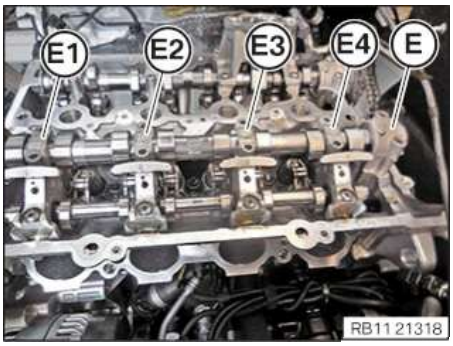


- Ensure the **correct** fit of the roller cam followers (1) before mounting the intake camshaft.
- Coat roller cam follower (1) with **new** engine oil.

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- Insert the intake camshaft (1) into the cylinder head so that the mark (2) points up.



- Position the intake camshaft bearing cap on the cylinder head.

Note: The intake camshaft bearing caps can be read from the intake side and are identified by **E1**, **E2**, **E3 E4** and **E**.

Note: Intake camshaft bearing cap **E** is a thrust bearing.

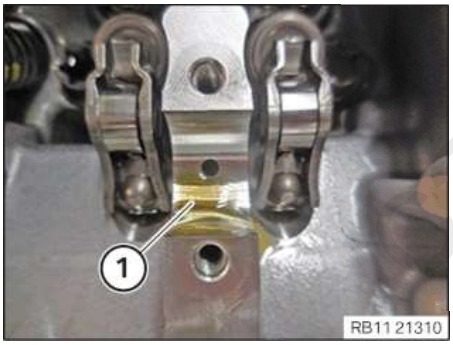


- Press intake camshaft bearing cap down and hand-tighten the bolts incrementally in sequence (1) to (10).
- Join bolts in sequence (1) to (10) **in half turns**.
- **Observe jointing torque.**
- **Tighten** all bolts in sequence from (1) to (10).

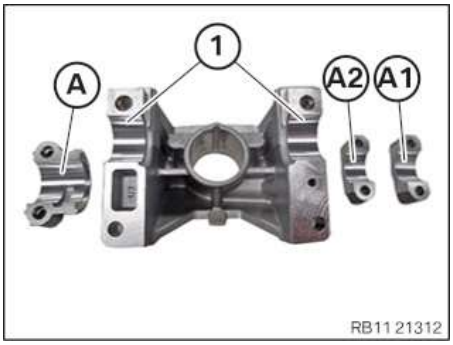
Intake camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

56 – Install exhaust camshaft

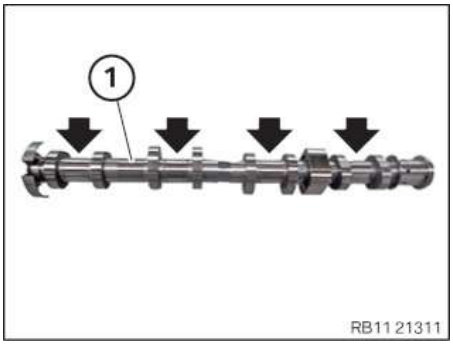


- Coat all bearing positions (1) with **fresh** engine oil.

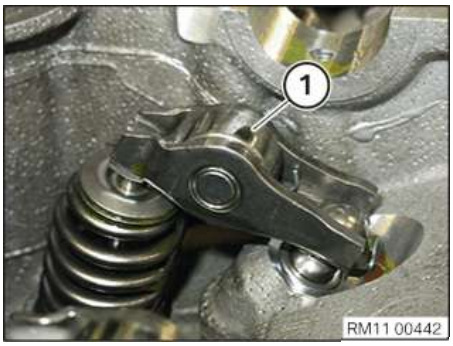


- Clean all the bearing positions of exhaust camshaft bearing caps (A1), (A2) and (A) and coat them with engine oil.
- Clean bearing positions (1) of the high pressure pump bracket and coat with engine oil.

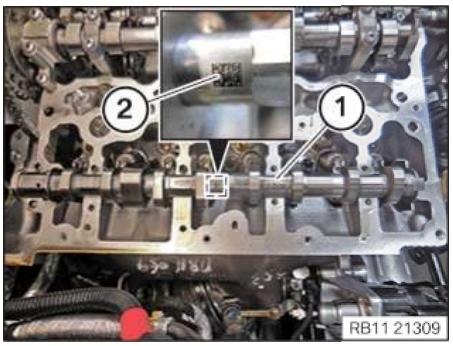
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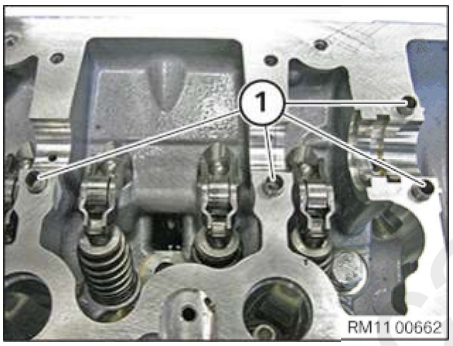
- Clean all the bearing positions (arrows) of exhaust camshaft (1) and coat with engine oil.



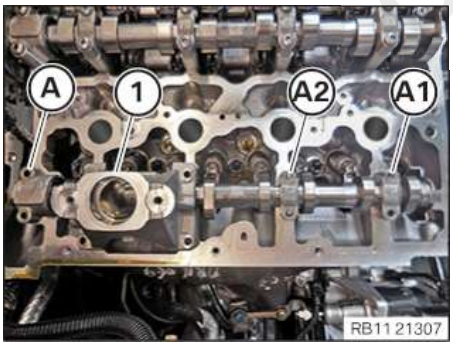
- Ensure the **correct** fit of the roller cam followers (1) before mounting the exhaust camshaft.
- Coat roller cam follower (1) with **new** engine oil.



- Insert exhaust camshaft (1) in the cylinder head, such that the mark (2) points **upwards**.



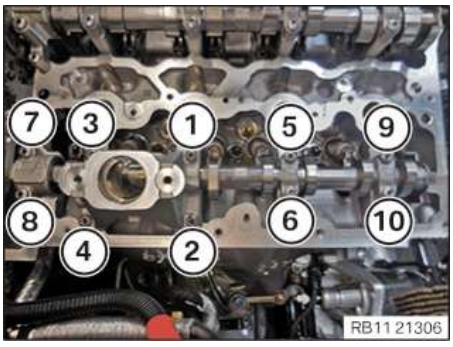
- Check the fitting sleeves (1) for **correct** fit and damage and replace where required.



- Position all exhaust camshaft bearing caps (A1) (A2) (A) and high pressure pump bracket (1) on the cylinder head and press down.

Note: The exhaust camshaft bearing caps can be read from the intake side and are identified by **A1**, **A2** and **A**.

Note: Exhaust camshaft bearing cap **A** is a thrust bearing.

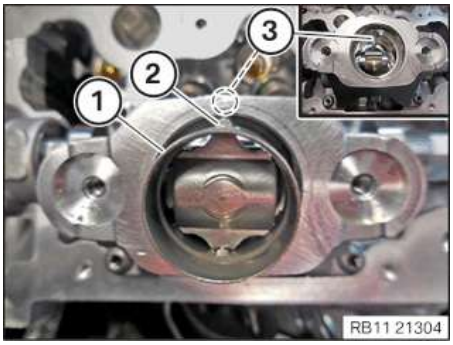


- Join all the screws in the **sequence** (1) to (10) **in half turns**.
- **Adhere to** the **jointing torque**.
- **Tighten** all bolts in sequence (1) to (10).

Exhaust camshaft to cylinder head

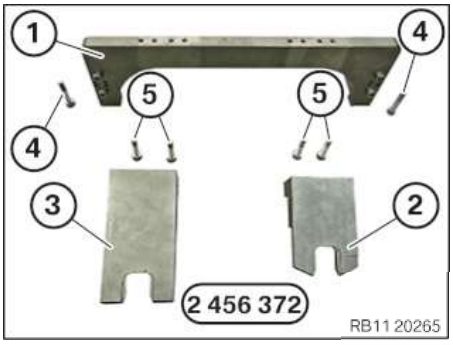
M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

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- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

57 – Adjust the camshafts with the special tool

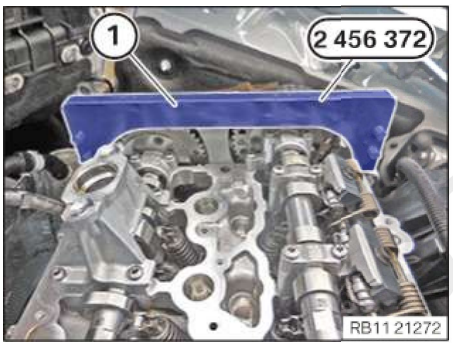


- Overview of the set of special tools 2 456 372:

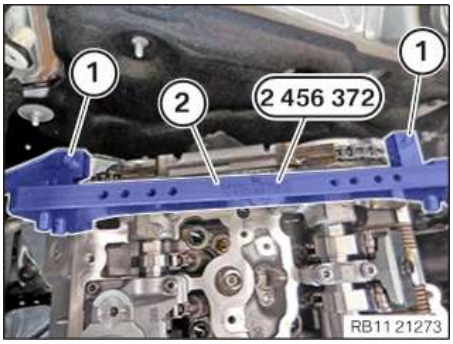
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

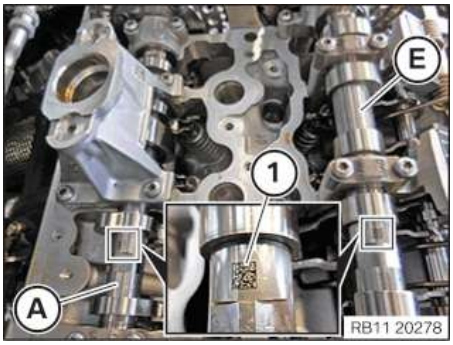


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

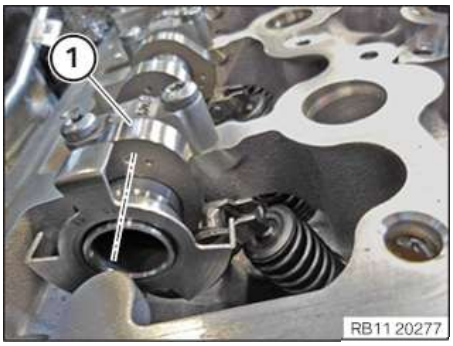
Basic carrier to cylinder head

M6		Tightening torque	8 Nm

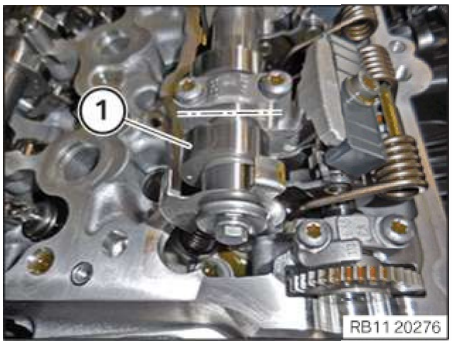
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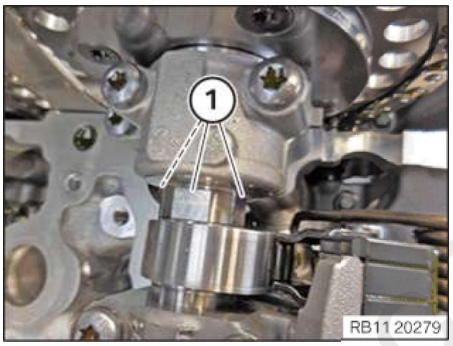
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



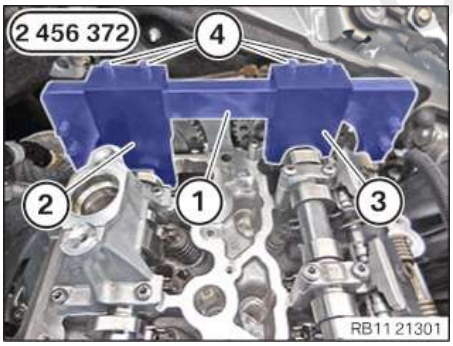
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

58 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

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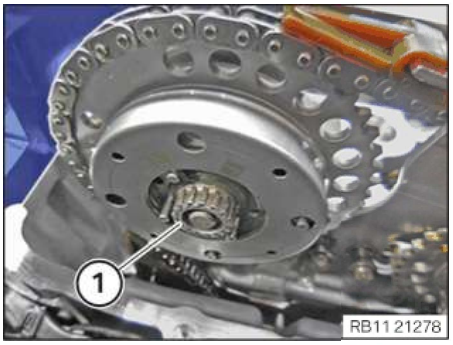


- Keep intake adjuster (1) marked IN ready.

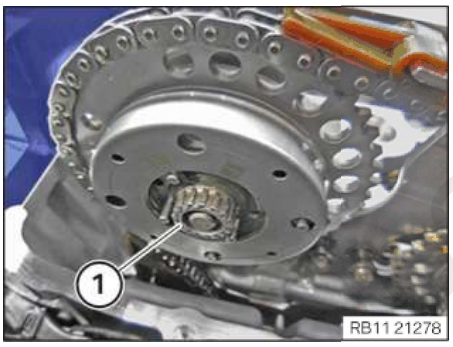


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

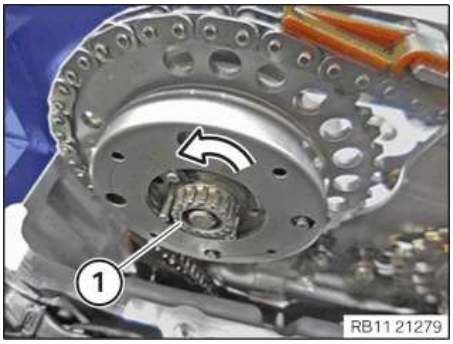
59 – Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.



- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

60 – Install exhaust camshaft adjuster

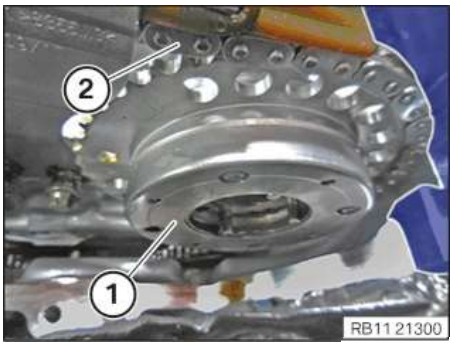
NOTICE

The figure shows the rear side of the engine.

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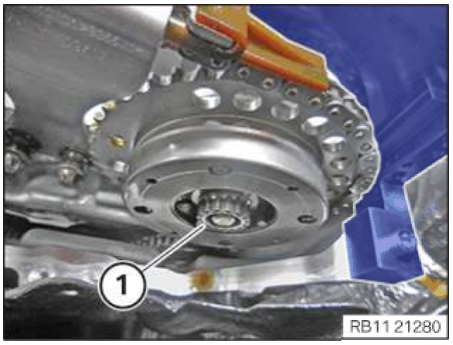


- Keep exhaust camshaft adjuster (1) marked EX ready.

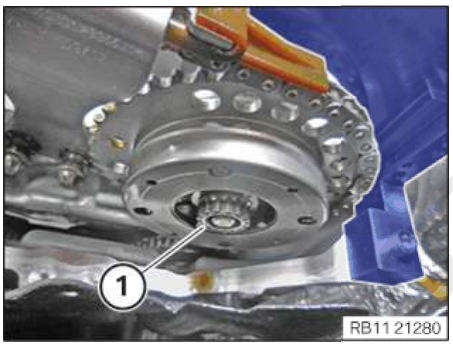


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

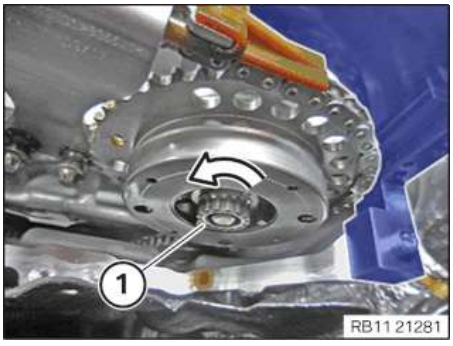
61 – Installing the VANOS central valve of the exhaust camshaft adjuster



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



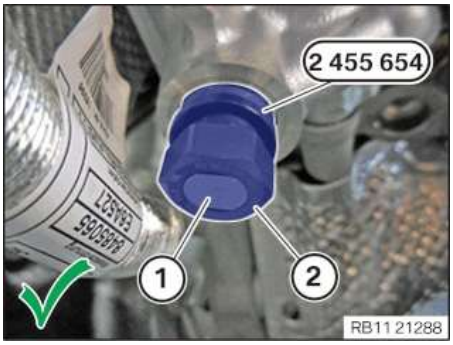
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

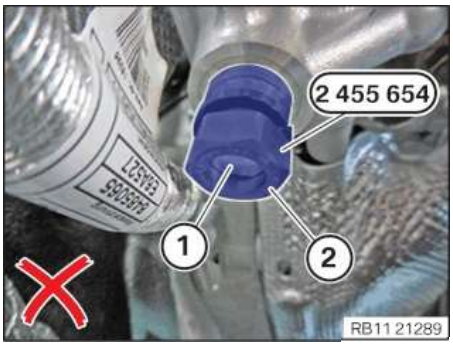
62 – Pretension the timing chain with the special tool

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- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

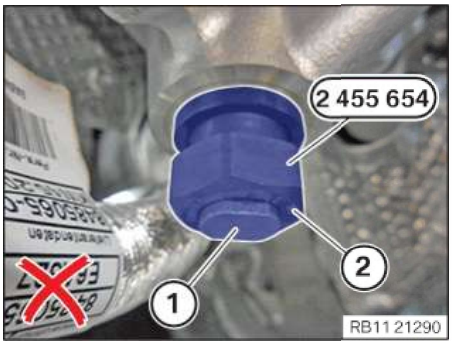
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

63 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

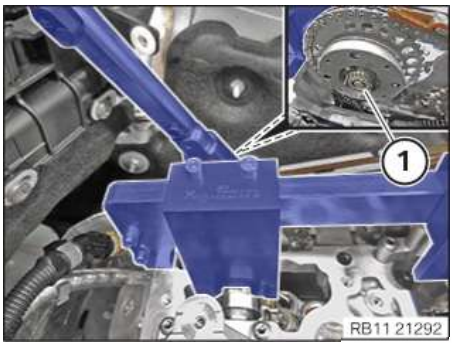
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

64 – Tightening the VANOS central valve of the exhaust camshaft adjuster

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- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

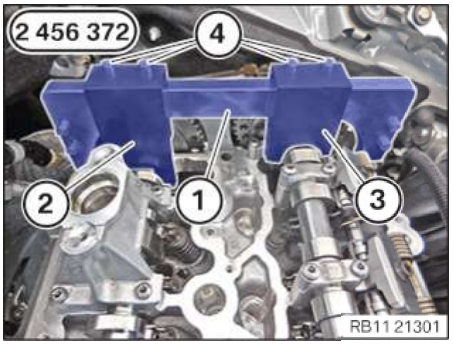


- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

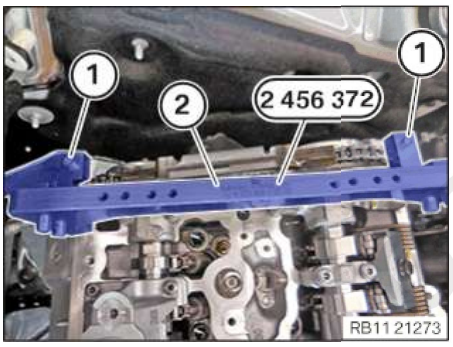
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

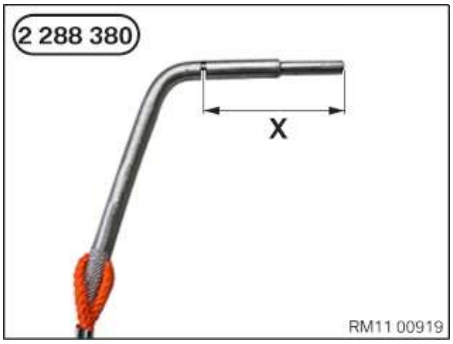
65 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

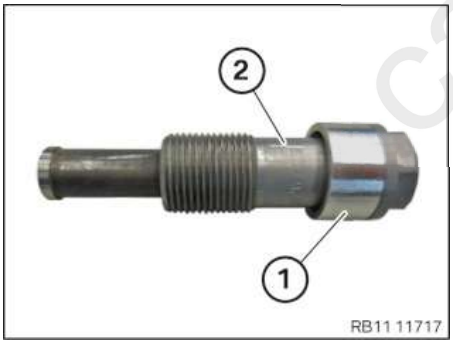
66 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



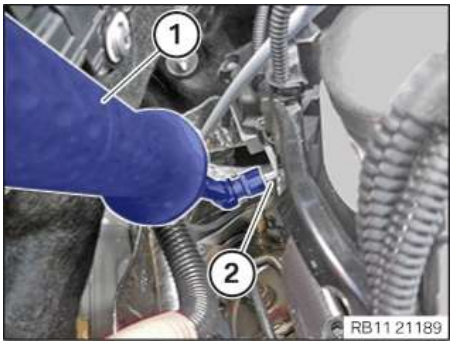
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

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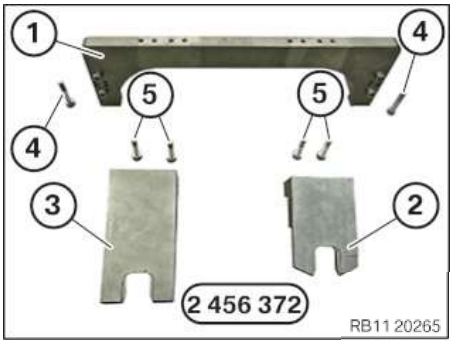


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

67 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



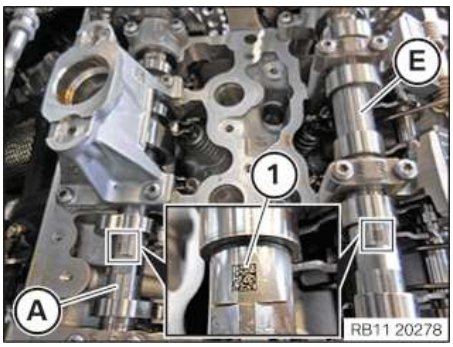
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

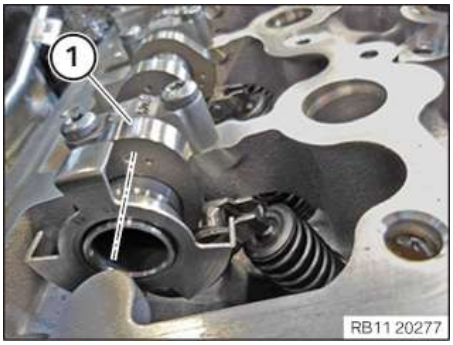
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

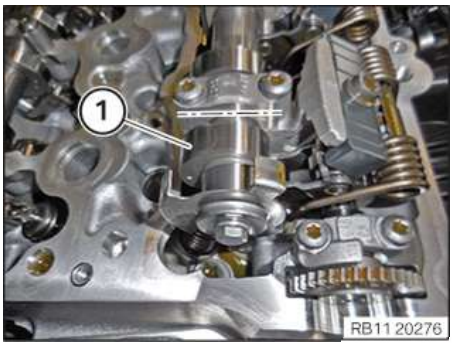


- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.

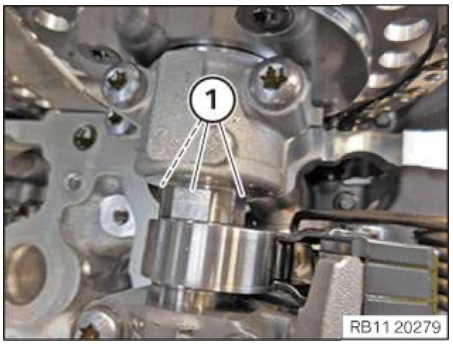
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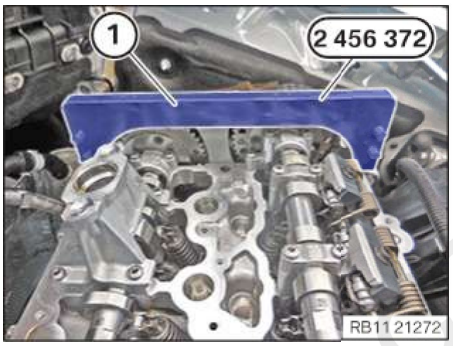
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



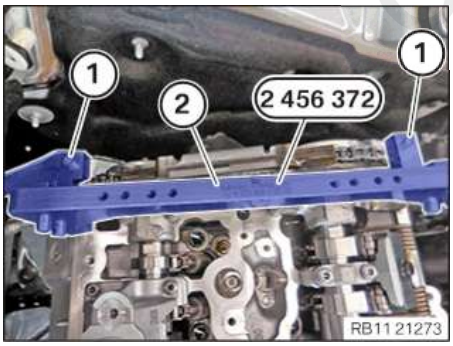
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



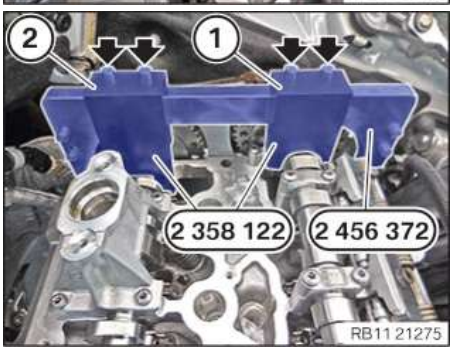
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

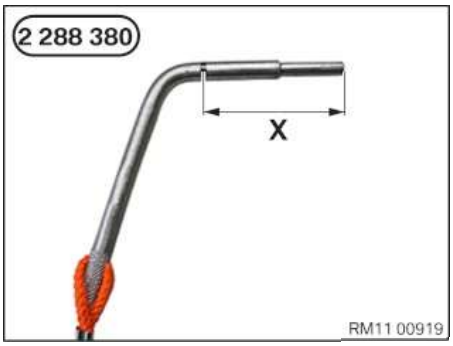
Test gauge to basic carrier

M6		Tightening torque	8 Nm

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- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

68 – Checking the intermediate lever classification



TECHNICAL INFORMATION

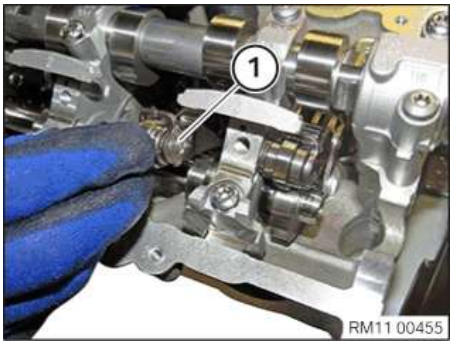
All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

- Check classification (arrow) of intermediate lever.

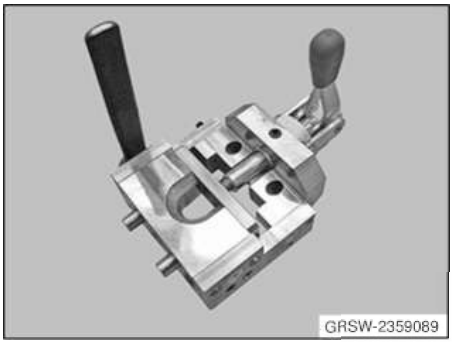
69 – Installing all intermediate levers

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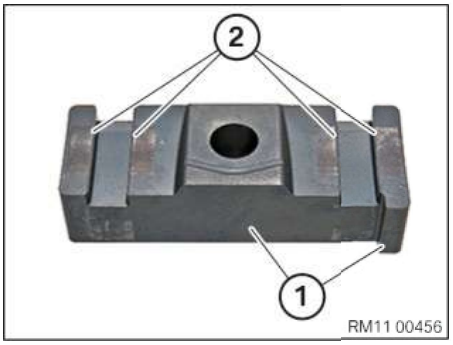


- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

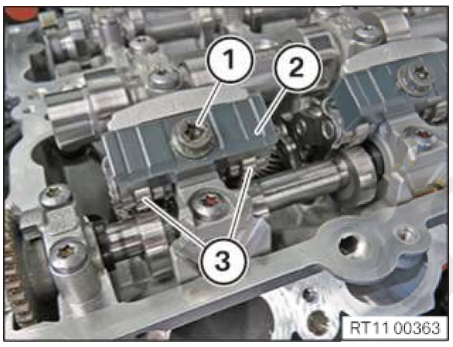
70 – Installing all gates



- Have the special tool 2 359 089 ready.

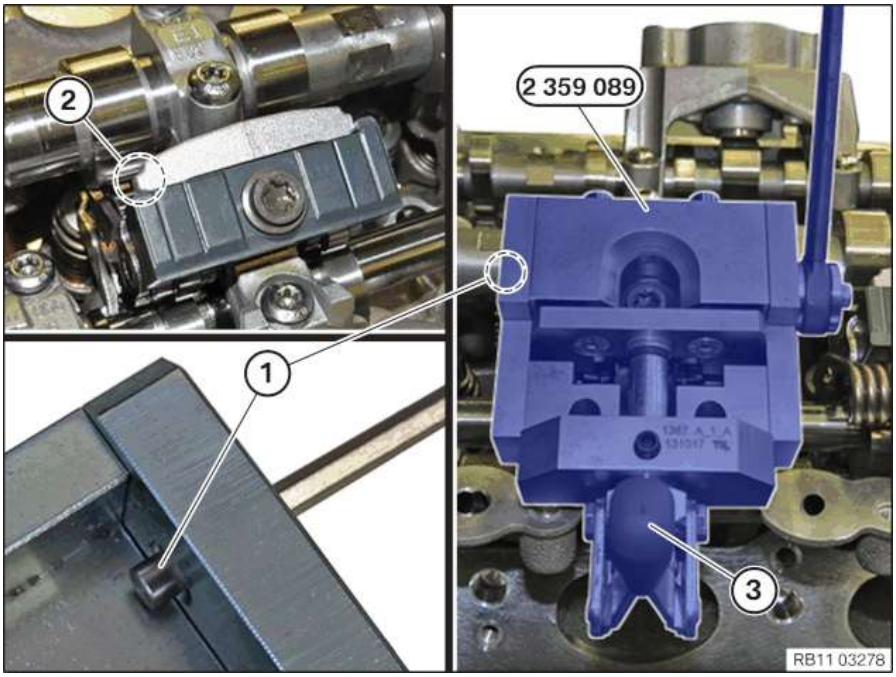


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

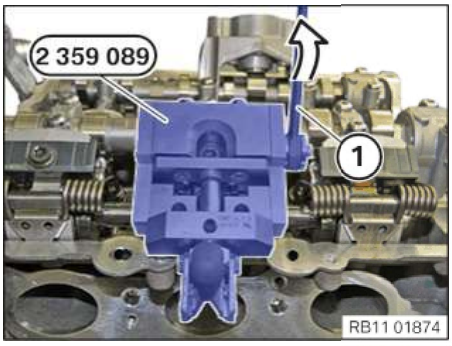


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.

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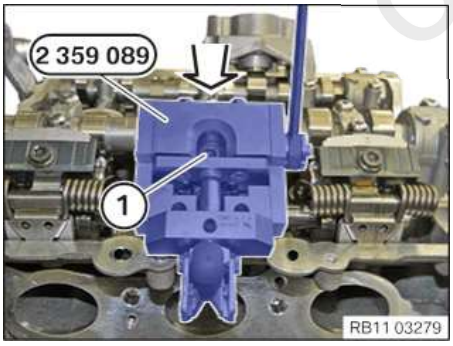
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1) in the direction of the arrow.



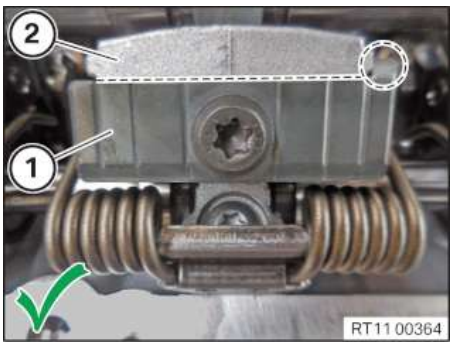
- Make sure that the special tool 2 359 089 rests flat against the cylinder head (arrows).



- Press the special tool 2 359 089 onto the cylinder head in the direction of the arrow.
- Tighten the bolt (1) at the same time.

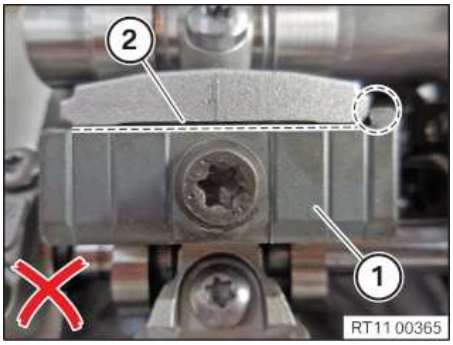
Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).
  Gate (1) is installed correctly in the marked area.

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- Ensure that gate (1) rests **correctly** against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area.

- Repeat the step for all the gates.

71 – Install all torsion springs

CAUTION

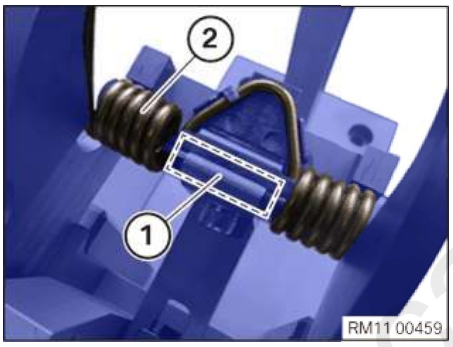
Spring preload.

Danger of injury!

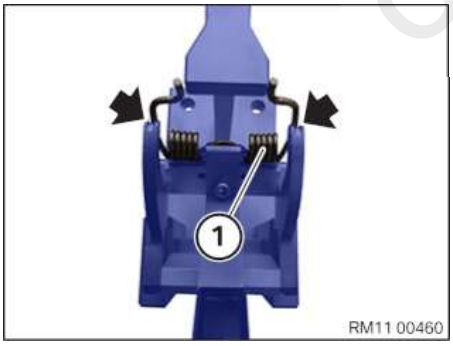
- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

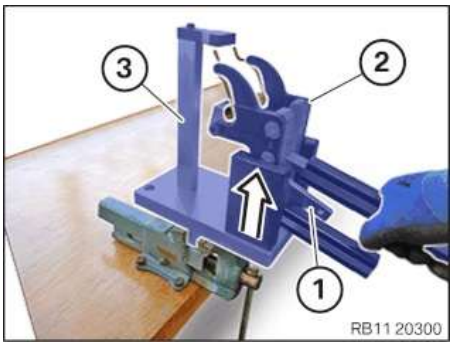
- Wear safety goggles.



- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.



- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

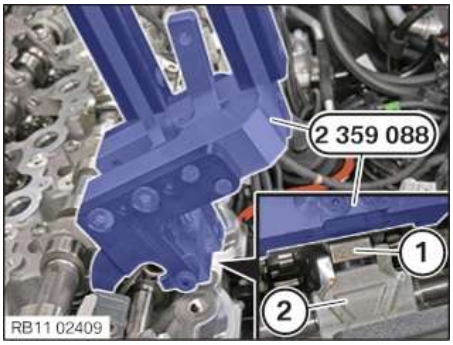


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the lever (1) audibly engages.

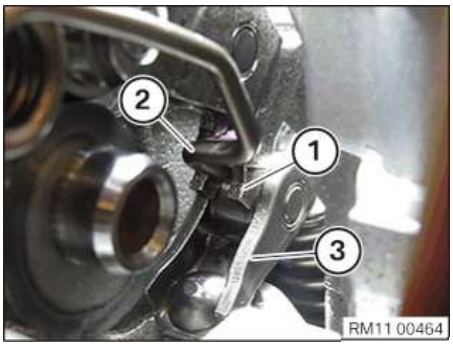
  The torsion spring is tensioned.

- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.

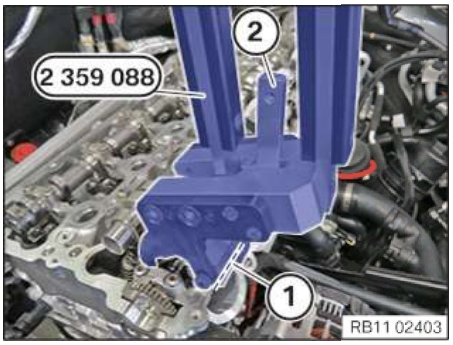
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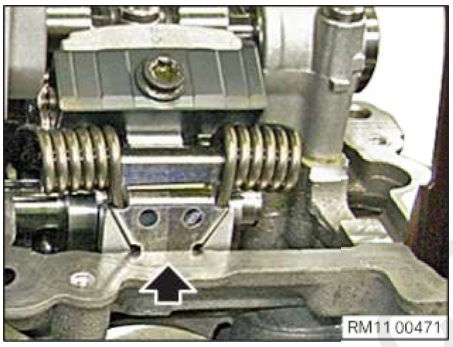
- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).



- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).
- Repeat the operations for the remaining torsion springs.

72 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

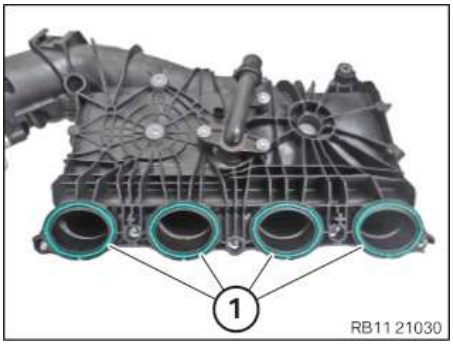
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

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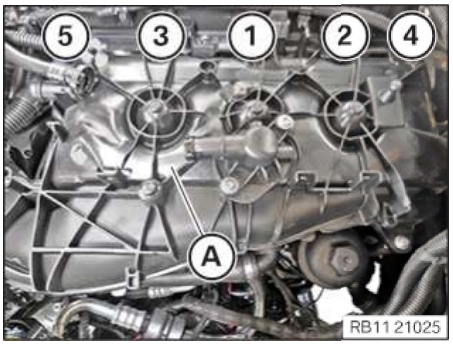


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6	Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

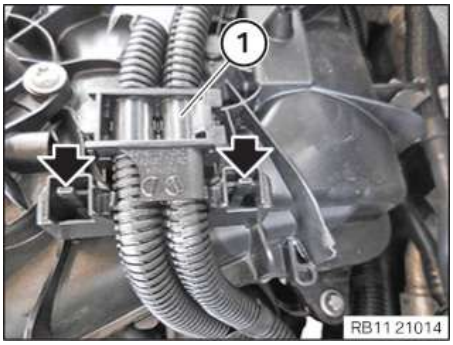


- Tighten down screw (1).

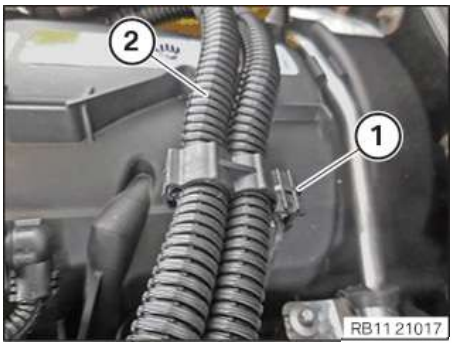
Intake plenum to support

M6X25		Tightening torque	8 Nm

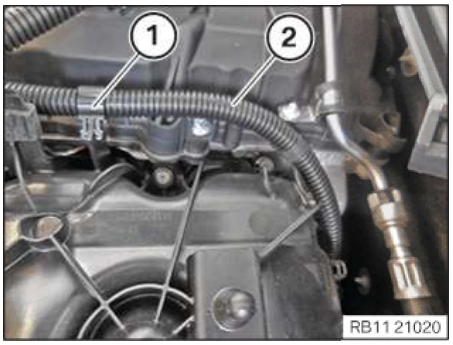
cardiagn.com



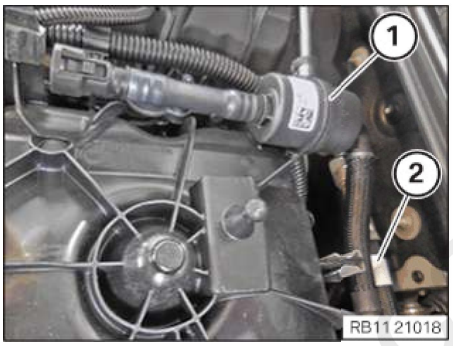
- Insert and install the wiring harness section (1) for the injectors and ignition coils.
  The locks (arrows) must engage audibly.



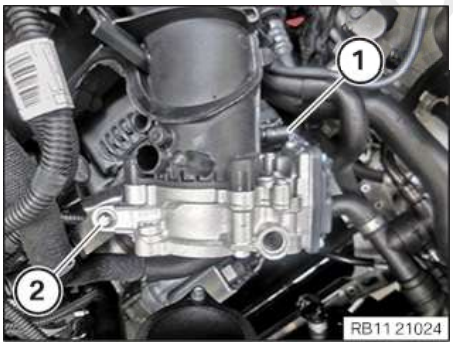
- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



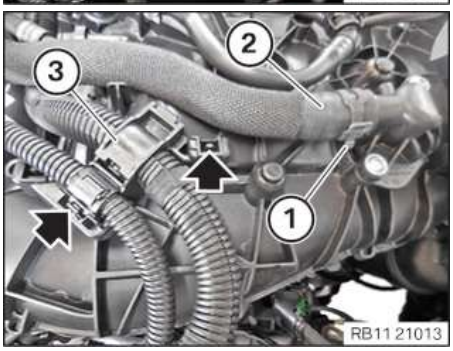
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

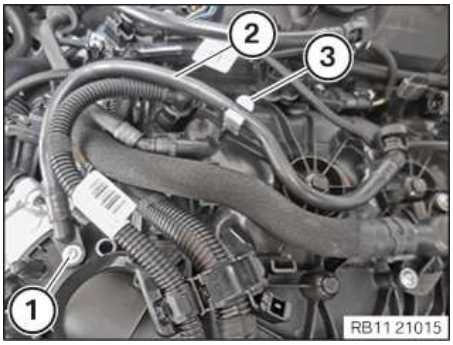
Throttle body to holder

M6X25		Tightening torque	8 Nm



- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

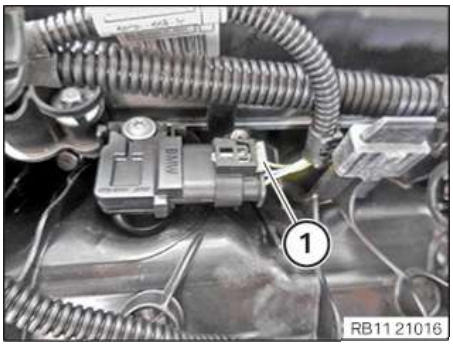
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- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

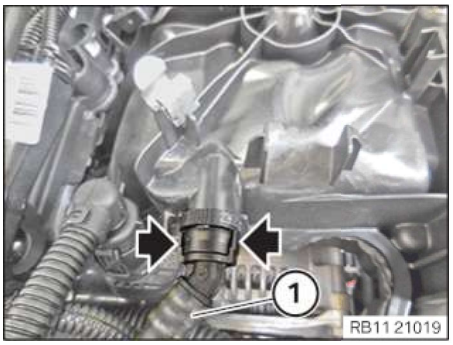
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



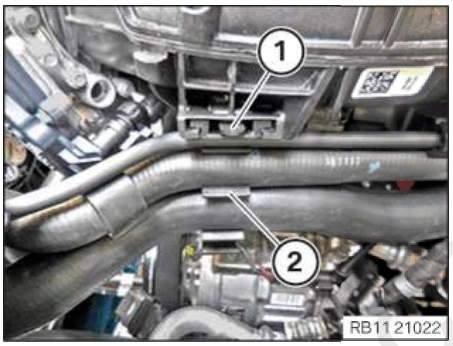
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

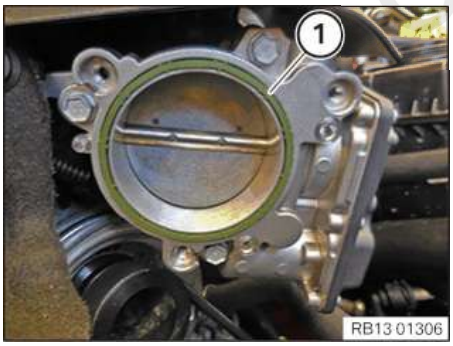


- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

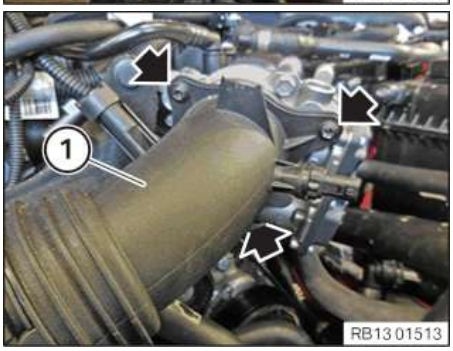


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

  Parts: Gasket

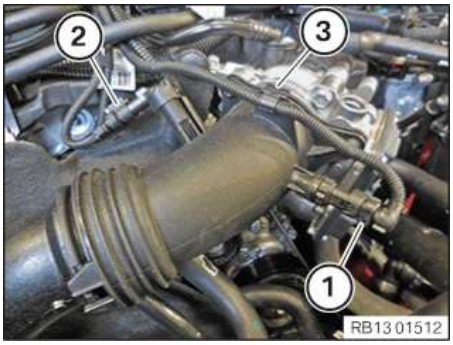


- Insert and install charge air line (1).
- Tighten screws (arrows).

Charge air line to throttle body

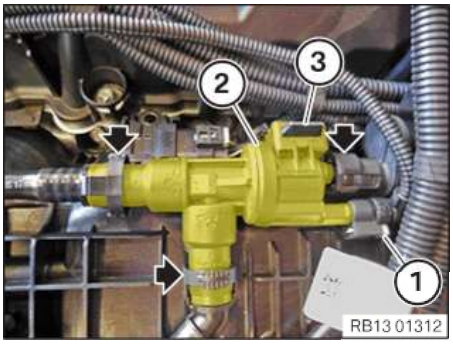
M6		Tightening torque	8 Nm

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- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

73 – Installing the tank vent valve

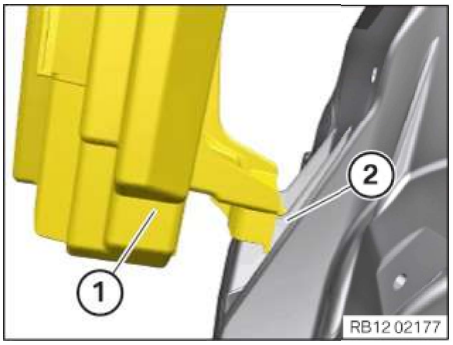


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

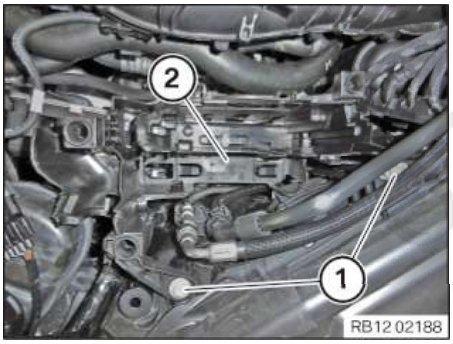
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

74 – Installing the control unit holder



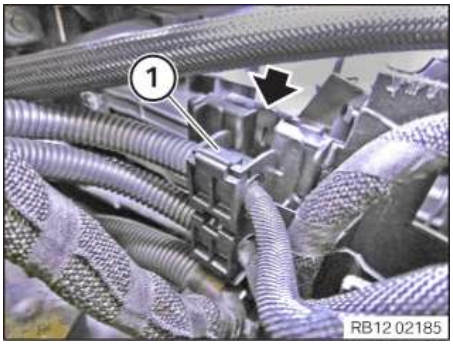
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

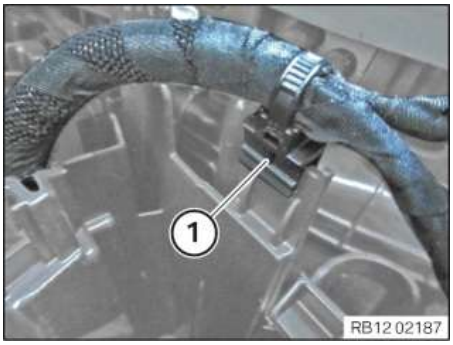
Hexagon screw		Tightening torque	8 Nm



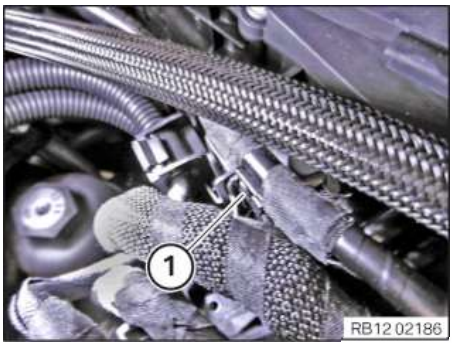
- Feed in and install the cable clip (1).

  Lock (arrow) must audibly engage.

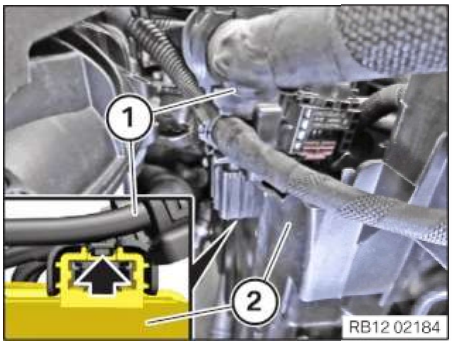
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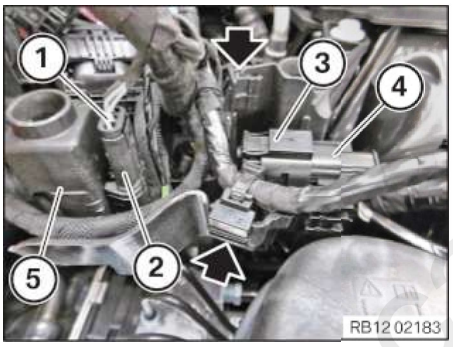
- Secure clamps (1).



- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

75 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

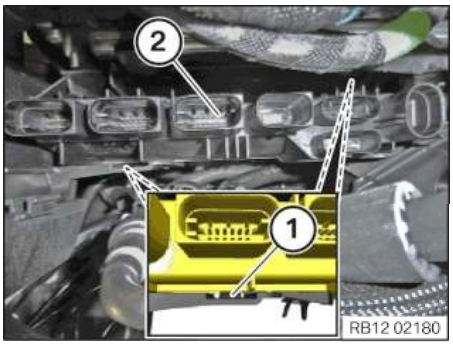
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Insert and install the integrated supply module (PDM) (2).

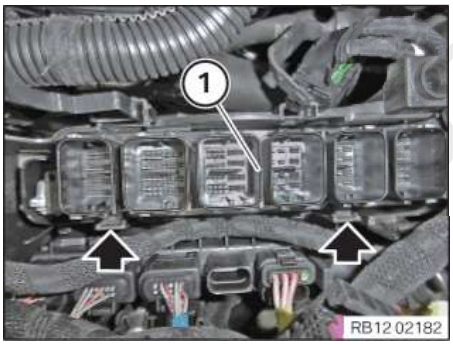
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



- Connect connectors (1) and lock.

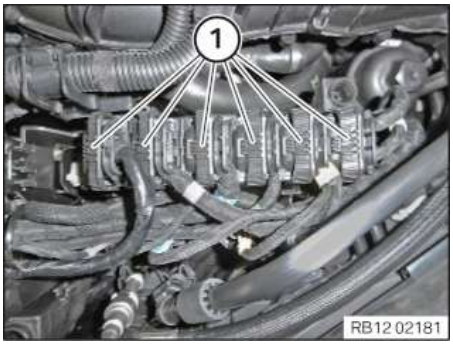
  The connectors (1) must engage audibly.

76 – Installing the DME control unit



- Feed in and install DME control unit (1).

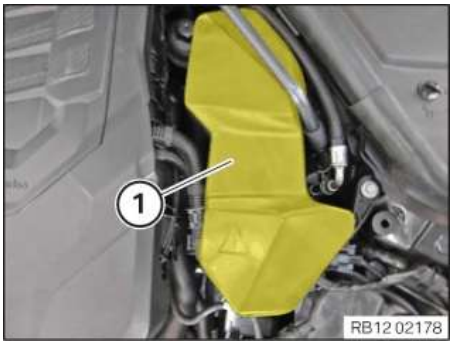
  The locks (arrows) must engage audibly.



- Connect connectors (1) and lock.

  All connectors (1) must engage audibly.

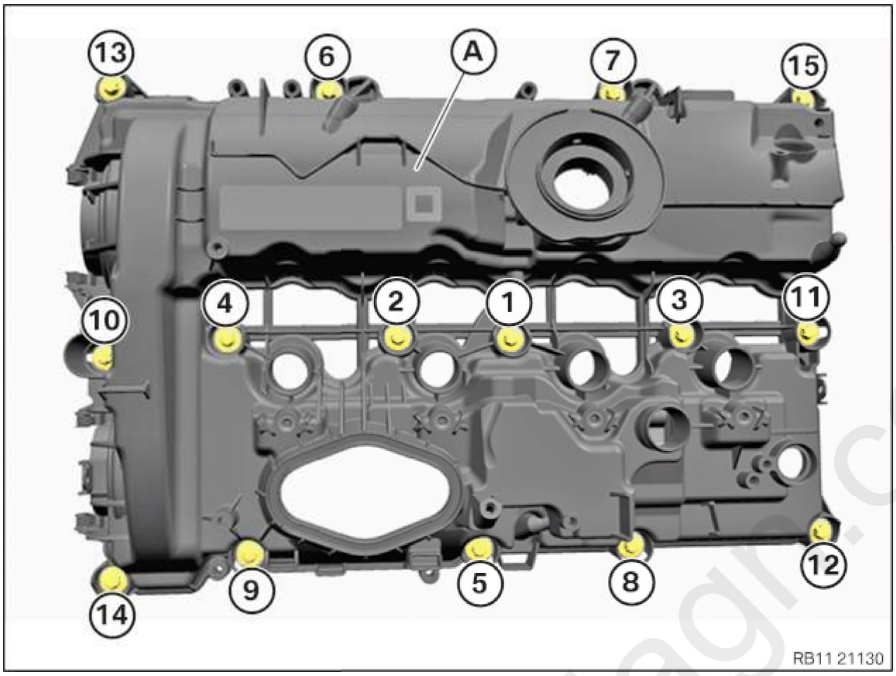
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- Insert and install cover (1) into guides.

77 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

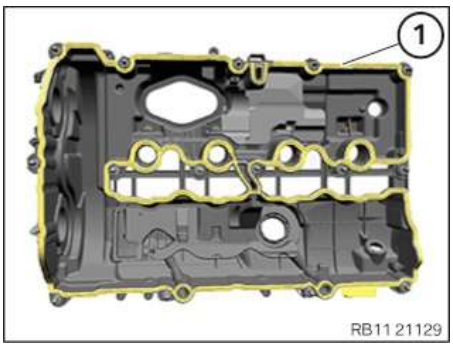
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

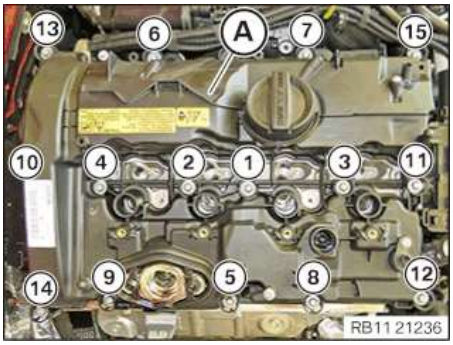
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

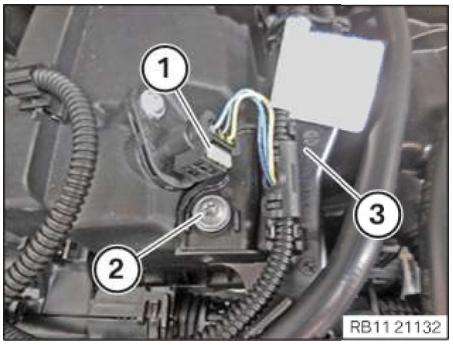
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

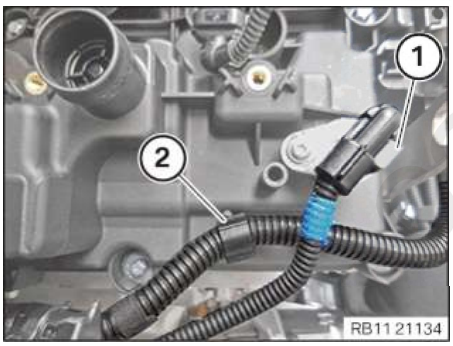


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

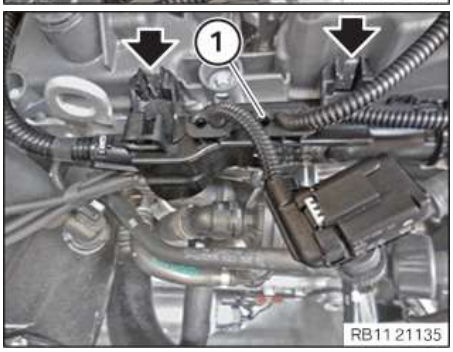
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

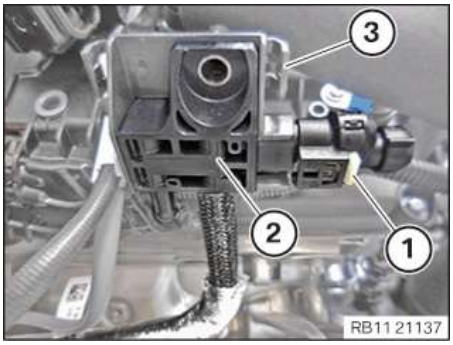


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

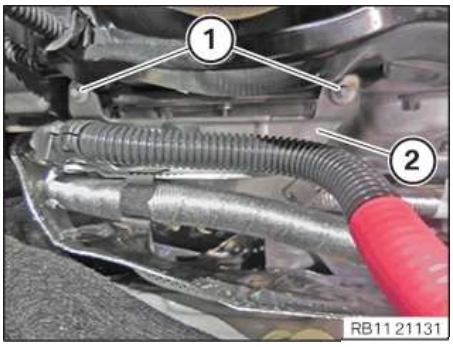


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

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- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

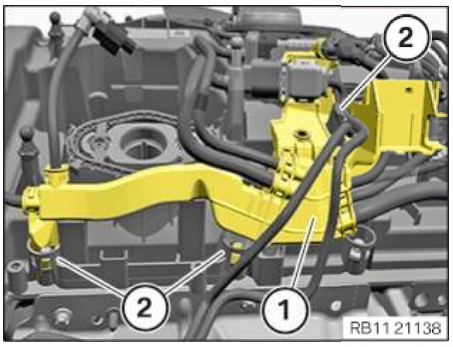
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

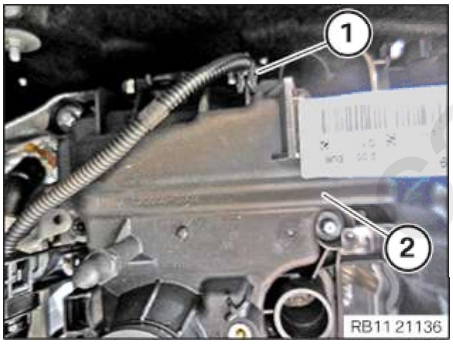
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

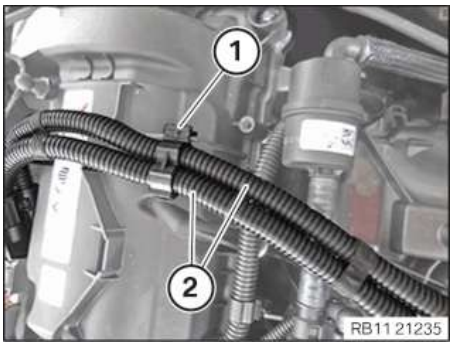
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.



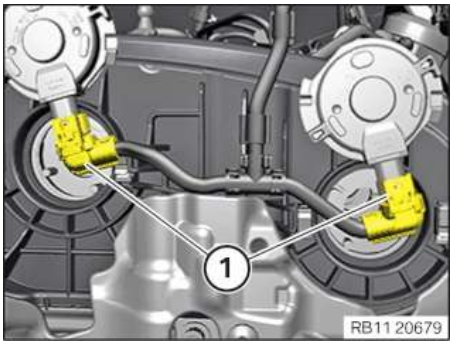
- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

78 – Installing both actuators

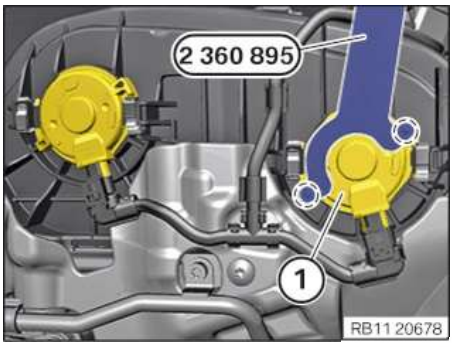
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NOTICE

The figure shows the rear side of the engine.

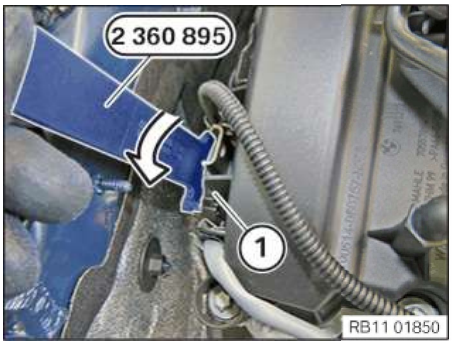
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



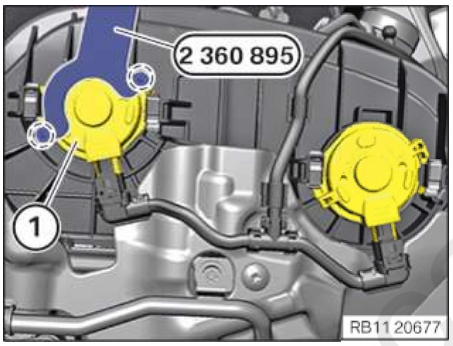
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



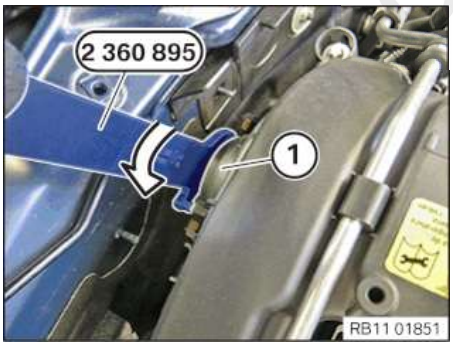
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

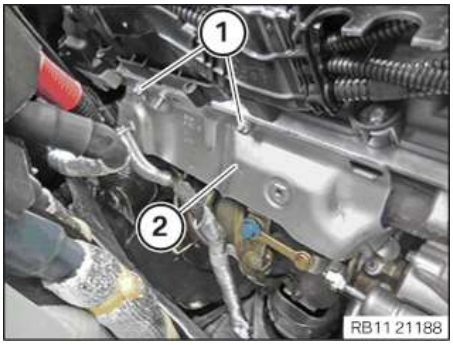
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

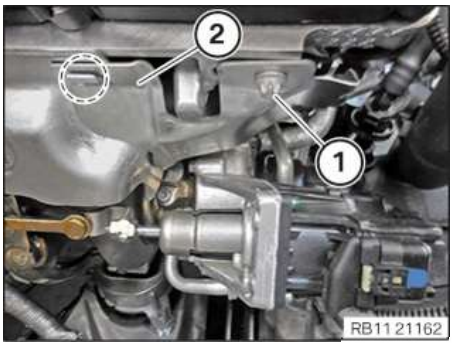
79 – Installing the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

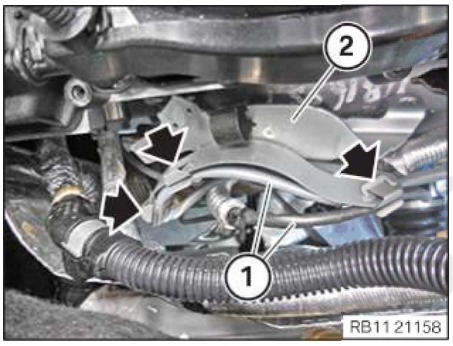


- Tighten down screw (1).

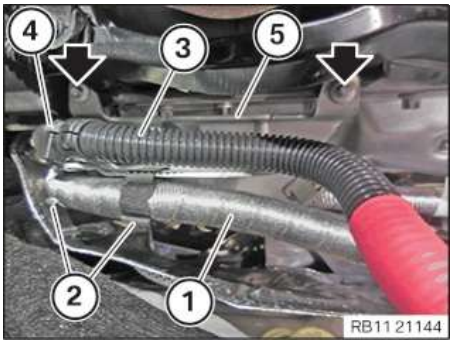
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

80 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

81 – Prepare the injectors for installation

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RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

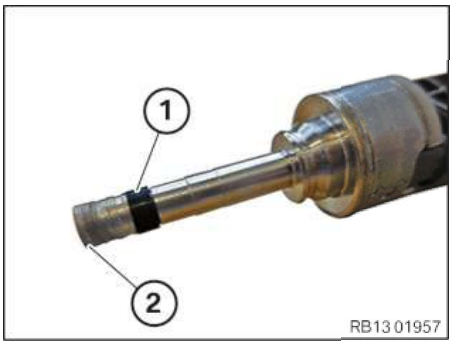
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

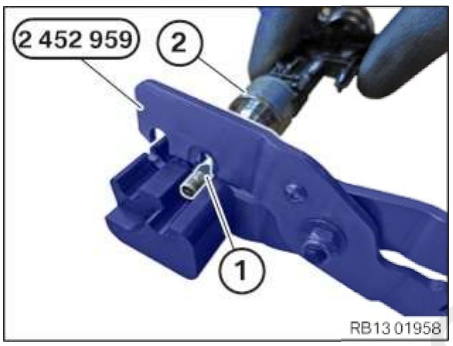
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

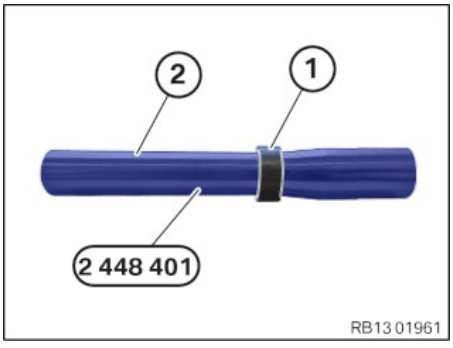


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

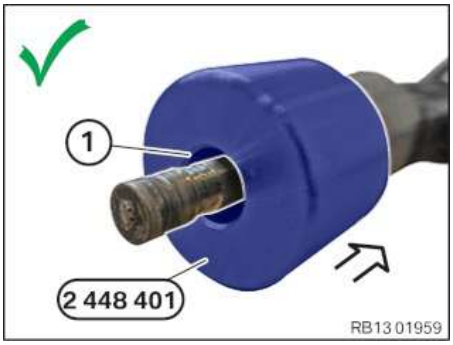
  (2) Sliding sleeve

  (3) Assembly sleeve



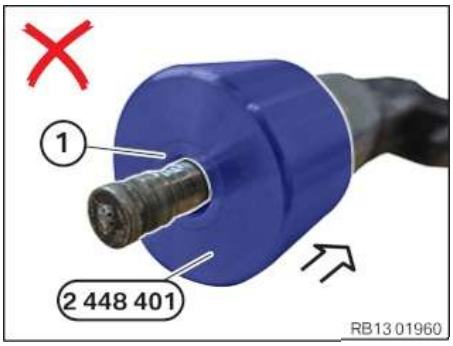
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.

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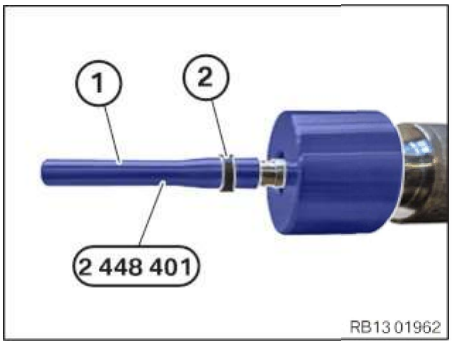
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

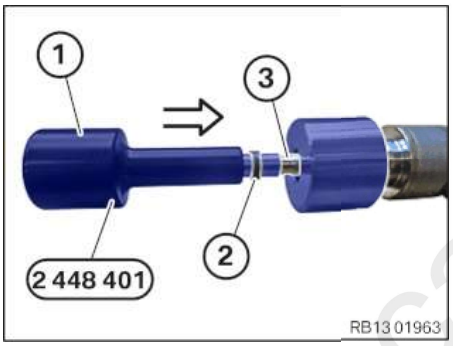


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

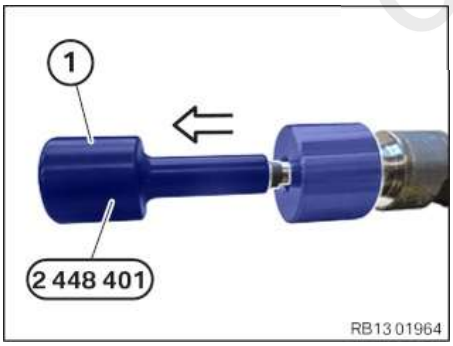
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



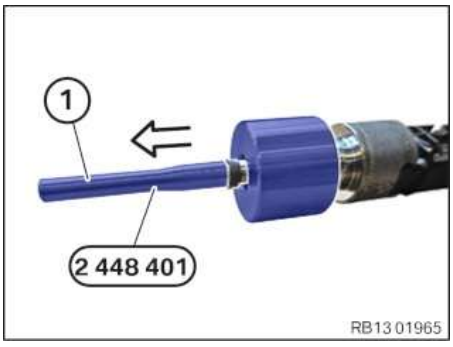
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

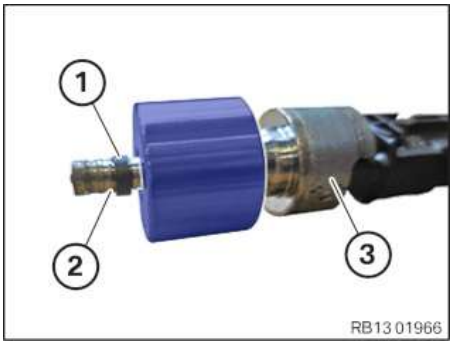


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

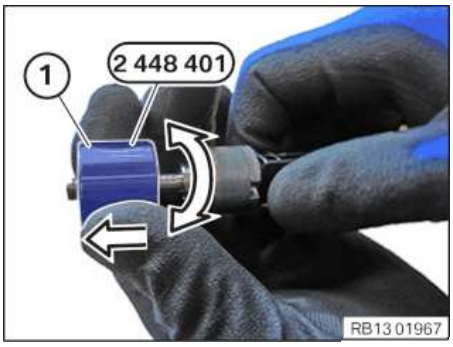


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

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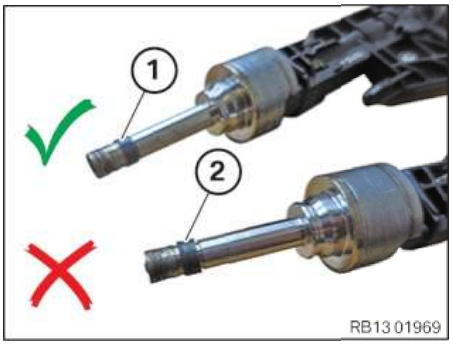


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

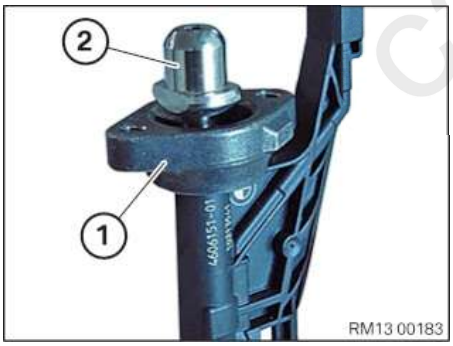


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

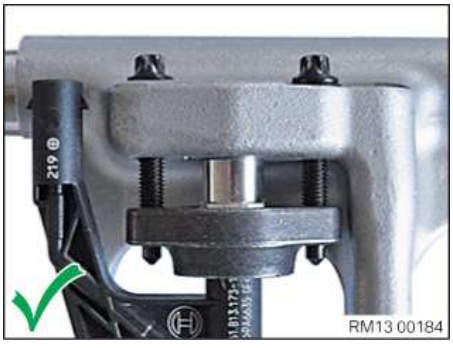
82 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



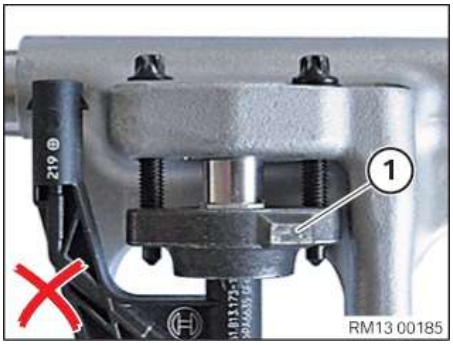
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

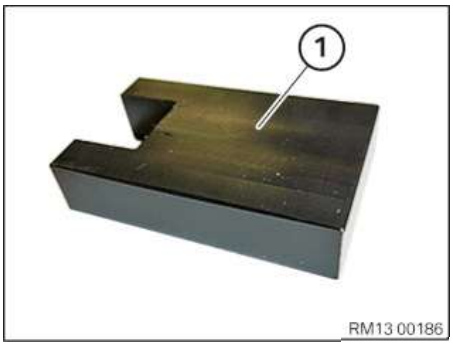
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



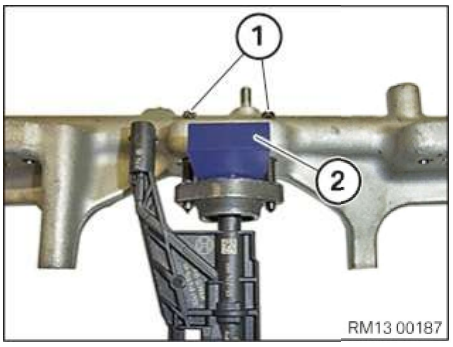
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)

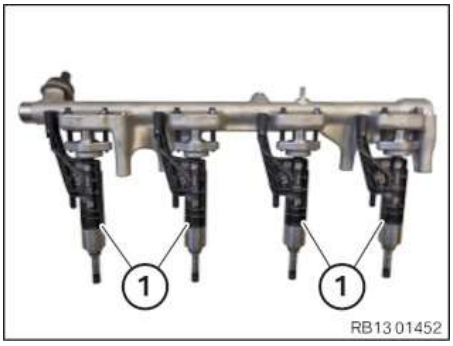
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.

- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



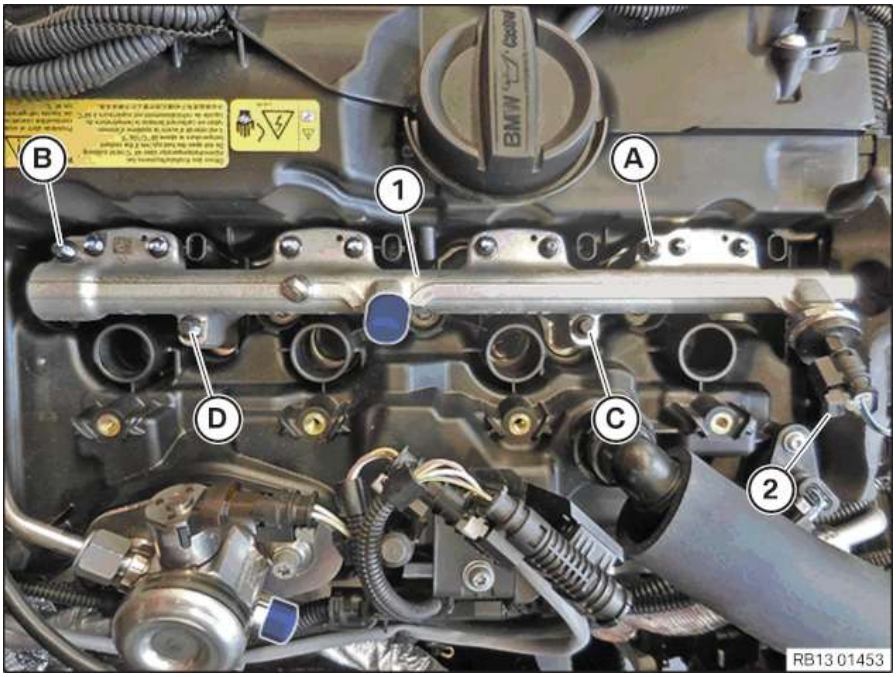
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

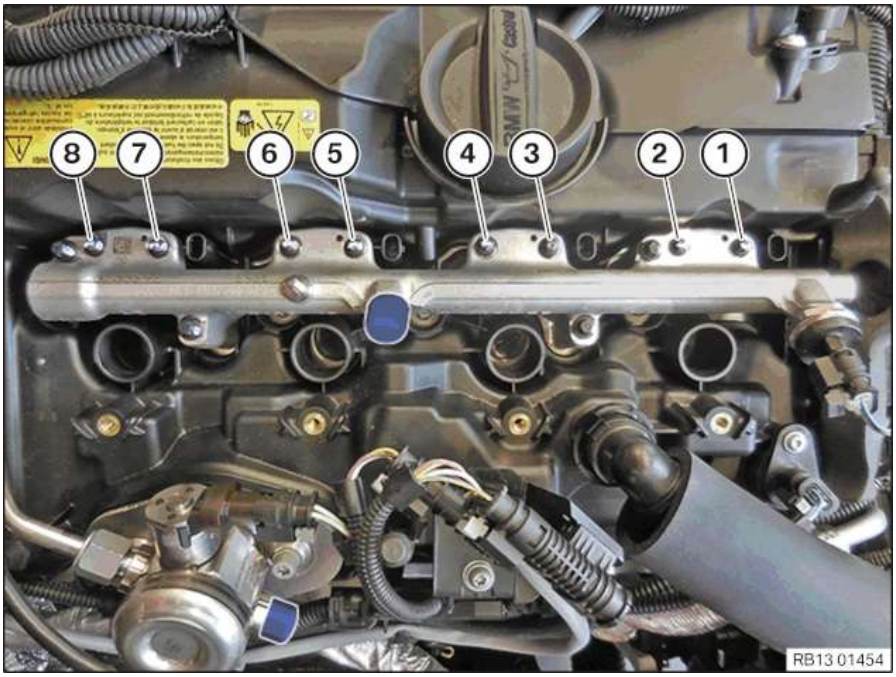
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

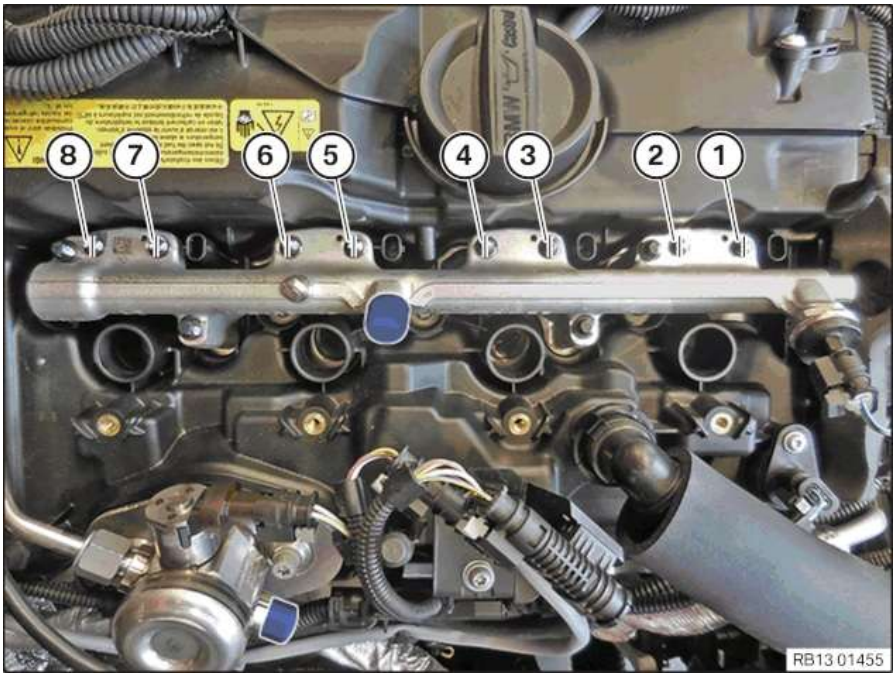
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

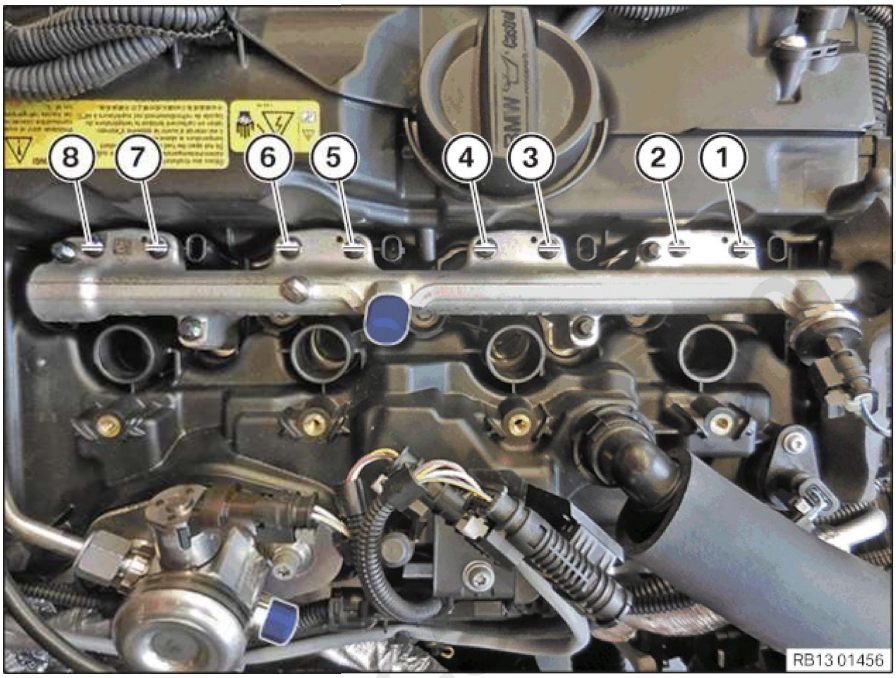
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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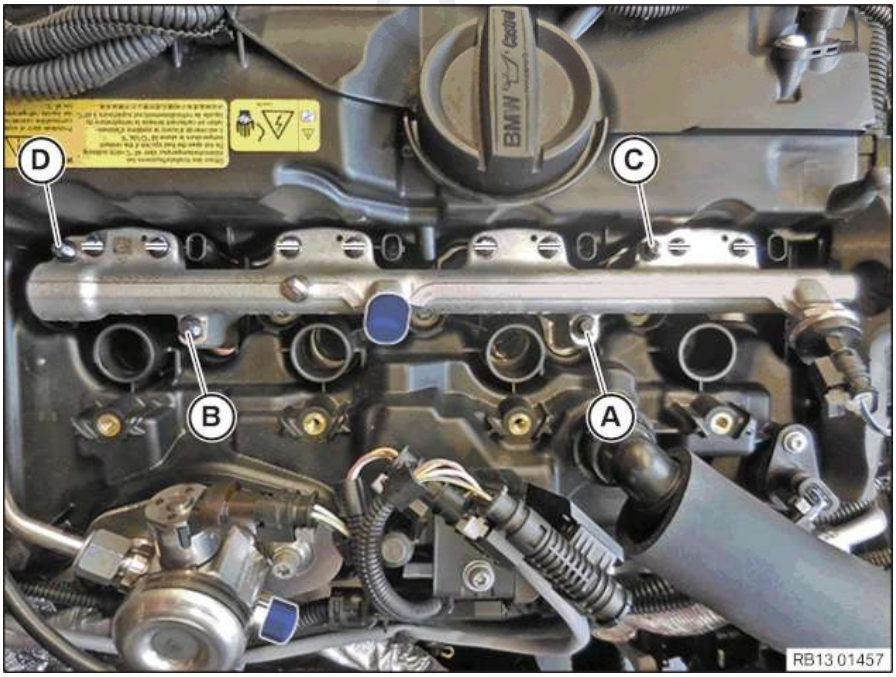


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

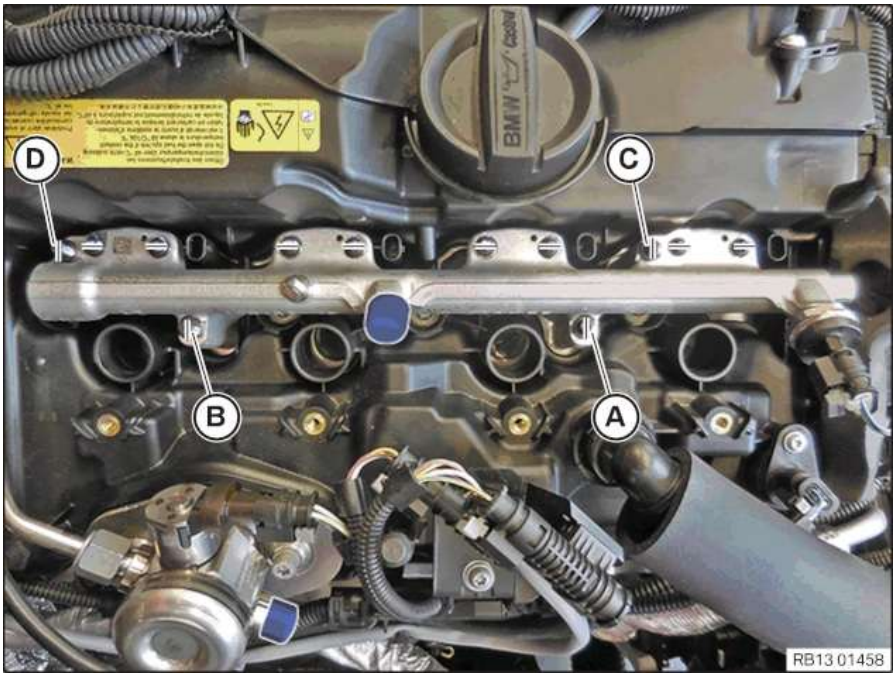
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

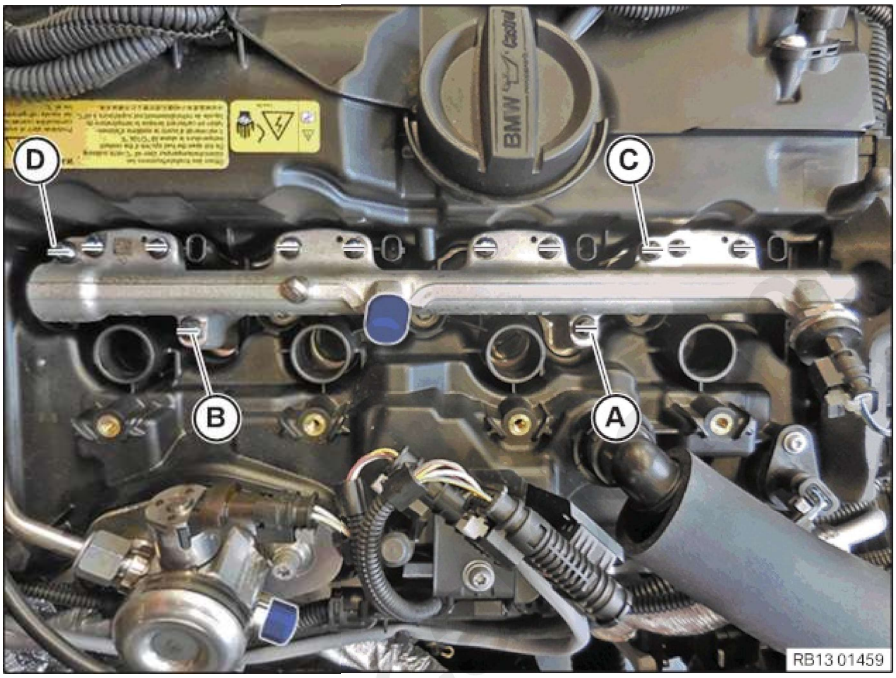
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

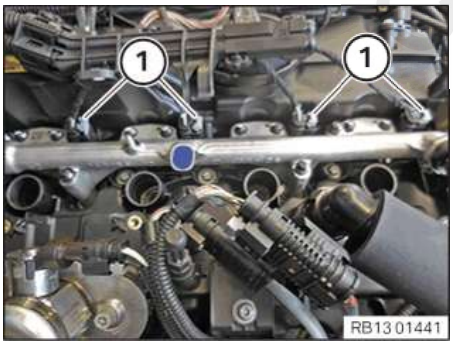


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



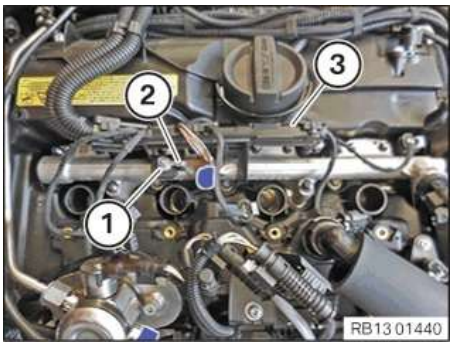
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

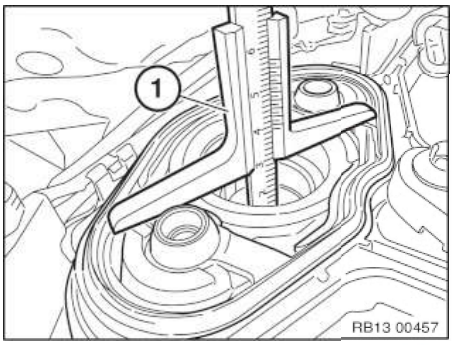
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

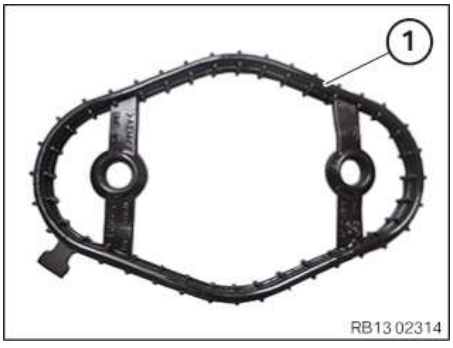
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

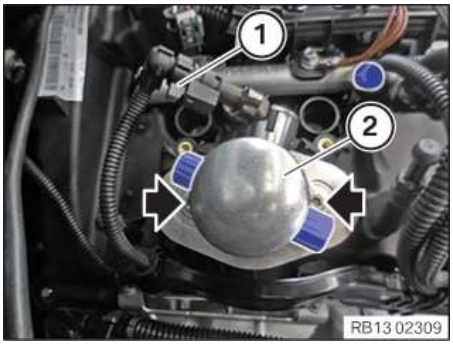
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

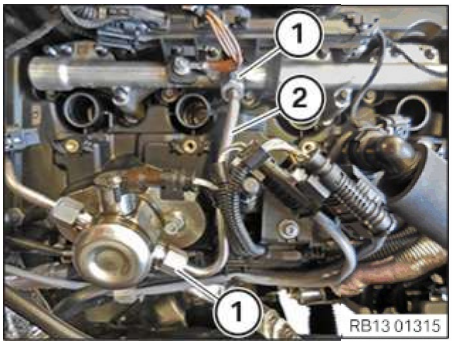
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

84 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

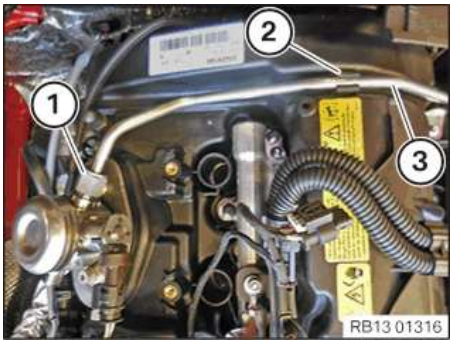
85 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

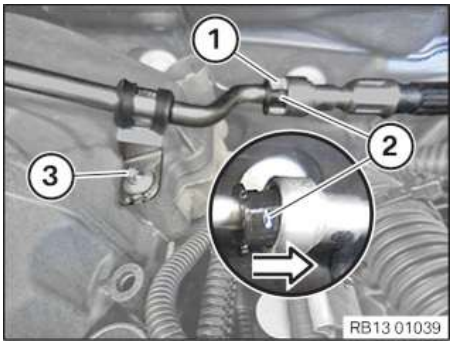


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

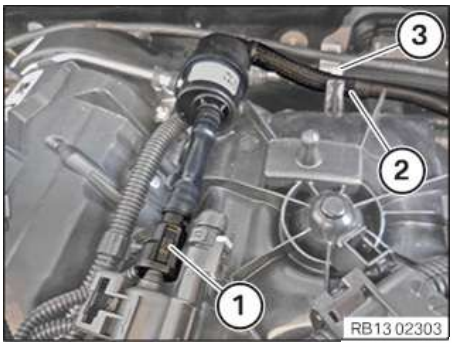
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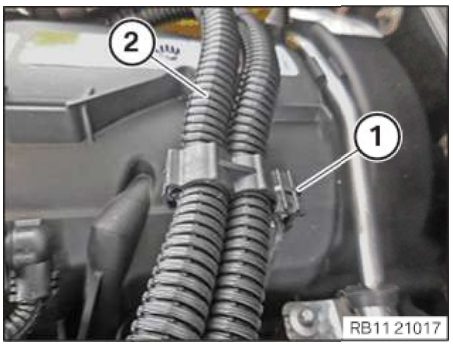
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

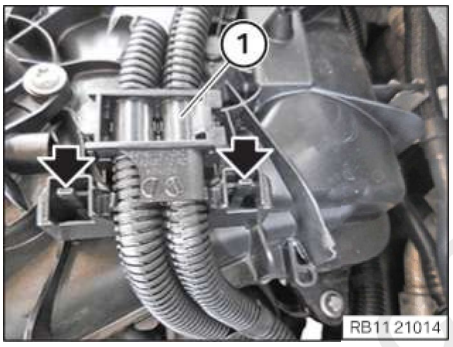
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

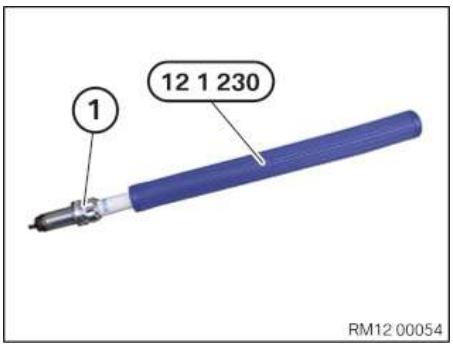


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

86 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

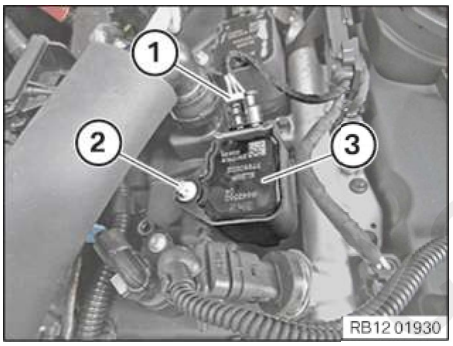
M12x1.25		Tightening torque	23 Nm

87 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



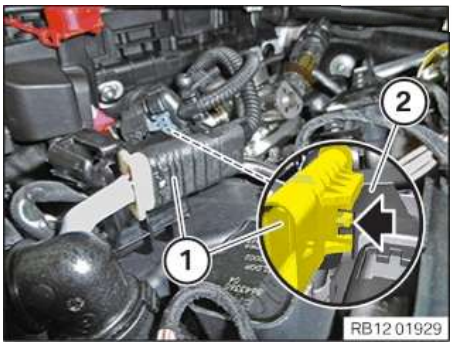
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

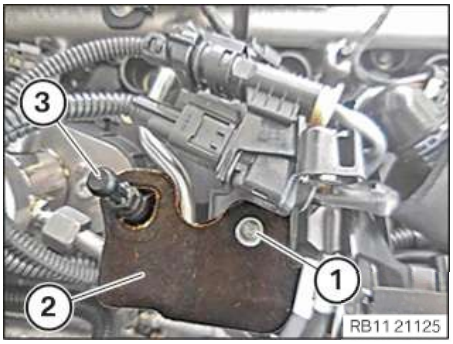
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

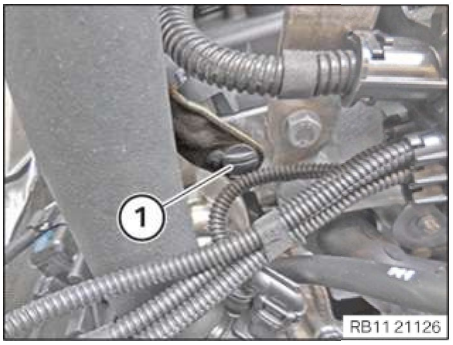
88 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

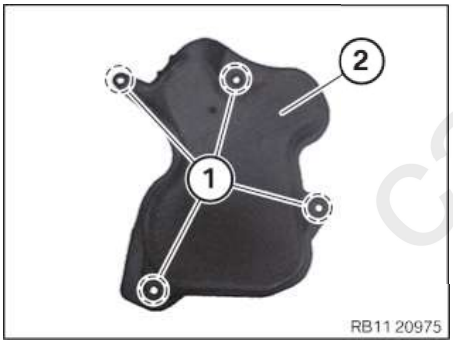
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



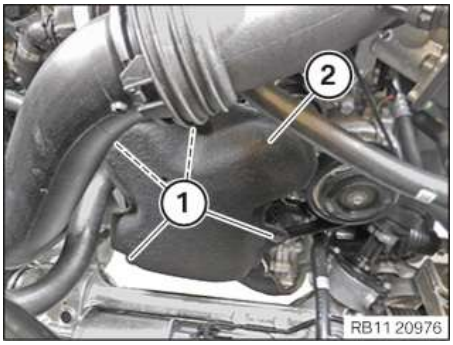
- Secure the clip (1).

89 – Install the acoustic cover for the engine at the front



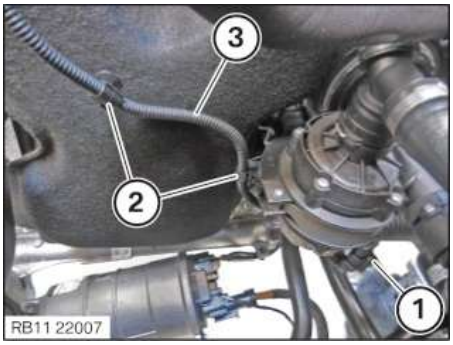
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



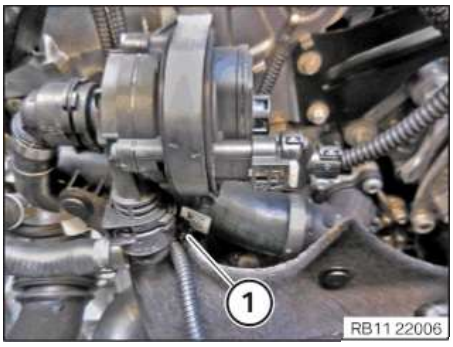
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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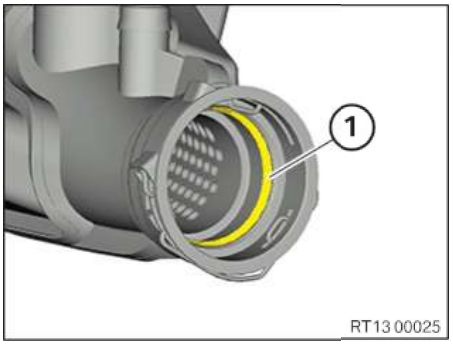
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

90 – Installing the clean air pipe with resonator

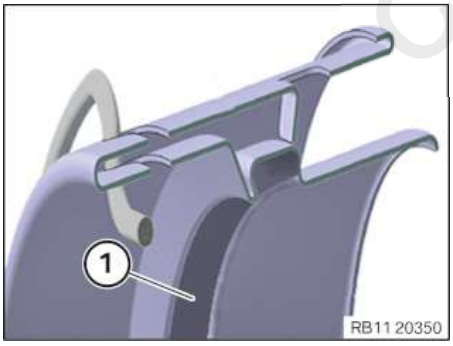


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

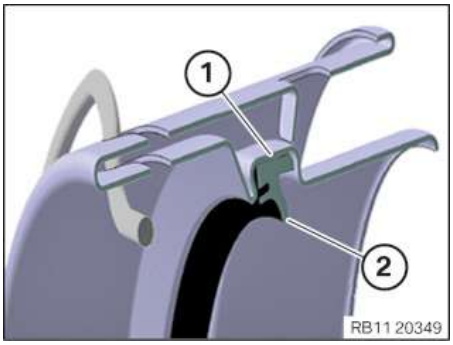
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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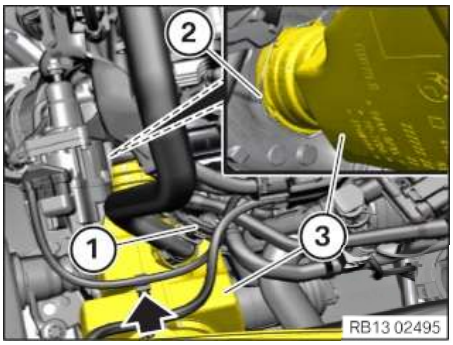
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

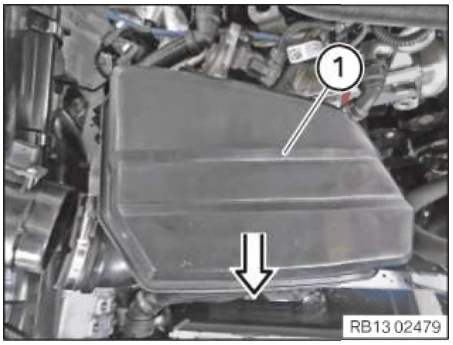
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



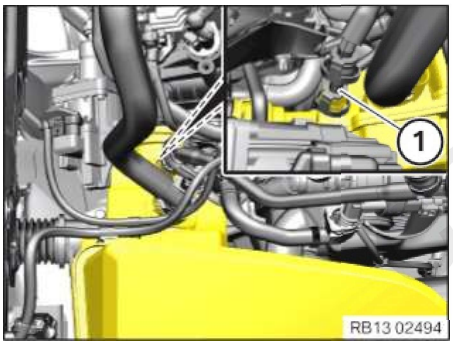
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

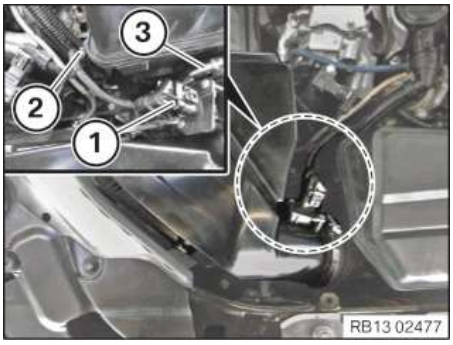
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

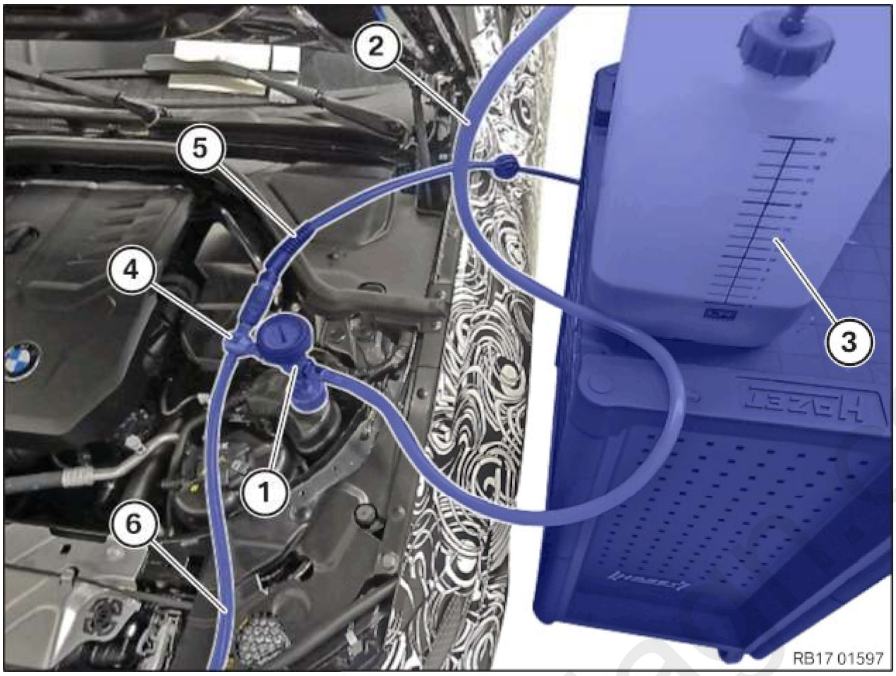
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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

91 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

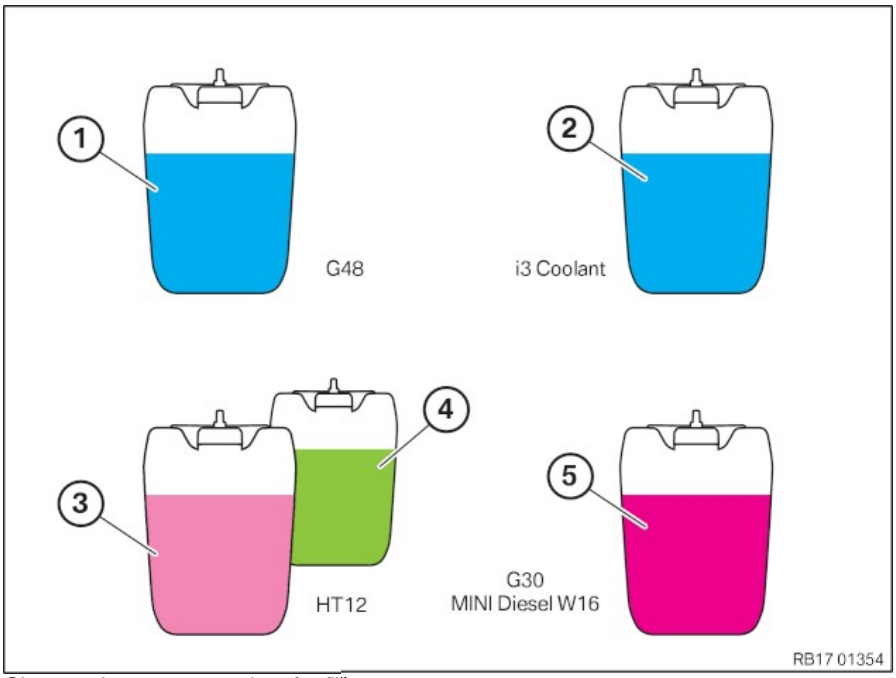
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

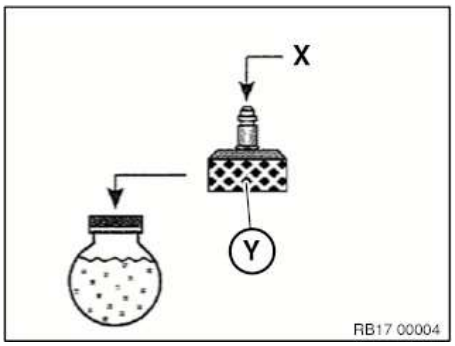
- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

Capacity of low-temperature coolant circuit G20

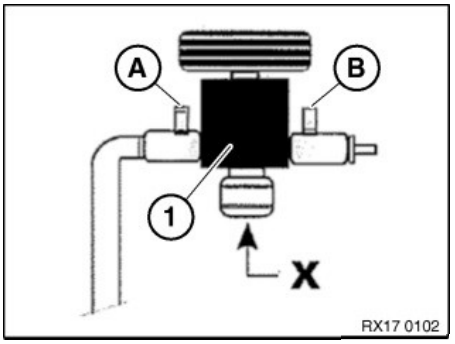
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

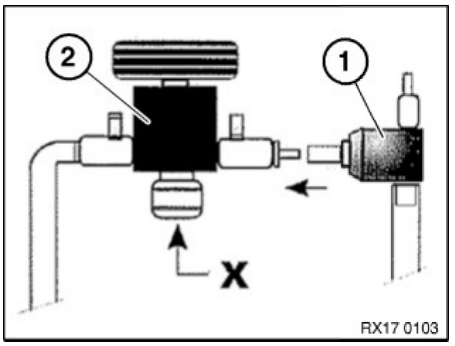
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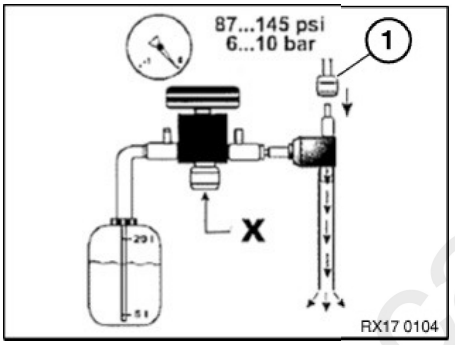
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



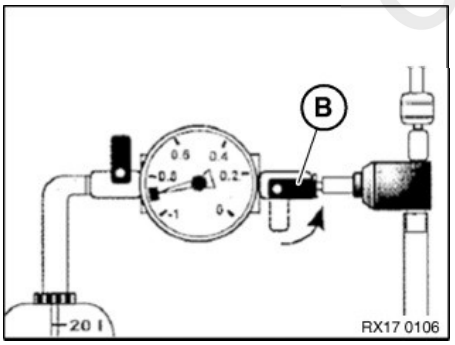
- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



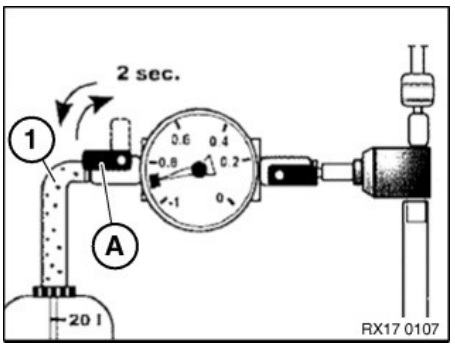
- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.



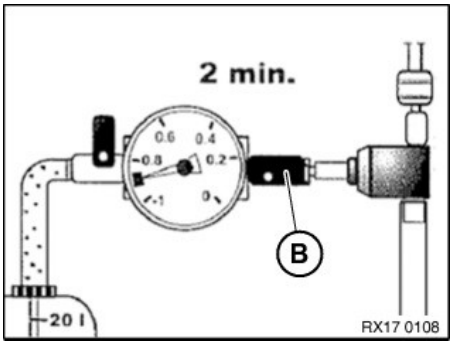
- Open shut-off valve (B).
  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

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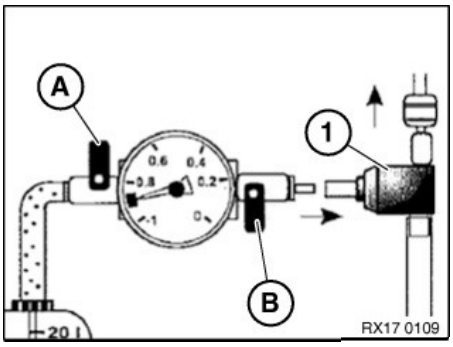


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

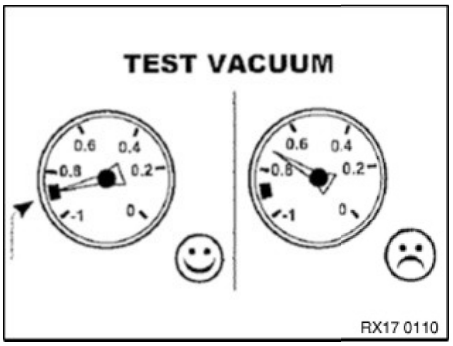
- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.



Result

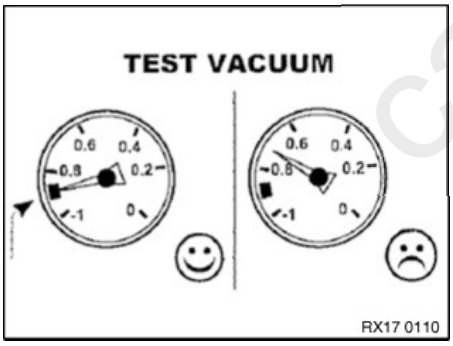
» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

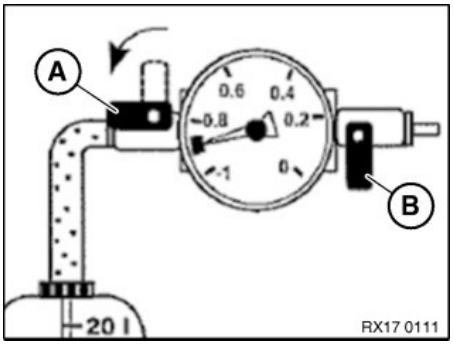


Result

» Vacuum remains constant.

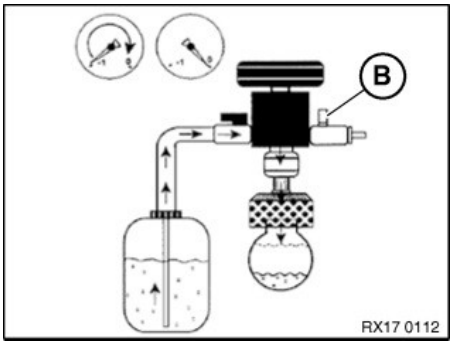
Measure

- Continue with filling.

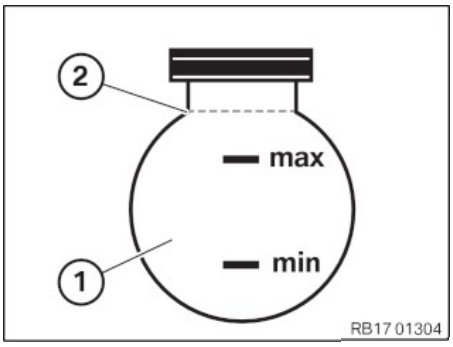


- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.

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- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

92 – Disconnecting all battery earth leads



- See additional information.

93 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

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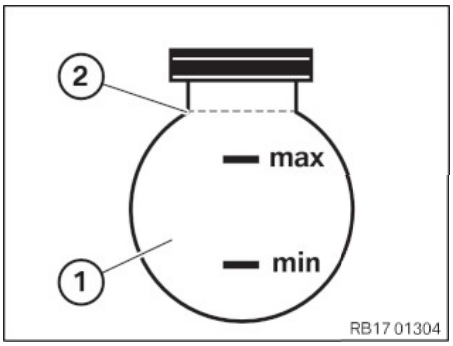
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

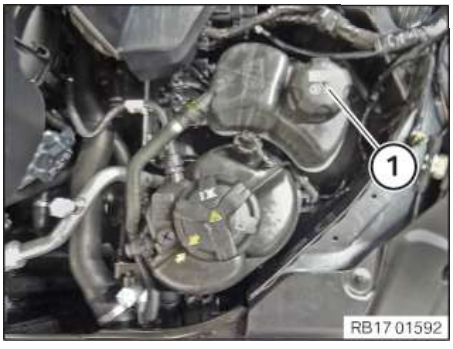
  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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TECHNICAL INFORMATION

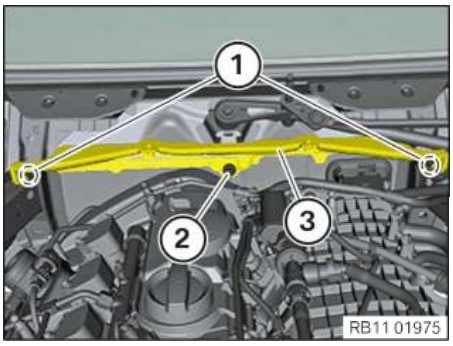
After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

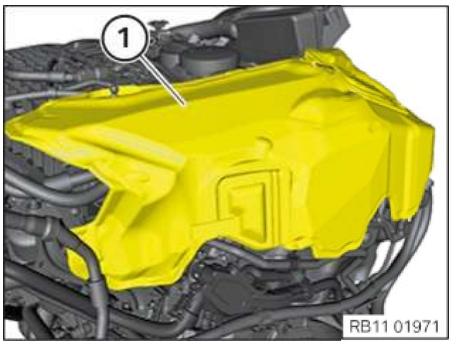
- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

94 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

95 – Installing acoustic cover at rear

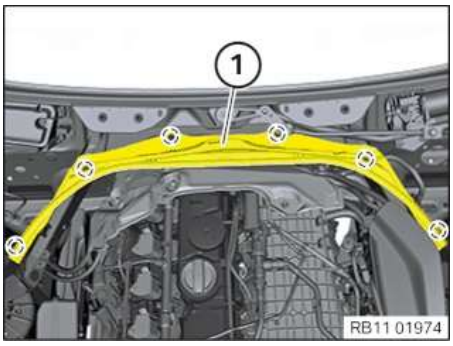


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

96 – Installing the centre bulkhead upper part

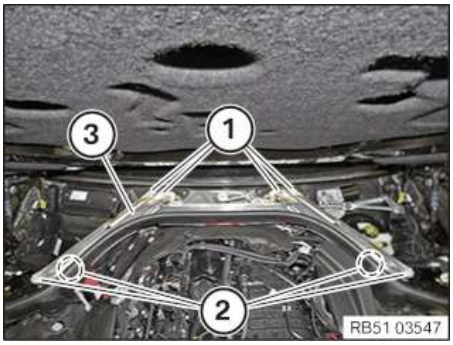


- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

	Tightening torque	3 Nm

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- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

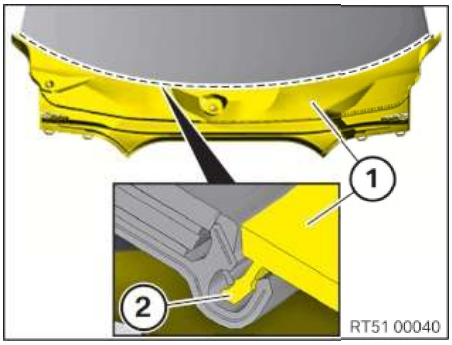
97 – Installing cowl panel cover

RISK OF DAMAGE

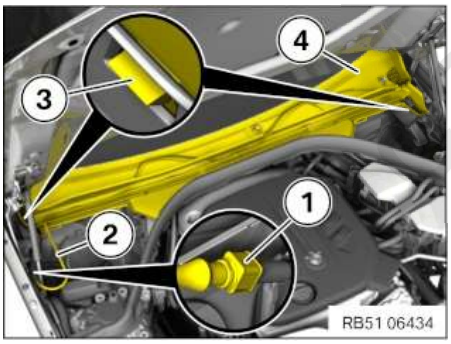
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

98 – Installing both wiper arms

NOTICE

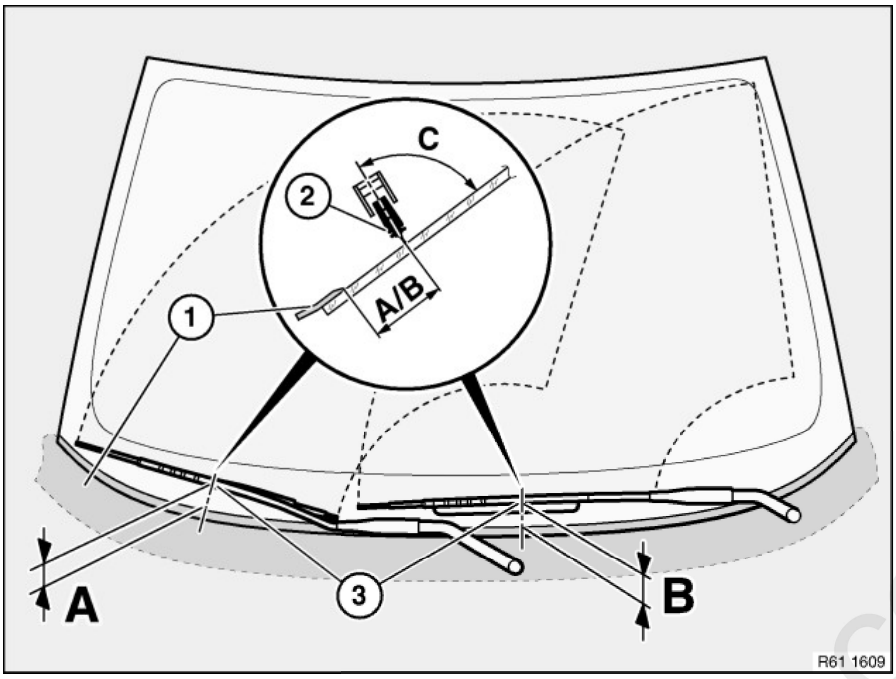
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

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TECHNICAL INFORMATION

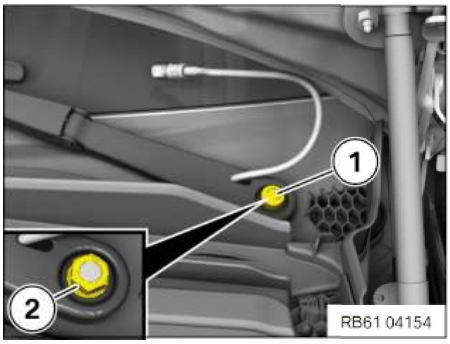
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

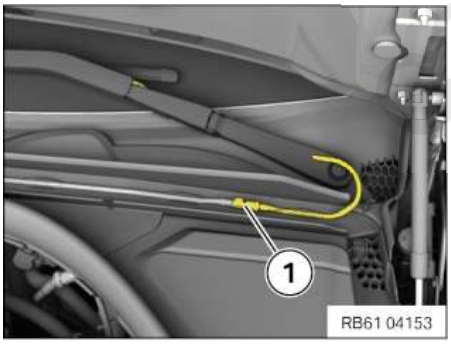


- Tighten nut (2).

Windscreen wiper arm

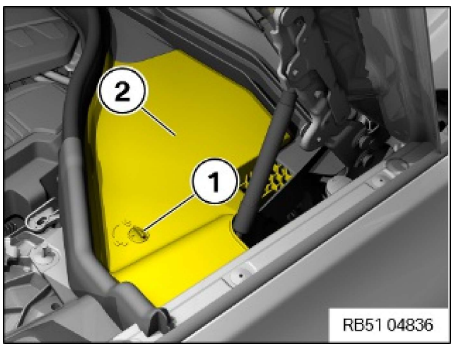
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

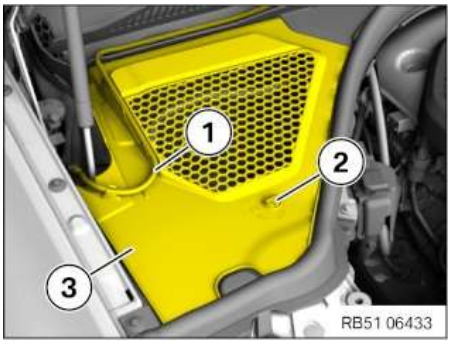
99 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

100 – Install the rear right engine compartment cover

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- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

101 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

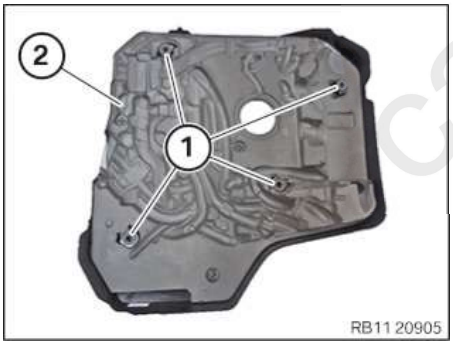
102 – Install acoustic cover

RISK OF DAMAGE

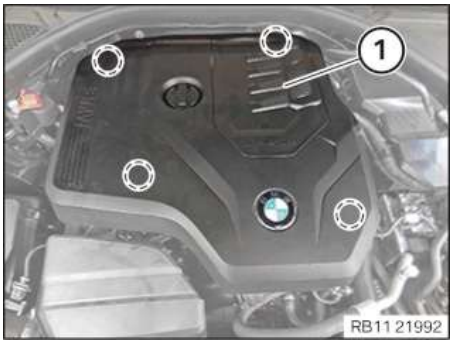
Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

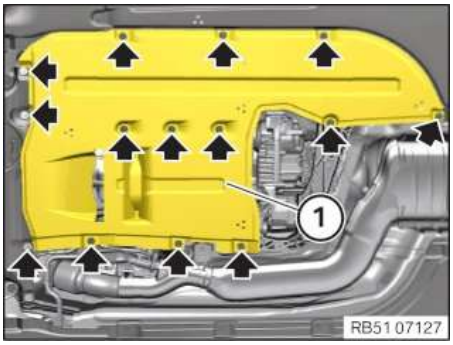


- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

103 – Installing underbody protection at rear

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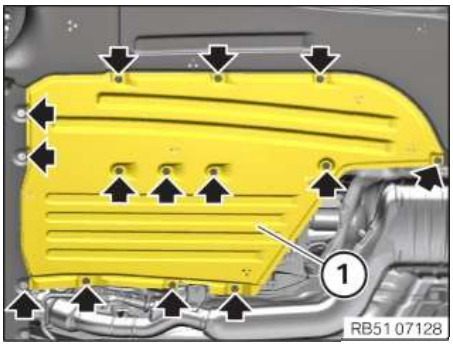
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

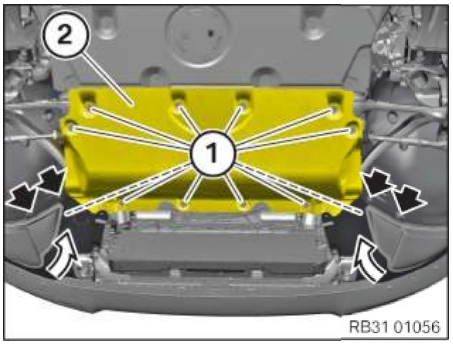
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

104 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

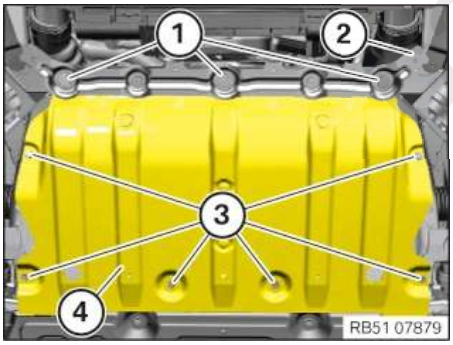
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

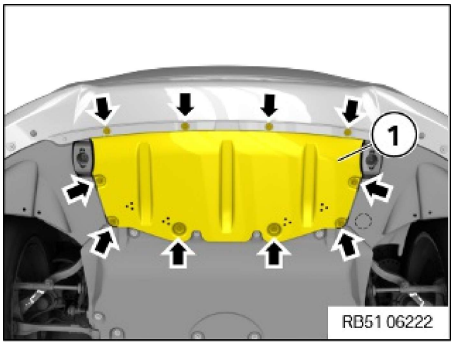
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

105 – Installing the front underbody protection



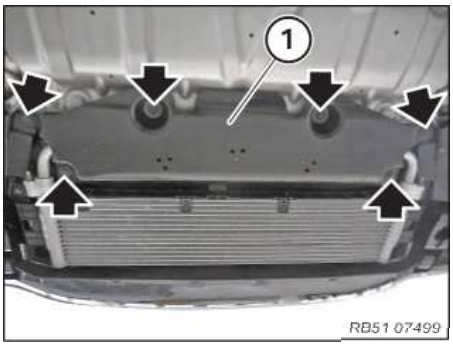
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



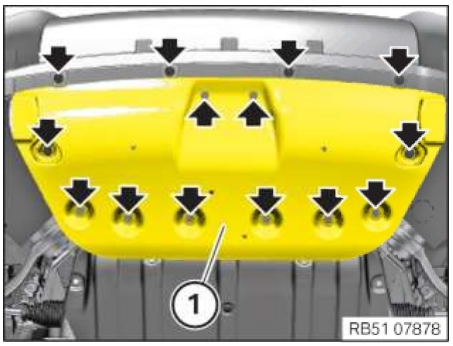
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

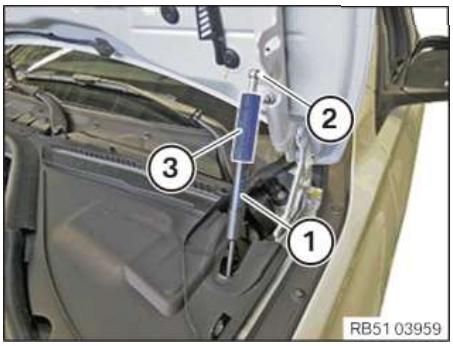
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

106 – Check engine oil level

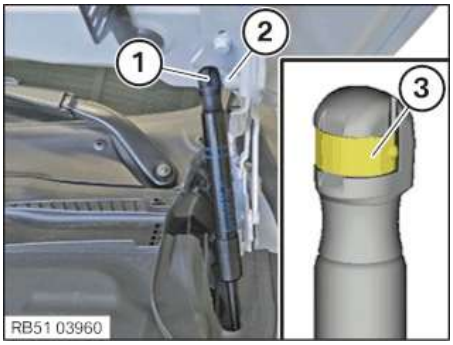
- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

107 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 29

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head — Used in step 405767

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 405767

M6		Tightening torque	8 Nm

Intake camshaft to cylinder head — Used in step 55

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Exhaust camshaft to cylinder head — Used in step 56

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

VANOS central valve to camshaft — Used in step 6364

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 66

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Gate to bearing bracket — Used in step 70

M8			20 Nm

Intake plenum to cylinder head — Used in step 72

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 72

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 72

M6X25		Tightening torque	8 Nm

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Tank ventilation line to intake plenum — Used in step 72

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 72

M6		Tightening torque	8 Nm

Control unit holder on spring strut dome — Used in step 74

Hexagon screw		Tightening torque	8 Nm

Cylinder head cover to cylinder head — Used in step 77

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 77

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 7780

6X18		Tightening torque	6 Nm

Heat shield to cylinder head — Used in step 79

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 79

M6 x 12		Tightening torque	8 Nm

Ground cable to rail — Used in step 82

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 83

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 84

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 85

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 85

M6 screw		Tightening torque	6,5 Nm

Spark plugs — Used in step 86

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 87

Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover — Used in step 88

TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 90

Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead — Used in step 96

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 96

M10x25 screw		Tightening torque	56 Nm

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Tension strut to spring strut dome — Used in step 96

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 98

Combination hexagon nut		Tightening torque	35 Nm

Underbody protection — Used in step 103

Hexagon screw		Tightening torque	3 Nm

Underbody protection of the steering gear — Used in step 104

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 104

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 104

M10		Tightening torque	56 Nm

Underbody protection front — Used in step 105

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

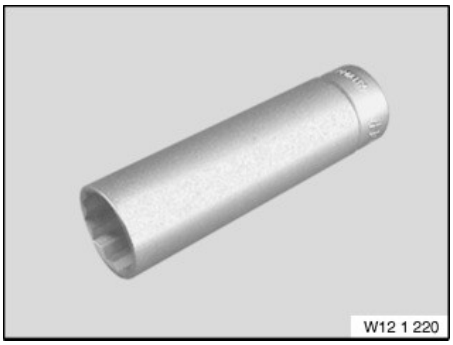
2 360 895 Pin wrench



Common — Used in step 1278

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 560 (12 1 220) Socket

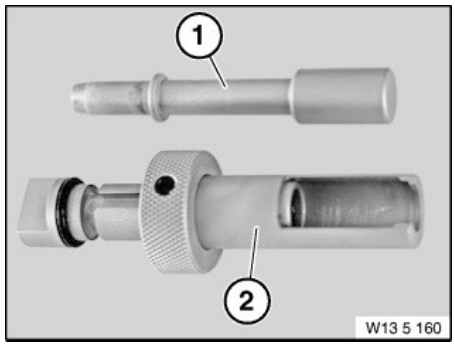


Common — Used in step 1686

Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

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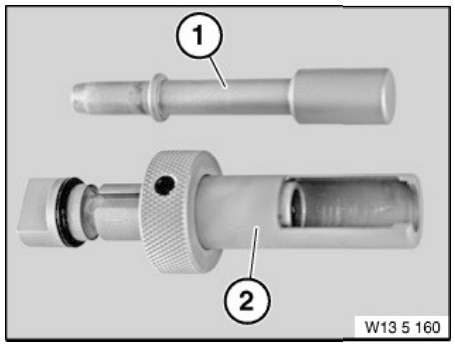
0 496 567 (13 5 161) Fastener



Common Used in step 19

Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

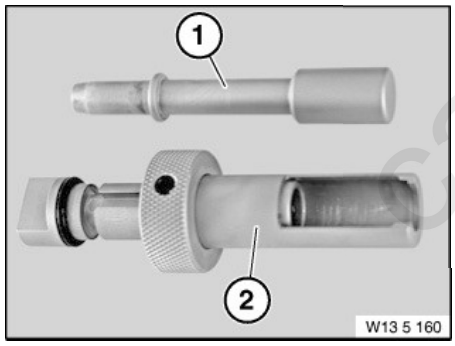
0 496 568 (13 5 162) Fastener



Common Used in step 19

Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener



Common Used in step 19

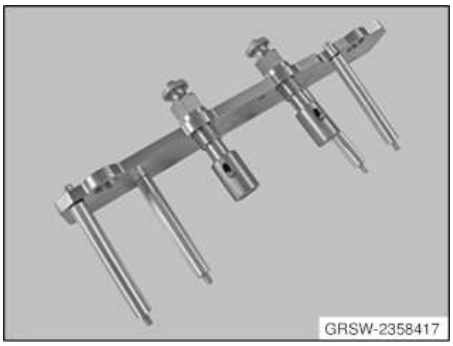
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

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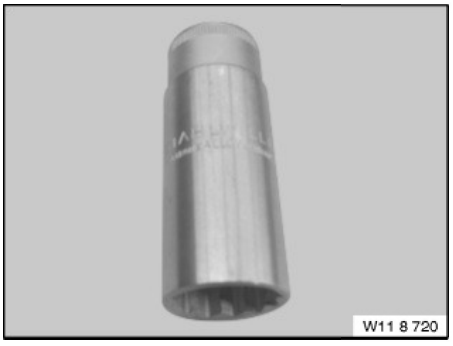
2 358 417 Device



Common Used in step 20

Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46

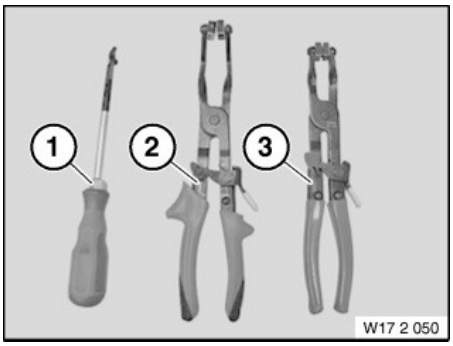


Common Used in step 20

Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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0 495 794 (17 2 050) Pliers



Common Used in step 3472

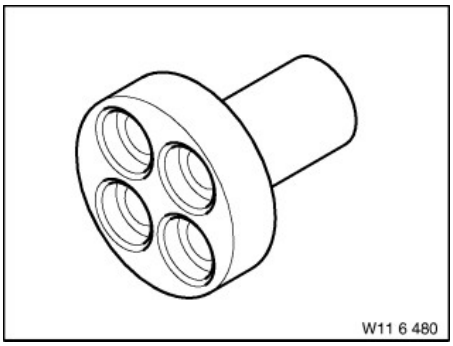
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 493 380 (11 6 480) Connector



Common Used in step 3640656783

Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

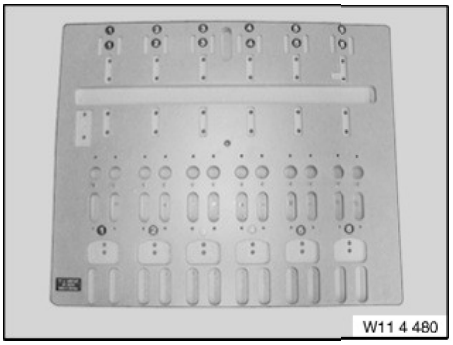
2 359 088 Device



Common Used in step 3771

Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 105 (11 4 480) oddments tray



Common Used in step 37383949505152

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

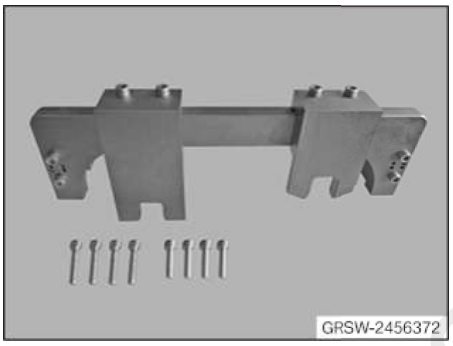
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2 288 380 Locating stud



Common	Used in step 406567
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 4048576567
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 404867
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



Common	Used in step 42436364
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 42436364
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

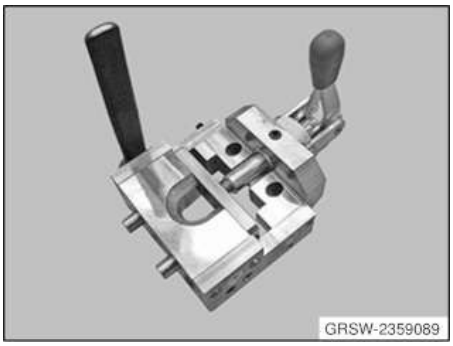
2 455 654 Tensioning tool



Common	Used in step 6265
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

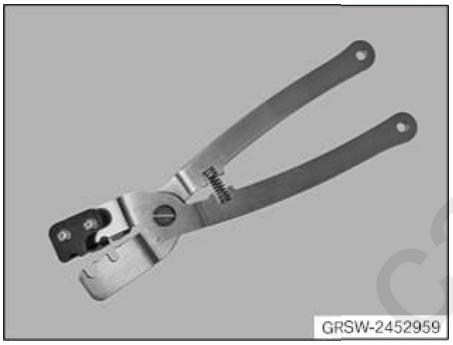
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2 359 089 Device



Common	Used in step 70
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

2 452 959 Pliers



Common	Used in step 81
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 81
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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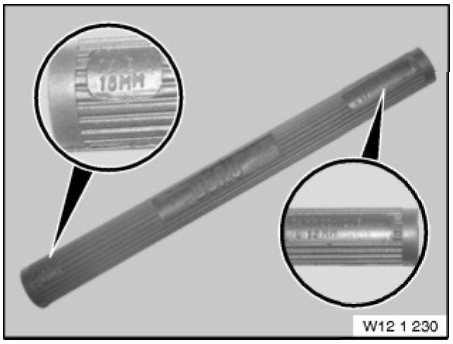
2 358 022 Gauge



Common Used in step 82

Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



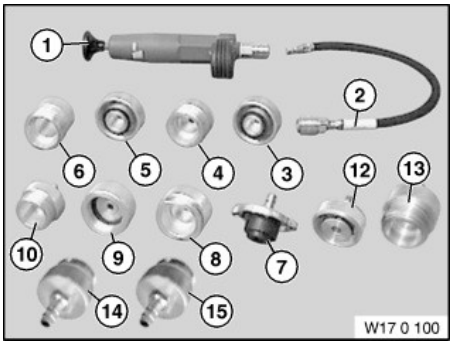
Common Used in step 86

Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 494 417 (17 0 100) Tester

Used in step 91

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Common

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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Overview Technical Data

Distance from window pane edge to wiper blade Used in step 98

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Capacity of low-temperature coolant circuit G20	Used in step 91
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

General repair instructions	**Used in step**
12 00 ... Instructions for removal and replacement of control units	3076

Repair instructions	**Used in step**
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	192
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	192
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
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61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 20 900 Disconnecting and connecting battery earth lead	192
61 35 ... Notes on ESD protection (Electro Static Discharge)	1233
61 35 ... Notes on ESD protection (Electro Static Discharge)	12152030313375
13 53 ... Clean the cylinder head around the injectors due to grit / dust	20
61 13 ... Unlocking and disconnecting different plug connections	202477
61 00 730 Encode/program control unit(s) (after vehicle test)	76
17 00 ... Notes for working on cooling system.	91

Operating materials	**Used in step**

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11 34 552 Removing and installing/replacing all valves

PRELIMINARY WORK

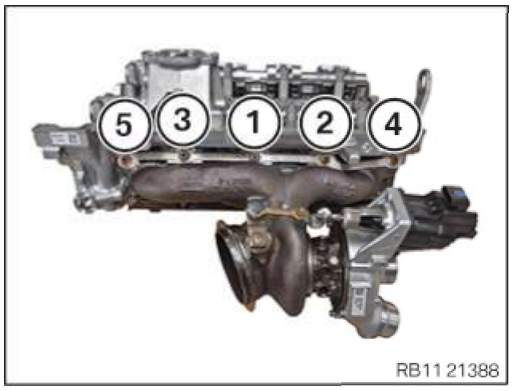
1 – Removing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

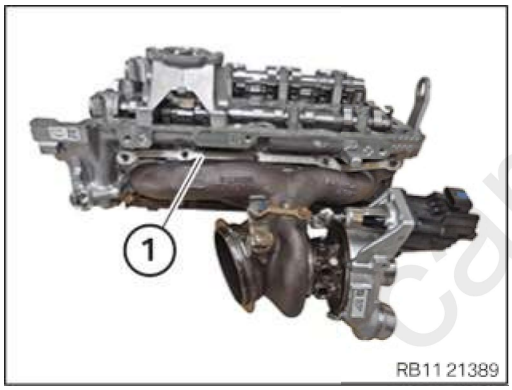
- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.



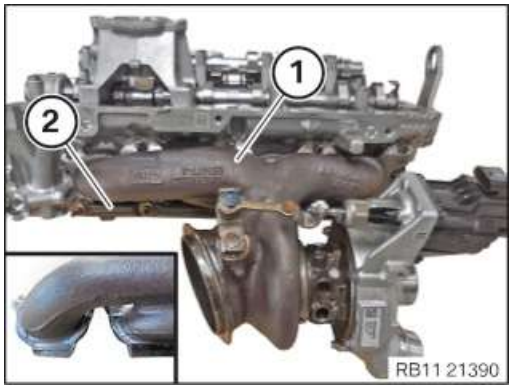
TECHNICAL INFORMATION

Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (5) to (1).



- Remove reinforcement plate (1).



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

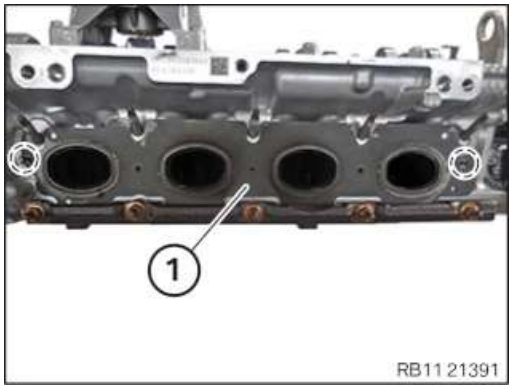
- Remove and install heavy components with the aid of another person/other persons.

- Ensure that the clamping strip (2) remains screwed into place during the removal of the exhaust turbocharger (1).

  The exhaust turbocharger (1) is **not** screwed onto the bottom, but clamped in the clamping strip (2).

  Thread out and remove exhaust turbocharger (1).

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- Guide seal (1) out of the **marked** area and remove it.

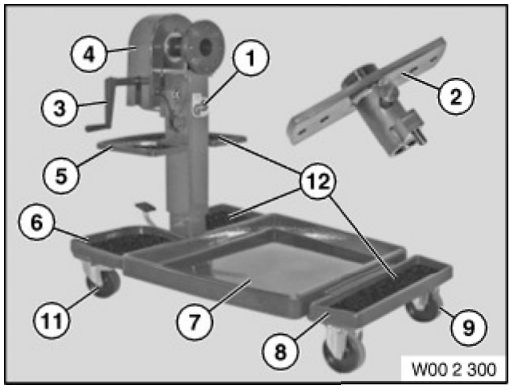
2 – Installing the cylinder head on the assembly stand

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

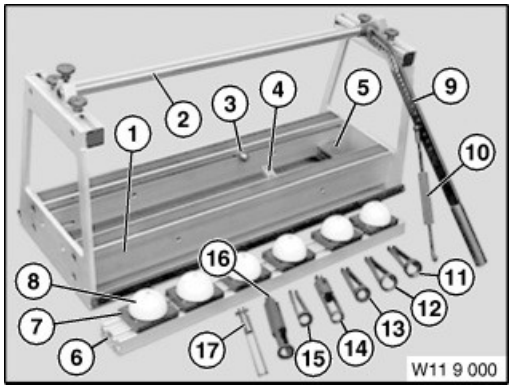
- Remove and install heavy components with the aid of another person/other persons.



- Have the set of special tools 0 495 187 (00 2 300) ready.

Number	Description
1	Assembly stand
2	Flange
3	Crank
4	Cover
5	oddments tray
6	Shaped element rear
7	Collection pan
8	Shaped element front
9	Front wheel
10	Rear wheel with stop
11	Mat

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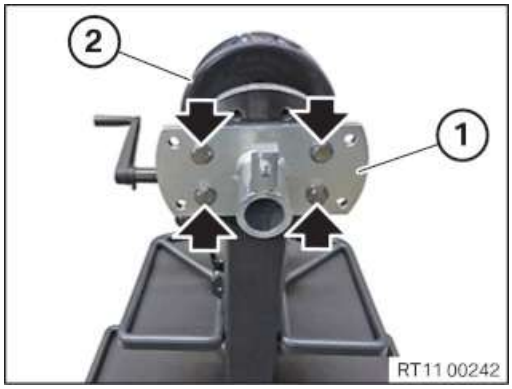
- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Stage special tool (workshop crane) 2 220 718.

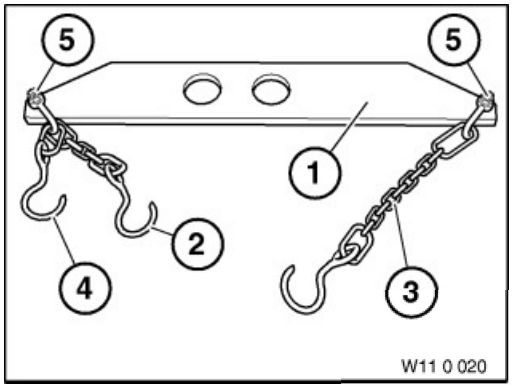
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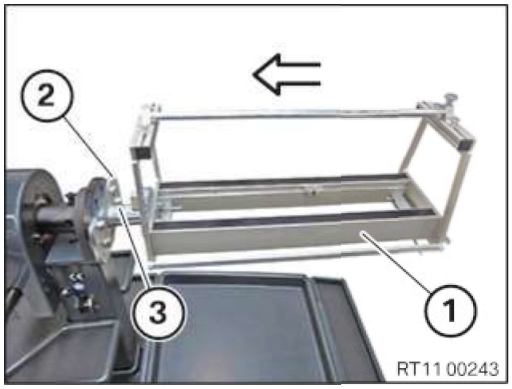
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

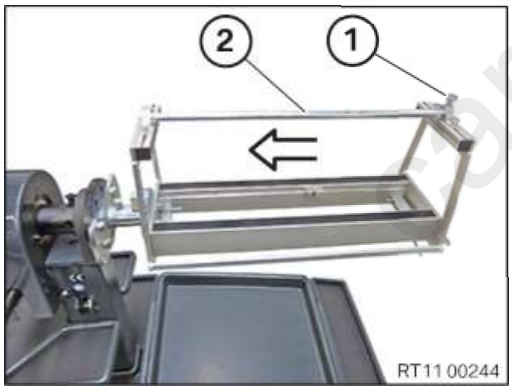
M14X30		Tightening torque	135 Nm



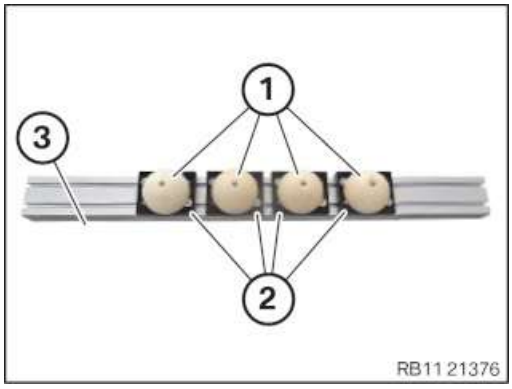
- Prepare the special tool .



- Fit device (1) onto the flange (2) in the direction of the arrow and install.
- Make sure that the lock (3) engages audibly.

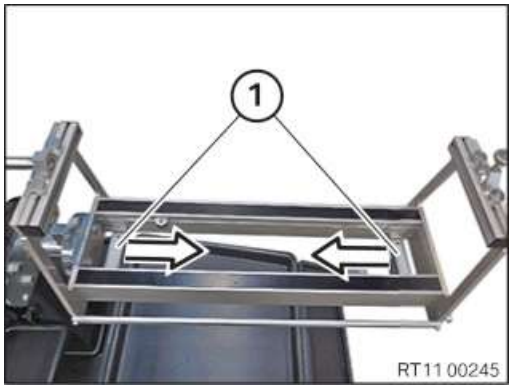


- Loosen screw (1).
- Pull out rod (2) in direction of arrow and set it aside.

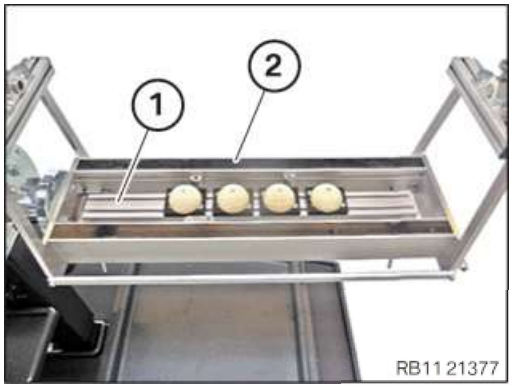


- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).

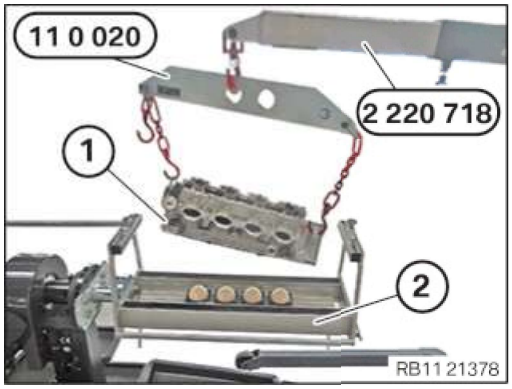
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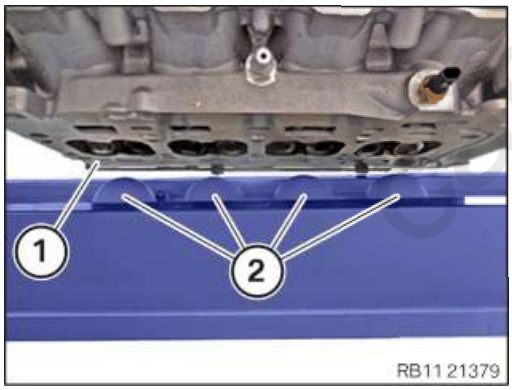
- Slide quick fastener (1) in the **direction of the arrow** up to the limit position.



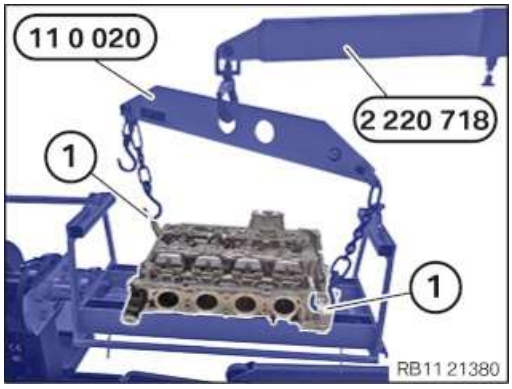
- Position completed aluminium strip (1) **centred** on the device (2).



- Position cylinder head (1) with the work crane 2 220 718 and special tool on the device (2).

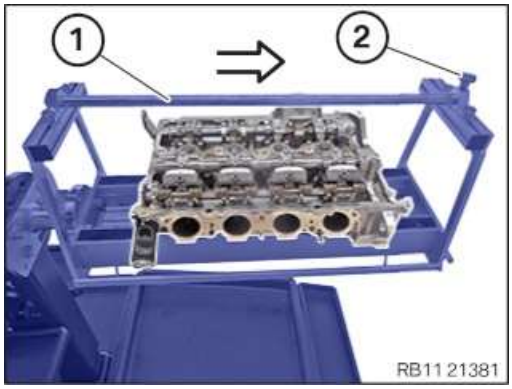


- Position cylinder head (1) correctly on the completed aluminium strip (2).

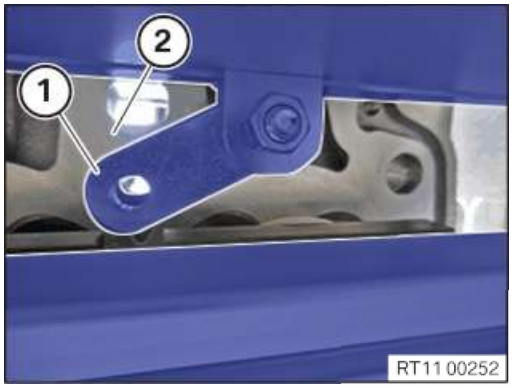


- Lower workshop crane 2 220 718.
- Pull out special tool at the cylinder head (1) and remove.
- Remove workshop crane 2 220 718 and set aside.

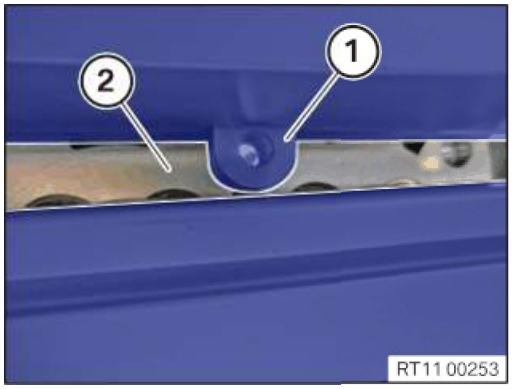
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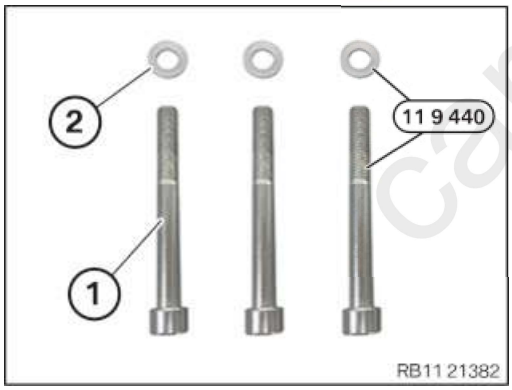
- Pull in rod (1) in the direction of the arrow and install.
- Hand-tighten the bolt (2).



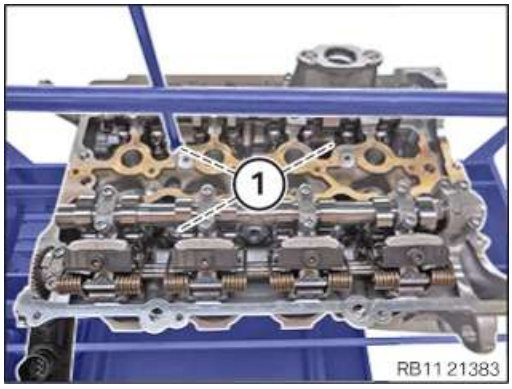
- Position screw connection (1) on cylinder head (2).



- Position screw connection (1) on cylinder head (2).



- Keep **M10x90** screws (1) from special tool ready.
- Keep washers (2) from special tool ready.

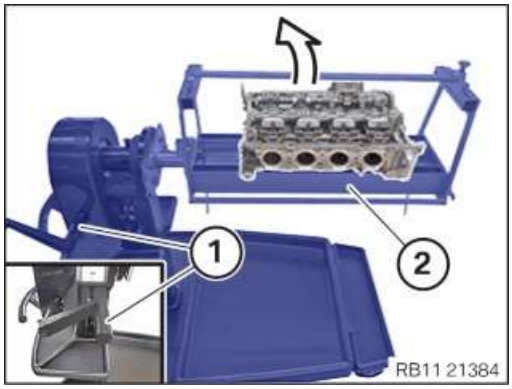


- Tighten the screws (1) from special tool .

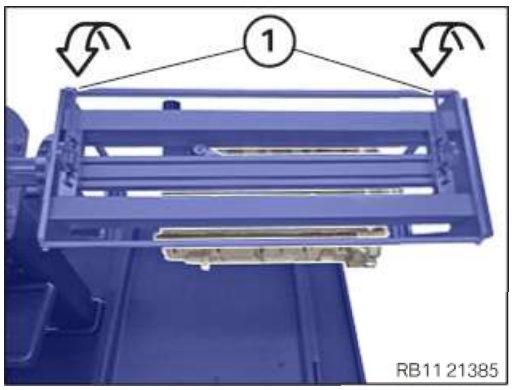
Cylinder head on device

M10X90x1.5		Tightening torque	30 Nm

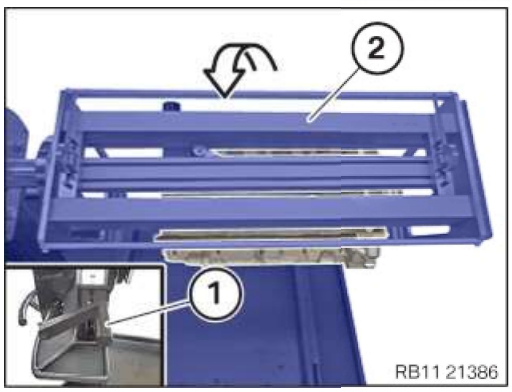
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- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

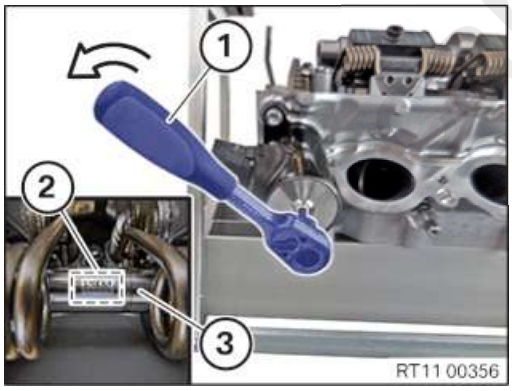


- Lock quick fastener (1) in the **direction of the arrow**.



- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

3 – Adjusting eccentric shaft to minimum lift (cylinder head removed)

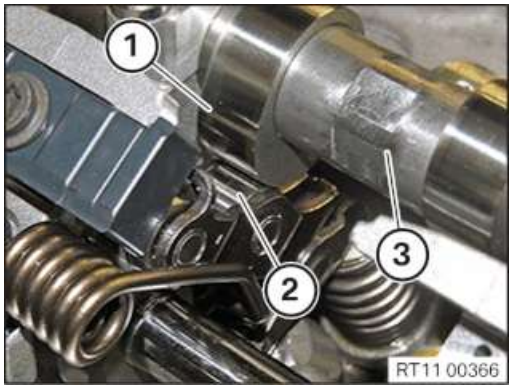


- With the help of the servomotor, use a standard hexagon socket wrench (1) to slowly adjust eccentric shaft (3) to the minimum lift at **4 mm** in the **direction of the arrow**.
- Make sure that the mark (2) on the eccentric shaft (3) points upwards.

4 – Checking the position of the intake camshaft (cylinder head removed)

Check

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- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

5 – Remove all torsion springs

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

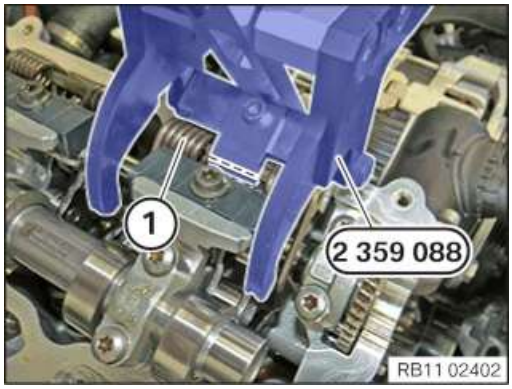
TECHNICAL INFORMATION

- Wear safety goggles.



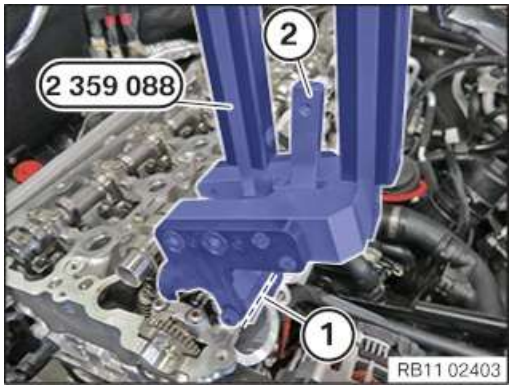
- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)

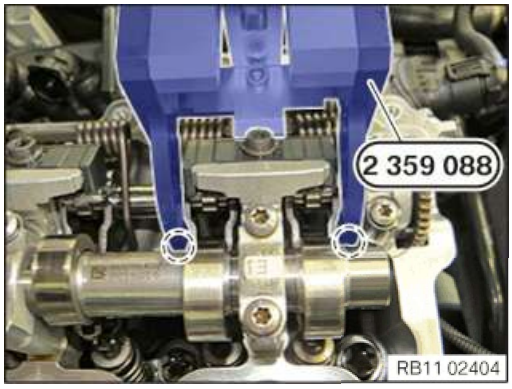


- Open the special tool 2 359 088 and position it at the torsion spring (1).

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- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.



Check

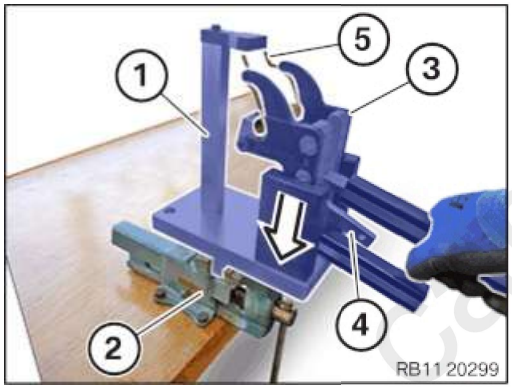
- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

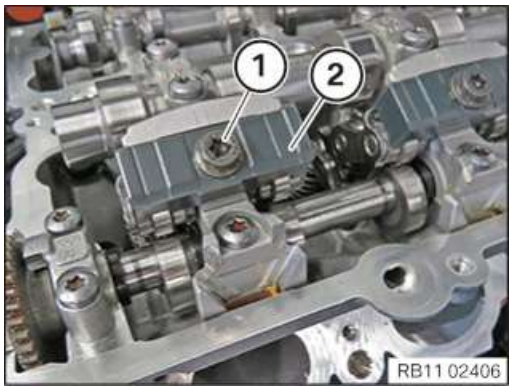
- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.



- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

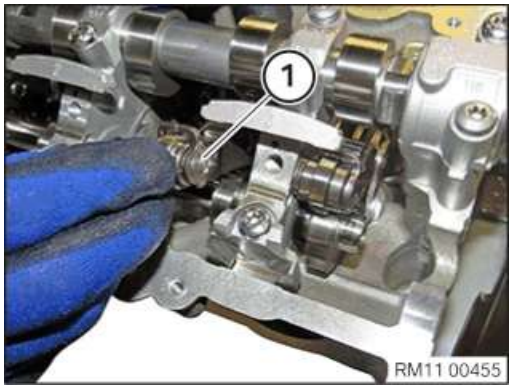
6 – Removing all gates



- Loosen screw (1).
- Remove the gate (2) and place it arranged in order into 0 495 105 (11 4 480).
- Repeat the step for all the gates.

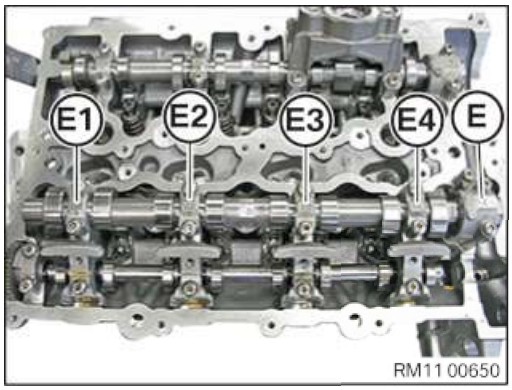
7 – Removing all intermediate levers

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- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

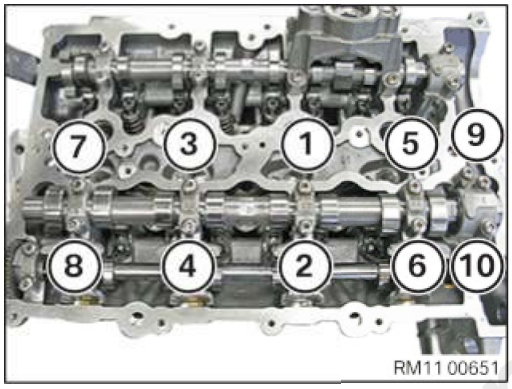
8 – Remove intake camshaft



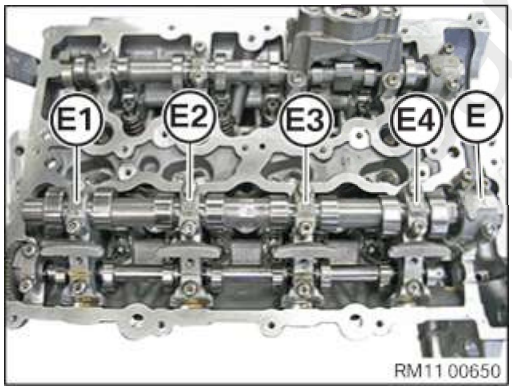
- Make sure that the exhaust camshaft bearing cap is placed in the correct position in the special tool 0 495 105 (11 4 480).

Note: The intake camshaft bearing caps are legibly labelled from the intake side with E1, E2, E3, E4 and E.

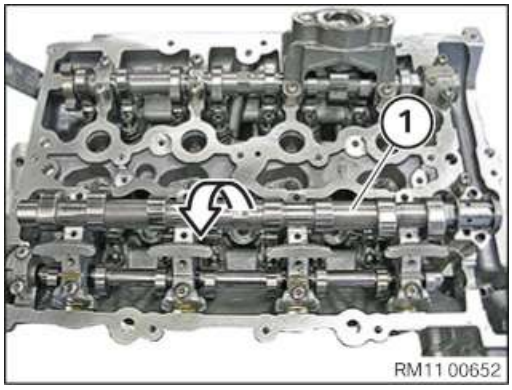
Note: Intake camshaft bearing cap E is a thrust bearing.



- Loosen all screws on the intake camshaft bearing caps in sequence from (10) to (1).



- Take off intake camshaft bearing caps (E1), (E2), (E3), (E4) and (E) and place them in order in the special tool 0 495 105 (11 4 480).



- Remove the intake shaft (1)in the direction of the arrow.

9 – Remove the servomotor for the eccentric shaft (cylinder head removed)

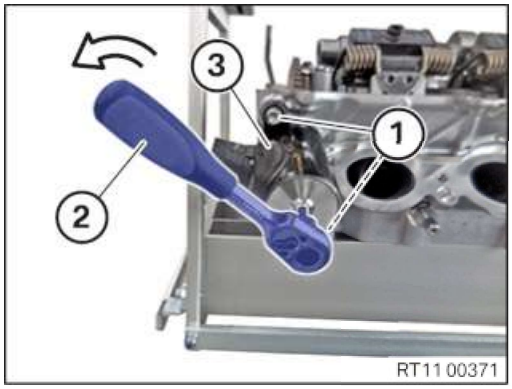
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

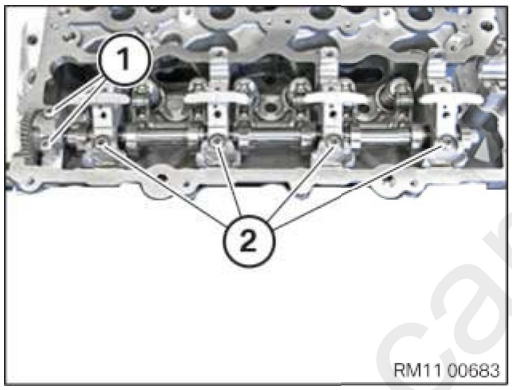


- Loosen screws (1).
- Use a standard hexagon socket wrench (2) to slowly adjust the servomotor for eccentric shaft (3) to the minimum lift at **4 mm** in direction of arrow.

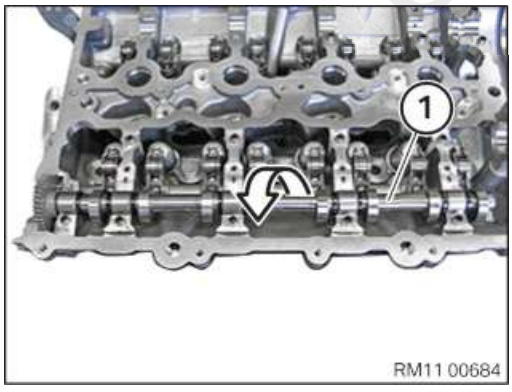
  This releases the tension of the eccentric shaft.

  Do **not** turn the eccentric shaft beyond the end stop.
- Guide out and remove the servomotor for eccentric shaft (3).

10 – Remove eccentric shaft

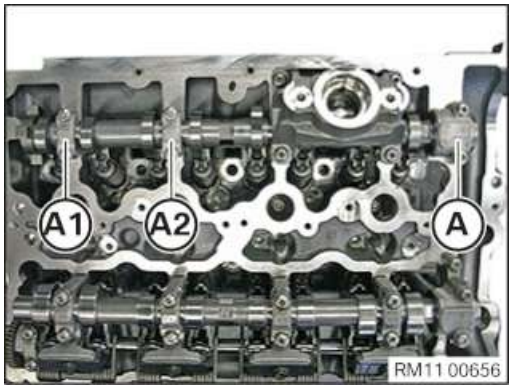


- Release screws (1) and set down the bearing cap neatly in special tool 0 495 105 (11 4 480).
- Release screws (2) and set down the bearing support neatly in special tool 0 495 105 (11 4 480).
- For an engine that has been in use, make sure all bearing supports are reinstalled in the same position.



- Remove eccentric shaft (1) in direction of arrow.

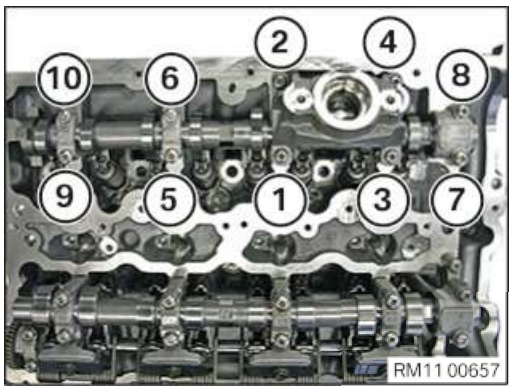
11 – Remove exhaust camshaft.



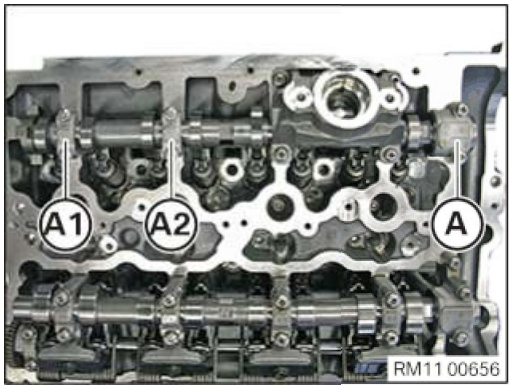
- Subsequently ensure that the exhaust camshaft bearing cap is placed in 0 495 105 (11 4 480) in the special tool.

Note: The exhaust camshaft bearing caps are legibly labelled from the intake side and marked with A1, A2 and A.

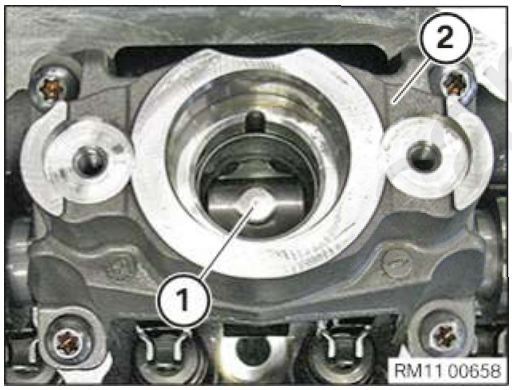
Note: Exhaust camshaft bearing cap A is a thrust bearing.



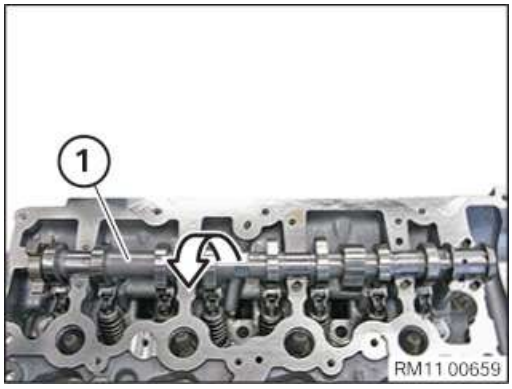
- Loosen all screws on the exhaust camshaft bearing cap in sequence from (10) to (1) in half turn.



- Drop the exhaust camshaft bearing cap (A1), (A2) and (A) and place in order in the special tool 0 495 105 (11 4 480).



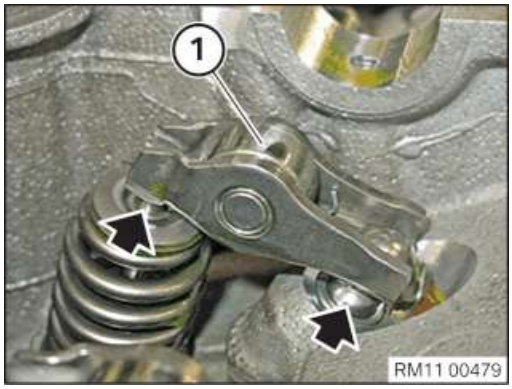
- Remove the roller tappet (1).
- Remove the high pressure pump bracket (2).



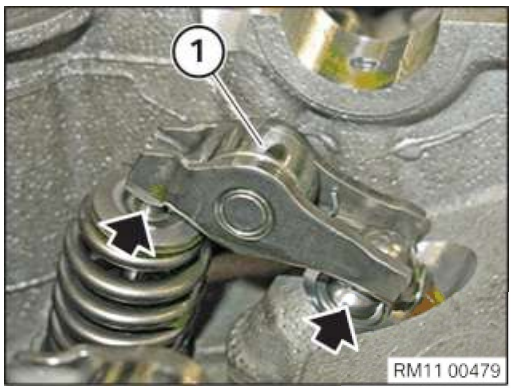
- Remove the exhaust camshaft (1) in the direction of the arrow.

12 – Remove all roller cam followers

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- Detach and remove the roller cam followers (1) on the intake side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).



- Detach and remove the roller cam followers (1) on the output side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).

13 – Remove all valve springs

CAUTION

Spring preload.

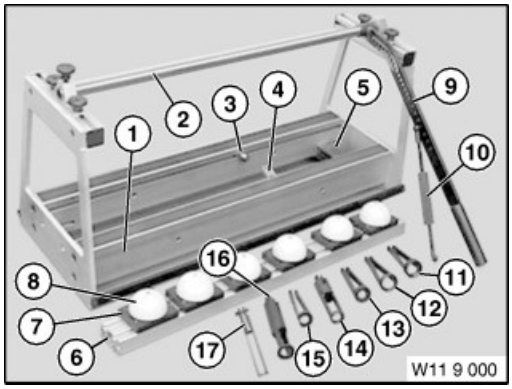
Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

NOTICE

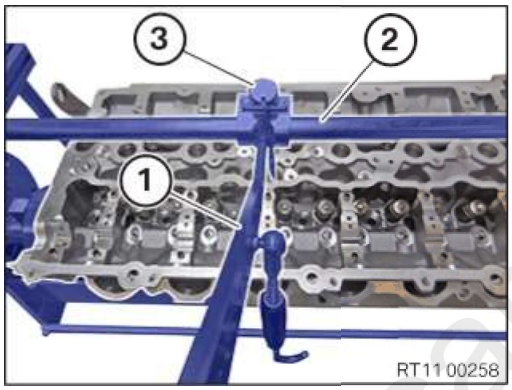
The description is for one component only. The procedure is identical for all further components.

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- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Feed in and install lever (1) on the rod (2).
- Guide in and install lock (3).

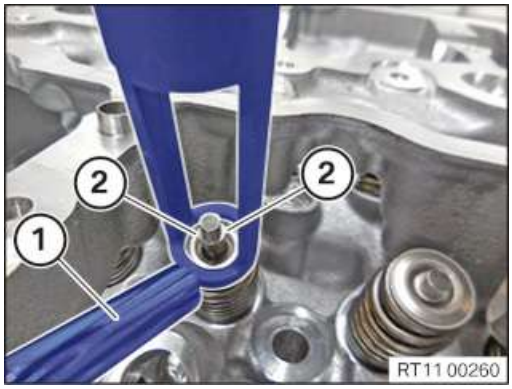


TECHNICAL INFORMATION

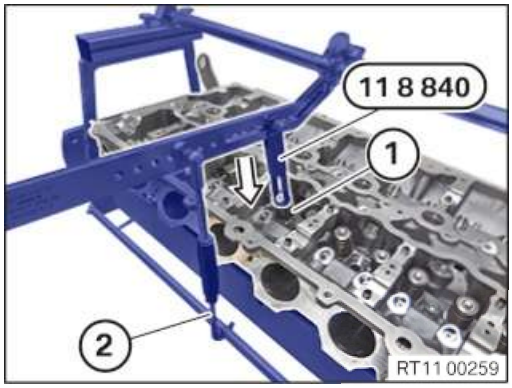
- Wear safety goggles.

- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).

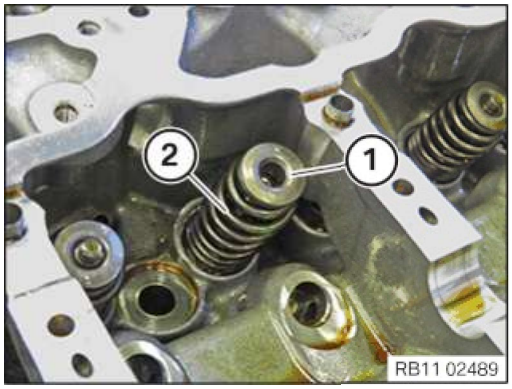
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- Remove valve shims (2) with a magnet (1).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Remove the spring cup (1) and the valve spring (2) and position neatly in the special tool 0 495 105 (11 4 480).

14 – Remove valve stem seals

RISK OF DAMAGE

Contaminant or foreign body.

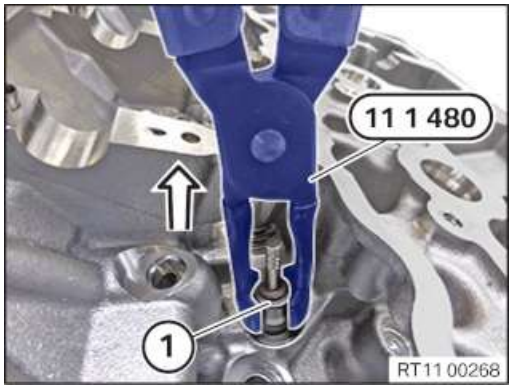
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

NOTICE

The description is for one component only. The procedure is identical for all further components.

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- Remove the valve stem seal (1) in the **direction of arrow** using the special tool 0 490 796 (11 1 480).

MAIN WORK

15 – Remove all valves

RISK OF DAMAGE

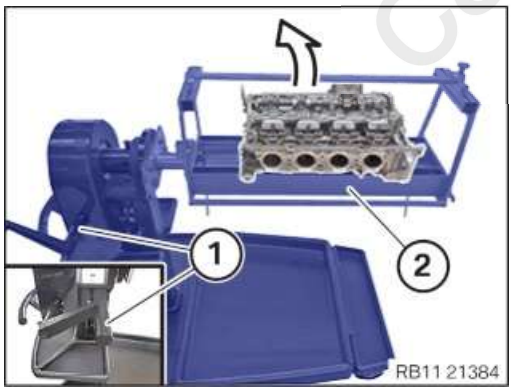
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

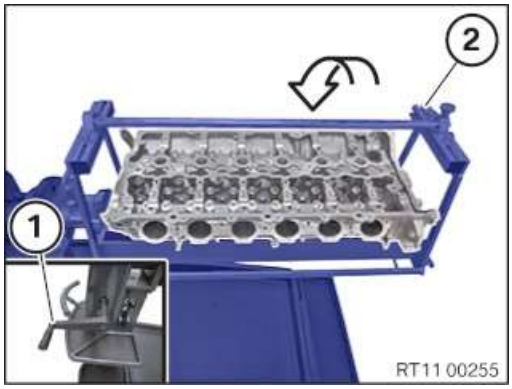


- **Equipment specification B38**
- Twist the device (2) on the crank (1) 180°.



- **Equipment specification B46/B48**
- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

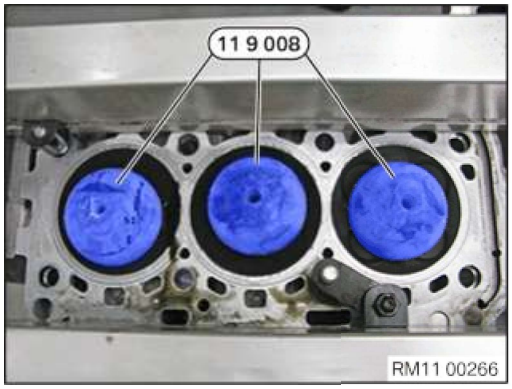
cardiagn.com



- **Equipment specification B58**
- Turn device (2) on the crank (1) by 180° in direction of arrow.



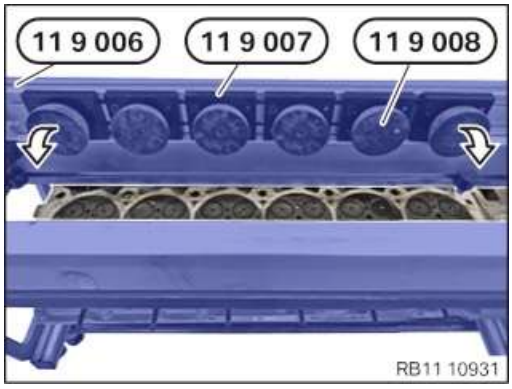
- Unlock the special tool 0 494 370 (11 9 005) in **direction of arrow**.



- **Equipment specification B38**
- Remove special tool 0 494 373 (11 9 008) if necessary.

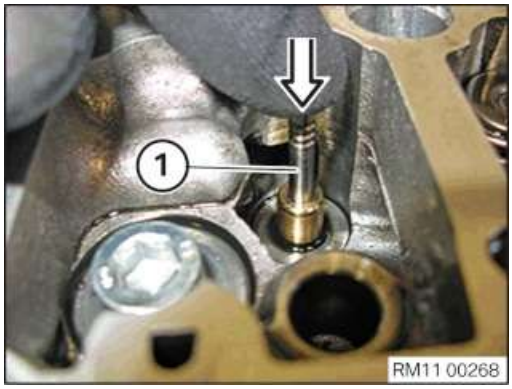


- **Equipment specification B46/B48**
- Remove special tool 0 494 373 (11 9 008) if necessary.

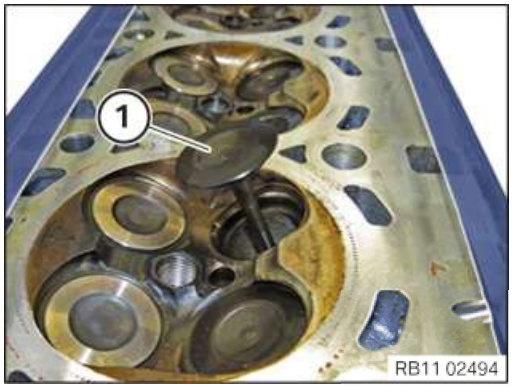


- **Equipment specification B58**
- Thread out and remove special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) in direction of arrow.

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- Push the valve stem (1) into the cylinder head in **direction of arrow**.



- Remove the valve (1) and position in special tool 0 495 105 (11 4 480) in order.

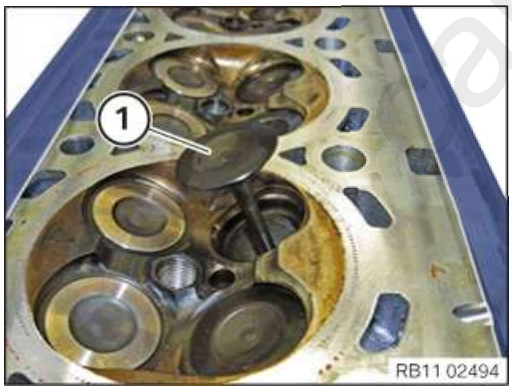
16 – Install all valves

RISK OF DAMAGE

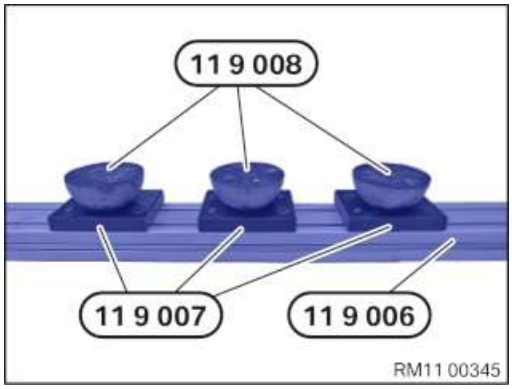
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

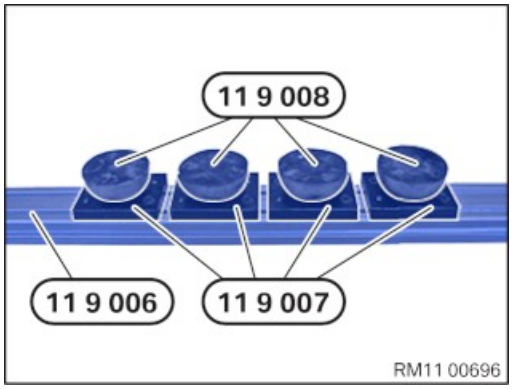


- Slide the valve (1) **carefully** into the cylinder head.

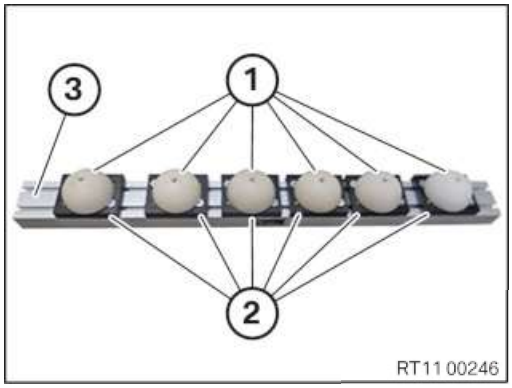


- **Equipment specification B38**
- Prepare the special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) as shown.

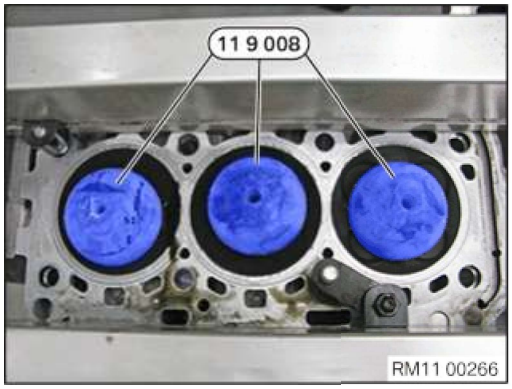
cardiagn.com



- **Equipment specification B46/B48**
- Prepare the special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) as shown.



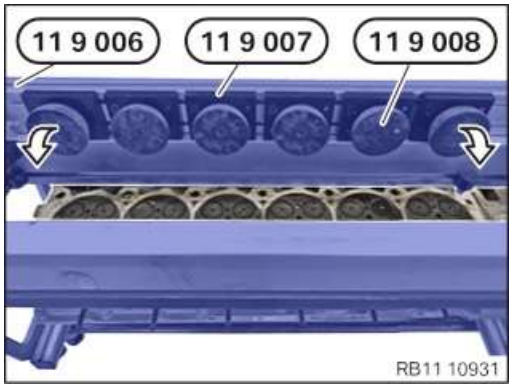
- **Equipment specification B58**
- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).



- **Equipment specification B38**
- The special tools 0 494 373 (11 9 008) must be set up accordingly in the next operation.



- **Equipment specification B46/B48**
- The special tools 0 494 373 (11 9 008) must be set up accordingly in the next operation.

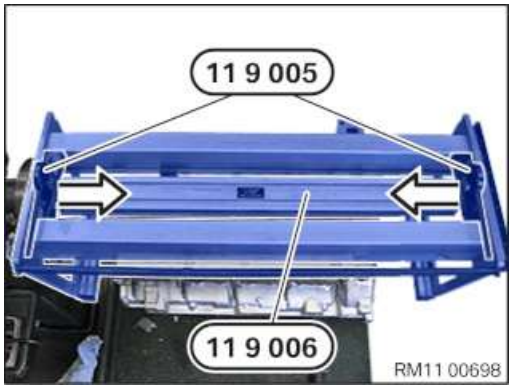


TECHNICAL INFORMATION

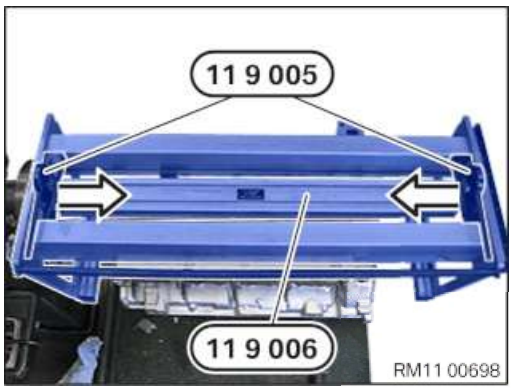
The figure shows the engine B58.

- Position special tools 0 494 371 (11 9 006), 0 494 372 (11 9 007) and 0 494 373 (11 9 008) in the centre on the cylinder head in the direction of the arrow.

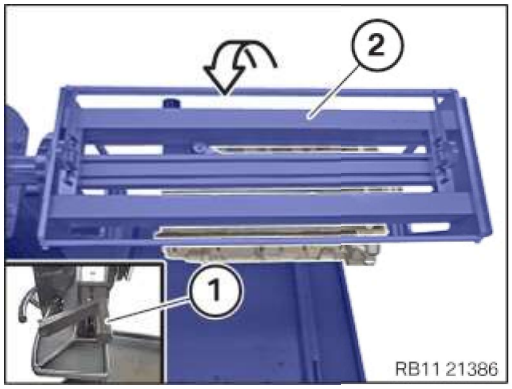
rdiagn.com



- Turn round special tool 0 494 371 (11 9 006) and insert as shown.
- Lock special tool 0 494 370 (11 9 005)in direction of arrow.



- Move and lock special tool 0 494 370 (11 9 005) in the direction of the arrow over the edges of special tool 0 494 371 (11 9 006).



- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

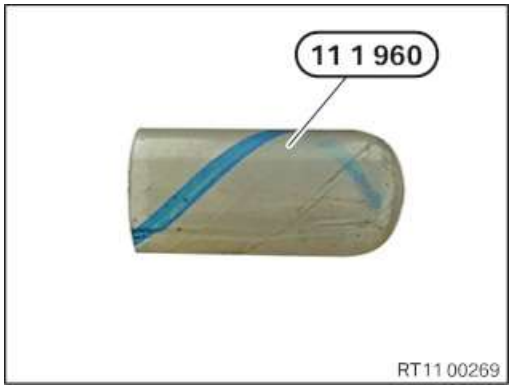
POSTPROCESSES

17 – Installing valve stem seals

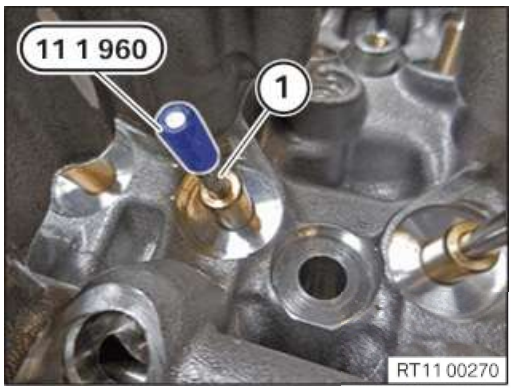


- Remove oil and dirt from the contact surface (1).

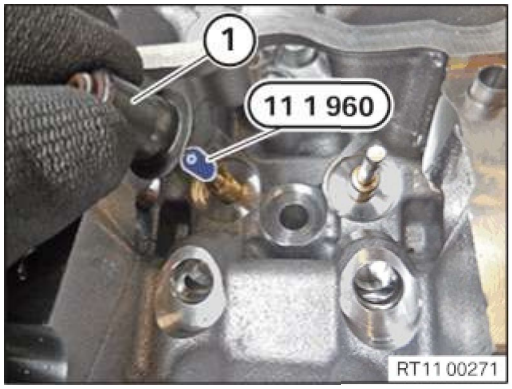
cardiagn.com



- Make sure that the special tool 0 490 797 (11 1 960) is used when installing the valve stem seal.



- Guide in and install the special tool 0 490 797 (11 1 960) on valve (1).



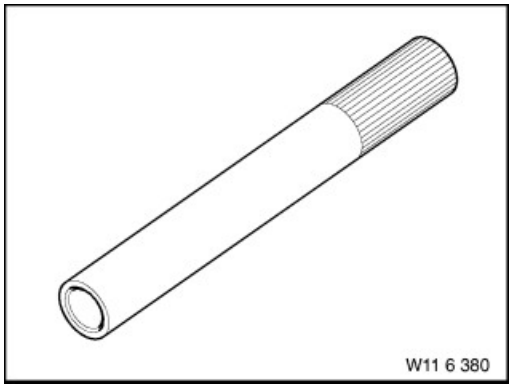
- Renew the valve stem seal (1).

  Parts: Valve stem seal

- Guide in and install valve stem seal (1) on the special tool 0 490 797 (11 1 960).

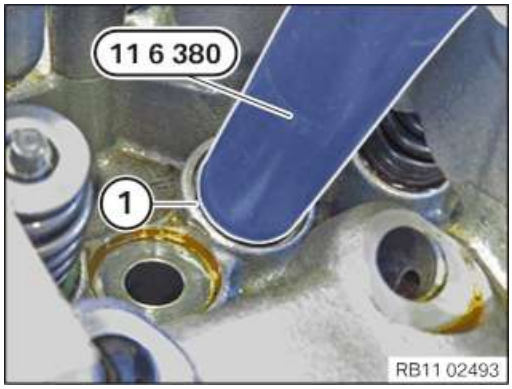


- Guide the special tool 0 490 797 (11 1 960) out and remove.

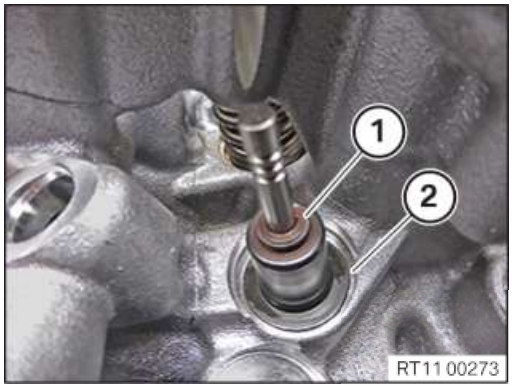


- Prepare special tool 0 493 249 (11 6 380).

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- Press the valve stem seal (1) onto the cylinder head till the limit position using special tool 0 493 249 (11 6 380).



- Make sure that valve stem seal (1) is positioned correctly on cylinder head (2).

18 – Install all valve springs

CAUTION

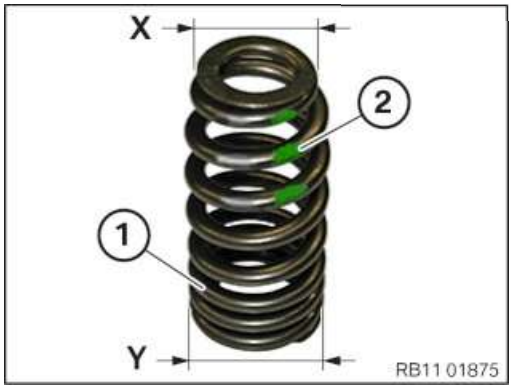
Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

NOTICE

The description is for one component only. The procedure is identical for all further components.



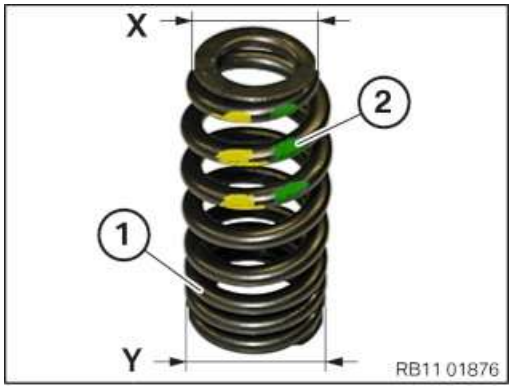
- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the intake valves: Green

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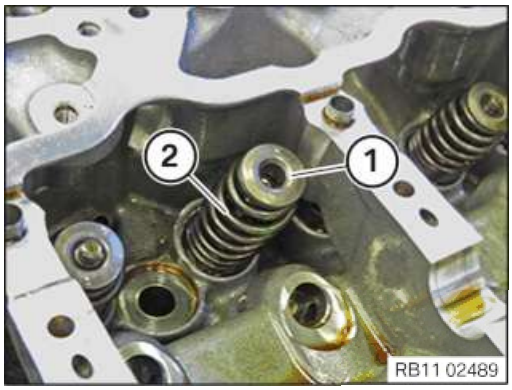


- Note the installation position of the valve spring.

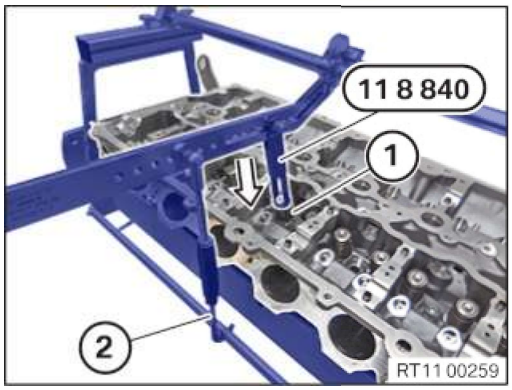
Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the exhaust valves: green/yellow



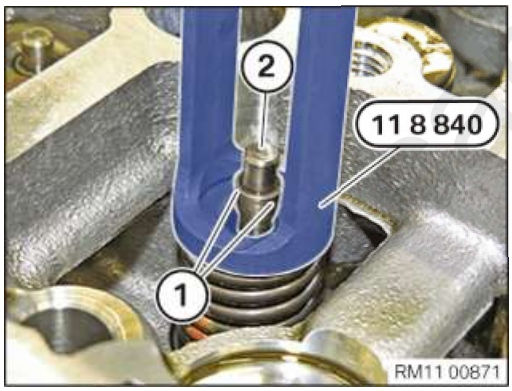
- Install the valve spring (2) and the spring cup (1).



TECHNICAL INFORMATION

- Wear safety goggles.

- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).

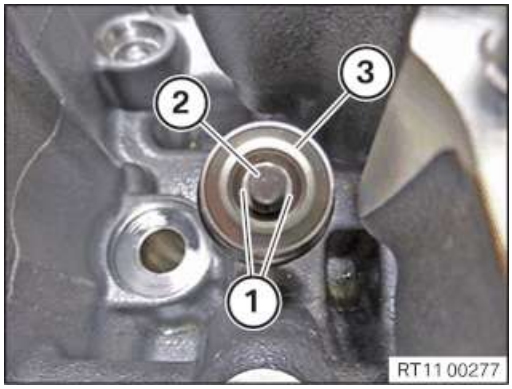


- Position the valve shims (1) on the valve (2).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.

mydiagram.com



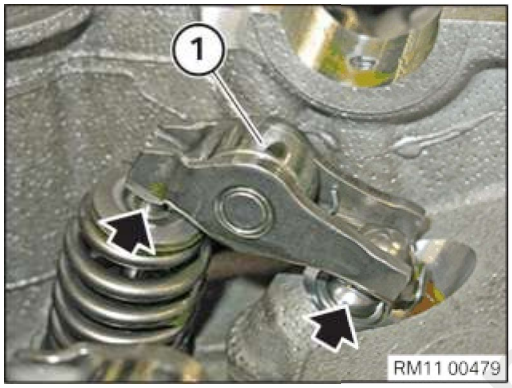
- Make sure that the valve shims (1) are positioned correctly on the valve (2) and on the valve spring (3).

19 – Install all roller cam followers

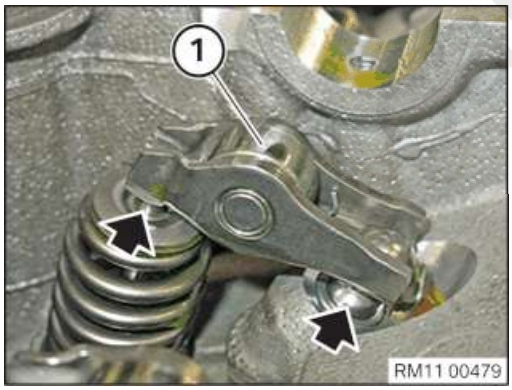


- The classification in digits from 1 to 5 has been printed on the roller cam follower.

Classification	Idle speed
1	Repair case - slow engine speed when idling
2	Installed as standard/initial installation
3	Installed as standard/initial installation
4	Installed as standard/initial installation
5	Repair case - high engine speed when idling

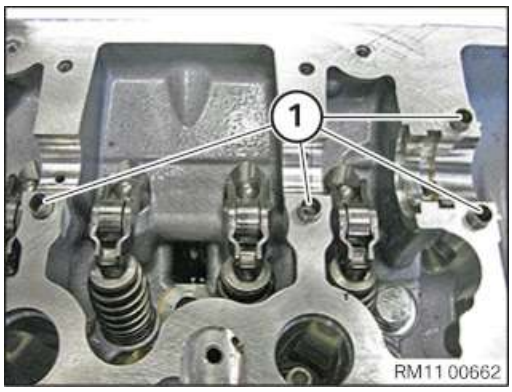


- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.

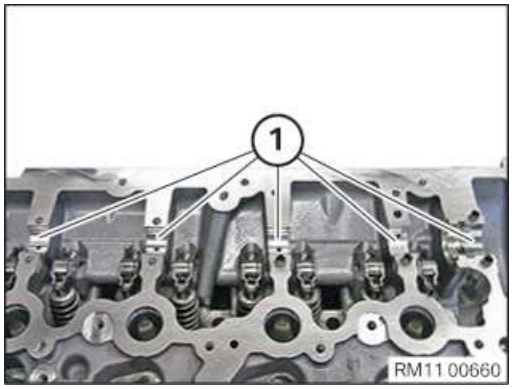


- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

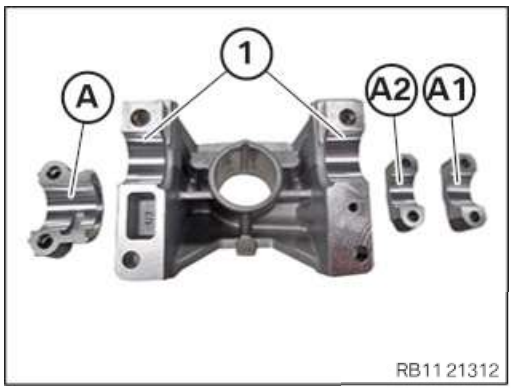
20 – Install exhaust camshaft



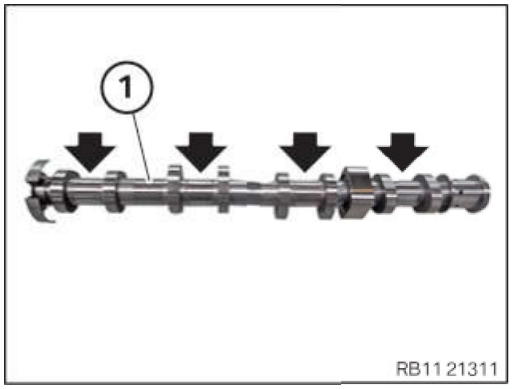
- Check the fitting sleeves (1) for **correct** fit and damage and replace where required.



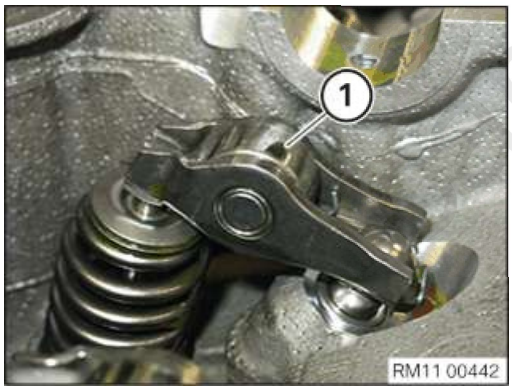
- Coat all bearing positions (1) with **fresh** engine oil.



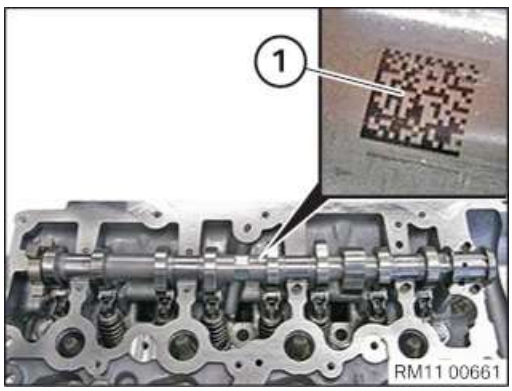
- Clean all bearing positions of the exhaust camshaft bearing cap (A1), (A2) and (A) and coat with **fresh** engine oil.
- Clean the bearing positions (1) of the high pressure pump bracket and coat with **fresh** engine oil.



- Clean all the bearing positions (arrows) of the exhaust camshaft (1) and coat with **fresh** engine oil.

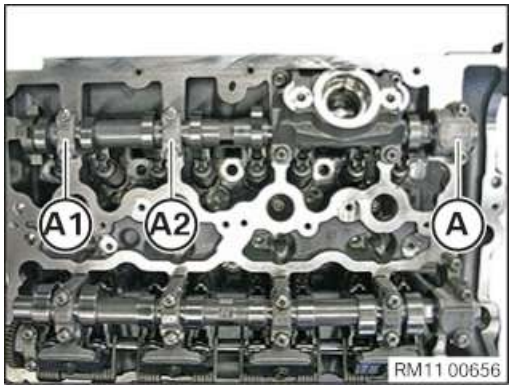


- Make sure that the roller cam follower (1) is fitted correctly before installing the exhaust camshaft.
- Coat the exhaust camshaft and the exhaust camshaft bearing cap with fresh engine oil.



- Insert exhaust camshaft in the cylinder head, such that the mark (1) points **upwards**.

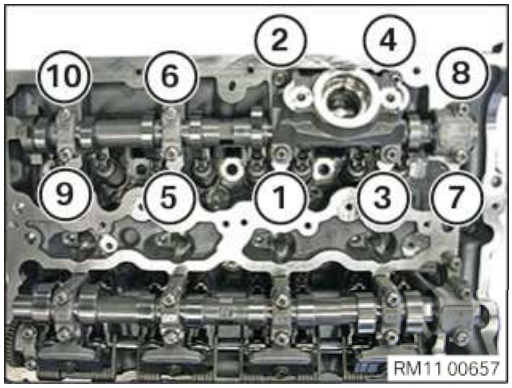
rdiagn.com



- Position all exhaust camshaft bearing caps on the cylinder head.

Note: The exhaust camshaft bearing caps are legibly labelled from the intake side and marked with A1, A2 and A.

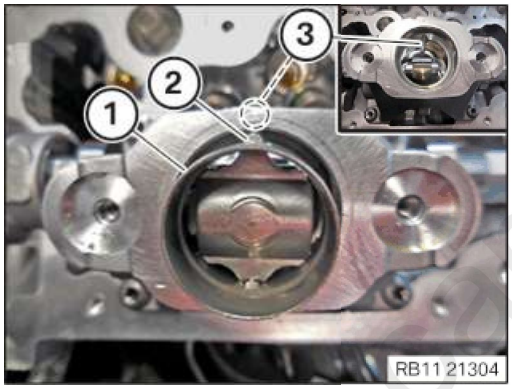
Note: Exhaust camshaft bearing cap A is a thrust bearing.



- Coat both bearing positions on the high pressure pump bracket with fresh engine oil.
- Position the high pressure pump bracket on the cylinder head.
- Join all bolts of the exhaust camshaft bearing caps in sequence (1) to (10) in half **turns**.
- **Adhere to the jointing torque.**
- Tighten all bolts of the exhaust camshaft bearing caps in sequence (1) to (10) **.**

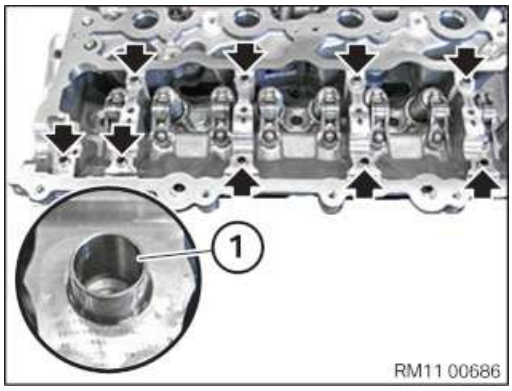
Exhaust camshaft to cylinder head

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm



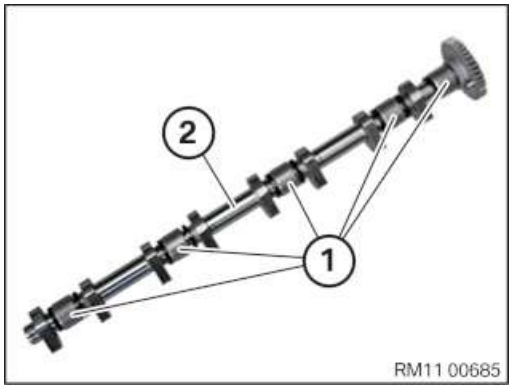
- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

21 – Install eccentric shaft



- Check guide sleeves (1) for damage and renew faulty guide sleeves (1).

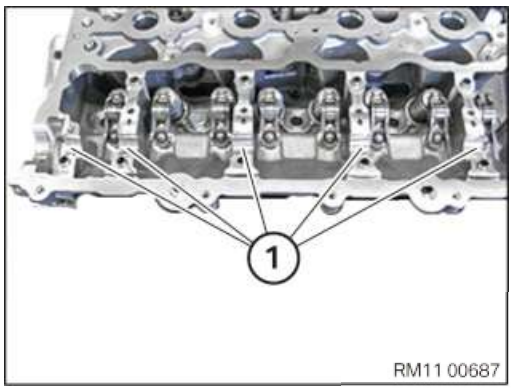
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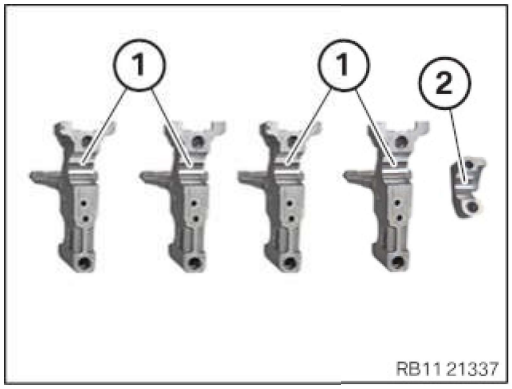
- Check needle bearing (1) for ease of movement.

Note: In the event of tight needle bearings, replace eccentric shaft 2.

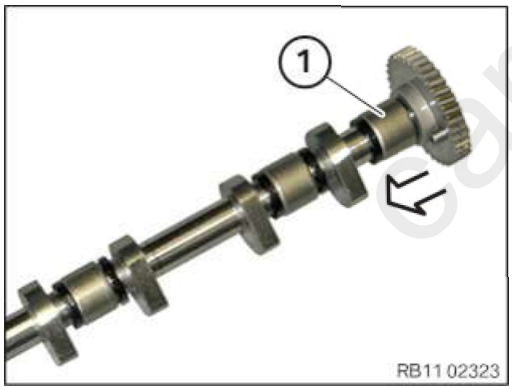
- Coat the needle bearing (1) with **new** engine oil.



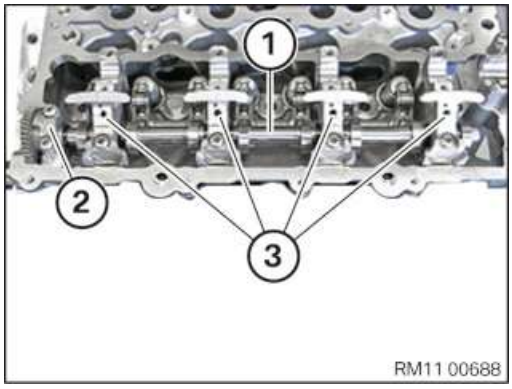
- Clean the bearing positions (1) and coat with **new** engine oil.



- Clean bearing positions of the bearing supports (1) and coat with fresh engine oil.
- Clean the bearing position of the bearing cap (1) and coat with **new** engine oil.

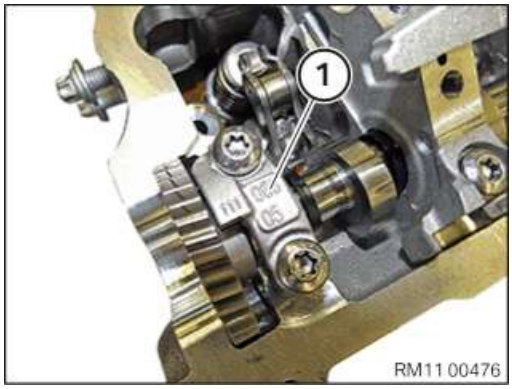


- Before installing the eccentric shaft, push needle bearing (1) in direction of arrow up to the limit position.



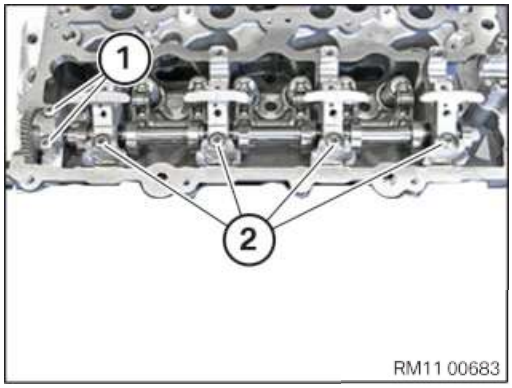
- Insert eccentric shaft (1) in the cylinder head.
- Attach bearing cap (2) and bearing supports (3) on the cylinder head.
- For an engine that has been in use, make sure all bearing supports are reinstalled in the same position.

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- Ensure correct installation of bearing cap (1).

Note: Bearing cap 1 is provided with a limit position.

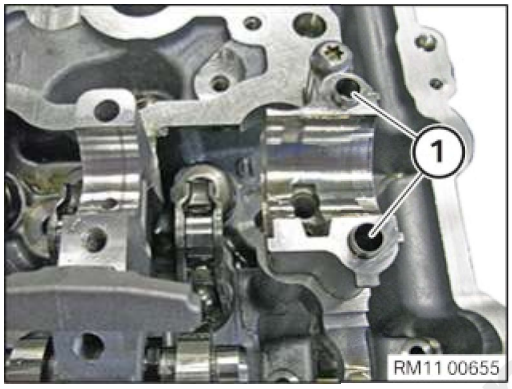


- Tighten down screws (1) and (2) uniformly.

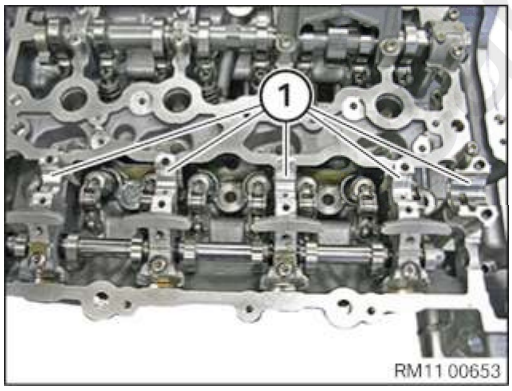
Eccentric shaft to bearing support/cylinder head

M6		10 Nm

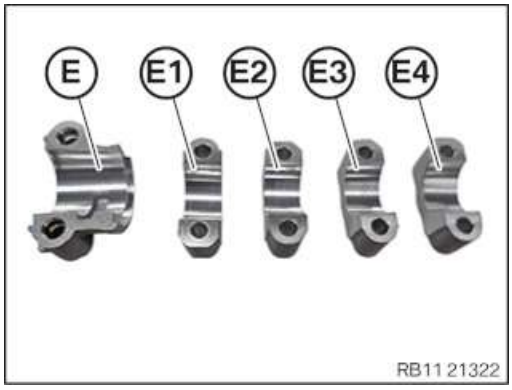
22 – Install intake camshaft



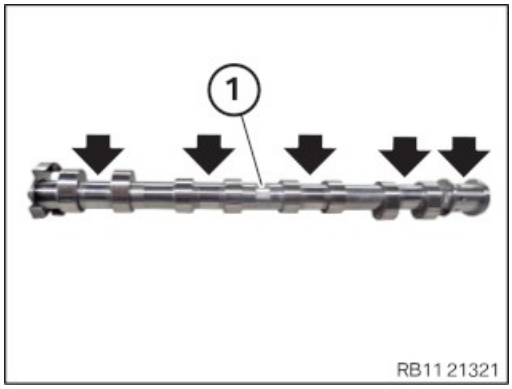
- Check the fitting sleeves for correct fit and damage and replace where required.



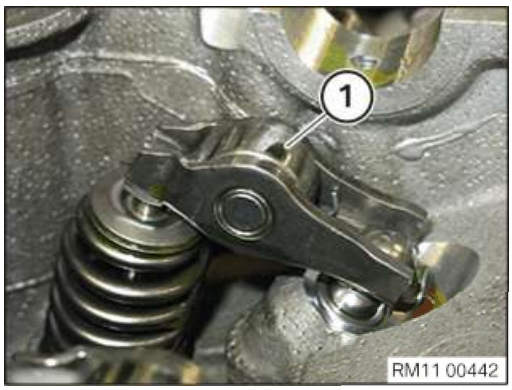
- Coat all bearing positions (1) with fresh engine oil.



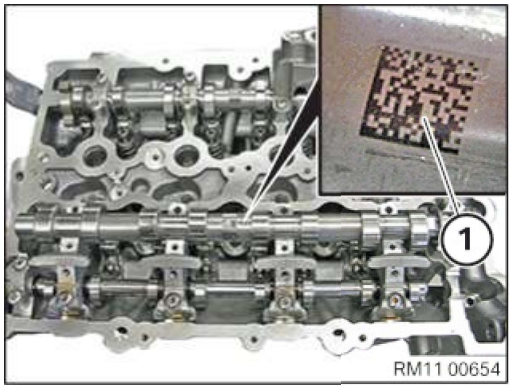
- Clean all the bearing positions of the intake camshaft bearing cap (E1) (E2) (E3), (E4) and (E) and coat with engine oil.



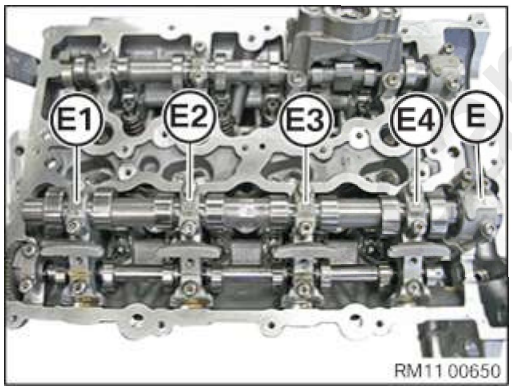
- Clean all bearing positions (arrows) of the intake camshaft (1) and coat with engine oil.



- Ensure the correct fit of the roller cam follower (1) before mounting the intake camshaft.
- Coat roller cam follower (1) with new engine oil.



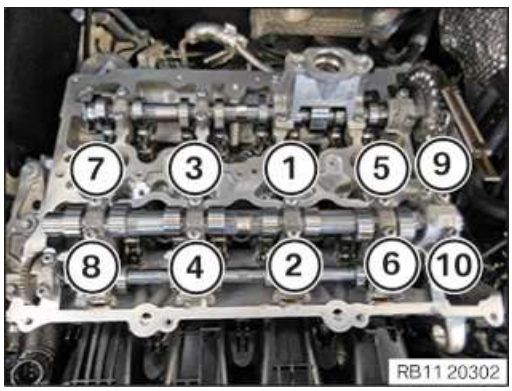
- Insert the intake camshaft into the cylinder head in such a way that the mark (1) points up.



- Position the intake camshaft bearing cap on the cylinder head.

Note: The intake camshaft bearing caps are legibly labelled from the intake side with E1, E2, E3, E4 and E.

Note: Intake camshaft bearing cap E is a thrust bearing.



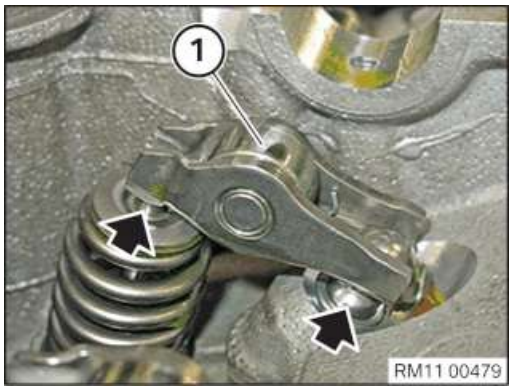
- Press intake camshaft bearing cap down and hand-tighten the screws incrementally in sequence (1) to (10).
- Join screws in sequence (1) to (10) **in half turns**.
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (10) **.**

Intake camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

mdiagn.com

– Checking installation position of roller cam followers



TECHNICAL INFORMATION

The rocker arms may slip slightly when the camshaft is positioned. Make sure rocker arms are correctly positioned on the hydraulic valve clearance compensating elements and on valves.

- Make sure the mounting orientation (arrows) of the roller cam followers (1) is correct.

24 – Checking the intermediate lever classification



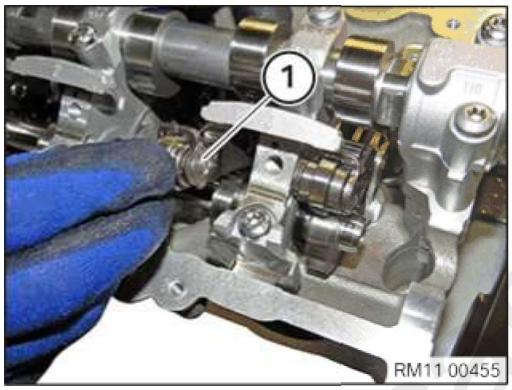
TECHNICAL INFORMATION

All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

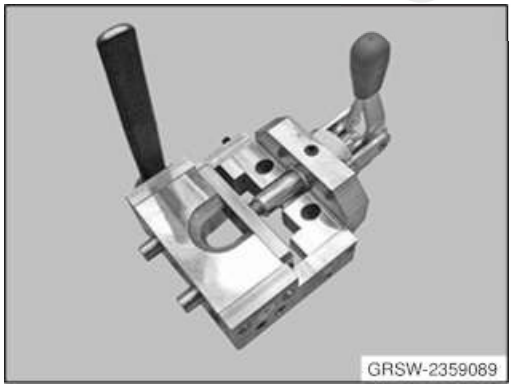
- Check classification (arrow) of intermediate lever.

25 – Installing all intermediate levers



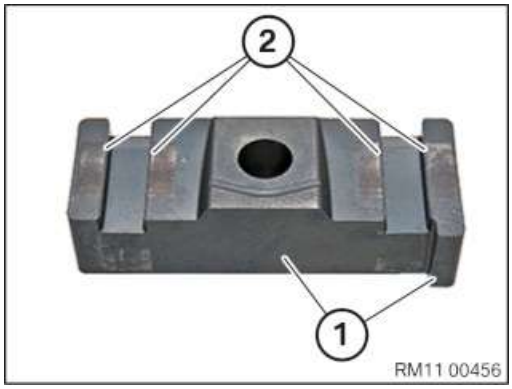
- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

26 – Installing all gates

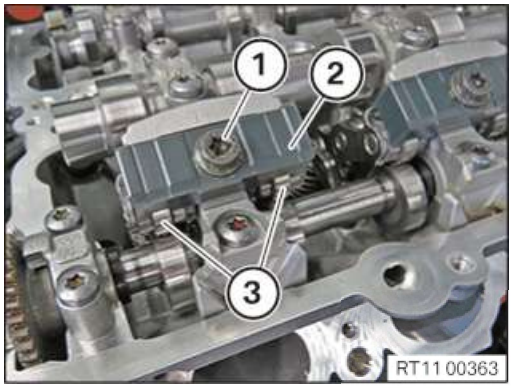


- Have the special tool 2 359 089 ready.

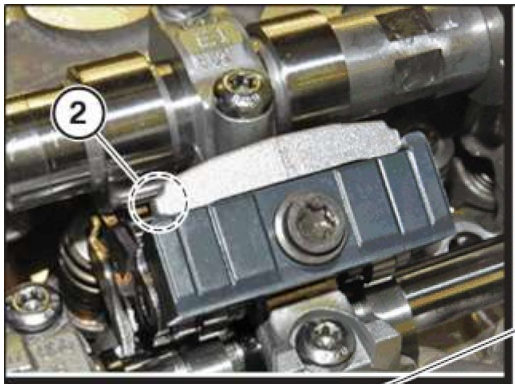
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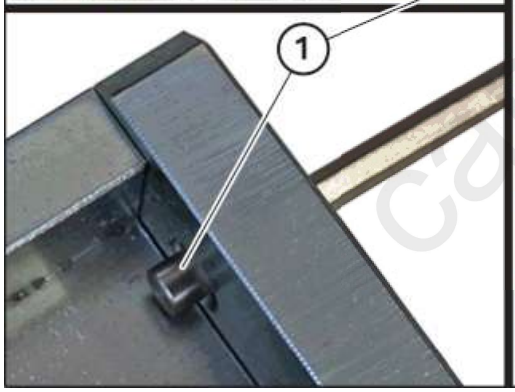


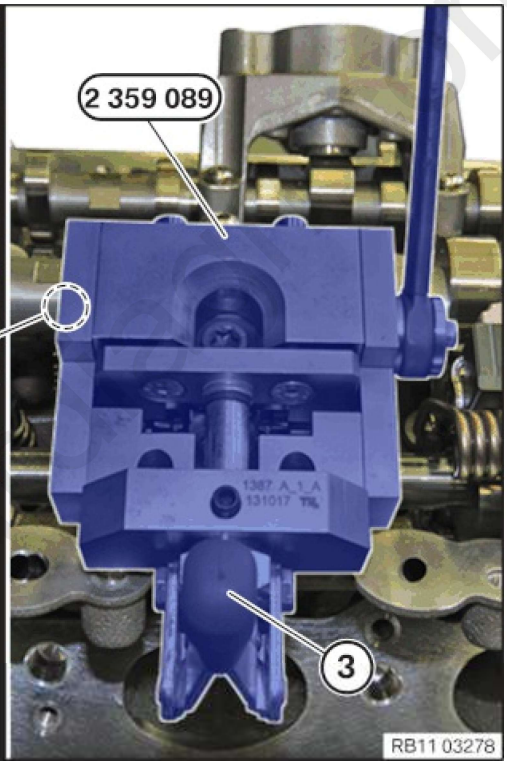
- Clean contact surfaces (1) and (2) off oil, grease and dirt.



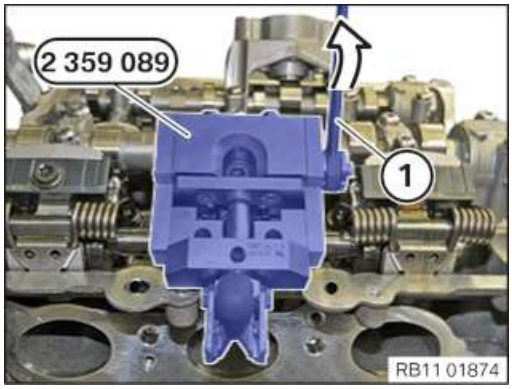
- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.



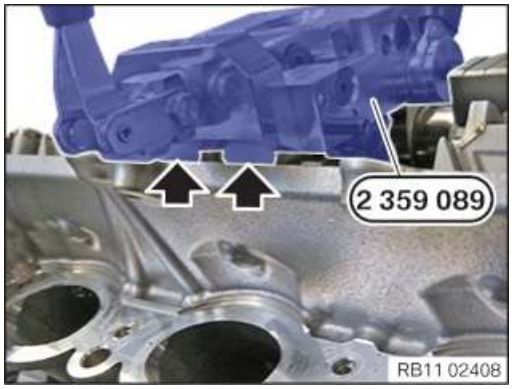




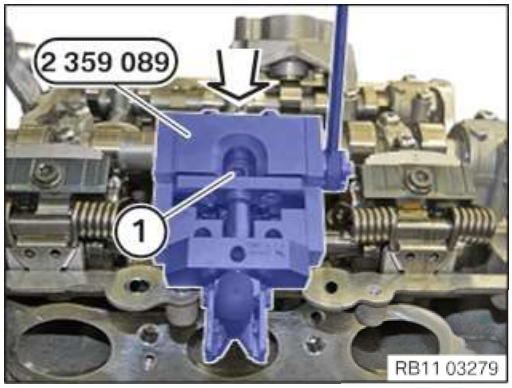
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1) in the direction of the arrow.



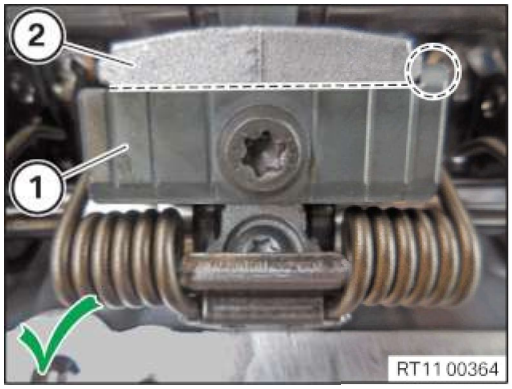
- Make sure that the special tool 2 359 089 rests flat against the cylinder head (arrows).



- Press the special tool 2 359 089 onto the cylinder head in the direction of the arrow.
- Tighten the bolt (1) at the same time.

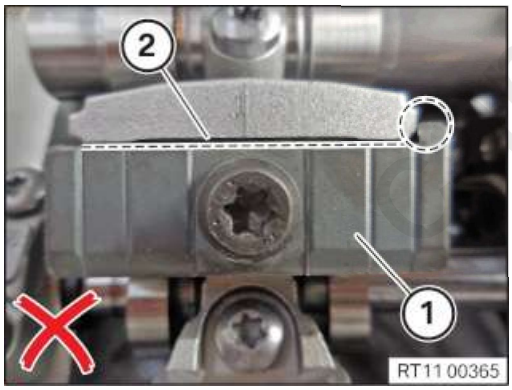
Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed correctly in the marked area.



- Ensure that gate (1) rests **correctly** against bearing bracket (2).

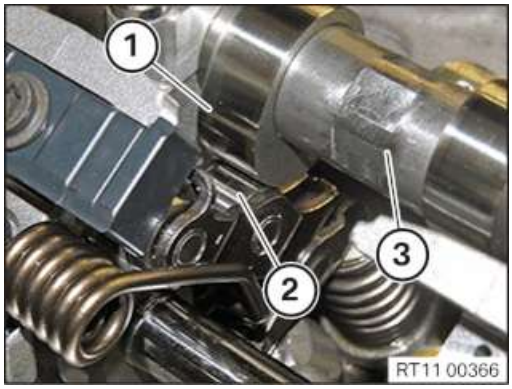
  Gate (1) is installed incorrectly in the marked area.

- Repeat the step for all the gates.

27 – Checking the position of the intake camshaft (cylinder head removed)

Check

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- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

28 – Install all torsion springs

CAUTION

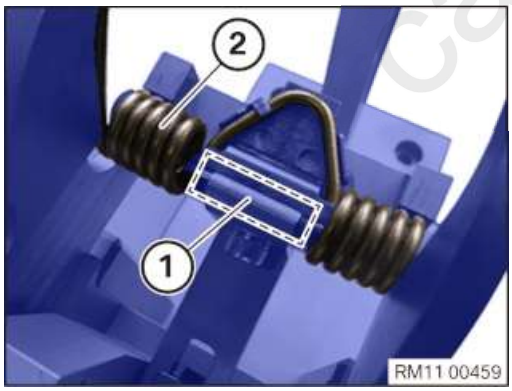
Spring preload.

Danger of injury!

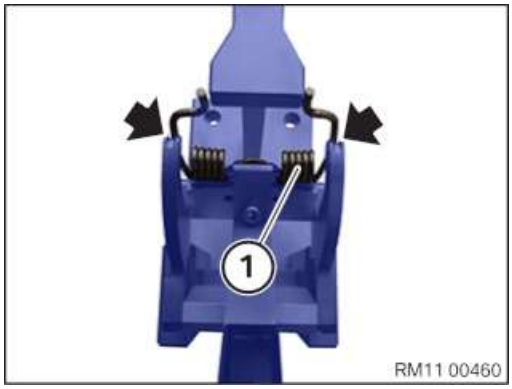
- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

- Wear safety goggles.

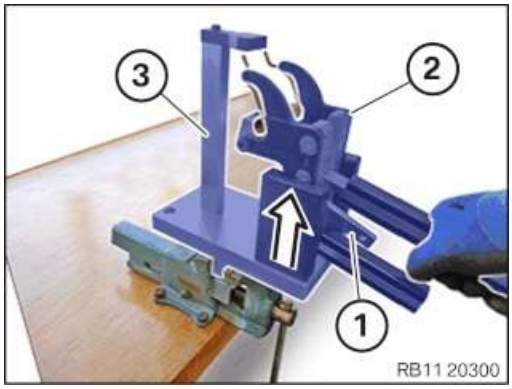


- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.



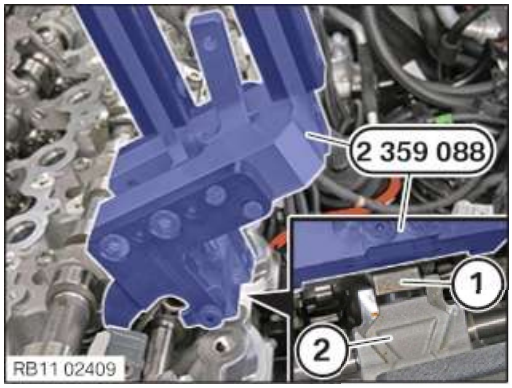
- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

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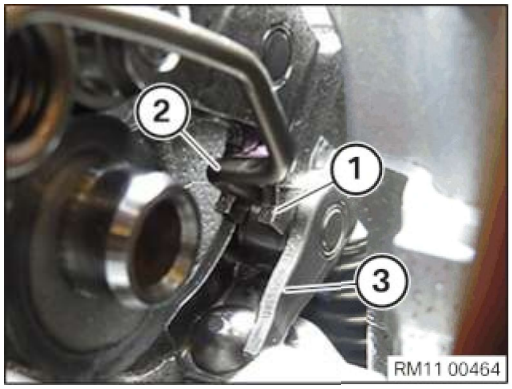


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the lever (1) audibly engages.

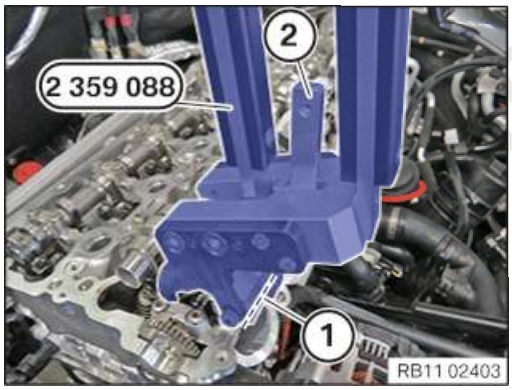
  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.



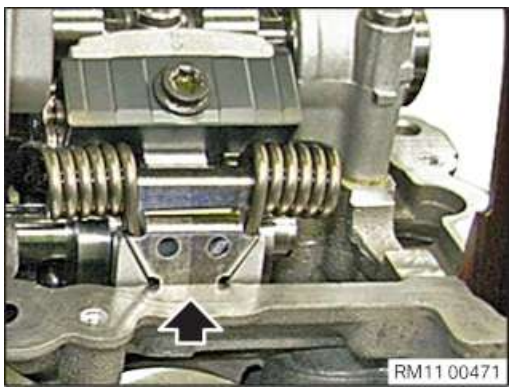
- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).



- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



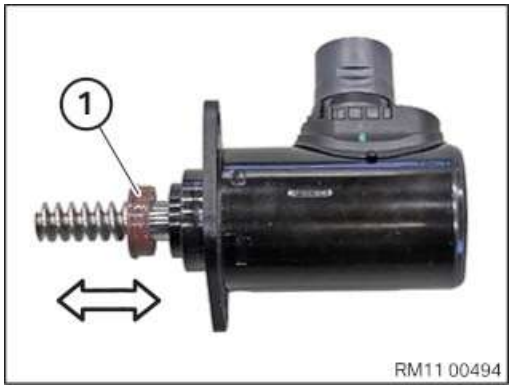
- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).
- Repeat the operations for the remaining torsion springs.

29 – Install the servomotor for the eccentric shaft (cylinder head removed)

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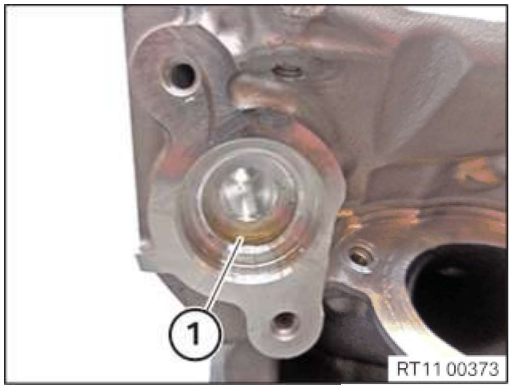


- Renew gasket (1).

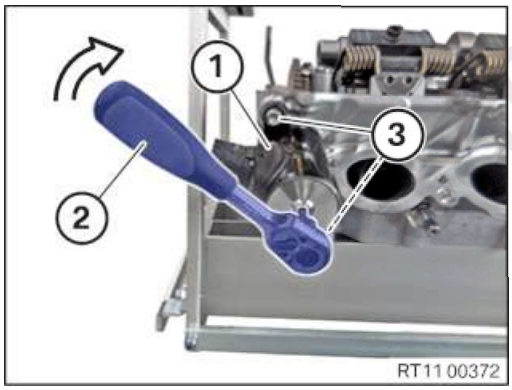
  Parts: Gasket



- Press the gasket (1) in to the limit position on the housing.



- Clean sealing surface (1).



- Slide servomotor for the eccentric shaft (1) up to the limit position and install it.
- Turn servomotor for the eccentric shaft (1) using a standard hexagon socket wrench (2) of **4 mm** in the **direction of arrow** until the servomotor for the eccentric shaft (1) lies on the cylinder head.
- Tighten down screws (3).

Electrical servomotor to cylinder head

M6		Tightening torque	8 Nm

30 – Removing cylinder engine from assembly stand

CAUTION

Heavy component.

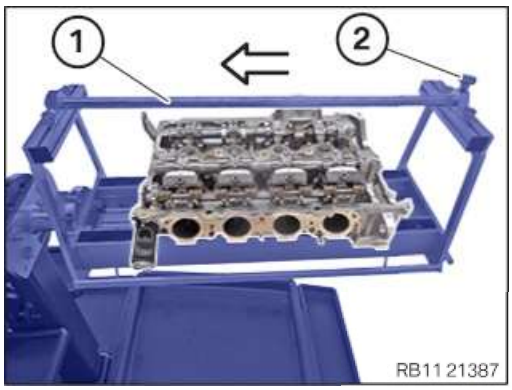
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

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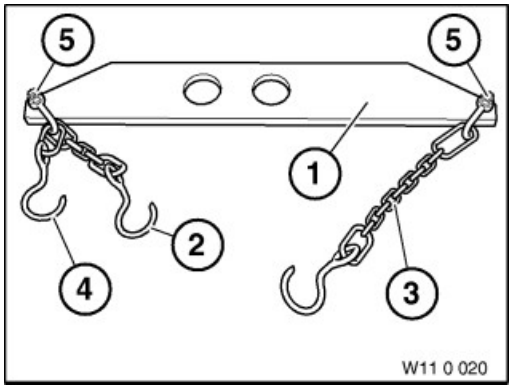
- Release screws (1) from special tool .



- Loosen screw (2).
- Pull out rod (1) in **direction of arrow** and set it aside.

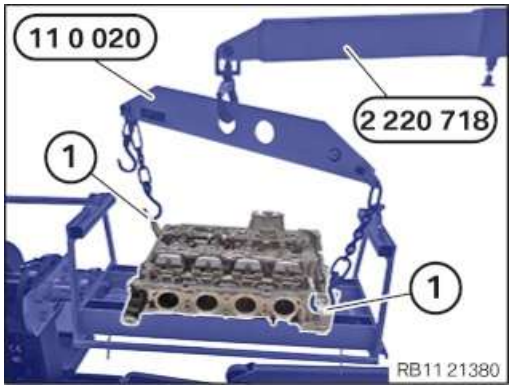


- Stage special tool (workshop crane) 2 220 718.

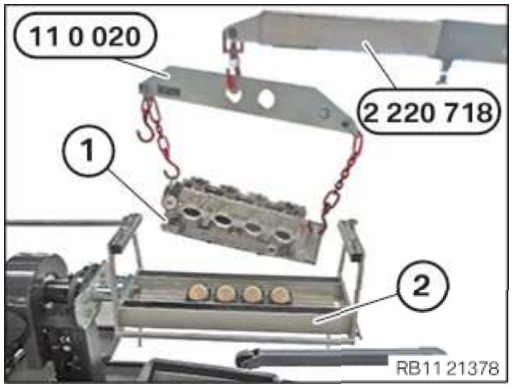


- Prepare the special tool .

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- Thread in and install the special tool on the cylinder head (1).
- Attach the special tool to the workshop crane 2 220 718.



- Feed cylinder head (1) out of device (2) using workshop crane 2 220 718 and special tool and lift.

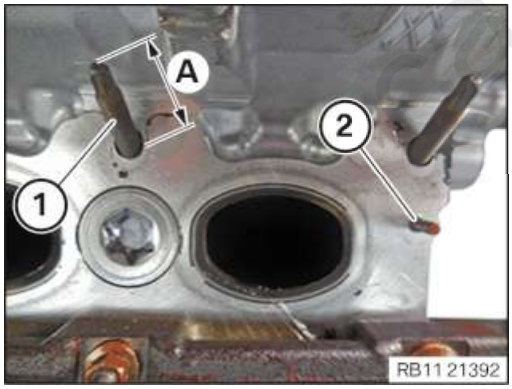
31 – Installing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.



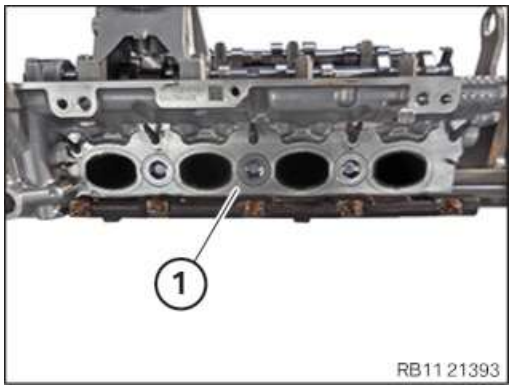
- Check stud bolt (1) for damage, renew stud bolt (1) if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1); if necessary screw in stud bolt further.

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm

- Check for correct fit of stud bolt (2).



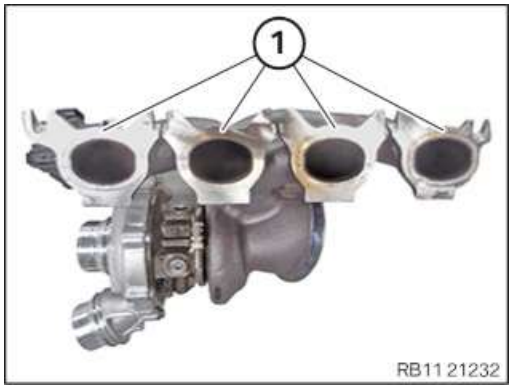
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the cylinder head (1) using the special tool 0 495 102 (11 4 470).



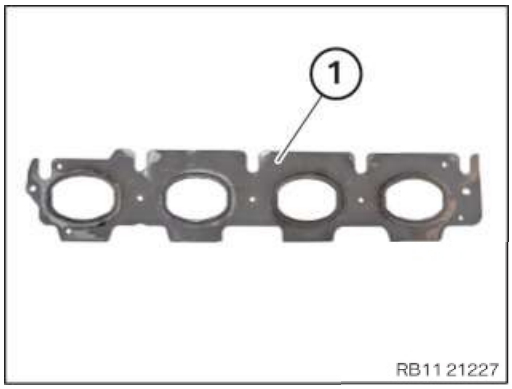
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

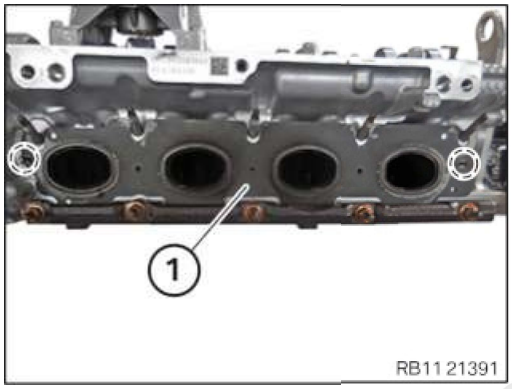
- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the exhaust turbocharger (1) using the special tool 0 495 102 (11 4 470).

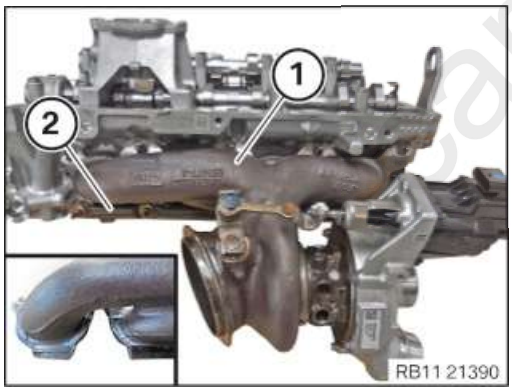


- Renew gasket (1).

  Parts: Seals



- Insert and install the gasket (1).
- Make sure the seal (1) has been **correctly** installed in the guide pins in the **marked** area.



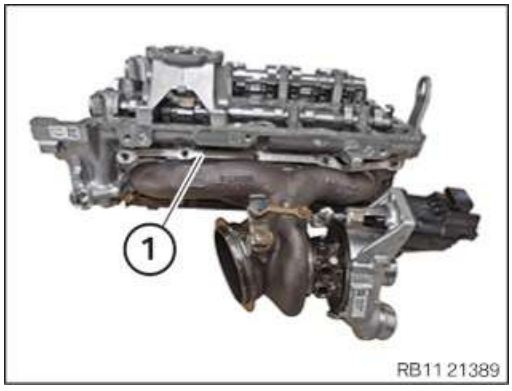
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide the exhaust turbocharger (1) toward the bottom into the clamping strip (2) and align it flush on the cylinder head.

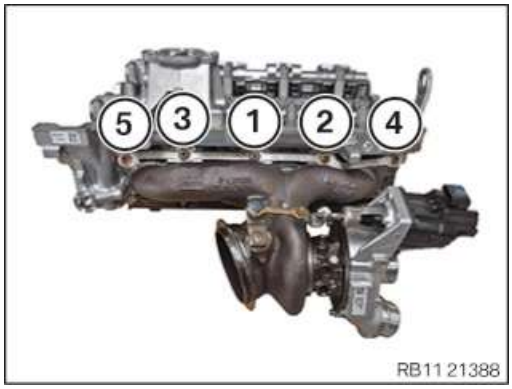


TECHNICAL INFORMATION

- Note the installation position of the component. The component may be installed in various installation positions.

- Mount sliding rail (1).
- The original BMW part number of the sliding rail (1) must be **legible** from the rear.

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Renew nuts (1) to (5).

  Parts: Nuts

- Tighten the nuts in sequence (1) to (5).

Exhaust turbocharger to cylinder head

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Additional Information

Overview of Tightening Torques

Flange to assembly stand — Used in step 2

M14X30		Tightening torque	135 Nm

Cylinder head on device — Used in step 2

M10X90x1.5		Tightening torque	30 Nm

Exhaust camshaft to cylinder head — Used in step 20

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Eccentric shaft to bearing support/cylinder head — Used in step 21

M6			10 Nm

Intake camshaft to cylinder head — Used in step 22

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Gate to bearing bracket — Used in step 26

M8			20 Nm

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Electrical servomotor to cylinder head Used in step 29

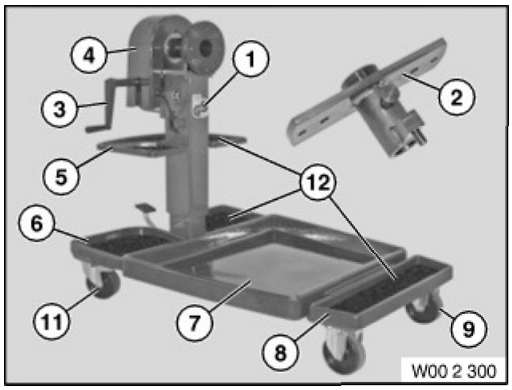
M6		Tightening torque	8 Nm

Exhaust turbocharger to cylinder head Used in step 31

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Overview of Special Tools

0 495 187 (00 2 300) Assembly stand



Common Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

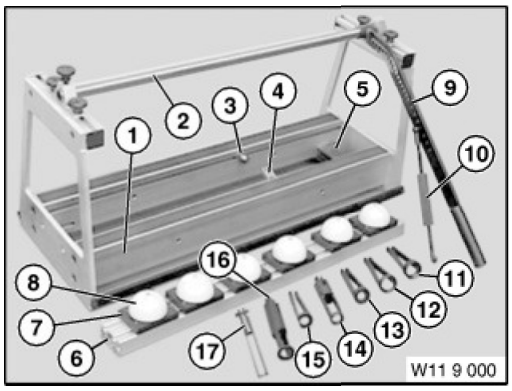
Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	
2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	

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7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

0 494 362 (11 9 000) Device



Common Used in step 213

Usage	(Cylinder head expander tool)
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 03 02 (833)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 366 (11 9 001)		**Device**	
6	0 494 371 (11 9 006)		**Insert** (Aluminium strip)	
11	0 494 376 (11 9 012)		**Basket** (Valve spring cage) Engine M41, M51, S50	
17	0 495 028 (11 9 017)		**Basket** (Valve spring cage) Engine N52	
2	0 494 367 (11 9 002)		**Rod**	
3	0 494 368 (11 9 003)		**Adapter** (Sliding block)	
4	0 494 369 (11 9 004)		**Tab**	
5	0 494 370 (11 9 005)		**Quick fastener**	
7	0 494 372 (11 9 007)		**Shaped part** (shaped part)	

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8	0 494 373 (11 9 008)		**Shaped part** (Shaped part) Shaped part made of plastic	
9	0 494 374 (11 9 009)		**Lever**	
10	0 494 375 (11 9 011)		**Hook**	
12	0 494 377 (11 9 013)		**Basket** (Valve spring cage) Engine M43, M73	
13	0 494 378 (11 9 014)		**Basket** (Valve spring cage) Engine M44, M52, M54, M56, M62, S52, S54, S62	
14	0 494 379 (11 9 015)		**Basket** (Valve spring cage) Engine M47, M47TU, M57, M57TU, N40, N42, N62, N73	
15	0 494 380 (11 9 016)		**Basket** (Valve spring cage) Engine M21, M40	

2 220 718 Workshop crane



Common	Used in step 230
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

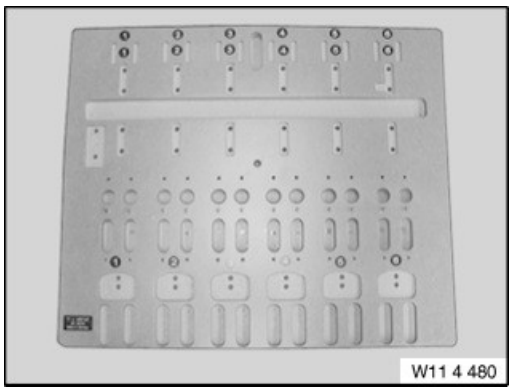
2 359 088 Device



Common	Used in step 528
Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 105 (11 4 480) oddments tray



Common Used in step 56781011121315

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

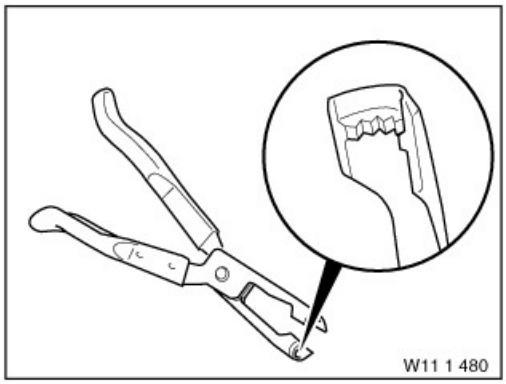
0 496 143 (11 8 840) Basket



Common Used in step 1318

Usage	(Valve spring cage) For removing and fitting the valves.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 490 796 (11 1 480) Pliers

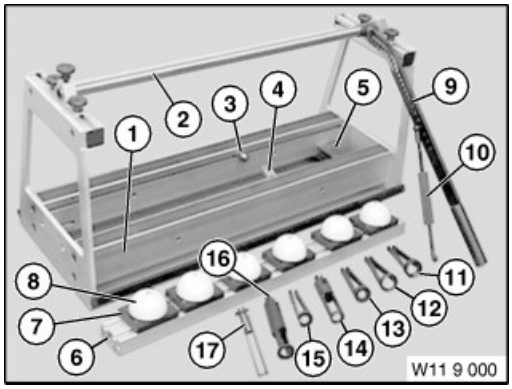


Common Used in step 14

Usage	For removing valve stem seal
Included in the tool or work	
Storage location	A10
Replaced by	
In connection with	
SI-Number	01 01 93 (621)

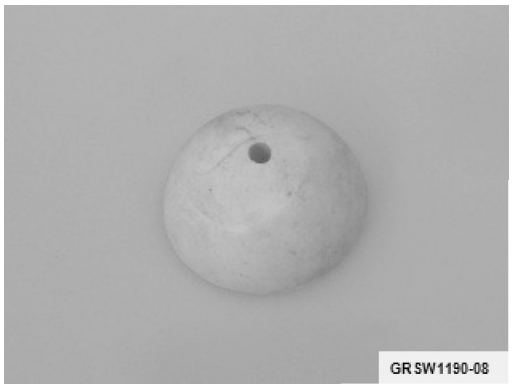
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0 494 370 (11 9 005) Quick fastener



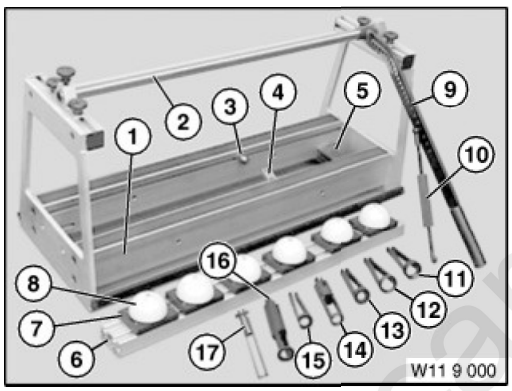
Common	Used in step 1516
Usage	
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 373 (11 9 008) Shaped part



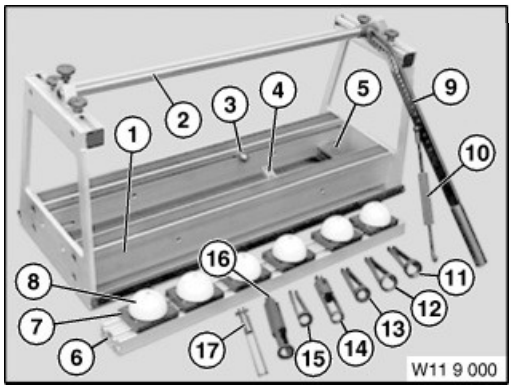
Common	Used in step 1516
Usage	(Shaped part) Shaped part made of plastic
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

0 494 371 (11 9 006) Insert



Common	Used in step 1516
Usage	(Aluminium strip)
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

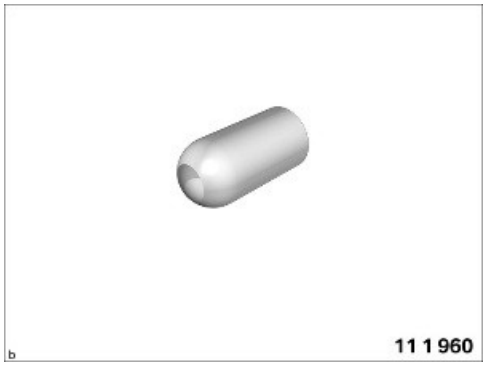
0 494 372 (11 9 007) Shaped part



Common	Used in step 1516
Usage	(Shaped part)
Included in the tool or work	0 494 362
Storage location	
Replaced by	
In connection with	
SI-Number	

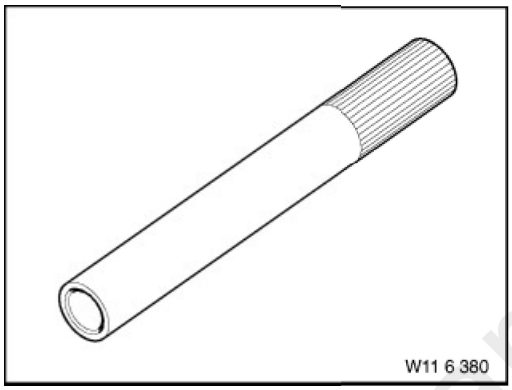
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0 490 797 (11 1 960) Holding sleeve



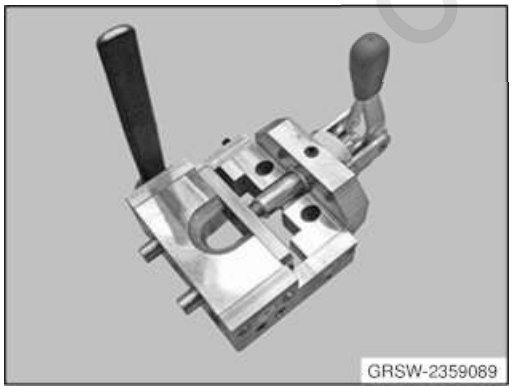
Common	Used in step 17
Usage	(Assembly sleeve) For fitting valve stem seals, 6 mm diameter
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 493 249 (11 6 380) Bush



Common	Used in step 17
Usage	For fitting valve stem seal
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 98 (306)

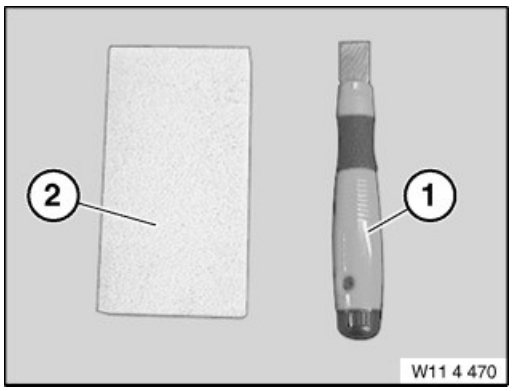
2 359 089 Device



Common	Used in step 26
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 102 (11 4 470) Tool



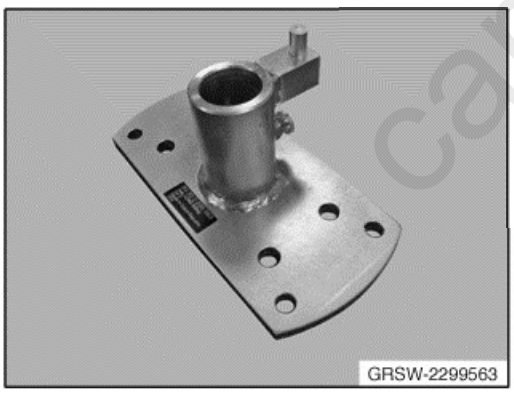
Common	Used in step 31
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

Replacement tools:

2 299 563 Adapter



Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

Overview Technical Data

Screw-in depth of upper stud bolt on cylinder head	Used in step 31
Dimension A	30 mm

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	9

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11 34 715 Replace all valve springs

PRELIMINARY WORK

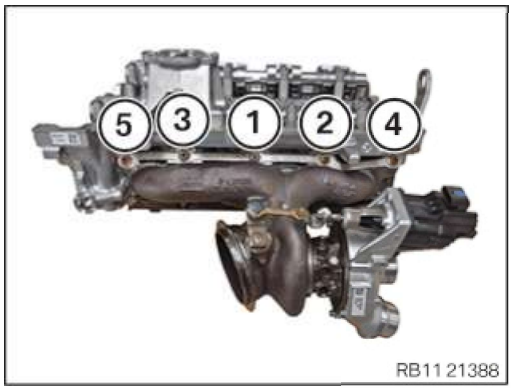
1 – Removing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

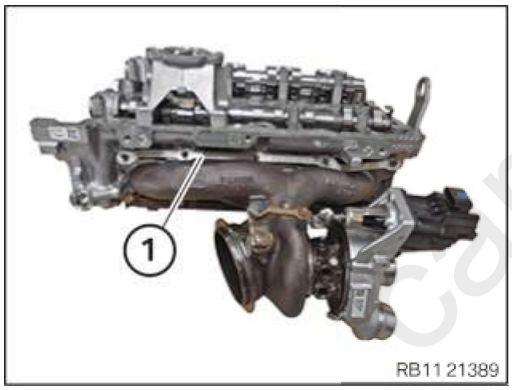
- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.



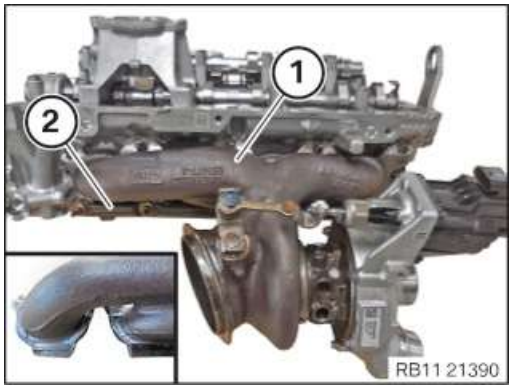
TECHNICAL INFORMATION

Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (5) to (1).



- Remove reinforcement plate (1).



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

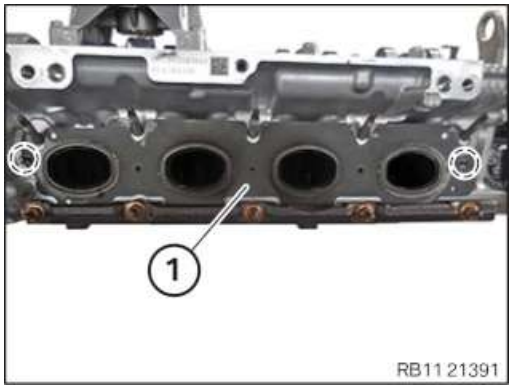
- Remove and install heavy components with the aid of another person/other persons.

- Ensure that the clamping strip (2) remains screwed into place during the removal of the exhaust turbocharger (1).

  The exhaust turbocharger (1) is **not** screwed onto the bottom, but clamped in the clamping strip (2).

  Thread out and remove exhaust turbocharger (1).

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- Guide seal (1) out of the **marked** area and remove it.

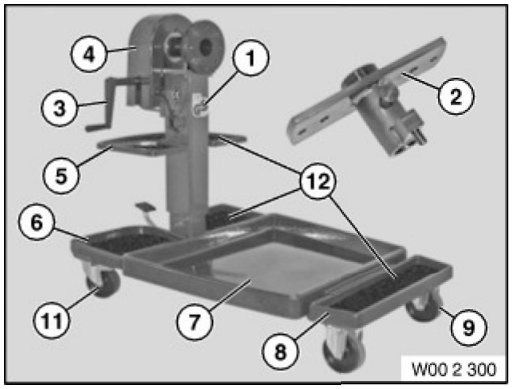
2 – Installing the cylinder head on the assembly stand

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

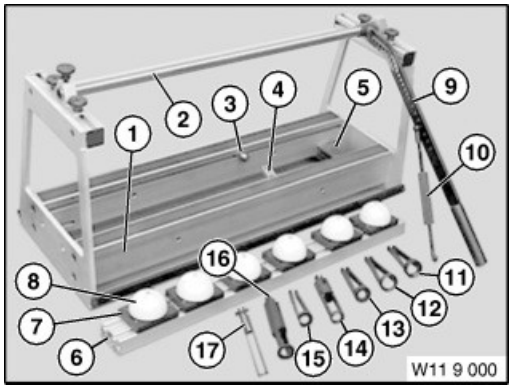
- Remove and install heavy components with the aid of another person/other persons.



- Have the set of special tools 0 495 187 (00 2 300) ready.

Number	Description
1	Assembly stand
2	Flange
3	Crank
4	Cover
5	oddments tray
6	Shaped element rear
7	Collection pan
8	Shaped element front
9	Front wheel
10	Rear wheel with stop
11	Mat

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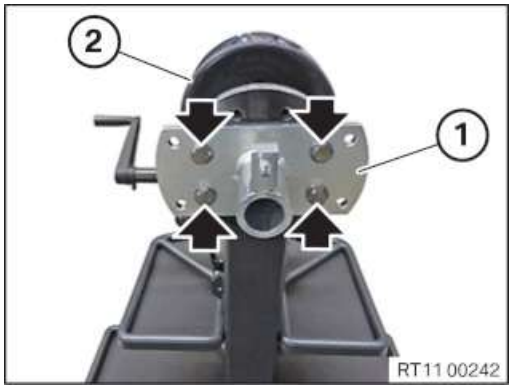
- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Stage special tool (workshop crane) 2 220 718.

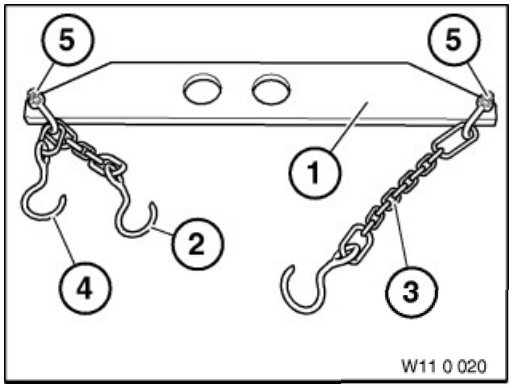
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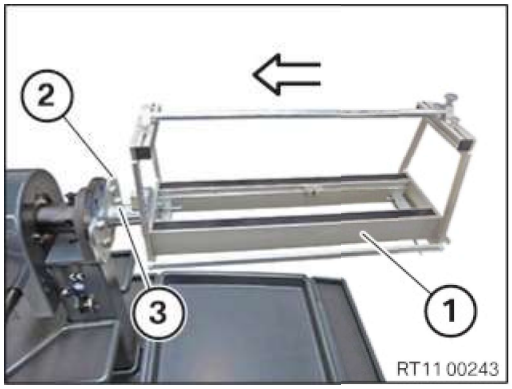
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

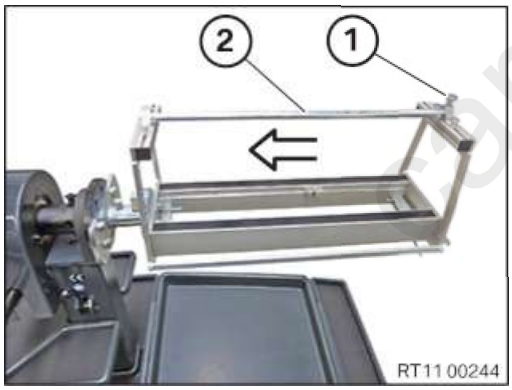
M14X30		Tightening torque	135 Nm



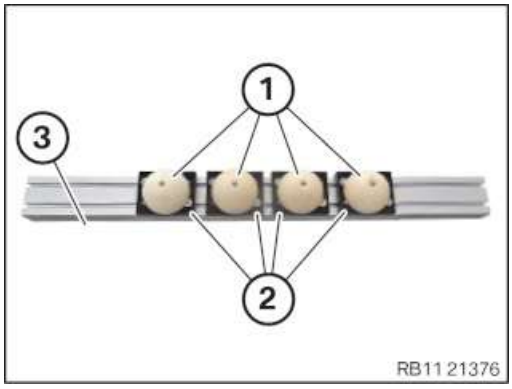
- Prepare the special tool .



- Fit device (1) onto the flange (2) in the direction of the arrow and install.
- Make sure that the lock (3) engages audibly.

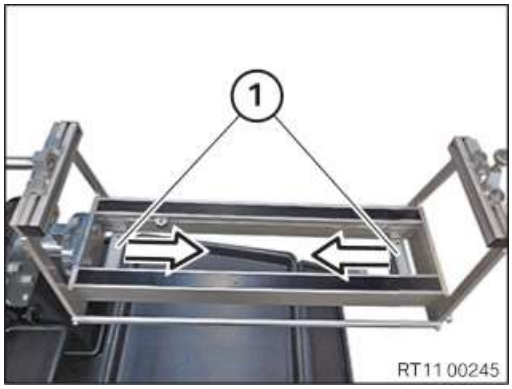


- Loosen screw (1).
- Pull out rod (2) in direction of arrow and set it aside.

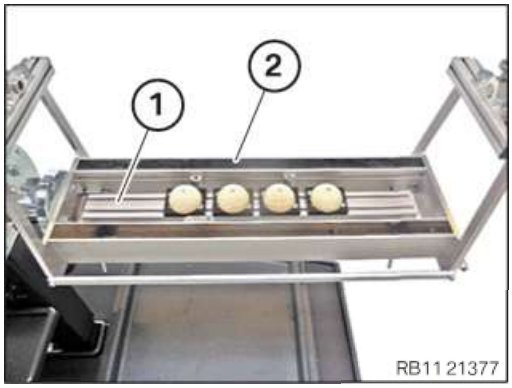


- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).

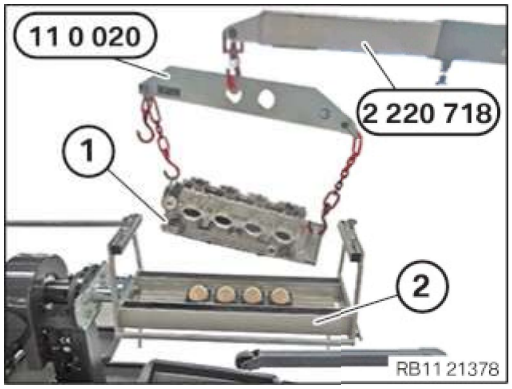
ardiagn.com



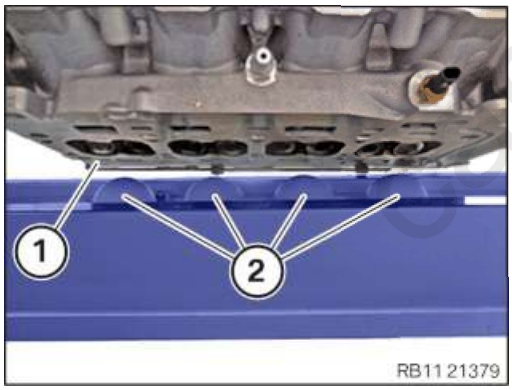
- Slide quick fastener (1) in the **direction of the arrow** up to the limit position.



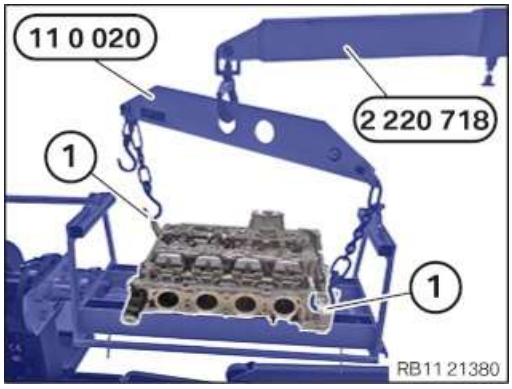
- Position completed aluminium strip (1) **centred** on the device (2).



- Position cylinder head (1) with the work crane 2 220 718 and special tool on the device (2).

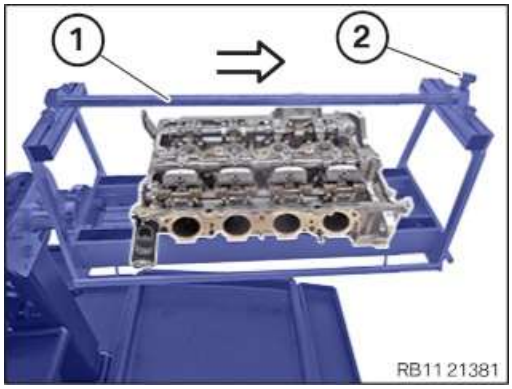


- Position cylinder head (1) correctly on the completed aluminium strip (2).

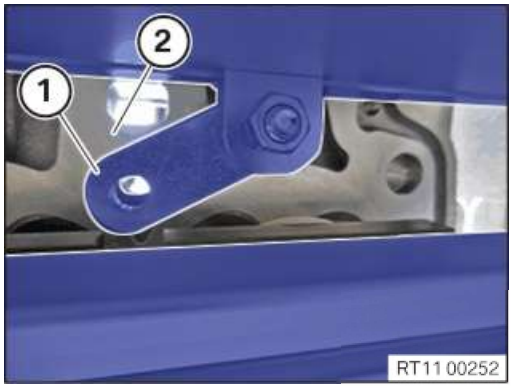


- Lower workshop crane 2 220 718.
- Pull out special tool at the cylinder head (1) and remove.
- Remove workshop crane 2 220 718 and set aside.

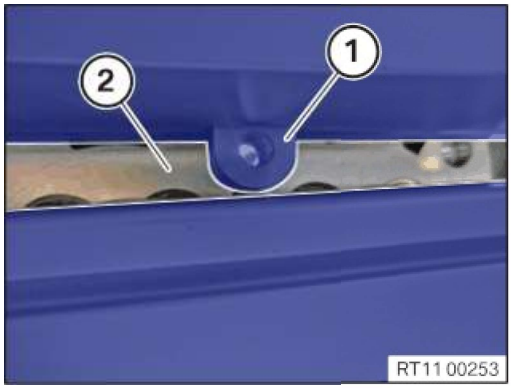
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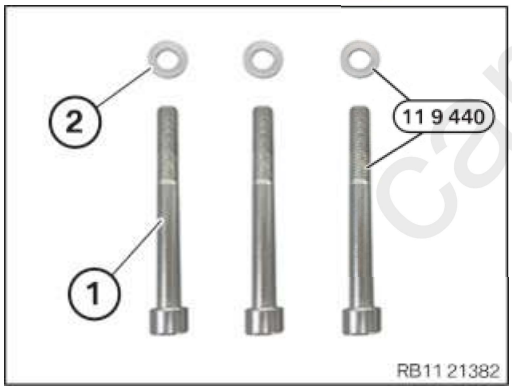
- Pull in rod (1) in the direction of the arrow and install.
- Hand-tighten the bolt (2).



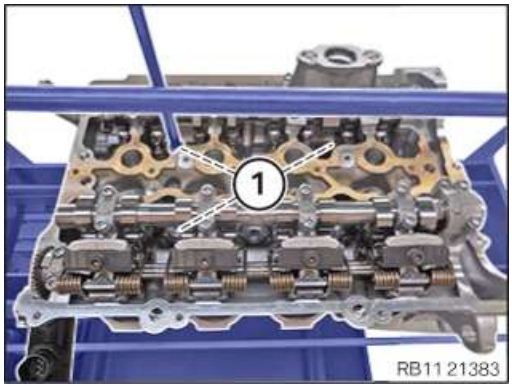
- Position screw connection (1) on cylinder head (2).



- Position screw connection (1) on cylinder head (2).



- Keep **M10x90** screws (1) from special tool ready.
- Keep washers (2) from special tool ready.

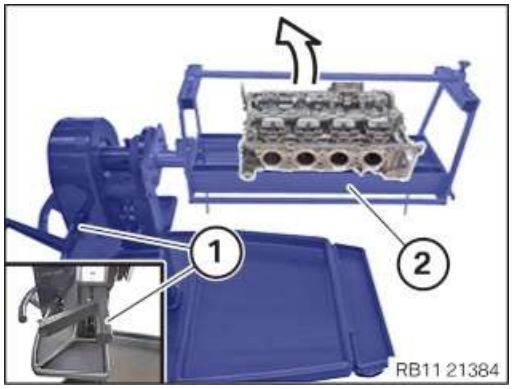


- Tighten the screws (1) from special tool .

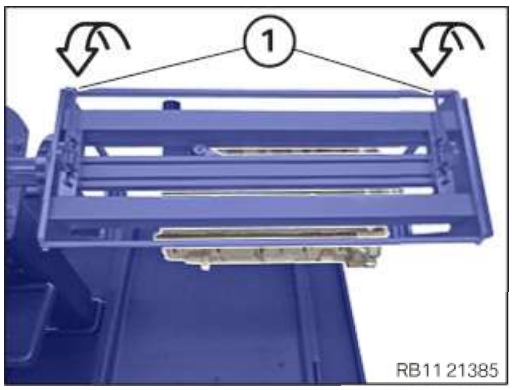
Cylinder head on device

M10X90x1.5		Tightening torque	30 Nm

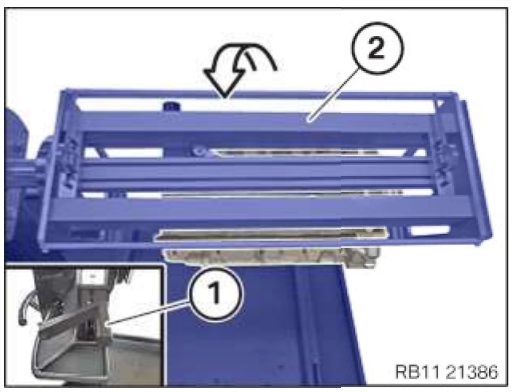
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- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

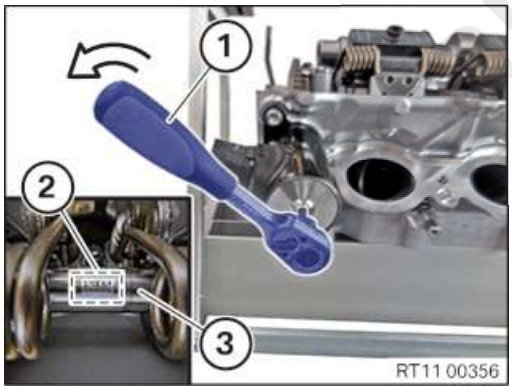


- Lock quick fastener (1) in the **direction of the arrow**.



- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

3 – Adjusting eccentric shaft to minimum lift (cylinder head removed)

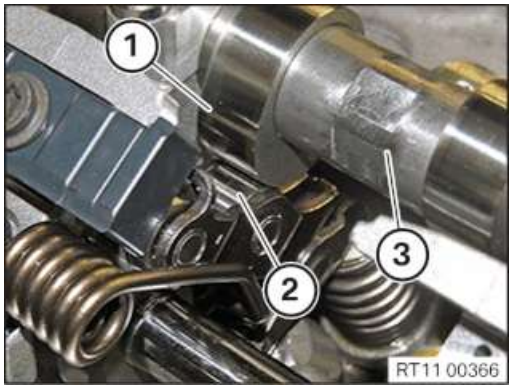


- With the help of the servomotor, use a standard hexagon socket wrench (1) to slowly adjust eccentric shaft (3) to the minimum lift at **4 mm** in the **direction of the arrow**.
- Make sure that the mark (2) on the eccentric shaft (3) points upwards.

4 – Checking the position of the intake camshaft (cylinder head removed)

Check

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- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

5 – Remove all torsion springs

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

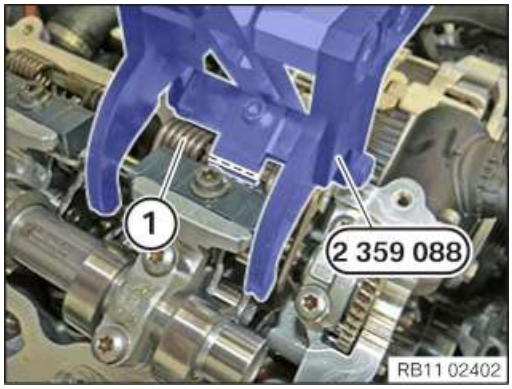
TECHNICAL INFORMATION

- Wear safety goggles.



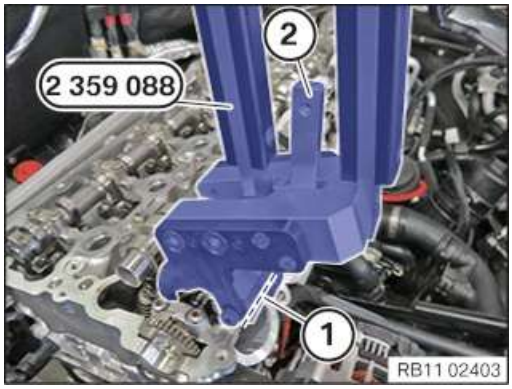
- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)

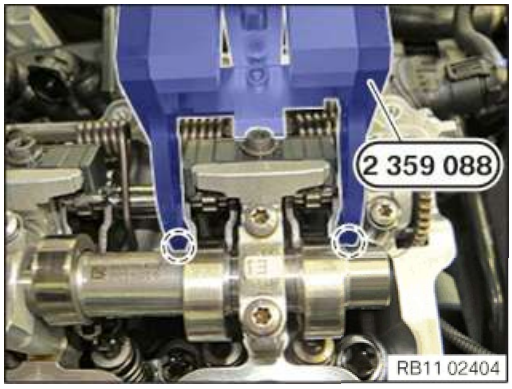


- Open the special tool 2 359 088 and position it at the torsion spring (1).

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- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.



Check

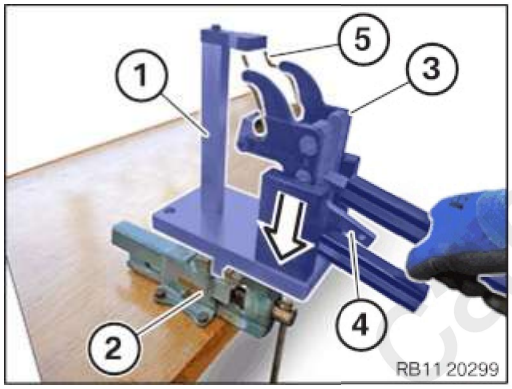
- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

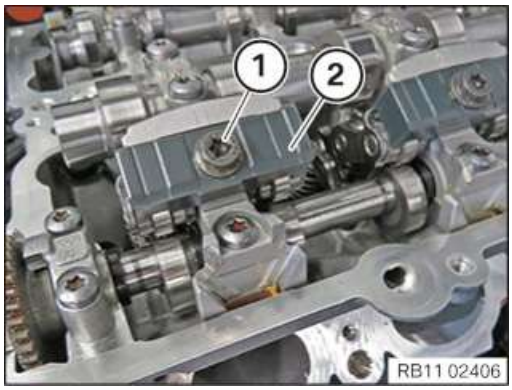
- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.



- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

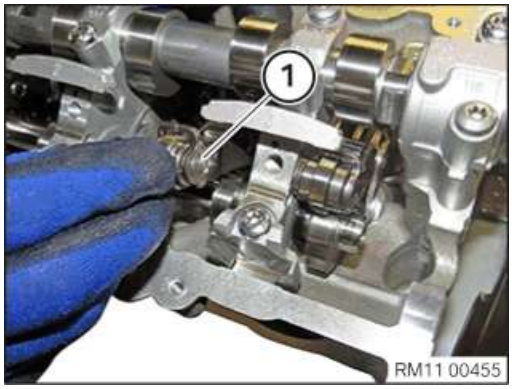
6 – Removing all gates



- Loosen screw (1).
- Remove the gate (2) and place it arranged in order into 0 495 105 (11 4 480).
- Repeat the step for all the gates.

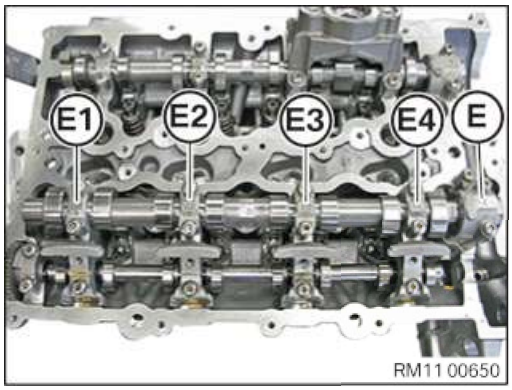
7 – Removing all intermediate levers

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- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

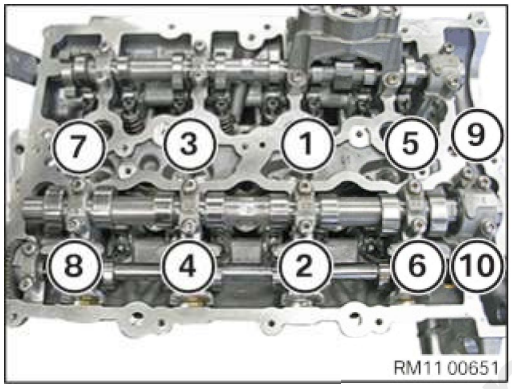
8 – Remove intake camshaft



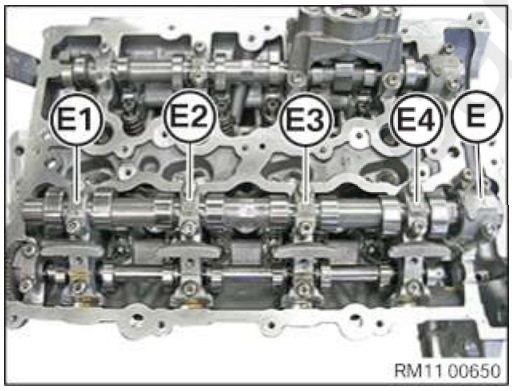
- Make sure that the exhaust camshaft bearing cap is placed in the correct position in the special tool 0 495 105 (11 4 480).

Note: The intake camshaft bearing caps are legibly labelled from the intake side with E1, E2, E3, E4 and E.

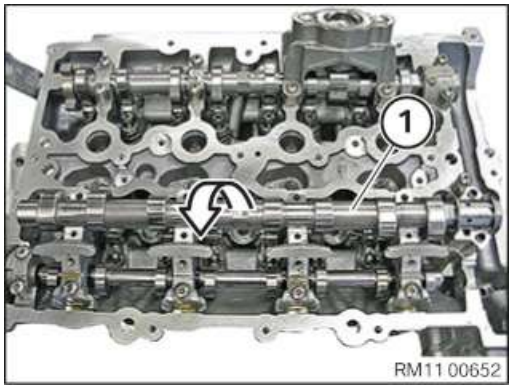
Note: Intake camshaft bearing cap E is a thrust bearing.



- Loosen all screws on the intake camshaft bearing caps in sequence from (10) to (1).



- Take off intake camshaft bearing caps (E1), (E2), (E3), (E4) and (E) and place them in order in the special tool 0 495 105 (11 4 480).



- Remove the intake shaft (1)in the direction of the arrow.

9 – Remove the servomotor for the eccentric shaft (cylinder head removed)

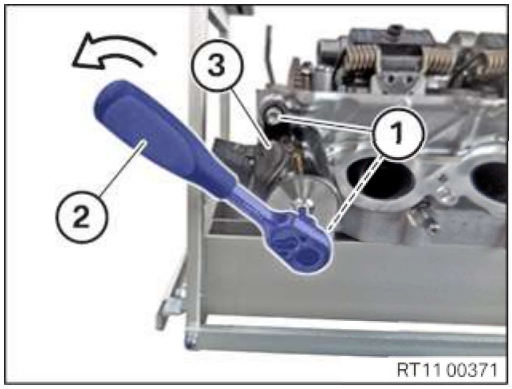
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

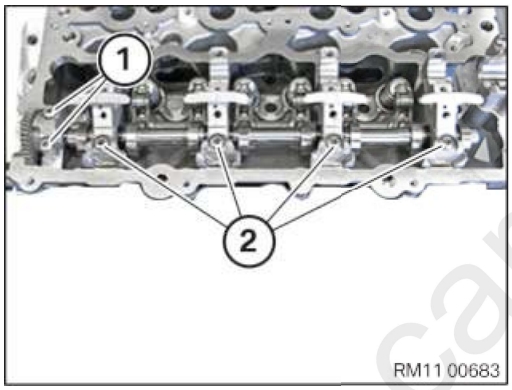


- Loosen screws (1).
- Use a standard hexagon socket wrench (2) to slowly adjust the servomotor for eccentric shaft (3) to the minimum lift at **4 mm** in direction of arrow.

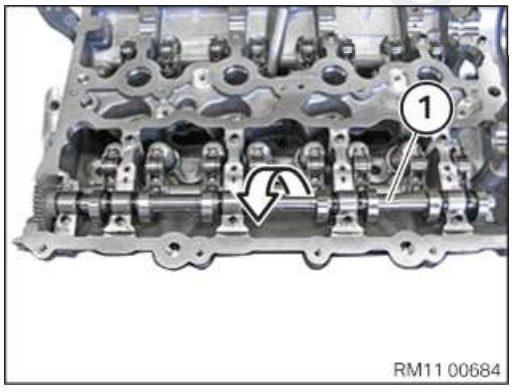
  This releases the tension of the eccentric shaft.

  Do **not** turn the eccentric shaft beyond the end stop.
- Guide out and remove the servomotor for eccentric shaft (3).

10 – Remove eccentric shaft

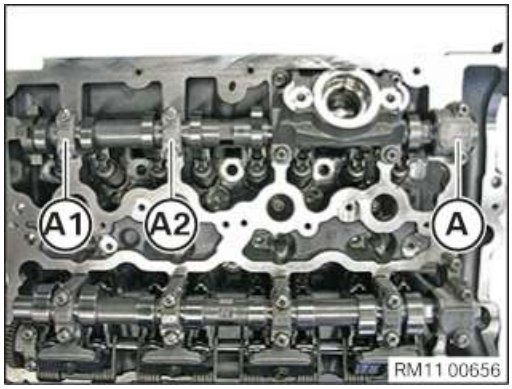


- Release screws (1) and set down the bearing cap neatly in special tool 0 495 105 (11 4 480).
- Release screws (2) and set down the bearing support neatly in special tool 0 495 105 (11 4 480).
- For an engine that has been in use, make sure all bearing supports are reinstalled in the same position.



- Remove eccentric shaft (1) in direction of arrow.

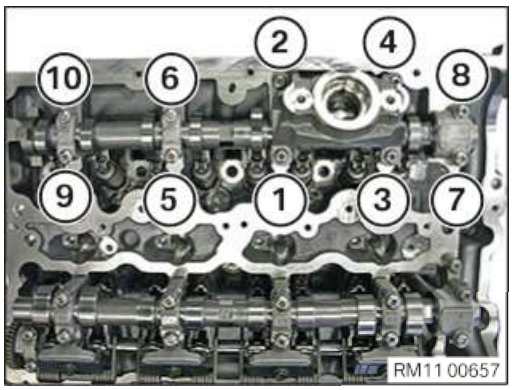
11 – Remove exhaust camshaft.



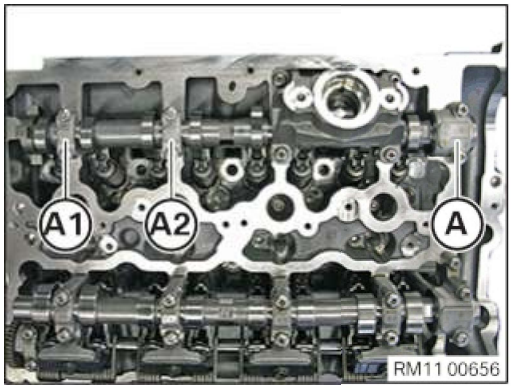
- Subsequently ensure that the exhaust camshaft bearing cap is placed in 0 495 105 (11 4 480) in the special tool.

Note: The exhaust camshaft bearing caps are legibly labelled from the intake side and marked with A1, A2 and A.

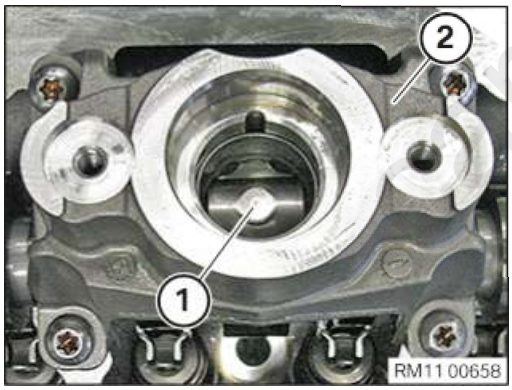
Note: Exhaust camshaft bearing cap A is a thrust bearing.



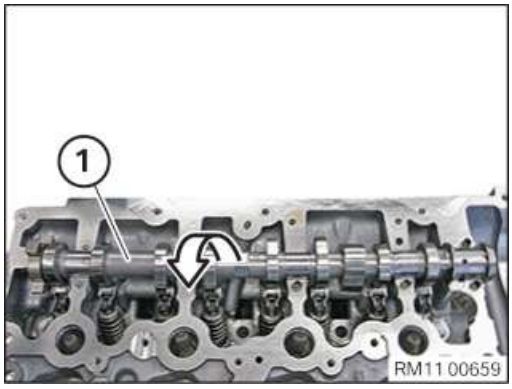
- Loosen all screws on the exhaust camshaft bearing cap in sequence from (10) to (1) in half turn.



- Drop the exhaust camshaft bearing cap (A1), (A2) and (A) and place in order in the special tool 0 495 105 (11 4 480).



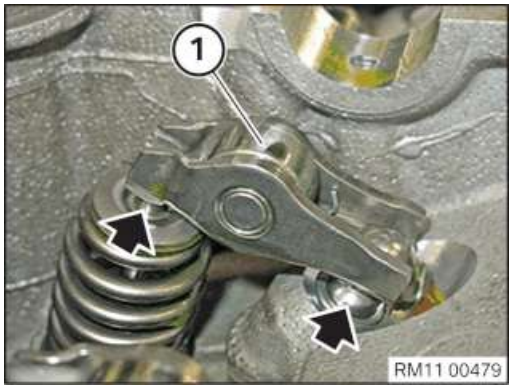
- Remove the roller tappet (1).
- Remove the high pressure pump bracket (2).



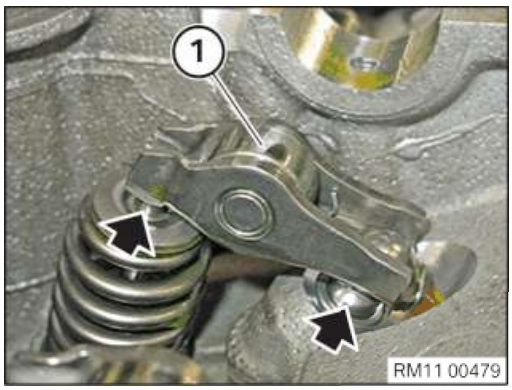
- Remove the exhaust camshaft (1) in the direction of the arrow.

12 – Remove all roller cam followers

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- Detach and remove the roller cam followers (1) on the intake side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).



- Detach and remove the roller cam followers (1) on the output side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).

MAIN WORK

13 – Remove all valve springs

CAUTION

Spring preload.

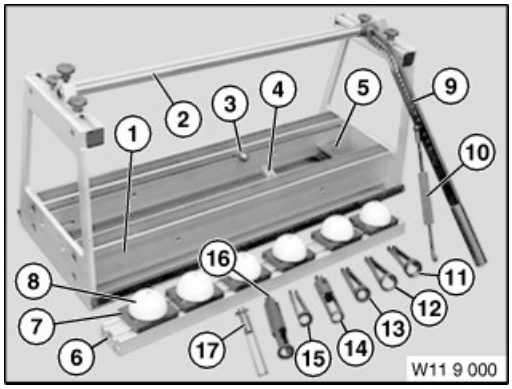
Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

NOTICE

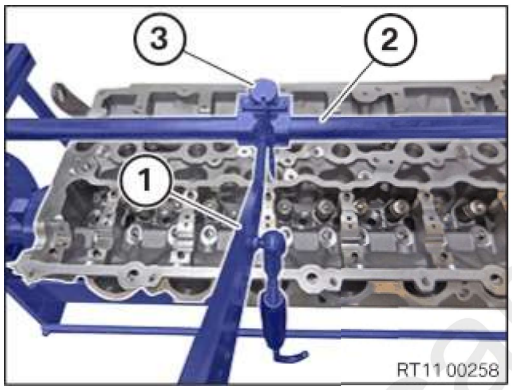
The description is for one component only. The procedure is identical for all further components.

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- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Feed in and install lever (1) on the rod (2).
- Guide in and install lock (3).

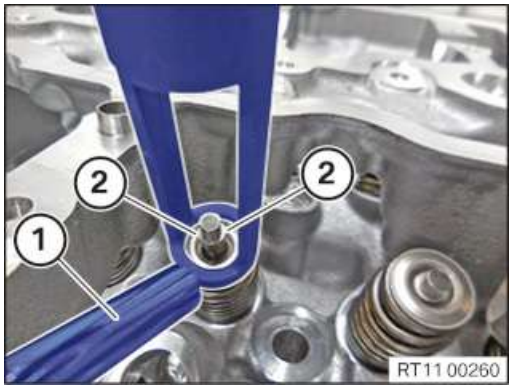


TECHNICAL INFORMATION

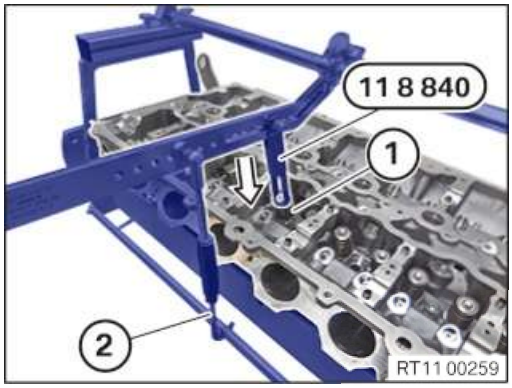
- Wear safety goggles.

- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).

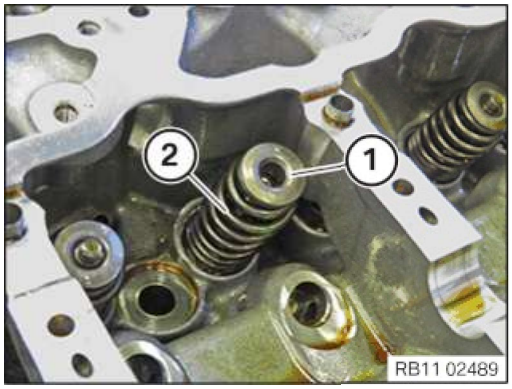
cardiagn.com



- Remove valve shims (2) with a magnet (1).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Remove the spring cup (1) and the valve spring (2) and position neatly in the special tool 0 495 105 (11 4 480).

14 – Renewing valve stem seals

▶ **Remove valve stem seals**

RISK OF DAMAGE

Contaminant or foreign body.

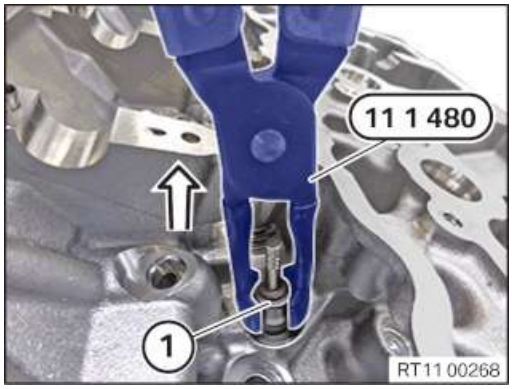
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

NOTICE

The description is for one component only. The procedure is identical for all further components.

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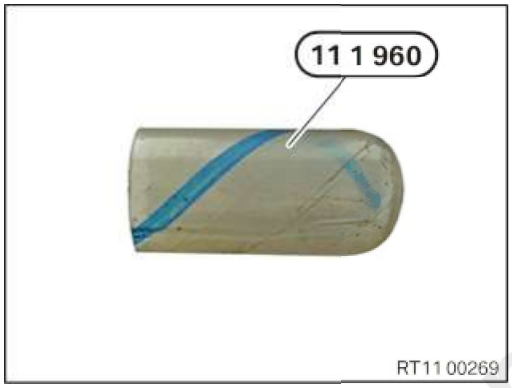


- Remove the valve stem seal (1) in the **direction of arrow** using the special tool 0 490 796 (11 1 480).

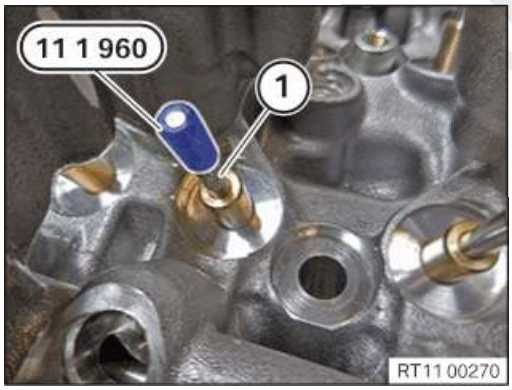
▶ **Installing valve stem seals**



- Remove oil and dirt from the contact surface (1).



- Make sure that the special tool 0 490 797 (11 1 960) is used when installing the valve stem seal.



- Guide in and install the special tool 0 490 797 (11 1 960) on valve (1).



- Renew the valve stem seal (1).

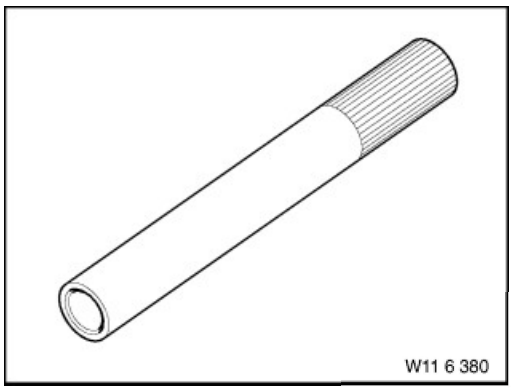
  Parts: Valve stem seal

- Guide in and install valve stem seal (1) on the special tool 0 490 797 (11 1 960).

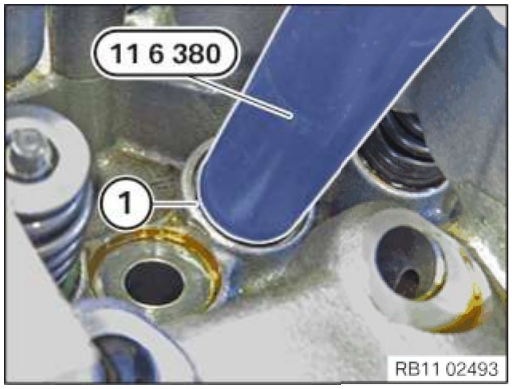
rdiagn.com



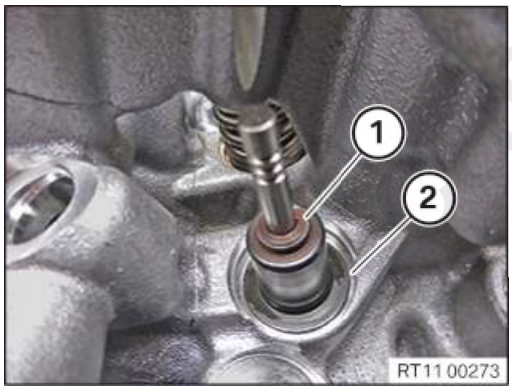
- Guide the special tool 0 490 797 (11 1 960) out and remove.



- Prepare special tool 0 493 249 (11 6 380).



- Press the valve stem seal (1) onto the cylinder head till the limit position using special tool 0 493 249 (11 6 380).



- Make sure that valve stem seal (1) is positioned correctly on cylinder head (2).

15 – Install all valve springs

CAUTION

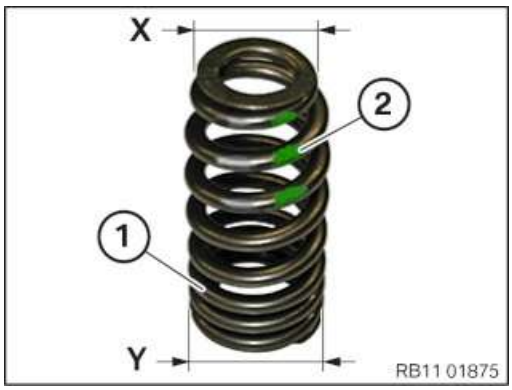
Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

NOTICE

The description is for one component only. The procedure is identical for all further components.

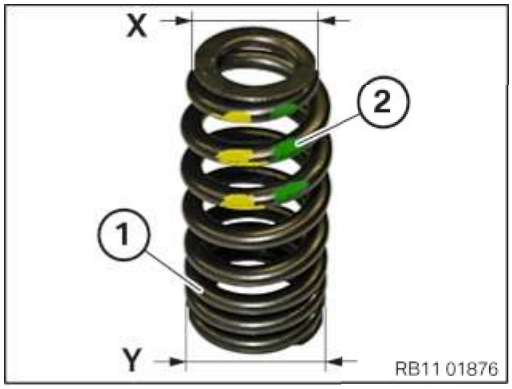


- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the intake valves: Green

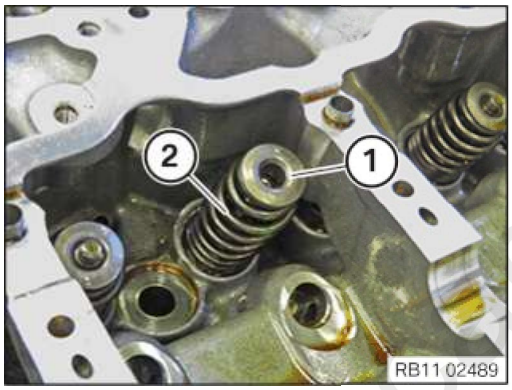


- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the exhaust valves: green/yellow



- Install the valve spring (2) and the spring cup (1).

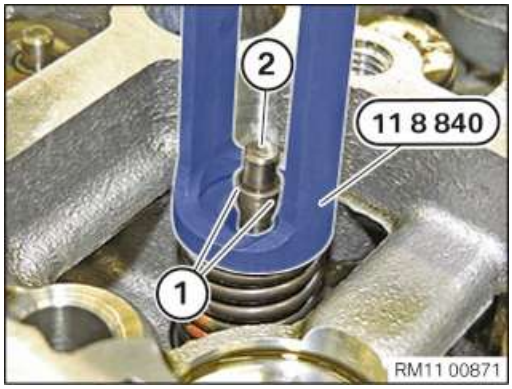


TECHNICAL INFORMATION

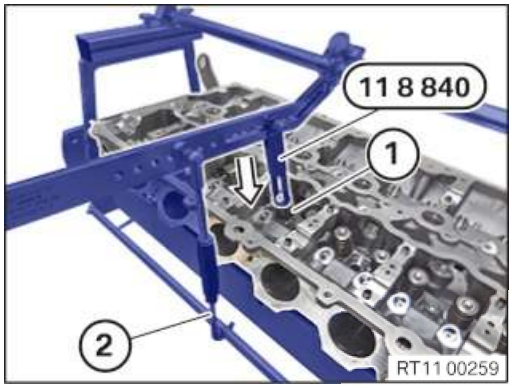
- Wear safety goggles.

- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).

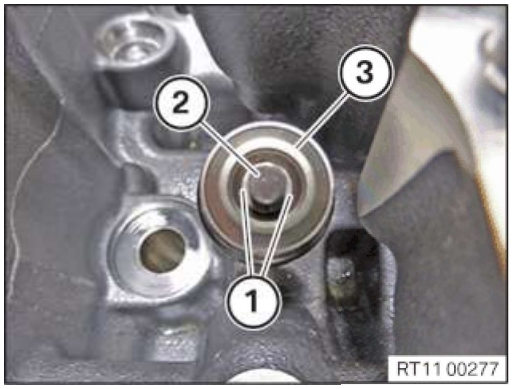
carsdiagn.com



- Position the valve shims (1) on the valve (2).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Make sure that the valve shims (1) are positioned correctly on the valve (2) and on the valve spring (3).

POSTPROCESSES

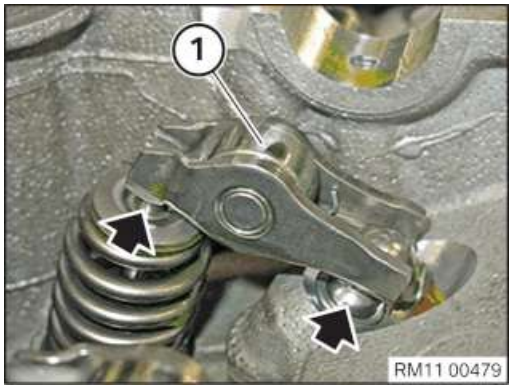
16 – Install all roller cam followers



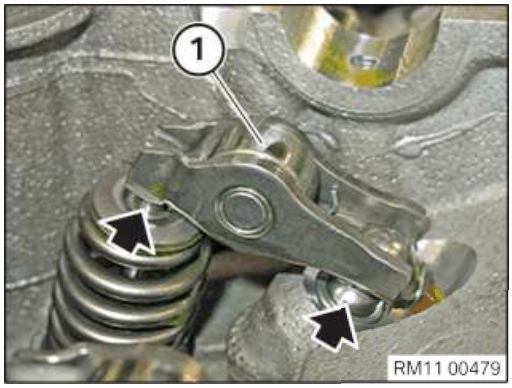
- The classification in digits from 1 to 5 has been printed on the roller cam follower.

Classification	Idle speed
1	Repair case - slow engine speed when idling
2	Installed as standard/initial installation
3	Installed as standard/initial installation
4	Installed as standard/initial installation
5	Repair case - high engine speed when idling

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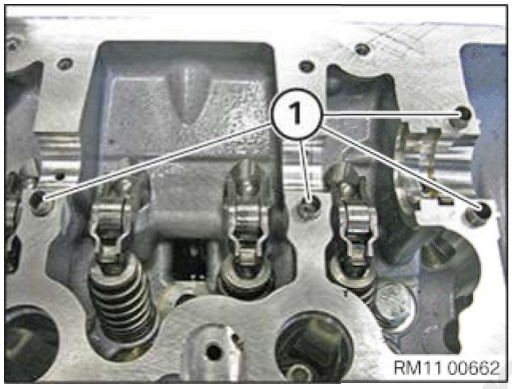


- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.

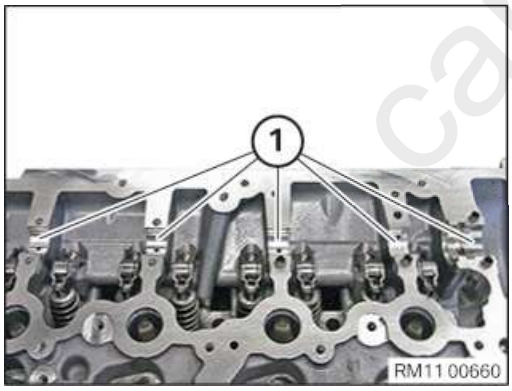


- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

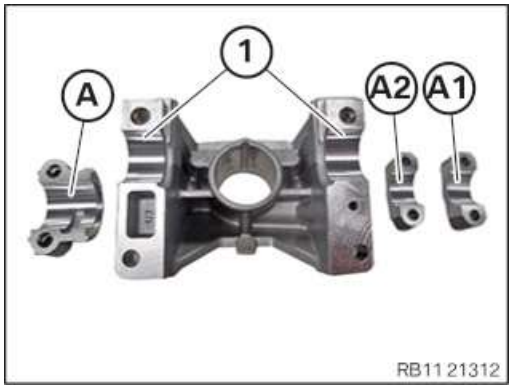
17 – Install exhaust camshaft



- Check the fitting sleeves (1) for **correct** fit and damage and replace where required.

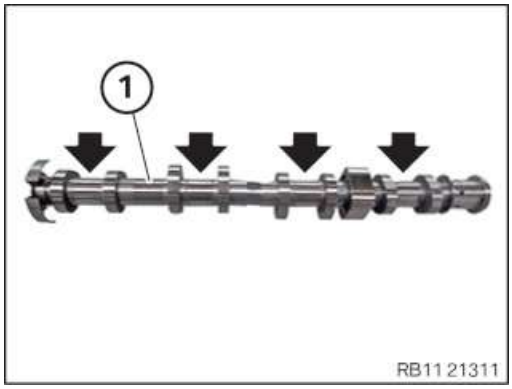


- Coat all bearing positions (1) with **fresh** engine oil.

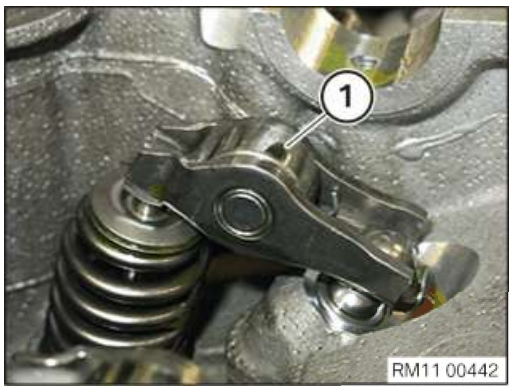


- Clean all bearing positions of the exhaust camshaft bearing cap (A1), (A2) and (A) and coat with **fresh** engine oil.
- Clean the bearing positions (1) of the high pressure pump bracket and coat with **fresh** engine oil.

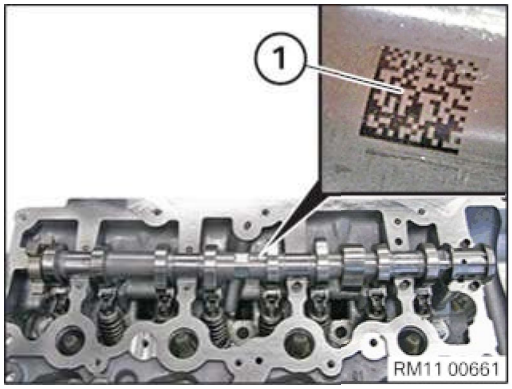
cardiagn.com



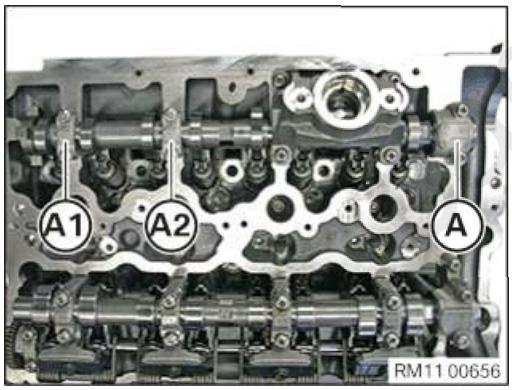
- Clean all the bearing positions (arrows) of the exhaust camshaft (1) and coat with **fresh** engine oil.



- Make sure that the roller cam follower (1) is fitted correctly before installing the exhaust camshaft.
- Coat the exhaust camshaft and the exhaust camshaft bearing cap with fresh engine oil.



- Insert exhaust camshaft in the cylinder head, such that the mark (1) points **upwards**.

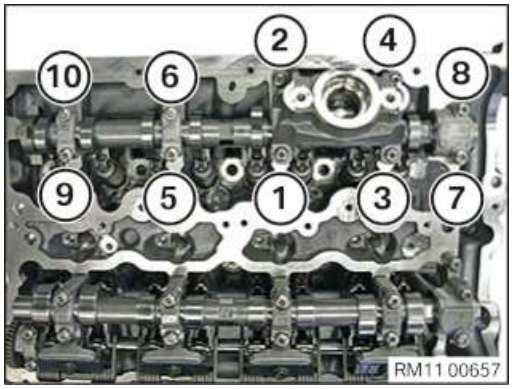


- Position all exhaust camshaft bearing caps on the cylinder head.

Note: The exhaust camshaft bearing caps are legibly labelled from the intake side and marked with A1, A2 and A.

Note: Exhaust camshaft bearing cap A is a thrust bearing.

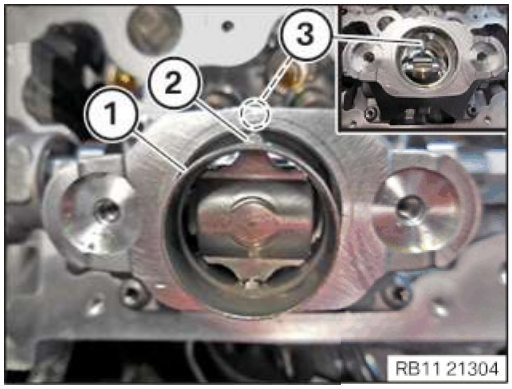
mdiagn.com



- Coat both bearing positions on the high pressure pump bracket with fresh engine oil.
- Position the high pressure pump bracket on the cylinder head.
- Join all bolts of the exhaust camshaft bearing caps in sequence (1) to (10) in half **turns**.
- **Adhere to the jointing torque.**
- Tighten all bolts of the exhaust camshaft bearing caps in sequence (1) to (10) **.**

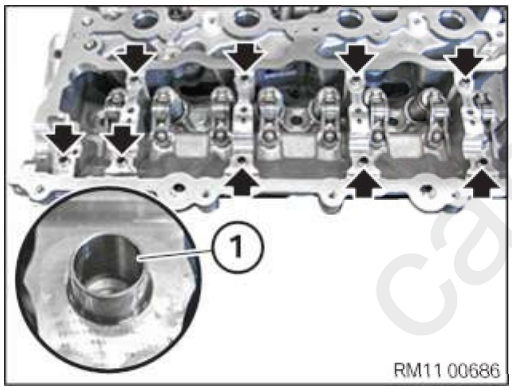
Exhaust camshaft to cylinder head

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

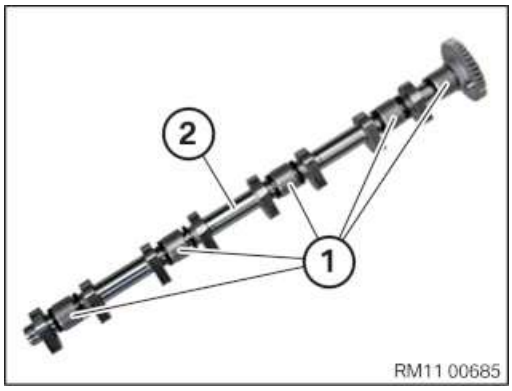


- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

18 – Install eccentric shaft



- Check guide sleeves (1) for damage and renew faulty guide sleeves (1).

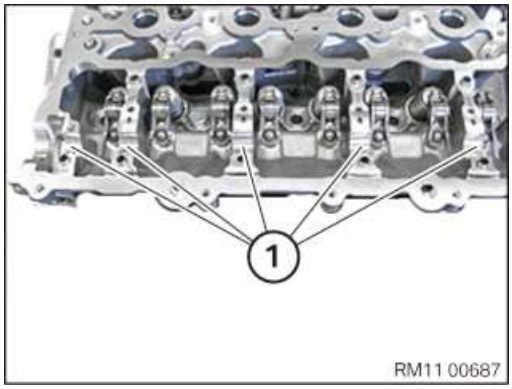


- Check needle bearing (1) for ease of movement.

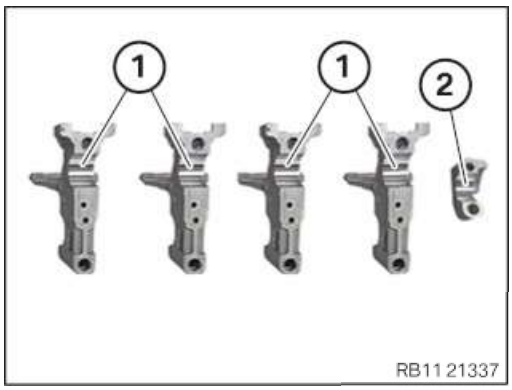
Note: In the event of tight needle bearings, replace eccentric shaft 2.

- Coat the needle bearing (1) with **new** engine oil.

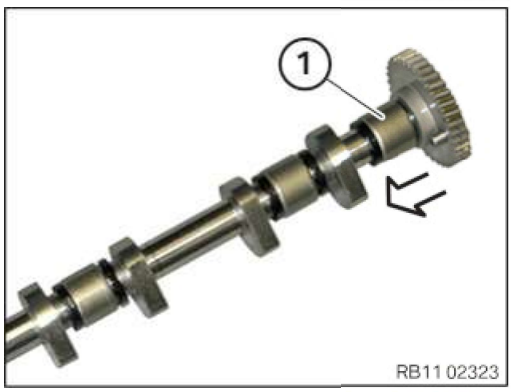
cardiagn.com



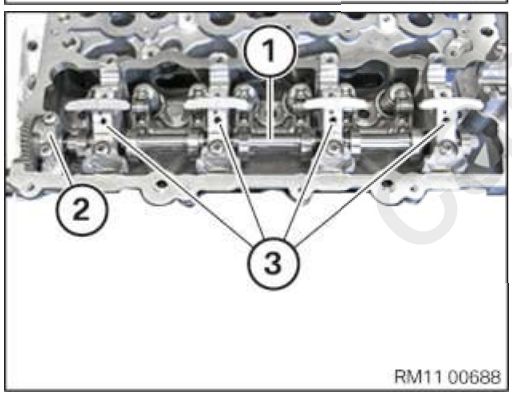
- Clean the bearing positions (1) and coat with **new** engine oil.



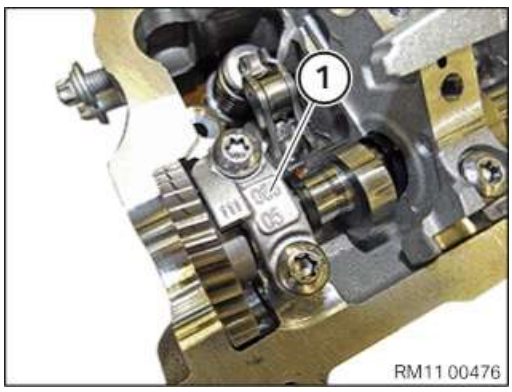
- Clean bearing positions of the bearing supports (1) and coat with fresh engine oil.
- Clean the bearing position of the bearing cap (1) and coat with **new** engine oil.



- Before installing the eccentric shaft, push needle bearing (1) in direction of arrow up to the limit position.



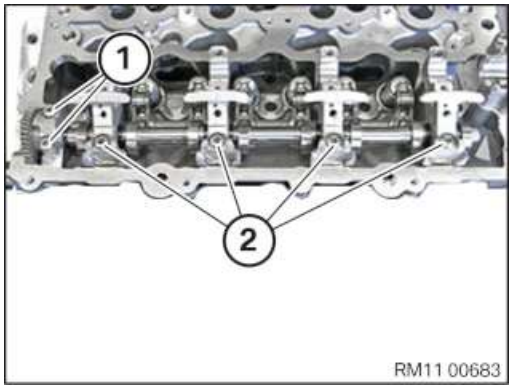
- Insert eccentric shaft (1) in the cylinder head.
- Attach bearing cap (2) and bearing supports (3) on the cylinder head.
- For an engine that has been in use, make sure all bearing supports are reinstalled in the same position.



- Ensure correct installation of bearing cap (1).

Note: Bearing cap 1 is provided with a limit position.

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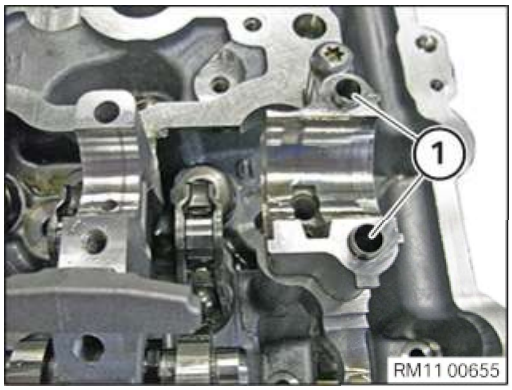


- Tighten down screws (1) and (2) uniformly.

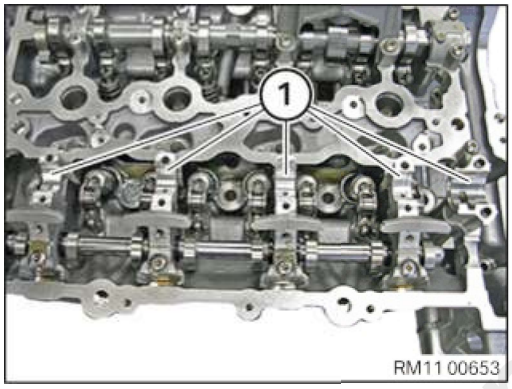
Eccentric shaft to bearing support/cylinder head

M6		10 Nm

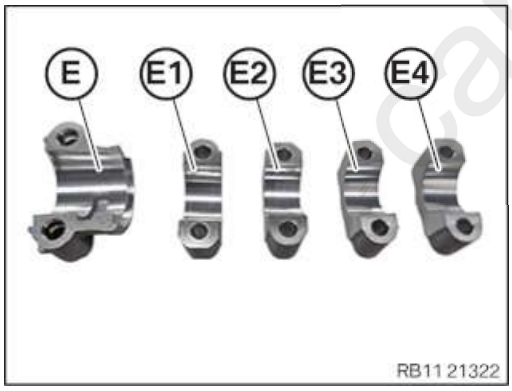
19 – Install intake camshaft



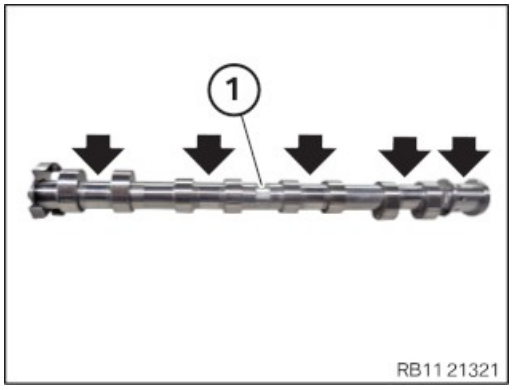
- Check the fitting sleeves for correct fit and damage and replace where required.



- Coat all bearing positions (1) with fresh engine oil.

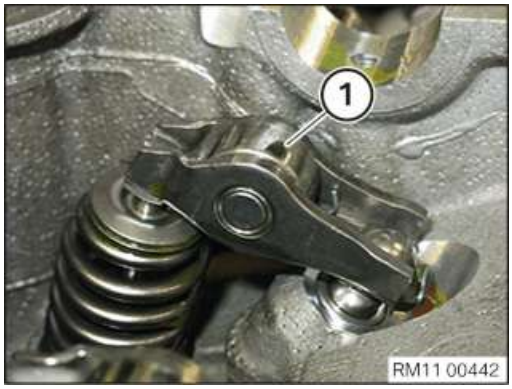


- Clean all the bearing positions of the intake camshaft bearing cap (E1) (E2) (E3), (E4) and (E) and coat with engine oil.

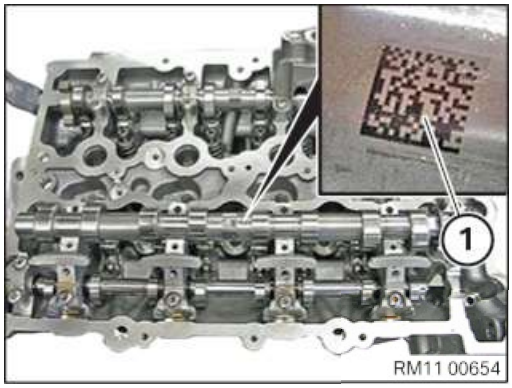


- Clean all bearing positions (arrows) of the intake camshaft (1) and coat with engine oil.

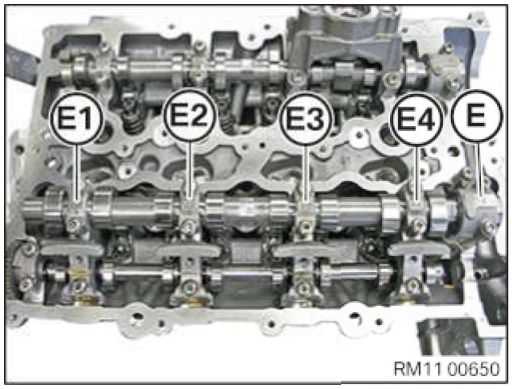
cardiagn.com



- Ensure the correct fit of the roller cam follower (1) before mounting the intake camshaft.
- Coat roller cam follower (1) with new engine oil.



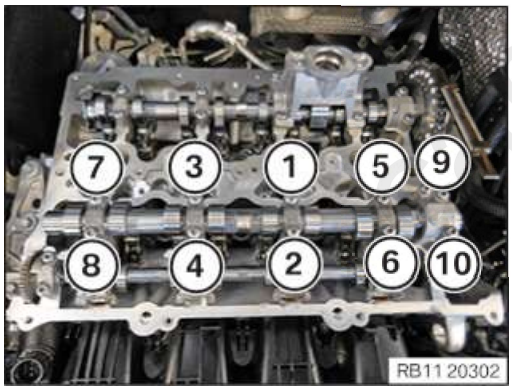
- Insert the intake camshaft into the cylinder head in such a way that the mark (1) points up.



- Position the intake camshaft bearing cap on the cylinder head.

Note: The intake camshaft bearing caps are legibly labelled from the intake side with E1, E2, E3, E4 and E.

Note: Intake camshaft bearing cap E is a thrust bearing.

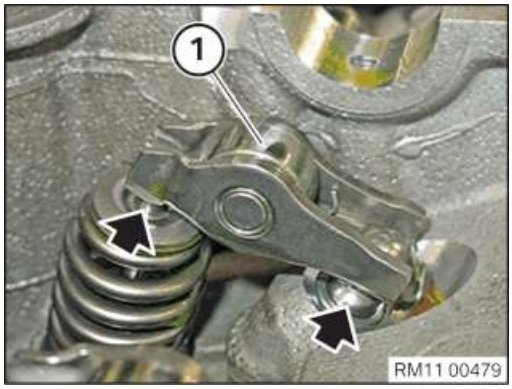


- Press intake camshaft bearing cap down and hand-tighten the screws incrementally in sequence (1) to (10).
- Join screws in sequence (1) to (10) **in half turns**.
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (10) **.**

Intake camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

20 – Checking installation position of roller cam followers



TECHNICAL INFORMATION

The rocker arms may slip slightly when the camshaft is positioned. Make sure rocker arms are correctly positioned on the hydraulic valve clearance compensating elements and on valves.

- Make sure the mounting orientation (arrows) of the roller cam followers (1) is correct.

21 – Checking the intermediate lever classification



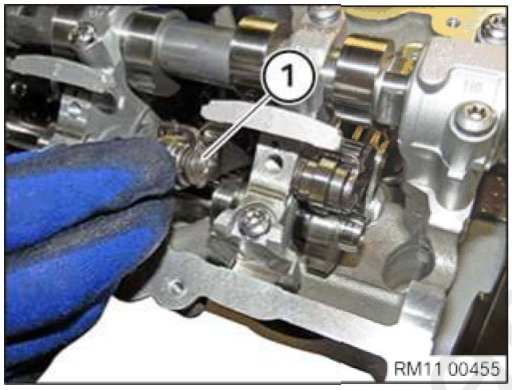
TECHNICAL INFORMATION

All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

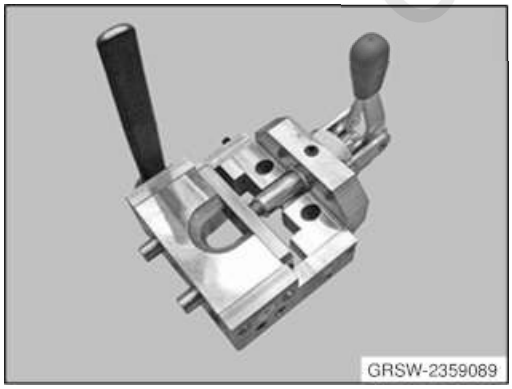
- Check classification (arrow) of intermediate lever.

22 – Installing all intermediate levers



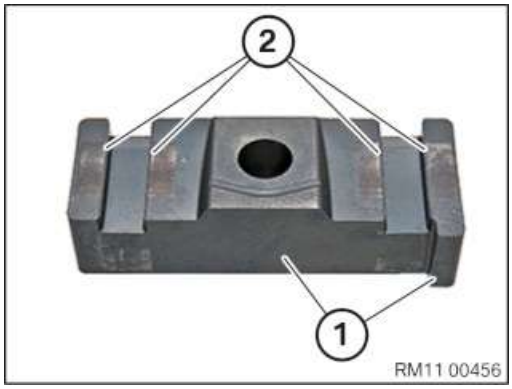
- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

23 – Installing all gates

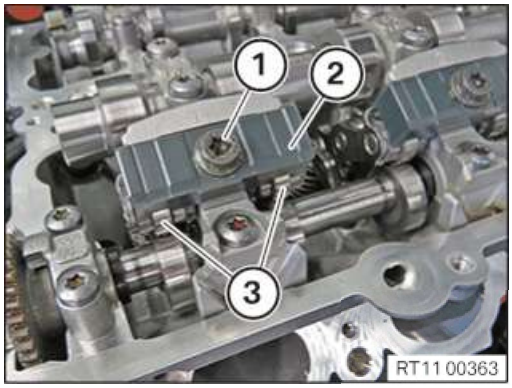


- Have the special tool 2 359 089 ready.

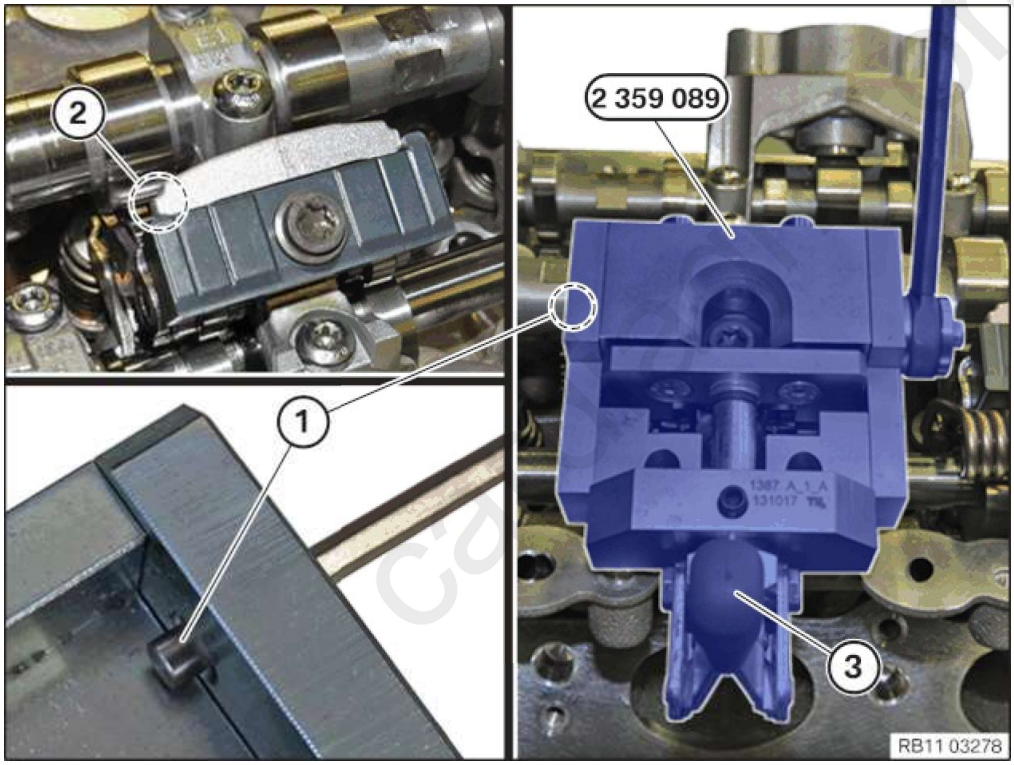
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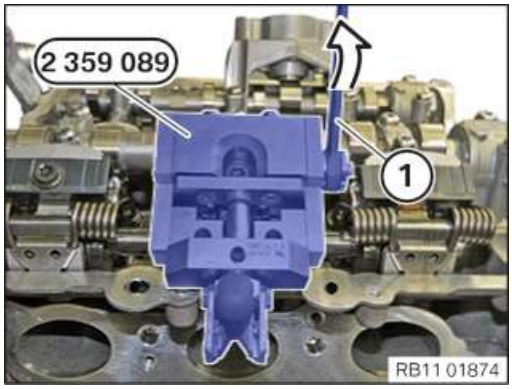
- Clean contact surfaces (1) and (2) off oil, grease and dirt.



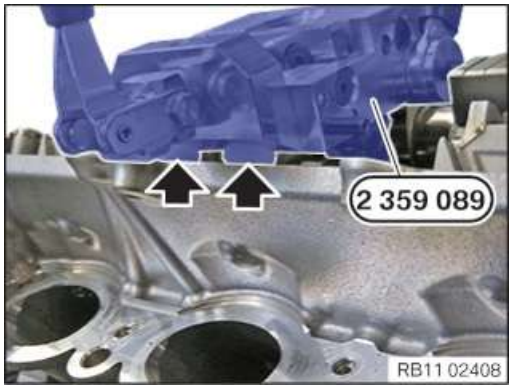
- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.



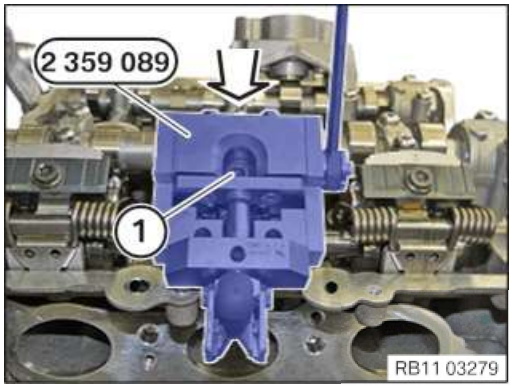
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1) in the direction of the arrow.



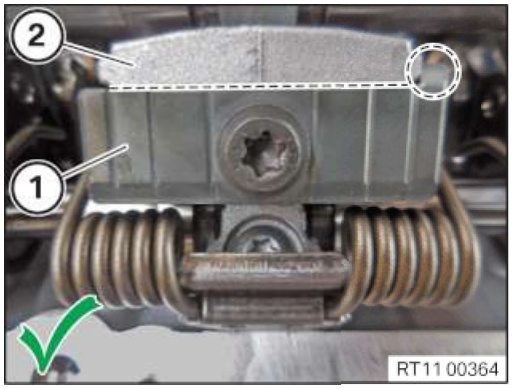
- Make sure that the special tool 2 359 089 rests flat against the cylinder head (arrows).



- Press the special tool 2 359 089 onto the cylinder head in the direction of the arrow.
- Tighten the bolt (1) at the same time.

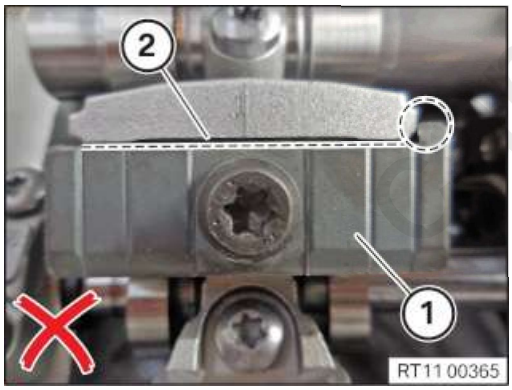
Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed correctly in the marked area.



- Ensure that gate (1) rests **correctly** against bearing bracket (2).

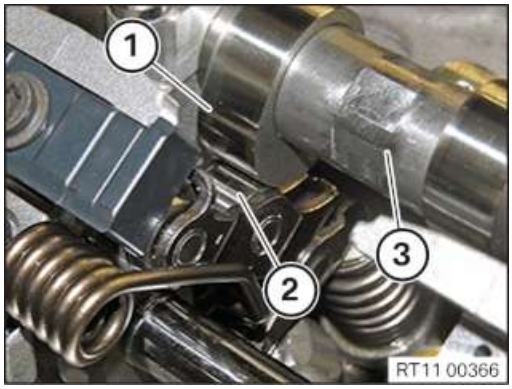
  Gate (1) is installed incorrectly in the marked area.

- Repeat the step for all the gates.

24 – Checking the position of the intake camshaft (cylinder head removed)

Check

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- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

25 – Install all torsion springs

CAUTION

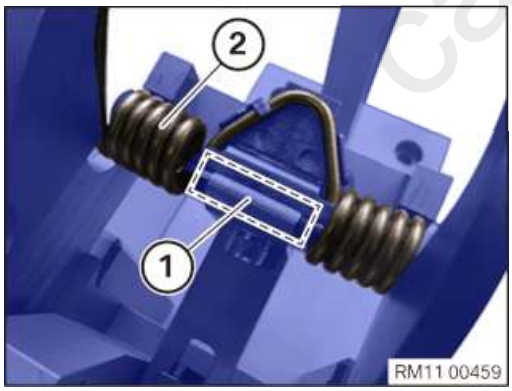
Spring preload.

Danger of injury!

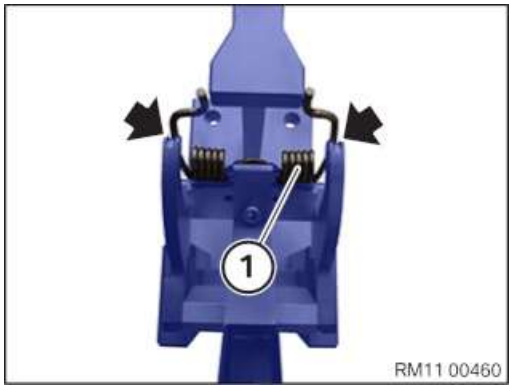
- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

- Wear safety goggles.

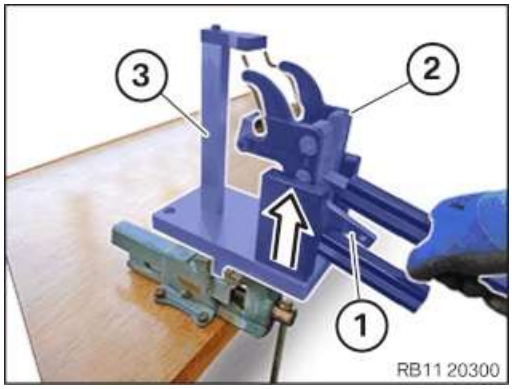


- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.



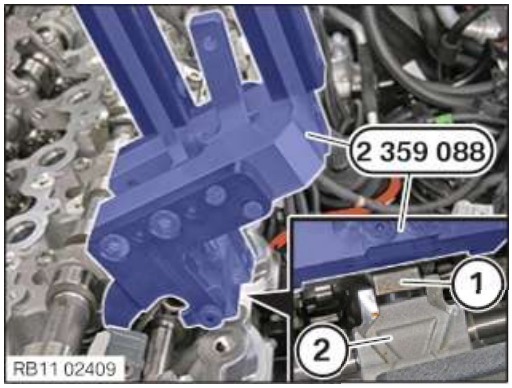
- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

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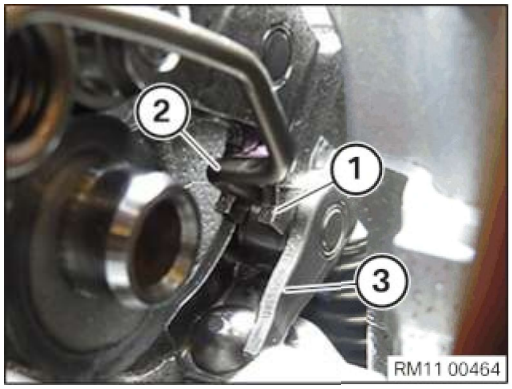


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the lever (1) audibly engages.

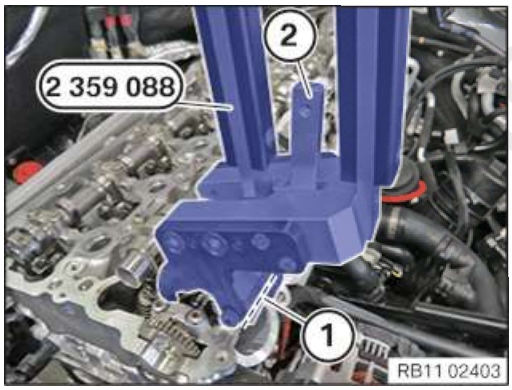
  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.



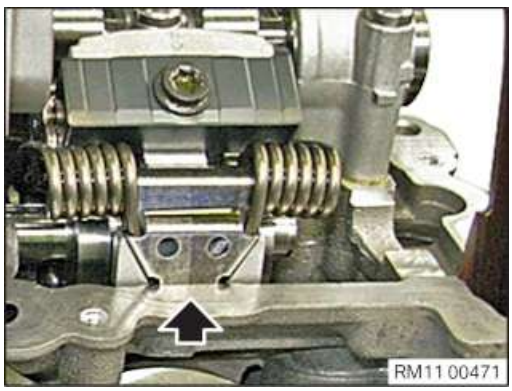
- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).



- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.

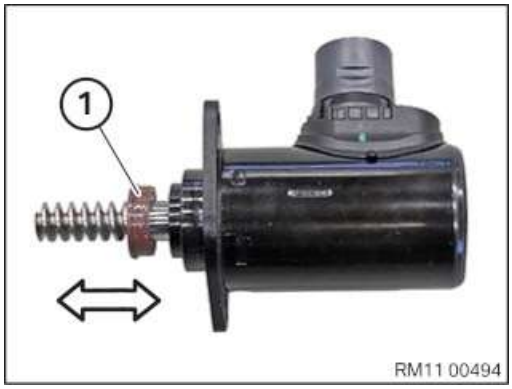


- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).
- Repeat the operations for the remaining torsion springs.

26 – Install the servomotor for the eccentric shaft (cylinder head removed)

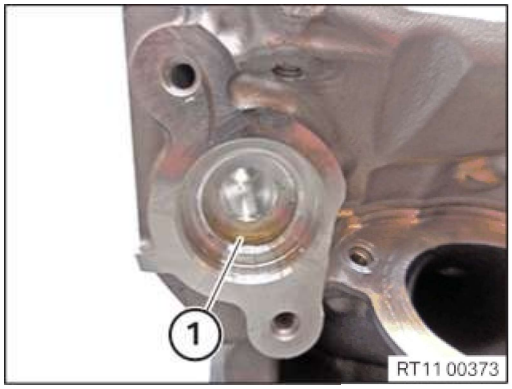


- Renew gasket (1).

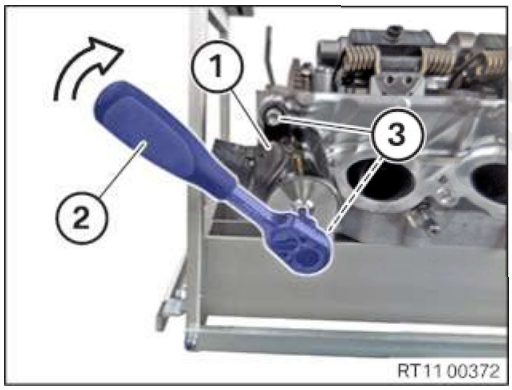
  Parts: Gasket



- Press the gasket (1) in to the limit position on the housing.



- Clean sealing surface (1).



- Slide servomotor for the eccentric shaft (1) up to the limit position and install it.
- Turn servomotor for the eccentric shaft (1) using a standard hexagon socket wrench (2) of **4 mm** in the **direction of arrow** until the servomotor for the eccentric shaft (1) lies on the cylinder head.
- Tighten down screws (3).

Electrical servomotor to cylinder head

M6		Tightening torque	8 Nm

27 – Removing cylinder engine from assembly stand

CAUTION

Heavy component.

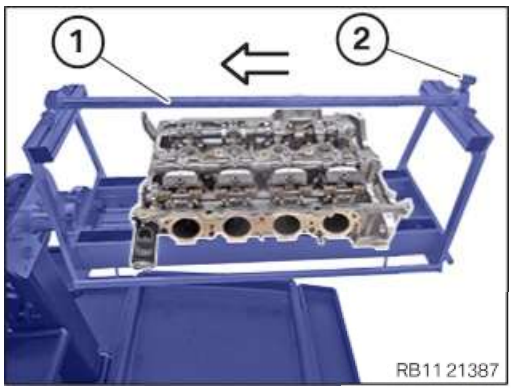
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

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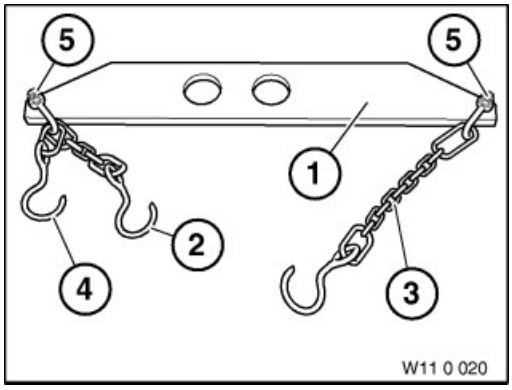
- Release screws (1) from special tool .



- Loosen screw (2).
- Pull out rod (1) in **direction of arrow** and set it aside.

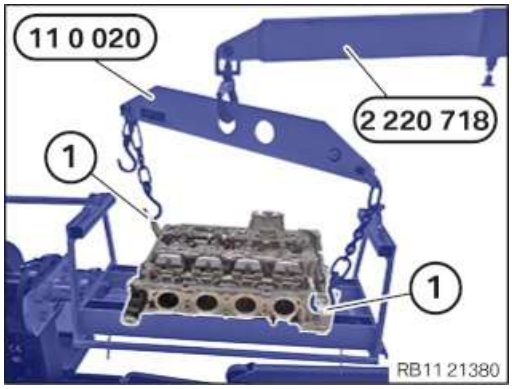


- Stage special tool (workshop crane) 2 220 718.

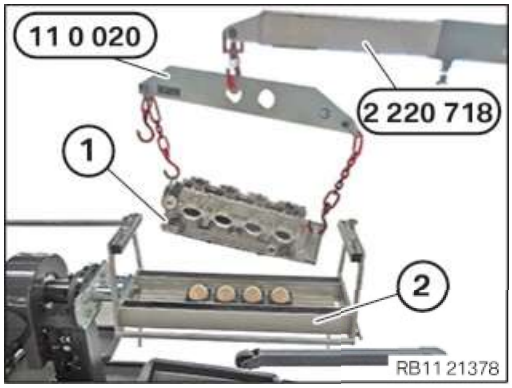


- Prepare the special tool .

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- Thread in and install the special tool on the cylinder head (1).
- Attach the special tool to the workshop crane 2 220 718.



- Feed cylinder head (1) out of device (2) using workshop crane 2 220 718 and special tool and lift.

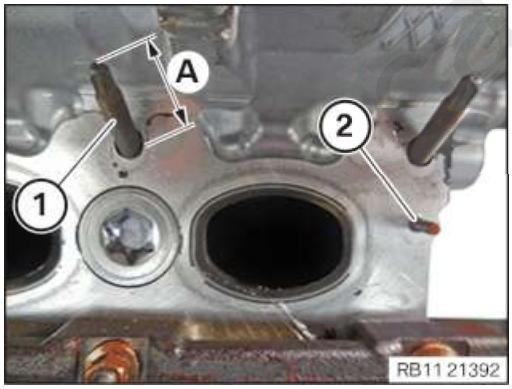
28 – Installing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.



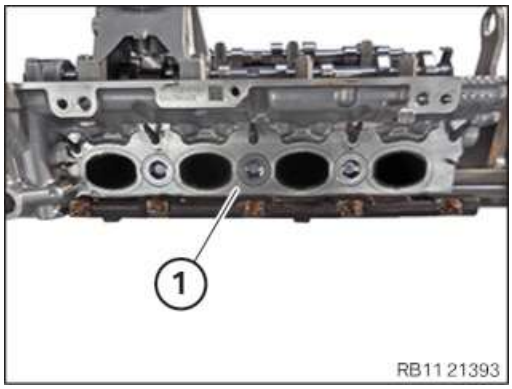
- Check stud bolt (1) for damage, renew stud bolt (1) if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1); if necessary screw in stud bolt further.

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm

- Check for correct fit of stud bolt (2).



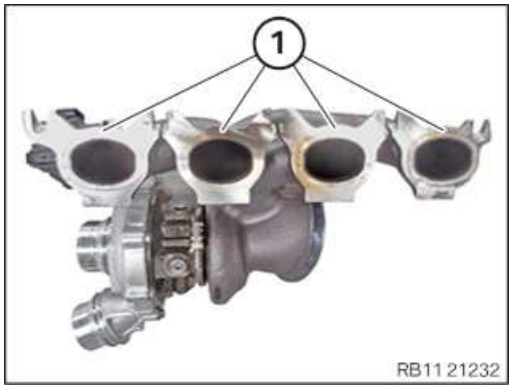
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the cylinder head (1) using the special tool 0 495 102 (11 4 470).



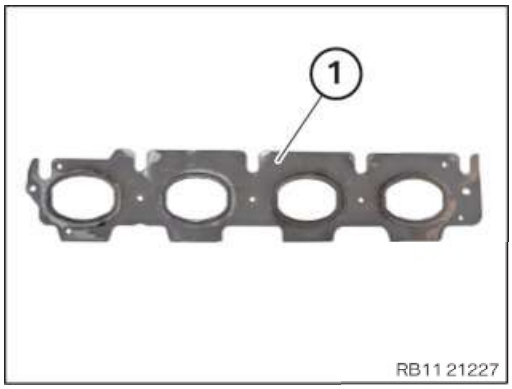
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

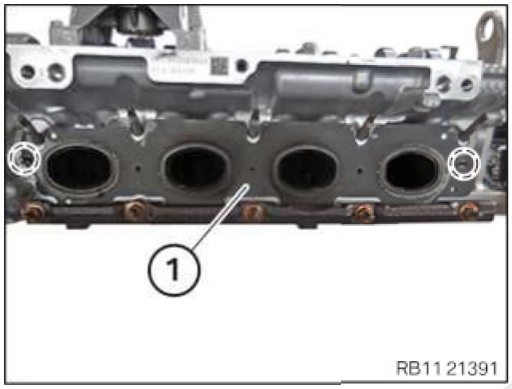
- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the exhaust turbocharger (1) using the special tool 0 495 102 (11 4 470).

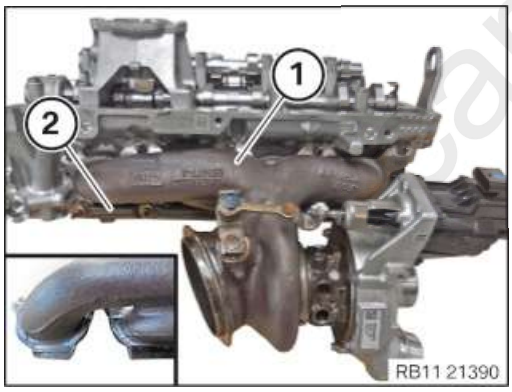


- Renew gasket (1).

  Parts: Seals



- Insert and install the gasket (1).
- Make sure the seal (1) has been **correctly** installed in the guide pins in the **marked** area.



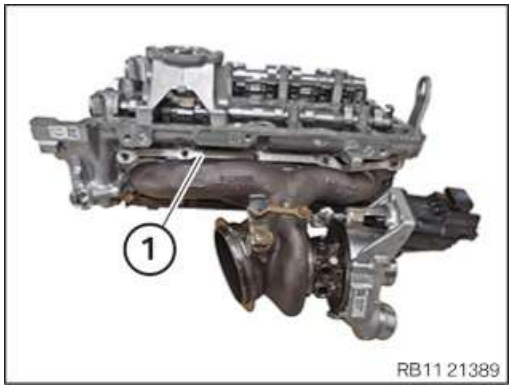
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide the exhaust turbocharger (1) toward the bottom into the clamping strip (2) and align it flush on the cylinder head.

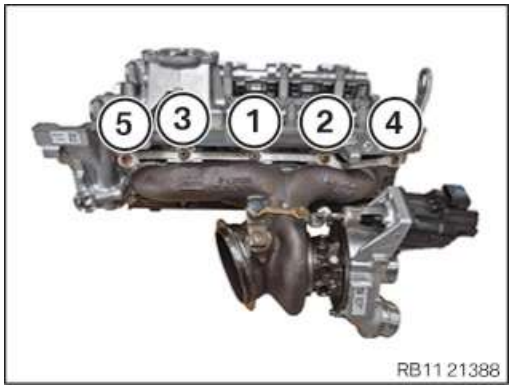


TECHNICAL INFORMATION

- Note the installation position of the component. The component may be installed in various installation positions.

- Mount sliding rail (1).
- The original BMW part number of the sliding rail (1) must be **legible** from the rear.

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Renew nuts (1) to (5).

  Parts: Nuts

- Tighten the nuts in sequence (1) to (5).

Exhaust turbocharger to cylinder head

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Additional Information

Overview of Tightening Torques

Flange to assembly stand — Used in step 2

M14X30		Tightening torque	135 Nm

Cylinder head on device — Used in step 2

M10X90x1.5		Tightening torque	30 Nm

Exhaust camshaft to cylinder head — Used in step 17

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Eccentric shaft to bearing support/cylinder head — Used in step 18

M6			10 Nm

Intake camshaft to cylinder head — Used in step 19

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Gate to bearing bracket — Used in step 23

M8			20 Nm

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Electrical servomotor to cylinder head Used in step 26

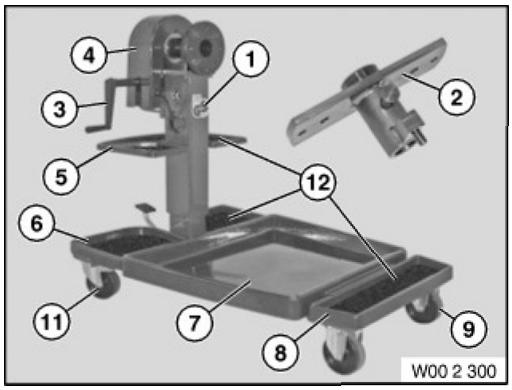
M6		Tightening torque	8 Nm

Exhaust turbocharger to cylinder head Used in step 28

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Overview of Special Tools

0 495 187 (00 2 300) Assembly stand



Common Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

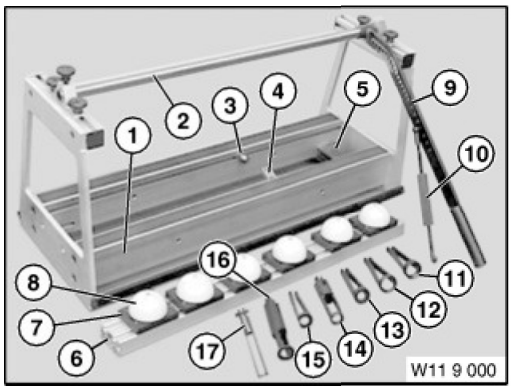
Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	
2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	

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7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

0 494 362 (11 9 000) Device



Common Used in step 213

Usage	(Cylinder head expander tool)
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 03 02 (833)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 366 (11 9 001)		**Device**	
6	0 494 371 (11 9 006)		**Insert** (Aluminium strip)	
11	0 494 376 (11 9 012)		**Basket** (Valve spring cage) Engine M41, M51, S50	
17	0 495 028 (11 9 017)		**Basket** (Valve spring cage) Engine N52	
2	0 494 367 (11 9 002)		**Rod**	
3	0 494 368 (11 9 003)		**Adapter** (Sliding block)	
4	0 494 369 (11 9 004)		**Tab**	
5	0 494 370 (11 9 005)		**Quick fastener**	
7	0 494 372 (11 9 007)		**Shaped part** (shaped part)	

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8	0 494 373 (11 9 008)		**Shaped part** (Shaped part) Shaped part made of plastic	
9	0 494 374 (11 9 009)		**Lever**	
10	0 494 375 (11 9 011)		**Hook**	
12	0 494 377 (11 9 013)		**Basket** (Valve spring cage) Engine M43, M73	
13	0 494 378 (11 9 014)		**Basket** (Valve spring cage) Engine M44, M52, M54, M56, M62, S52, S54, S62	
14	0 494 379 (11 9 015)		**Basket** (Valve spring cage) Engine M47, M47TU, M57, M57TU, N40, N42, N62, N73	
15	0 494 380 (11 9 016)		**Basket** (Valve spring cage) Engine M21, M40	

2 220 718 Workshop crane



Common	Used in step 227
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

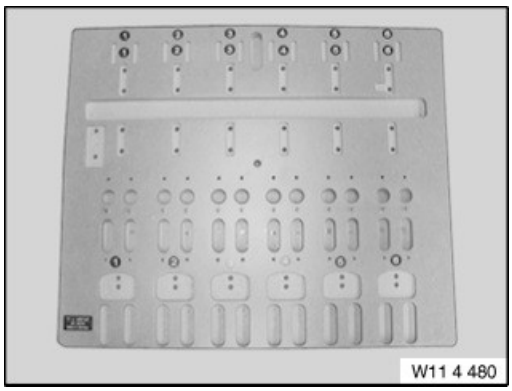
2 359 088 Device



Common	Used in step 525
Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 105 (11 4 480) oddments tray



Common Used in step 567810111213

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

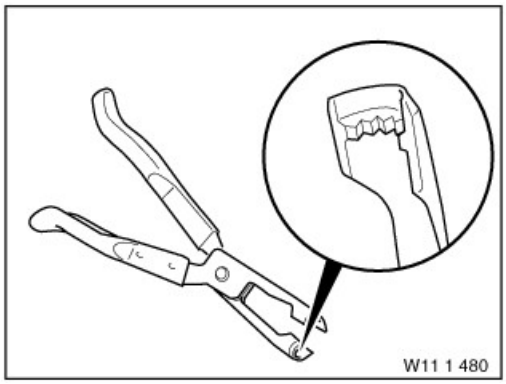
0 496 143 (11 8 840) Basket



Common Used in step 1315

Usage	(Valve spring cage) For removing and fitting the valves.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 490 796 (11 1 480) Pliers

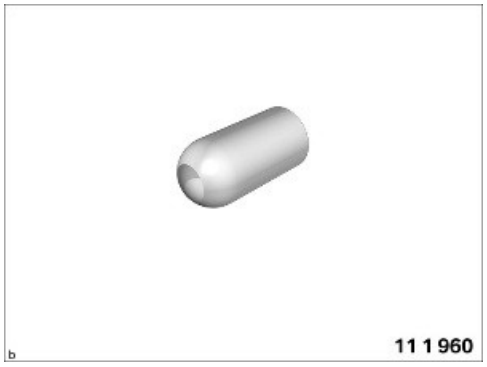


Common Used in step 14

Usage	For removing valve stem seal
Included in the tool or work	
Storage location	A10
Replaced by	
In connection with	
SI-Number	01 01 93 (621)

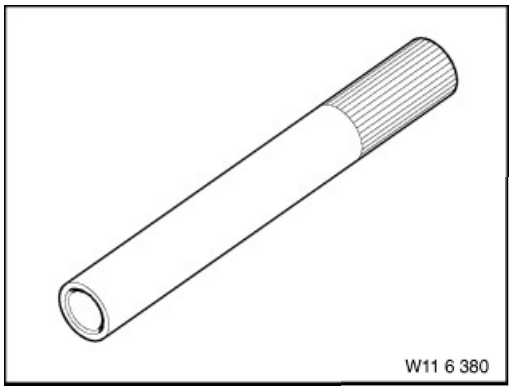
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0 490 797 (11 1 960) Holding sleeve



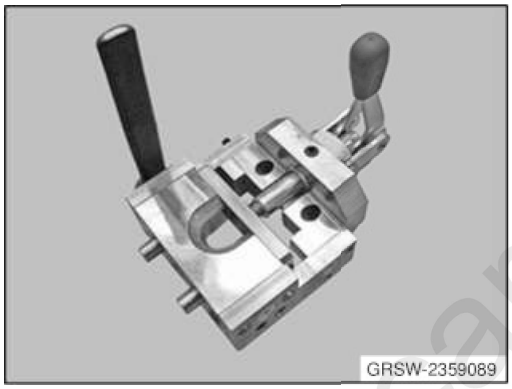
Common	Used in step 14
Usage	(Assembly sleeve) For fitting valve stem seals, 6 mm diameter
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 493 249 (11 6 380) Bush



Common	Used in step 14
Usage	For fitting valve stem seal
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 98 (306)

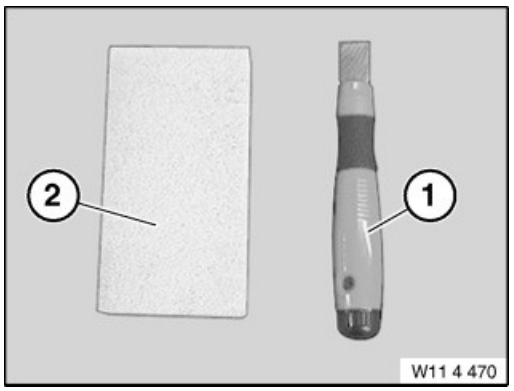
2 359 089 Device



Common	Used in step 23
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 102 (11 4 470) Tool



Common	Used in step 28
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

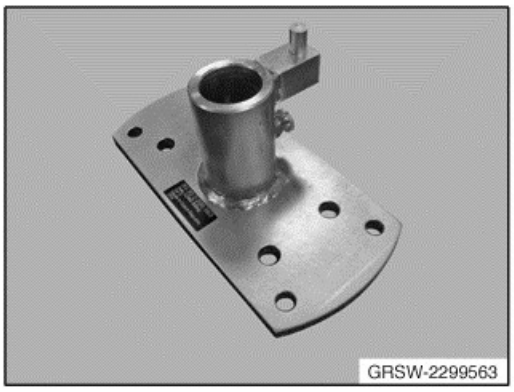
Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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Replacement tools:

2 299 563 Adapter



Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

Overview Technical Data

Screw-in depth of upper stud bolt on cylinder head	Used in step 28
Dimension A	30 mm

Links

Repair instructions	**Used in step**
61 35 ... Notes on ESD protection (Electro Static Discharge)	9

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11 34 560 Replacing all valve stem seals

PRELIMINARY WORK

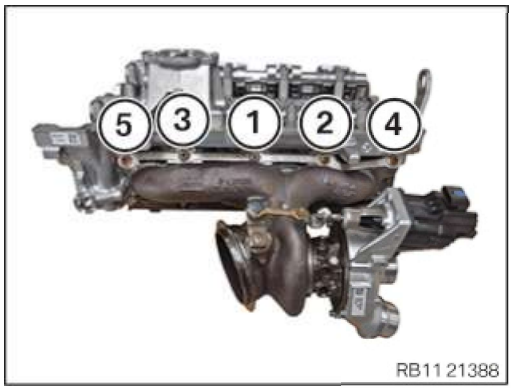
1 – Removing the exhaust turbocharger (cylinder head removed)

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

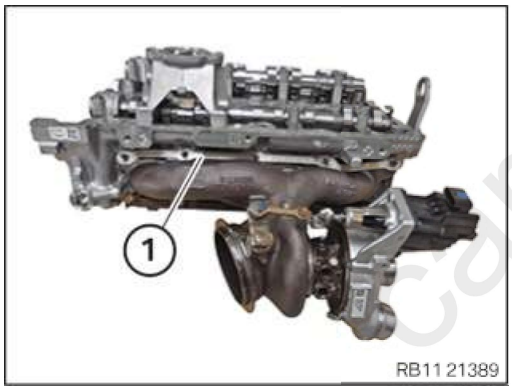
- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.



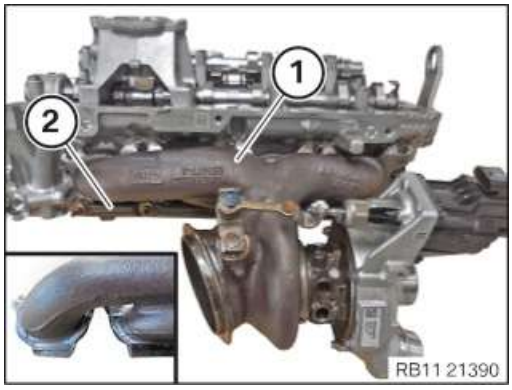
TECHNICAL INFORMATION

Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (5) to (1).



- Remove reinforcement plate (1).



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

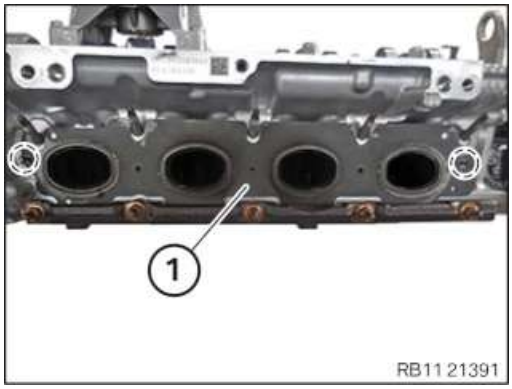
- Remove and install heavy components with the aid of another person/other persons.

- Ensure that the clamping strip (2) remains screwed into place during the removal of the exhaust turbocharger (1).

  The exhaust turbocharger (1) is **not** screwed onto the bottom, but clamped in the clamping strip (2).

  Thread out and remove exhaust turbocharger (1).

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- Guide seal (1) out of the **marked** area and remove it.

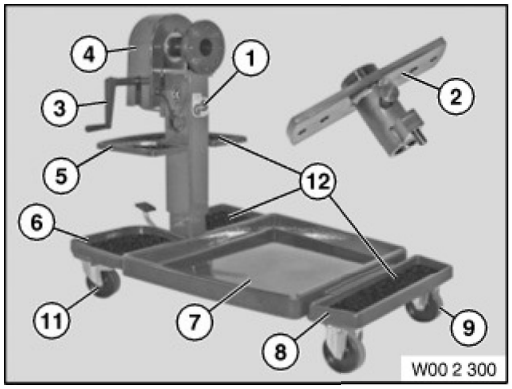
2 – Installing the cylinder head on the assembly stand

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

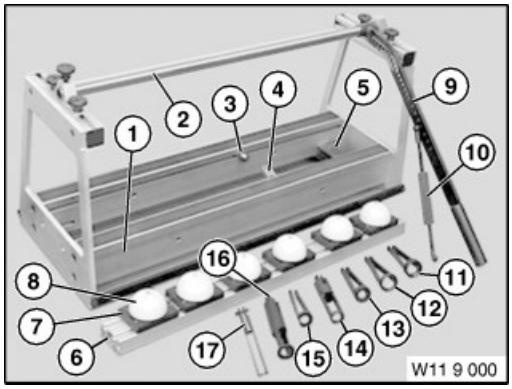
- Remove and install heavy components with the aid of another person/other persons.



- Have the set of special tools 0 495 187 (00 2 300) ready.

Number	Description
1	Assembly stand
2	Flange
3	Crank
4	Cover
5	oddments tray
6	Shaped element rear
7	Collection pan
8	Shaped element front
9	Front wheel
10	Rear wheel with stop
11	Mat

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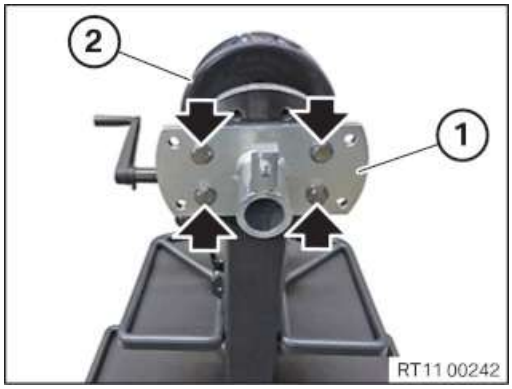
- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Stage special tool (workshop crane) 2 220 718.

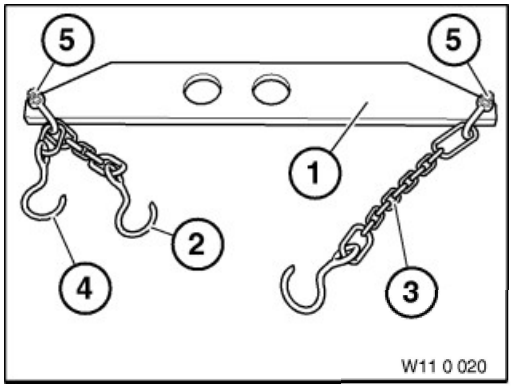
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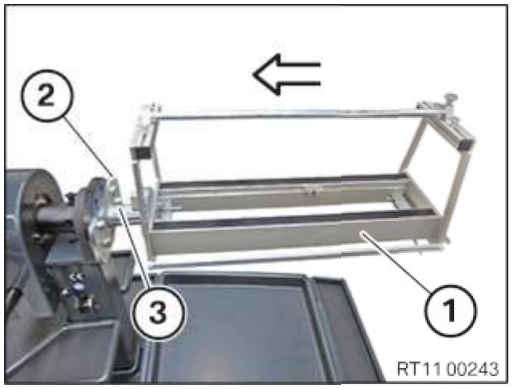
- Position flange (1) on assembly stand (2).
- Tighten screws (arrows).

Flange to assembly stand

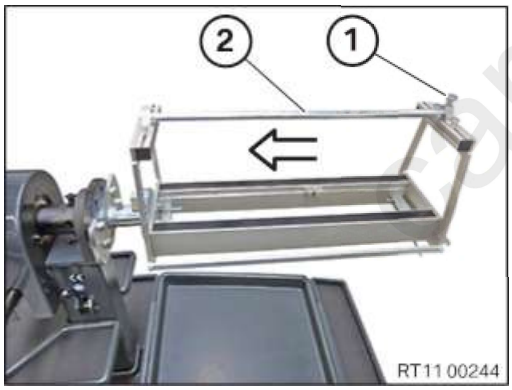
M14X30		Tightening torque	135 Nm



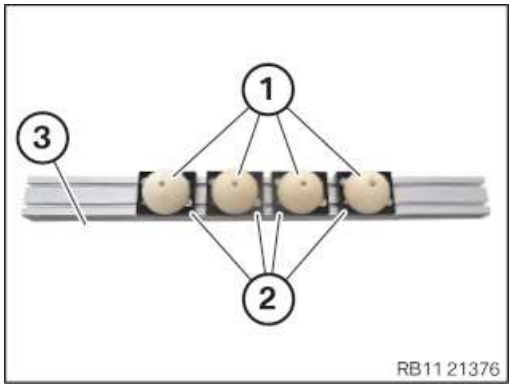
- Prepare the special tool .



- Fit device (1) onto the flange (2) in the direction of the arrow and install.
- Make sure that the lock (3) engages audibly.

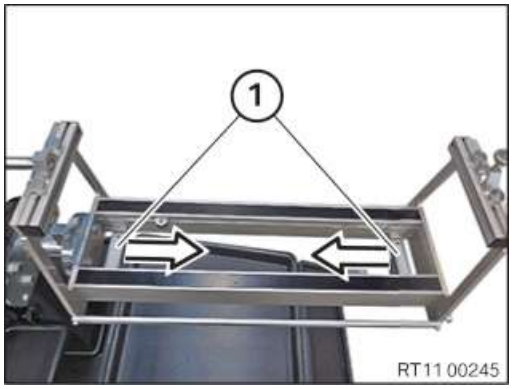


- Loosen screw (1).
- Pull out rod (2) in direction of arrow and set it aside.

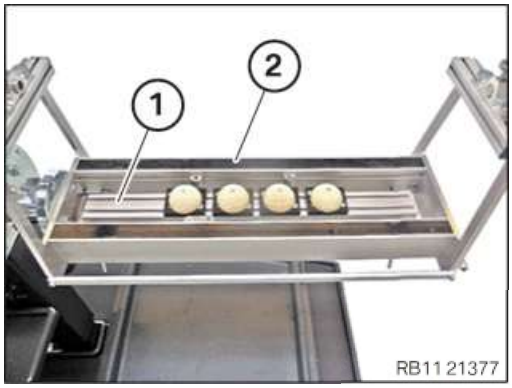


- Prepare plastic shaped part (1) with the shaped parts (2) and the aluminium strip (3).

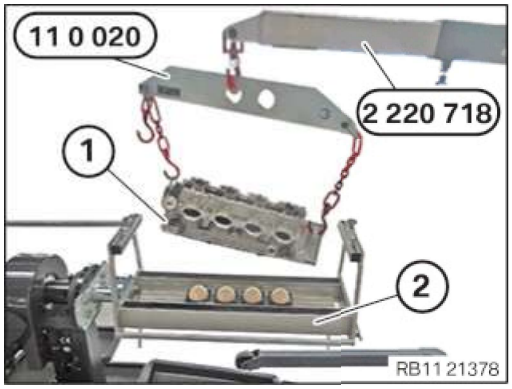
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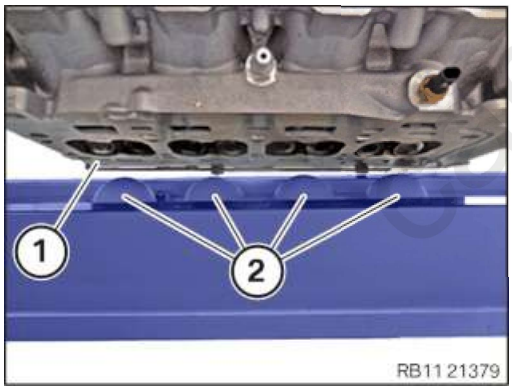
- Slide quick fastener (1) in the **direction of the arrow** up to the limit position.



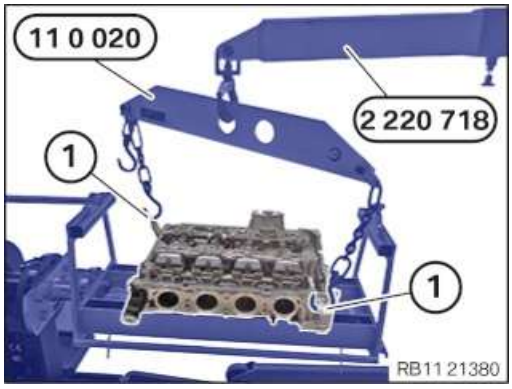
- Position completed aluminium strip (1) **centred** on the device (2).



- Position cylinder head (1) with the work crane 2 220 718 and special tool on the device (2).

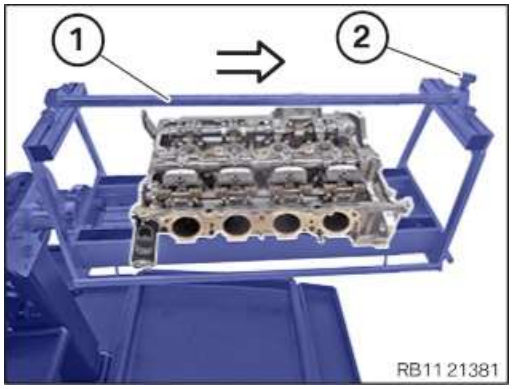


- Position cylinder head (1) correctly on the completed aluminium strip (2).

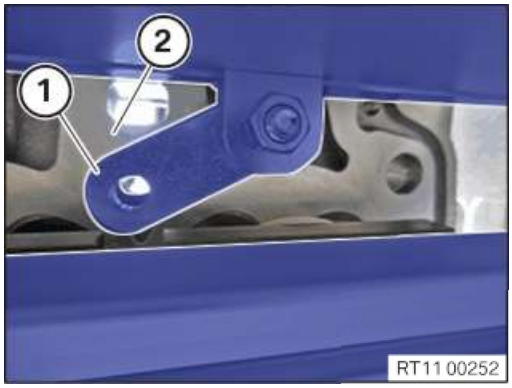


- Lower workshop crane 2 220 718.
- Pull out special tool at the cylinder head (1) and remove.
- Remove workshop crane 2 220 718 and set aside.

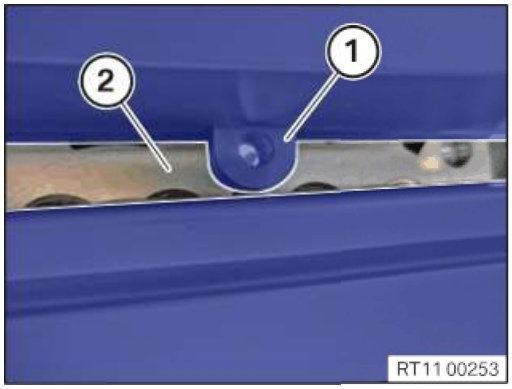
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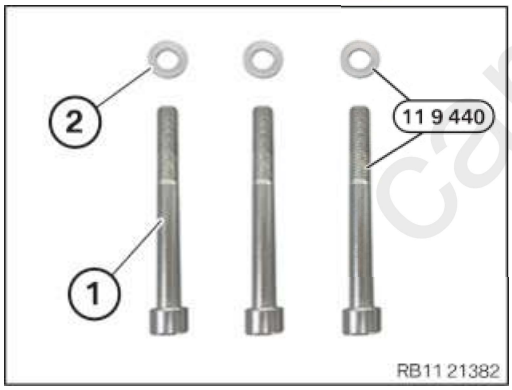
- Pull in rod (1) in the direction of the arrow and install.
- Hand-tighten the bolt (2).



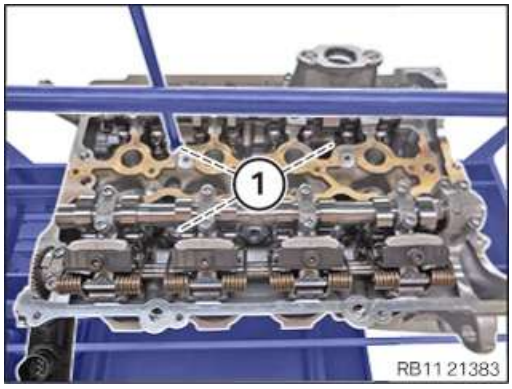
- Position screw connection (1) on cylinder head (2).



- Position screw connection (1) on cylinder head (2).



- Keep **M10x90** screws (1) from special tool ready.
- Keep washers (2) from special tool ready.

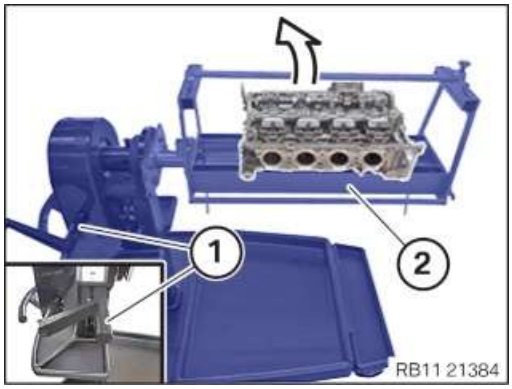


- Tighten the screws (1) from special tool .

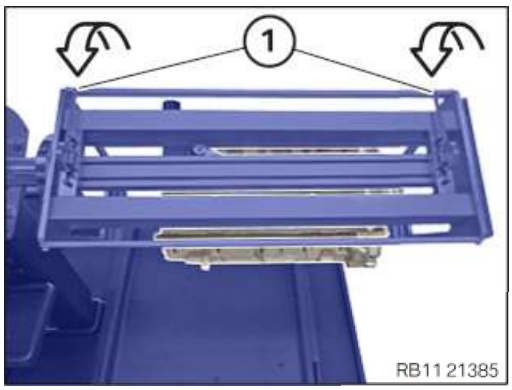
Cylinder head on device

M10X90x1.5		Tightening torque	30 Nm

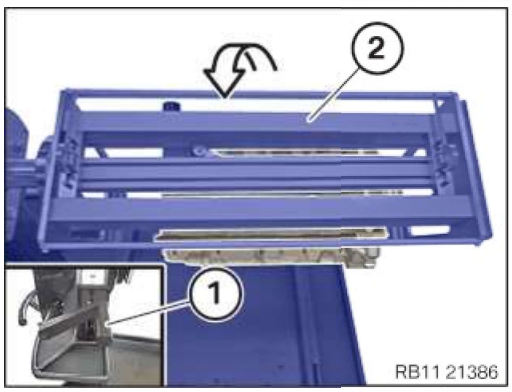
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- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

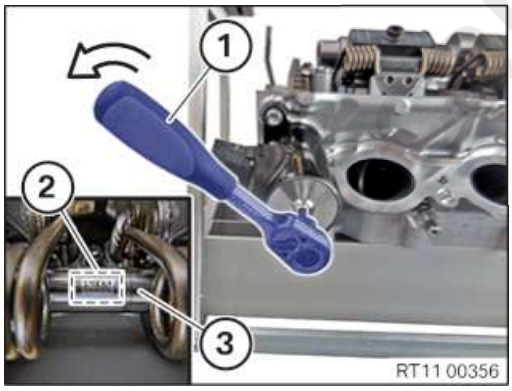


- Lock quick fastener (1) in the **direction of the arrow**.



- Turn device (2) on the crank (1) by 180° in **direction of arrow**.

3 – Adjusting eccentric shaft to minimum lift (cylinder head removed)

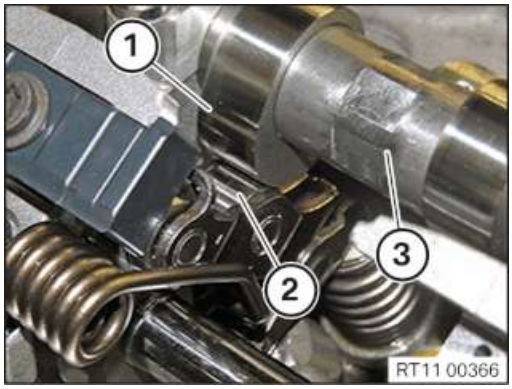


- With the help of the servomotor, use a standard hexagon socket wrench (1) to slowly adjust eccentric shaft (3) to the minimum lift at **4 mm** in the **direction of the arrow**.
- Make sure that the mark (2) on the eccentric shaft (3) points upwards.

4 – Checking the position of the intake camshaft (cylinder head removed)

Check

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- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

5 – Remove all torsion springs

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

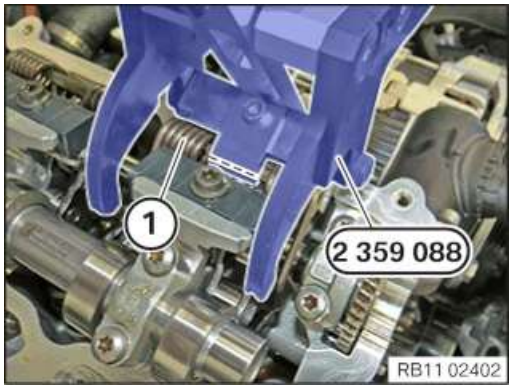
TECHNICAL INFORMATION

- Wear safety goggles.



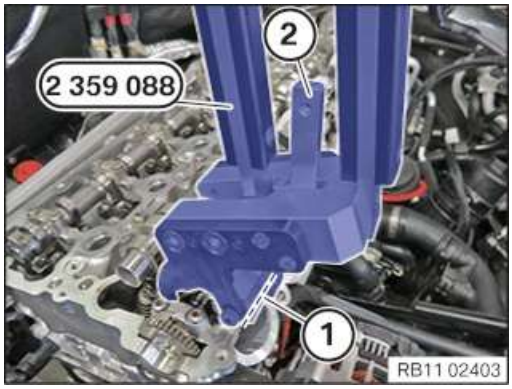
- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)

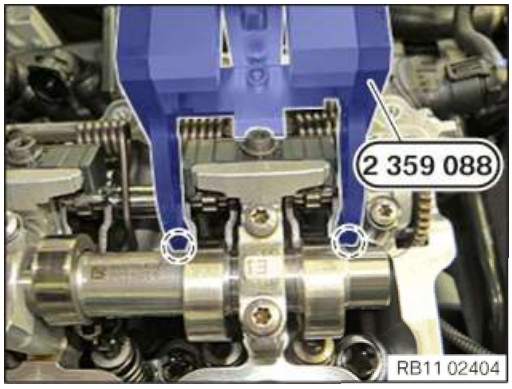


- Open the special tool 2 359 088 and position it at the torsion spring (1).

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- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.



Check

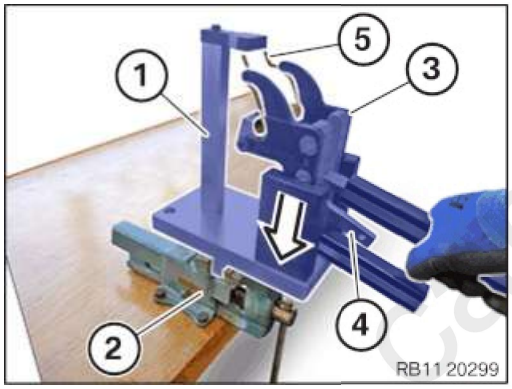
- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

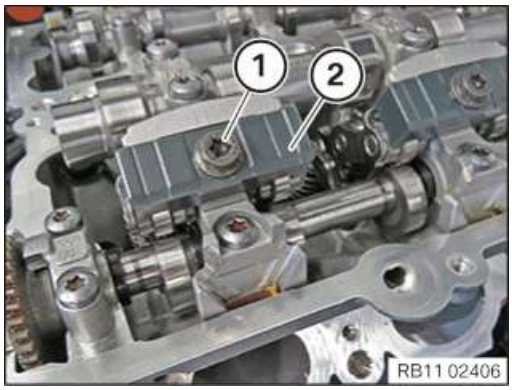
- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.



- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

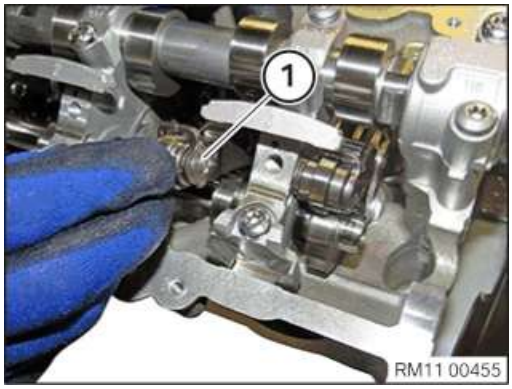
6 – Removing all gates



- Loosen screw (1).
- Remove the gate (2) and place it arranged in order into 0 495 105 (11 4 480).
- Repeat the step for all the gates.

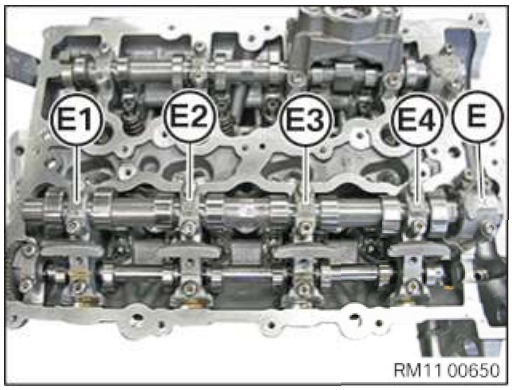
7 – Removing all intermediate levers

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- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

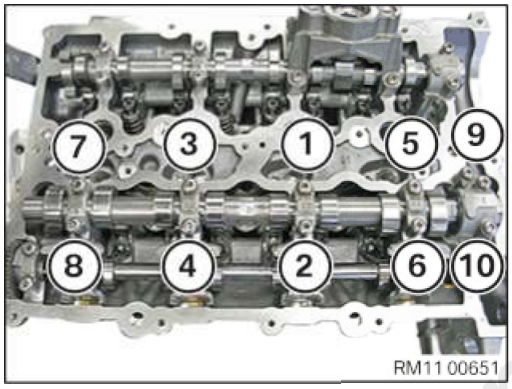
8 – Remove intake camshaft



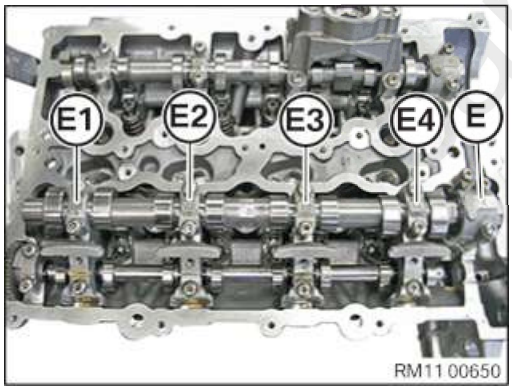
- Make sure that the exhaust camshaft bearing cap is placed in the correct position in the special tool 0 495 105 (11 4 480).

Note: The intake camshaft bearing caps are legibly labelled from the intake side with E1, E2, E3, E4 and E.

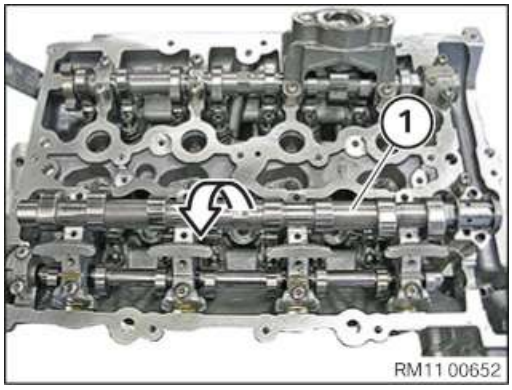
Note: Intake camshaft bearing cap E is a thrust bearing.



- Loosen all screws on the intake camshaft bearing caps in sequence from (10) to (1).



- Take off intake camshaft bearing caps (E1), (E2), (E3), (E4) and (E) and place them in order in the special tool 0 495 105 (11 4 480).



- Remove the intake shaft (1)in the direction of the arrow.

9 – Remove the servomotor for the eccentric shaft (cylinder head removed)

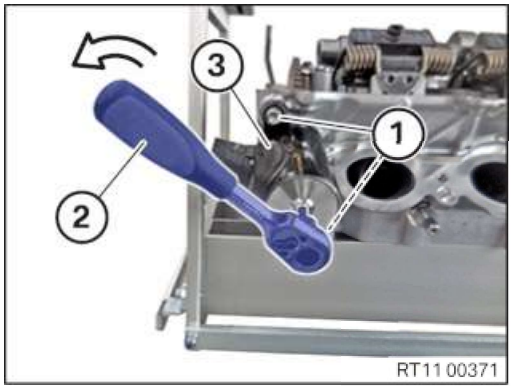
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

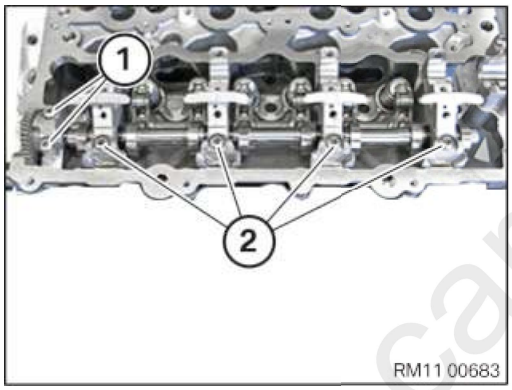


- Loosen screws (1).
- Use a standard hexagon socket wrench (2) to slowly adjust the servomotor for eccentric shaft (3) to the minimum lift at **4 mm** in direction of arrow.

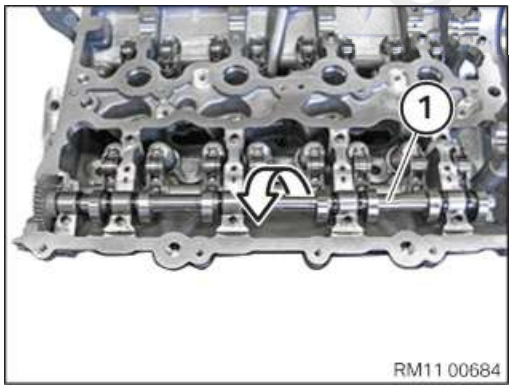
  This releases the tension of the eccentric shaft.

  Do **not** turn the eccentric shaft beyond the end stop.
- Guide out and remove the servomotor for eccentric shaft (3).

10 – Remove eccentric shaft

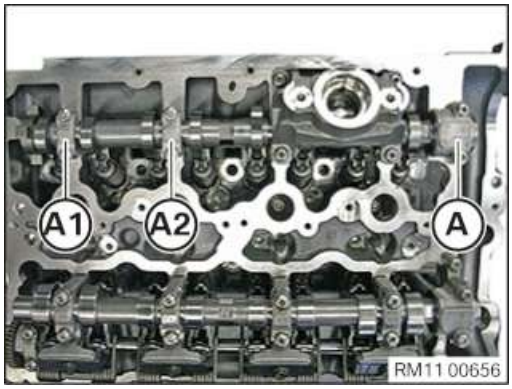


- Release screws (1) and set down the bearing cap neatly in special tool 0 495 105 (11 4 480).
- Release screws (2) and set down the bearing support neatly in special tool 0 495 105 (11 4 480).
- For an engine that has been in use, make sure all bearing supports are reinstalled in the same position.



- Remove eccentric shaft (1) in direction of arrow.

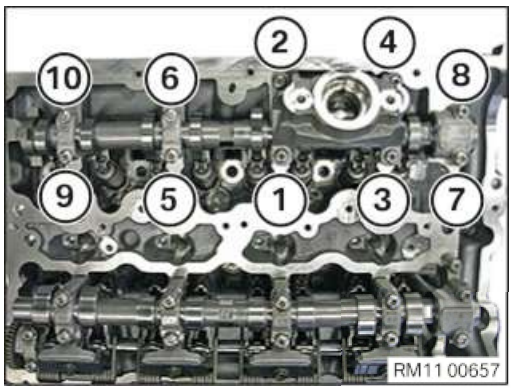
11 – Remove exhaust camshaft.



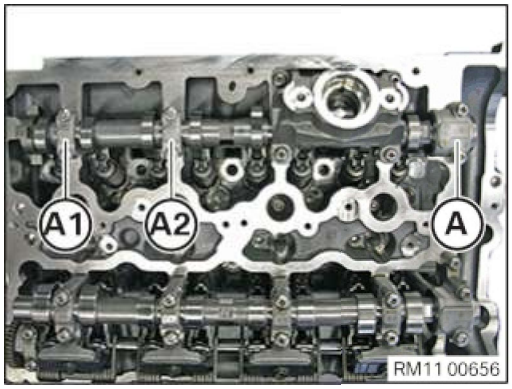
- Subsequently ensure that the exhaust camshaft bearing cap is placed in 0 495 105 (11 4 480) in the special tool.

Note: The exhaust camshaft bearing caps are legibly labelled from the intake side and marked with A1, A2 and A.

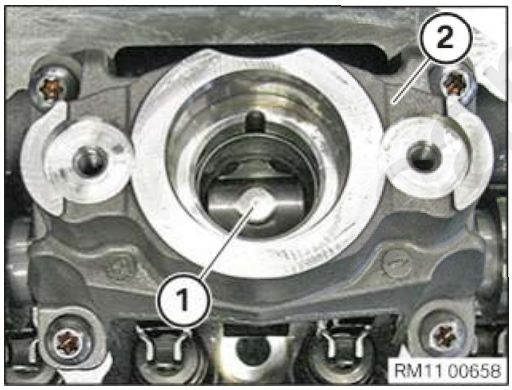
Note: Exhaust camshaft bearing cap A is a thrust bearing.



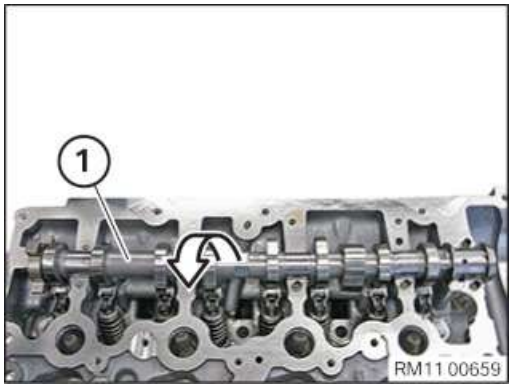
- Loosen all screws on the exhaust camshaft bearing cap in sequence from (10) to (1) in half turn.



- Drop the exhaust camshaft bearing cap (A1), (A2) and (A) and place in order in the special tool 0 495 105 (11 4 480).



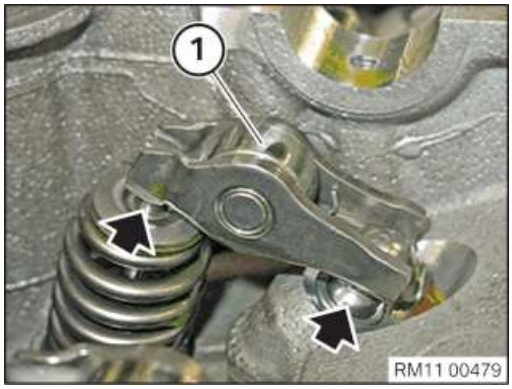
- Remove the roller tappet (1).
- Remove the high pressure pump bracket (2).



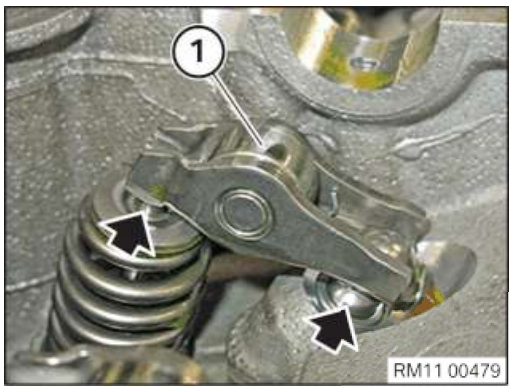
- Remove the exhaust camshaft (1) in the direction of the arrow.

12 – Remove all roller cam followers

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- Detach and remove the roller cam followers (1) on the intake side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).



- Detach and remove the roller cam followers (1) on the output side from hydraulic valve clearance compensating elements (arrows).
- Place all roller cam followers in order in special tool 0 495 105 (11 4 480).

13 – Remove all valve springs

CAUTION

Spring preload.

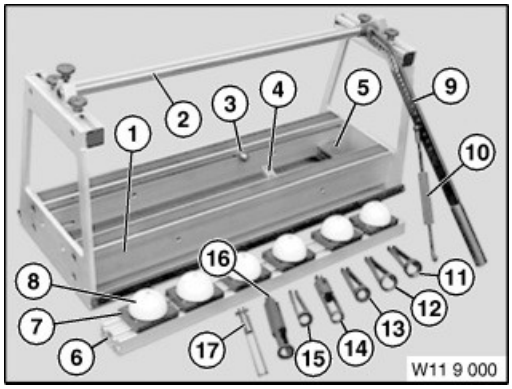
Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

NOTICE

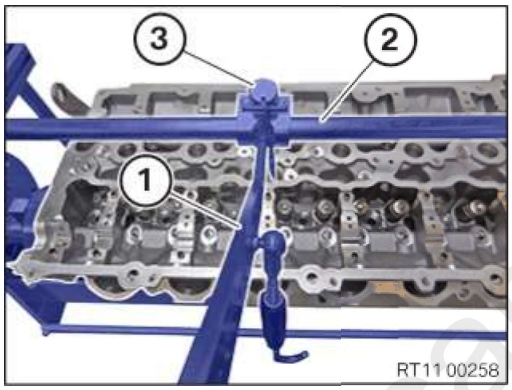
The description is for one component only. The procedure is identical for all further components.

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- Have the set of special tools 0 494 362 (11 9 000) ready.

Number	Description
1	Device
2	Rod
3	Adapter
4	Tab
5	Quick fastener
6	Aluminum strip
7	Shaped part
8	Shaped part made of plastic
9	Lever
10	Hook
11	Valve spring cage
12	Valve spring cage
13	Valve spring cage
14	Valve spring cage
15	Valve spring cage
16	Valve spring cage
17	Valve spring cage



- Feed in and install lever (1) on the rod (2).
- Guide in and install lock (3).

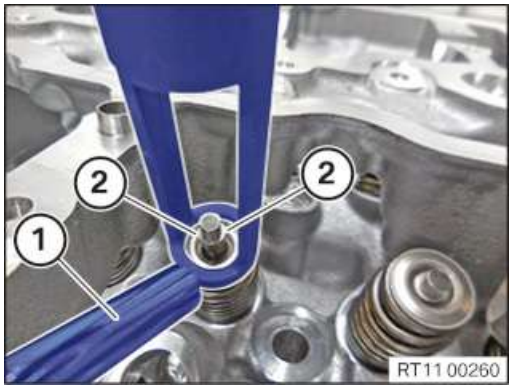


TECHNICAL INFORMATION

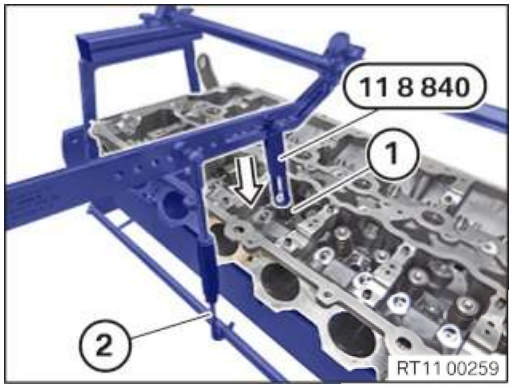
- Wear safety goggles.

- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).

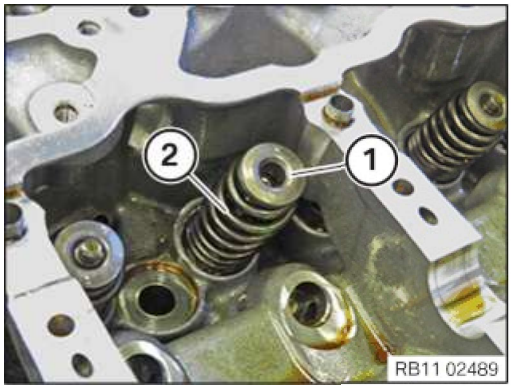
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- Remove valve shims (2) with a magnet (1).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



- Remove the spring cup (1) and the valve spring (2) and position neatly in the special tool 0 495 105 (11 4 480).

MAIN WORK

14 – Renewing valve stem seals

▸ **Remove valve stem seals**

RISK OF DAMAGE

Contaminant or foreign body.

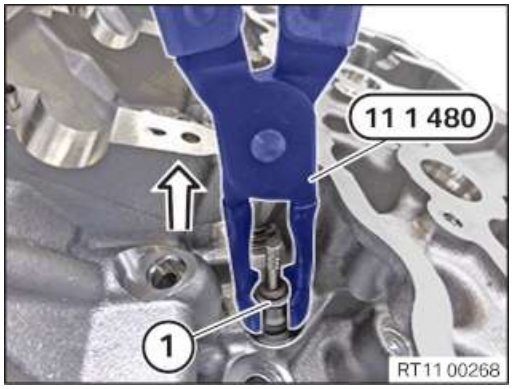
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

NOTICE

The description is for one component only. The procedure is identical for all further components.

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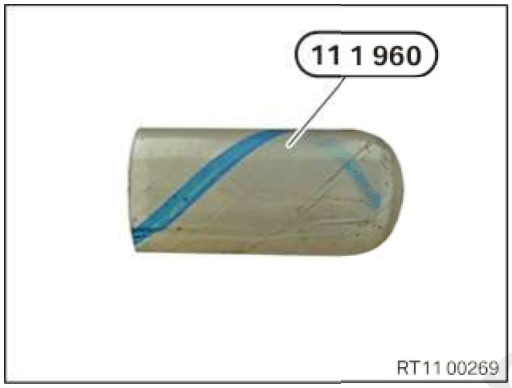


- Remove the valve stem seal (1) in the **direction of arrow** using the special tool 0 490 796 (11 1 480).

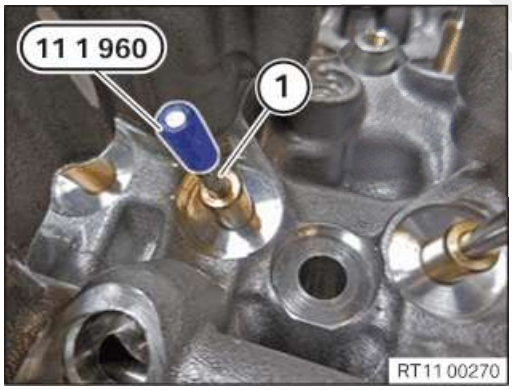
▶ **Installing valve stem seals**



- Remove oil and dirt from the contact surface (1).



- Make sure that the special tool 0 490 797 (11 1 960) is used when installing the valve stem seal.



- Guide in and install the special tool 0 490 797 (11 1 960) on valve (1).



- Renew the valve stem seal (1).

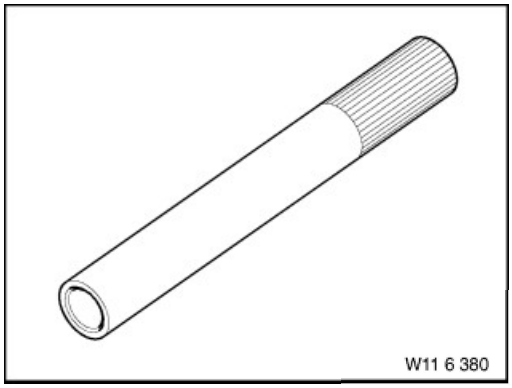
  Parts: Valve stem seal

- Guide in and install valve stem seal (1) on the special tool 0 490 797 (11 1 960).

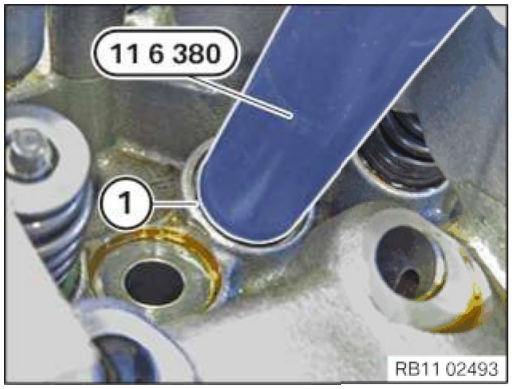
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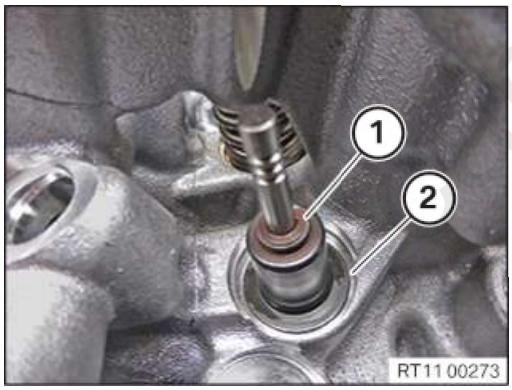
- Guide the special tool 0 490 797 (11 1 960) out and remove.



- Prepare special tool 0 493 249 (11 6 380).



- Press the valve stem seal (1) onto the cylinder head till the limit position using special tool 0 493 249 (11 6 380).



- Make sure that valve stem seal (1) is positioned correctly on cylinder head (2).

POSTPROCESSES

15 – Install all valve springs

CAUTION

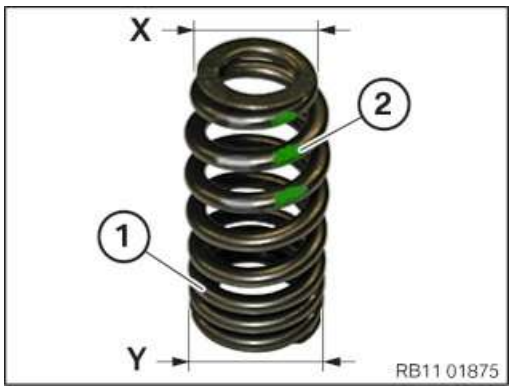
Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

NOTICE

The description is for one component only. The procedure is identical for all further components.

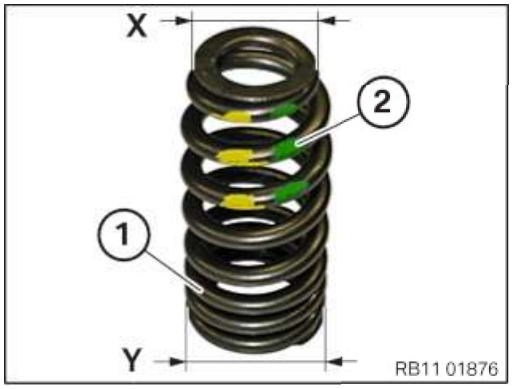


- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the intake valves: Green

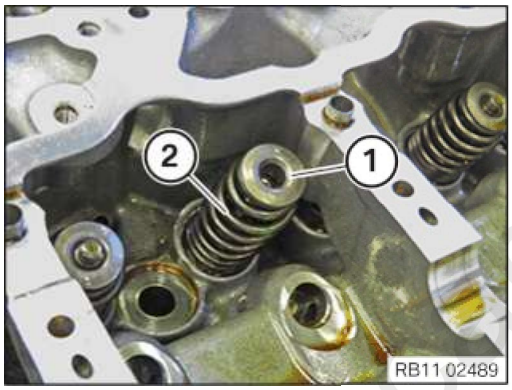


- Note the installation position of the valve spring.

Note: Install the valve spring so that the larger diameter (Y) points to the bottom spring cup.

- Make sure that the intake valves are not switched with the exhaust valves.

Note: Valve springs (1) are marked in colour (2). Colour for the exhaust valves: green/yellow



- Install the valve spring (2) and the spring cup (1).

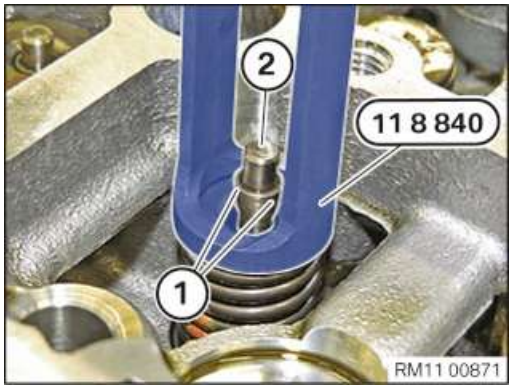


TECHNICAL INFORMATION

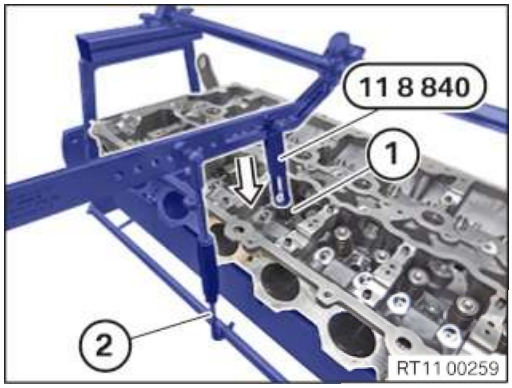
- Wear safety goggles.

- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in direction of arrow.
- Hold valve spring (1) **pressed down** using the hook (2).

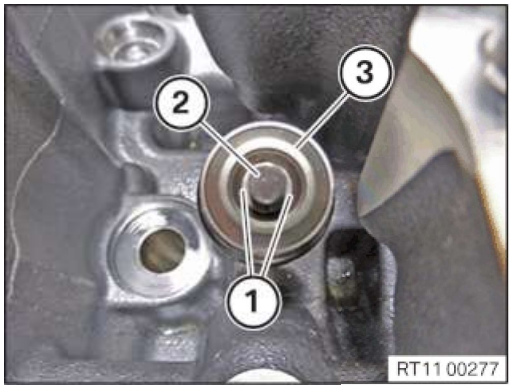
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- Position the valve shims (1) on the valve (2).



- Press down the valve spring (1) on the spring cup at the top with the special tool 0 496 143 (11 8 840) in **direction of arrow**.
- Thread out hook (2) and place to the side.
- Relieve the valve spring (1) **carefully**.



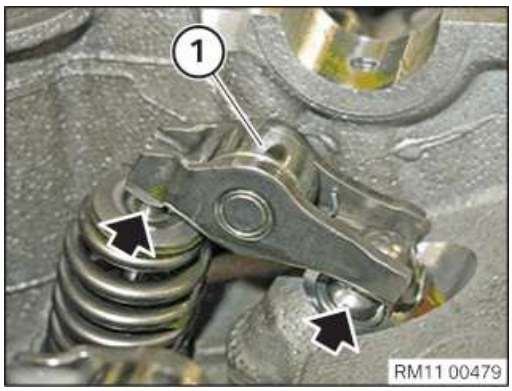
- Make sure that the valve shims (1) are positioned correctly on the valve (2) and on the valve spring (3).

16 – Install all roller cam followers



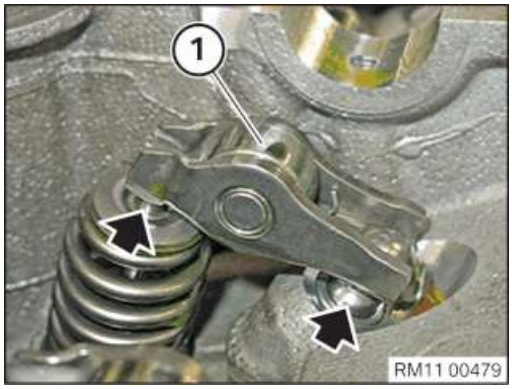
- The classification in digits from 1 to 5 has been printed on the roller cam follower.

Classification	Idle speed
1	Repair case - slow engine speed when idling
2	Installed as standard/initial installation
3	Installed as standard/initial installation
4	Installed as standard/initial installation
5	Repair case - high engine speed when idling



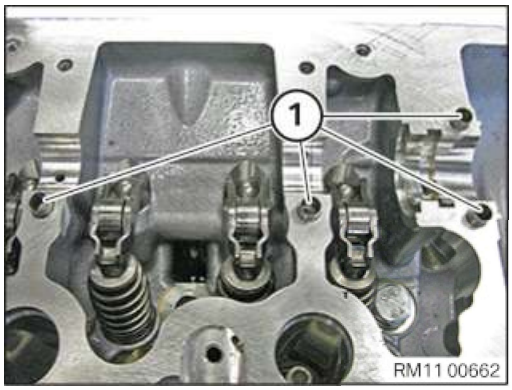
- Install the roller cam follower (1) on the intake side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the intake valves.

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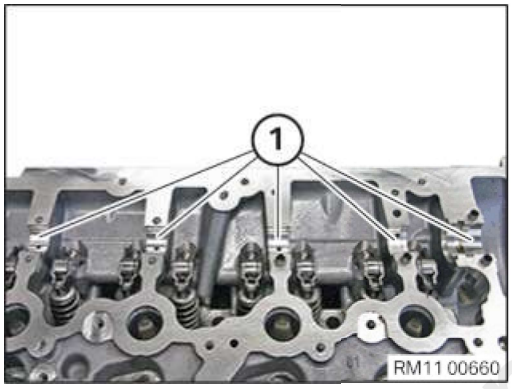


- Install the roller cam followers (1) on the exhaust side.
- Make sure the roller cam followers are correctly positioned on the hydraulic valve clearance compensating elements (arrows) and on the exhaust valves.

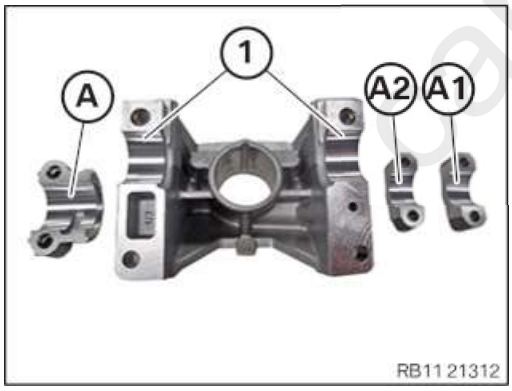
17 – Install exhaust camshaft



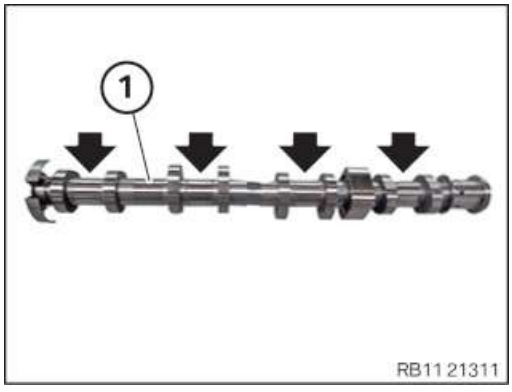
- Check the fitting sleeves (1) for **correct** fit and damage and replace where required.



- Coat all bearing positions (1) with **fresh** engine oil.

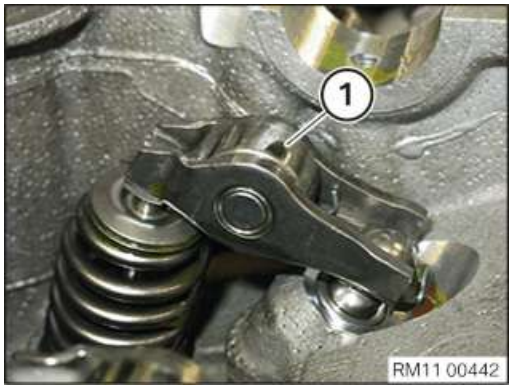


- Clean all bearing positions of the exhaust camshaft bearing cap (A1), (A2) and (A) and coat with **fresh** engine oil.
- Clean the bearing positions (1) of the high pressure pump bracket and coat with **fresh** engine oil.

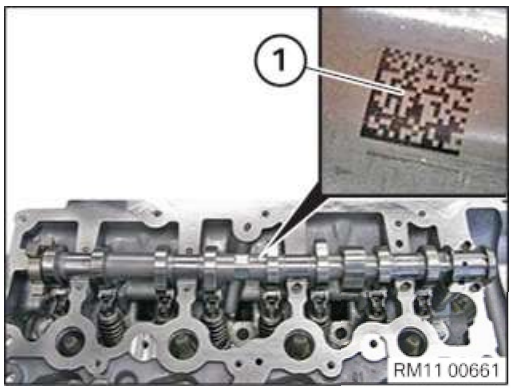


- Clean all the bearing positions (arrows) of the exhaust camshaft (1) and coat with **fresh** engine oil.

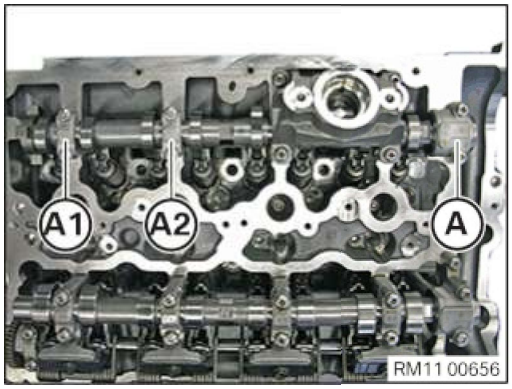
cardiagn.com



- Make sure that the roller cam follower (1) is fitted correctly before installing the exhaust camshaft.
- Coat the exhaust camshaft and the exhaust camshaft bearing cap with fresh engine oil.



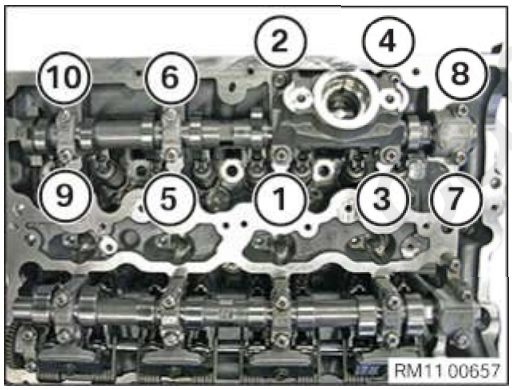
- Insert exhaust camshaft in the cylinder head, such that the mark (1) points **upwards**.



- Position all exhaust camshaft bearing caps on the cylinder head.

Note: The exhaust camshaft bearing caps are legibly labelled from the intake side and marked with A1, A2 and A.

Note: Exhaust camshaft bearing cap A is a thrust bearing.

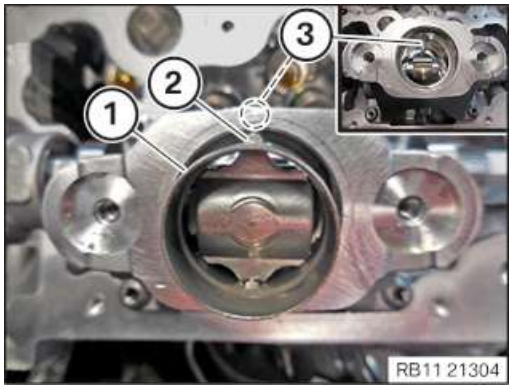


- Coat both bearing positions on the high pressure pump bracket with fresh engine oil.
- Position the high pressure pump bracket on the cylinder head.
- Join all bolts of the exhaust camshaft bearing caps in sequence (1) to (10) in half **turns**.
- **Adhere to the jointing torque.**
- Tighten all bolts of the exhaust camshaft bearing caps in sequence (1) to (10) **.**

Exhaust camshaft to cylinder head

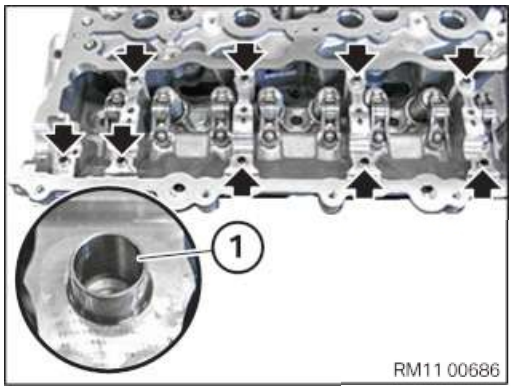
M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

rdiagn.com

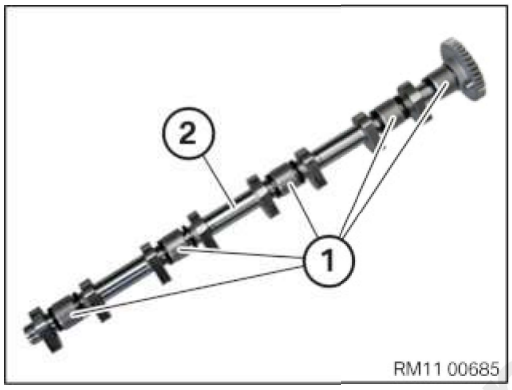


- Guide in and position roller tappet (1).
- Ensure that pin (2) is positioned correctly in guide (3).
- Feed in and install roller tappet (1).

18 – Install eccentric shaft



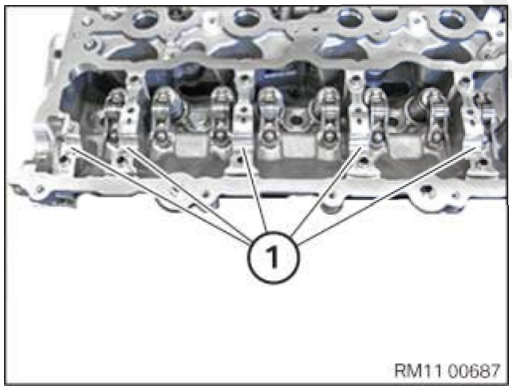
- Check guide sleeves (1) for damage and renew faulty guide sleeves (1).



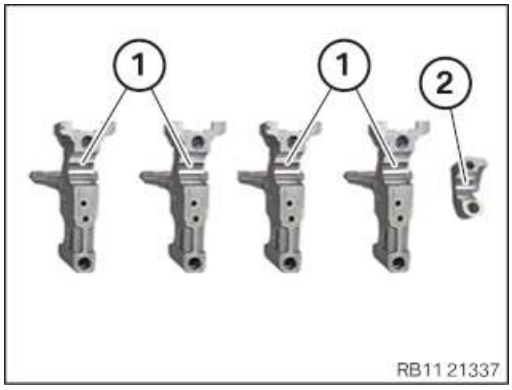
- Check needle bearing (1) for ease of movement.

Note: In the event of tight needle bearings, replace eccentric shaft 2.

- Coat the needle bearing (1) with **new** engine oil.

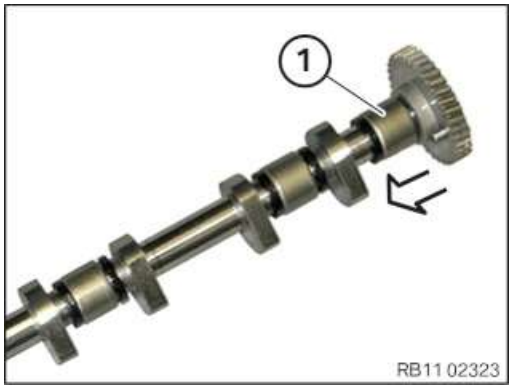


- Clean the bearing positions (1) and coat with **new** engine oil.

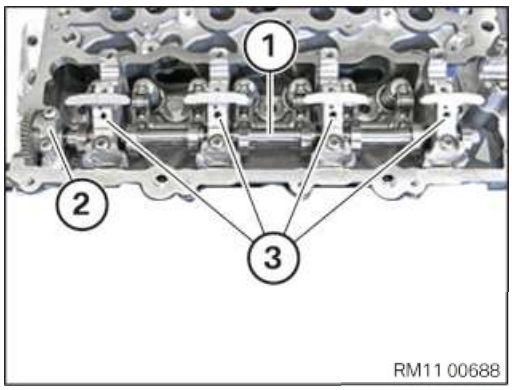


- Clean bearing positions of the bearing supports (1) and coat with fresh engine oil.
- Clean the bearing position of the bearing cap (1) and coat with **new** engine oil.

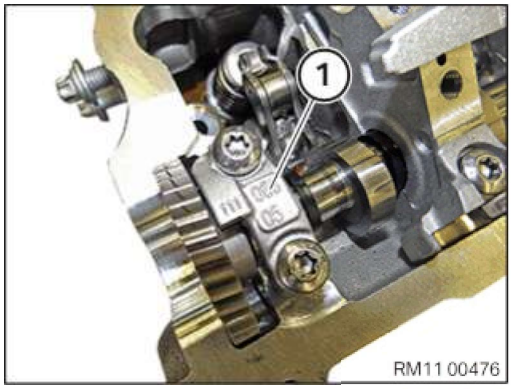
rdiagn.com



- Before installing the eccentric shaft, push needle bearing (1) in direction of arrow up to the limit position.

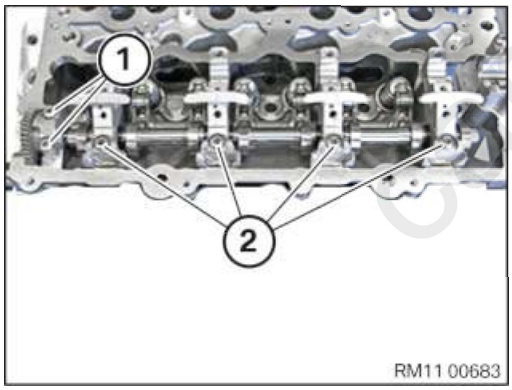


- Insert eccentric shaft (1) in the cylinder head.
- Attach bearing cap (2) and bearing supports (3) on the cylinder head.
- For an engine that has been in use, make sure all bearing supports are reinstalled in the same position.



- Ensure correct installation of bearing cap (1).

Note: Bearing cap 1 is provided with a limit position.

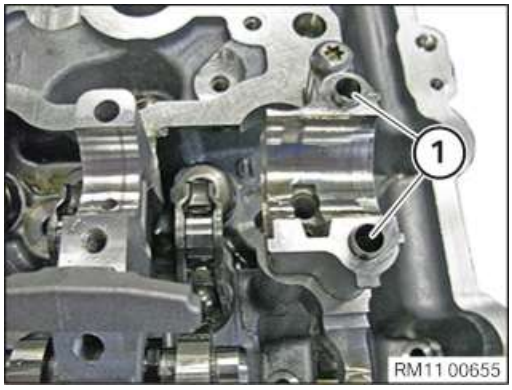


- Tighten down screws (1) and (2) uniformly.

Eccentric shaft to bearing support/cylinder head

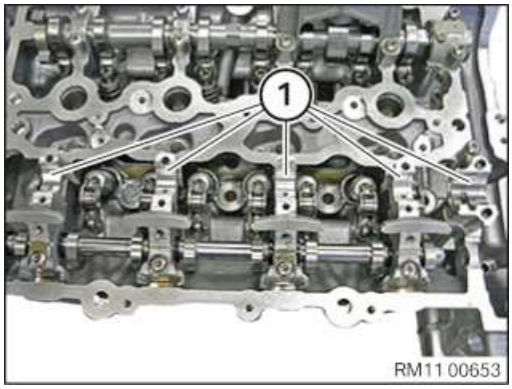
M6		10 Nm

19 – Install intake camshaft

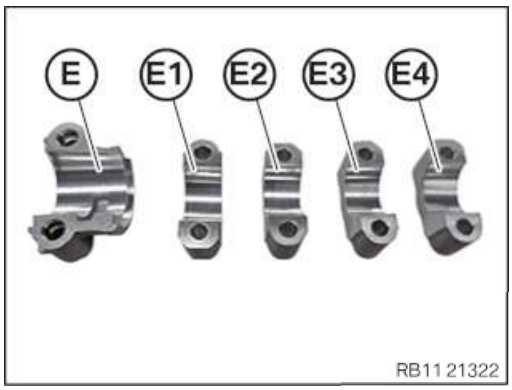


- Check the fitting sleeves for correct fit and damage and replace where required.

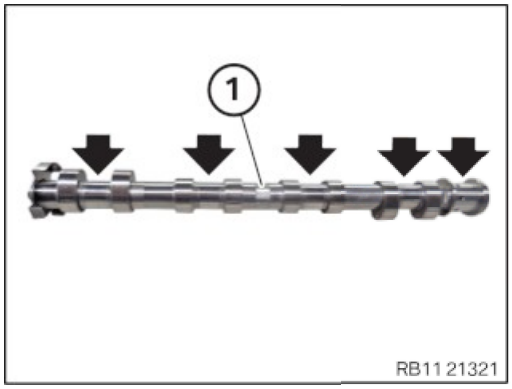
carjiagn.com



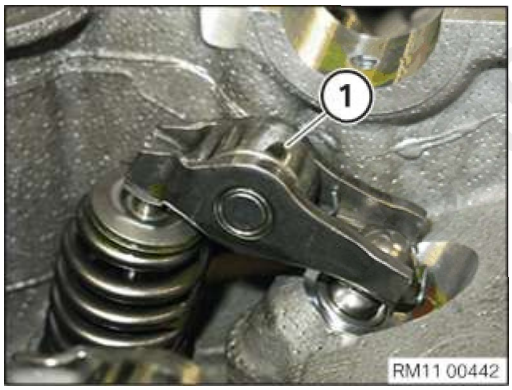
- Coat all bearing positions (1) with fresh engine oil.



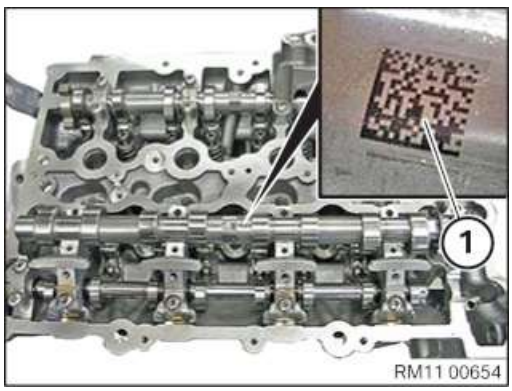
- Clean all the bearing positions of the intake camshaft bearing cap (E1) (E2) (E3), (E4) and (E) and coat with engine oil.



- Clean all bearing positions (arrows) of the intake camshaft (1) and coat with engine oil.

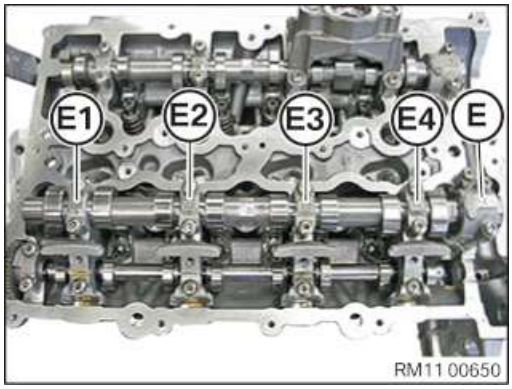


- Ensure the correct fit of the roller cam follower (1) before mounting the intake camshaft.
- Coat roller cam follower (1) with new engine oil.



- Insert the intake camshaft into the cylinder head in such a way that the mark (1) points up.

rdiagn.com



- Position the intake camshaft bearing cap on the cylinder head.

Note: The intake camshaft bearing caps are legibly labelled from the intake side with E1, E2, E3, E4 and E.

Note: Intake camshaft bearing cap E is a thrust bearing.

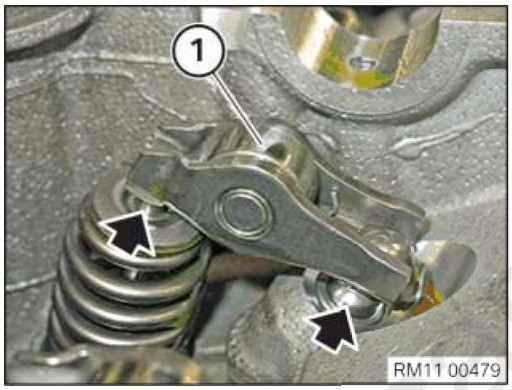


- Press intake camshaft bearing cap down and hand-tighten the screws incrementally in sequence (1) to (10).
- Join screws in sequence (1) to (10) **in half turns**.
- **Adhere to the jointing torque.**
- Tighten all screws in a sequence from (1) to (10) **.**

Intake camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

20 – Checking installation position of roller cam followers



TECHNICAL INFORMATION

The rocker arms may slip slightly when the camshaft is positioned. Make sure rocker arms are correctly positioned on the hydraulic valve clearance compensating elements and on valves.

- Make sure the mounting orientation (arrows) of the roller cam followers (1) is correct.

21 – Checking the intermediate lever classification



TECHNICAL INFORMATION

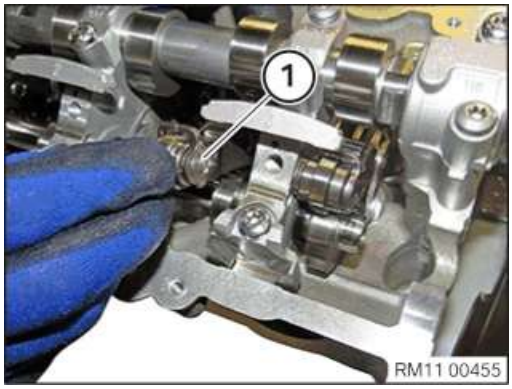
All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

- Check classification (arrow) of intermediate lever.

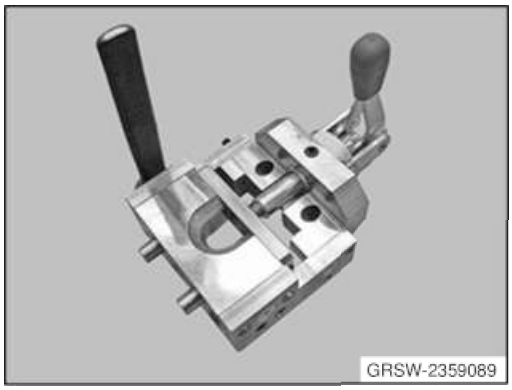
22 – Installing all intermediate levers

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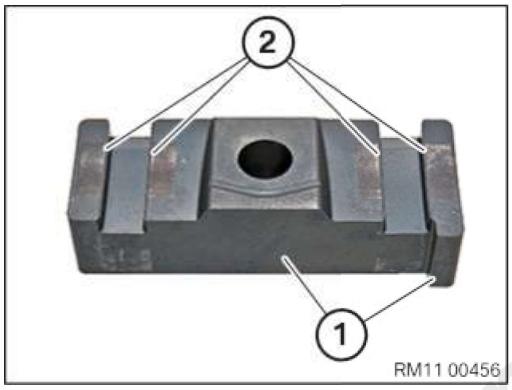


- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

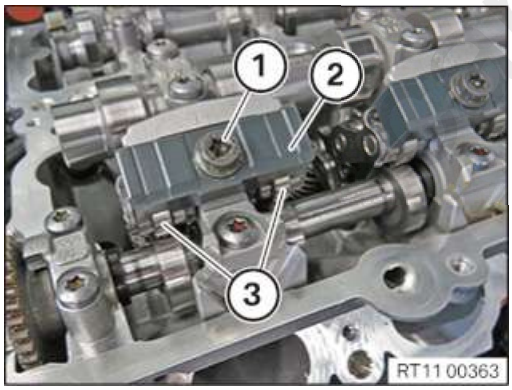
23 – Installing all gates



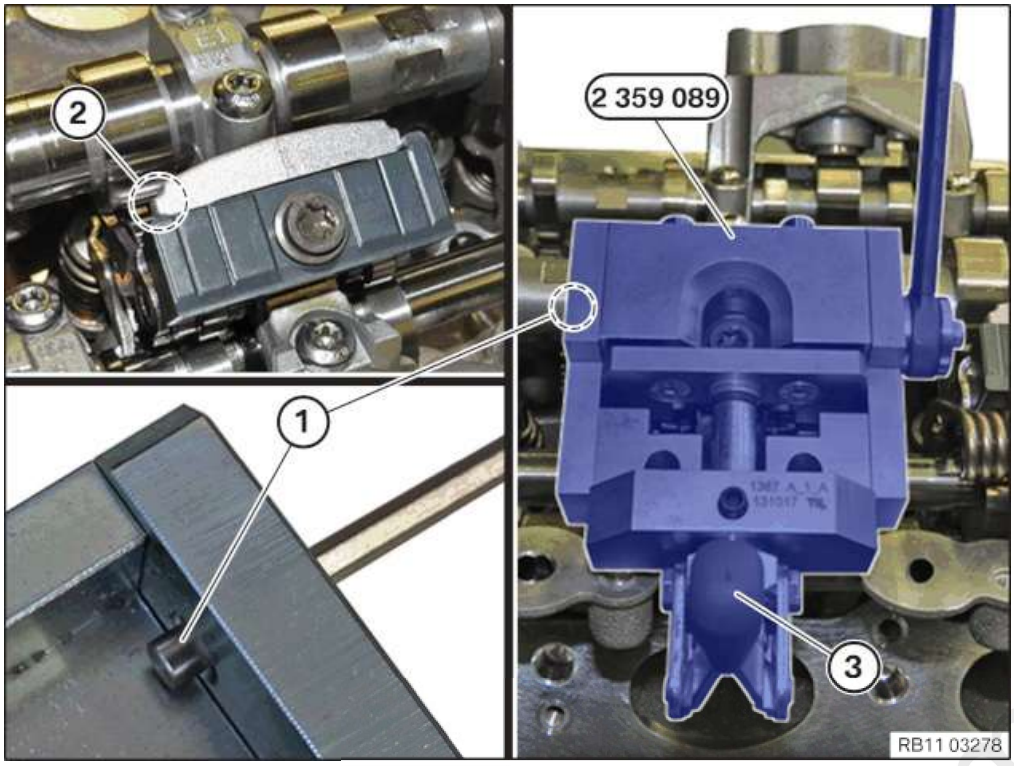
- Have the special tool 2 359 089 ready.



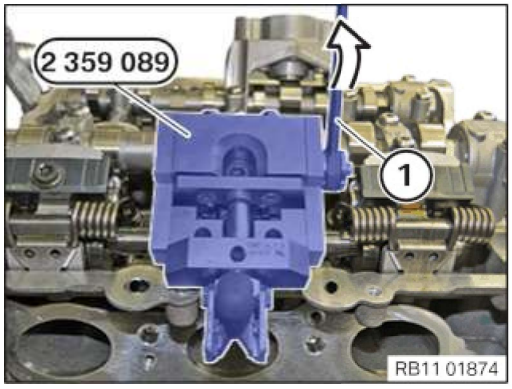
- Clean contact surfaces (1) and (2) off oil, grease and dirt.



- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.



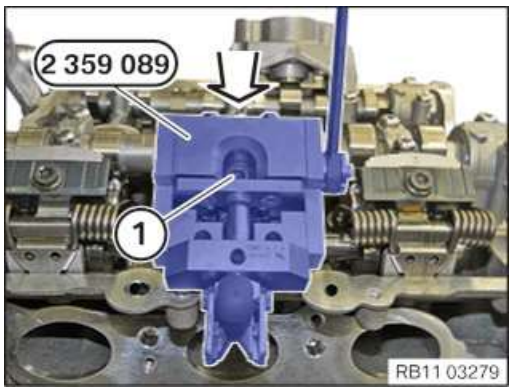
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1) in the direction of the arrow.



- Make sure that the special tool 2 359 089 rests flat against the cylinder head (arrows).

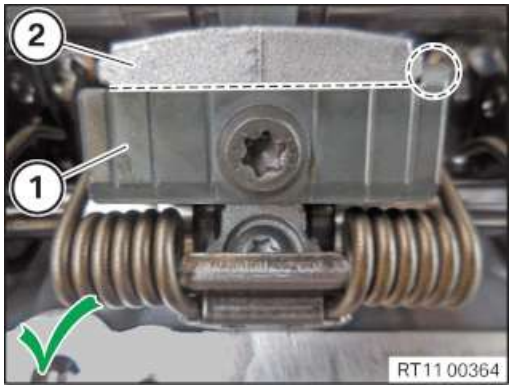


- Press the special tool 2 359 089 onto the cylinder head in the direction of the arrow.
- Tighten the bolt (1) at the same time.

Gate to bearing bracket

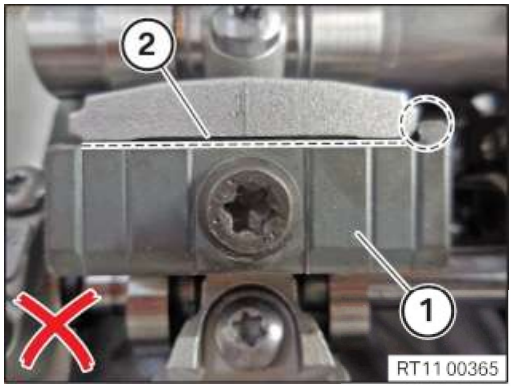
M8		20 Nm

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- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed correctly in the marked area.

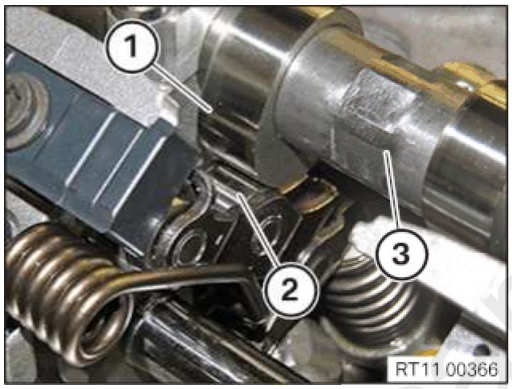


- Ensure that gate (1) rests **correctly** against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area**.**

- Repeat the step for all the gates.

24 – Checking the position of the intake camshaft (cylinder head removed)



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever (2).

Measure

- Turn intake camshaft (3) further using a standard open-end spanner until the cam (1) does not override on the intermediate lever (2).

25 – Install all torsion springs

CAUTION

Spring preload.

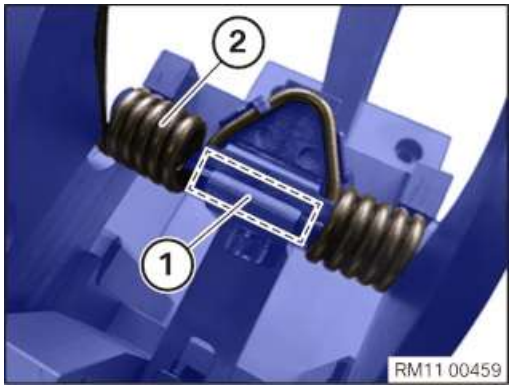
Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

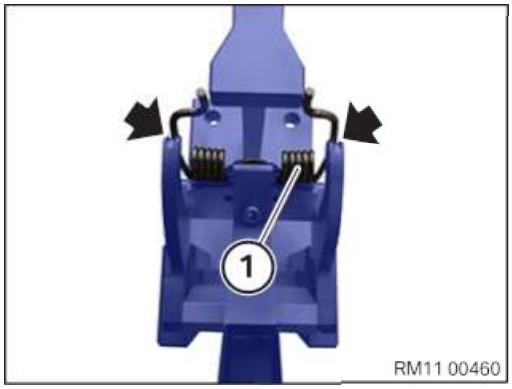
cardiagn.com

TECHNICAL INFORMATION

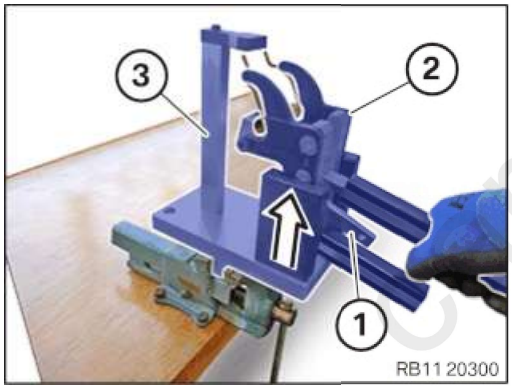
- Wear safety goggles.



- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.

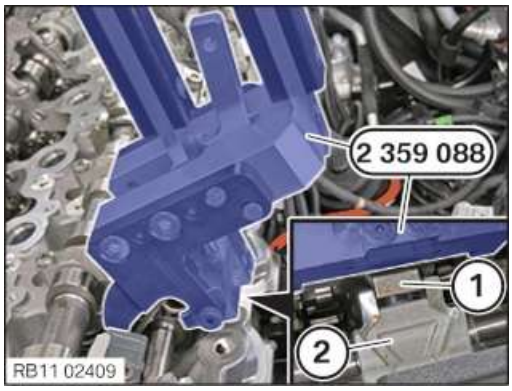


- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.



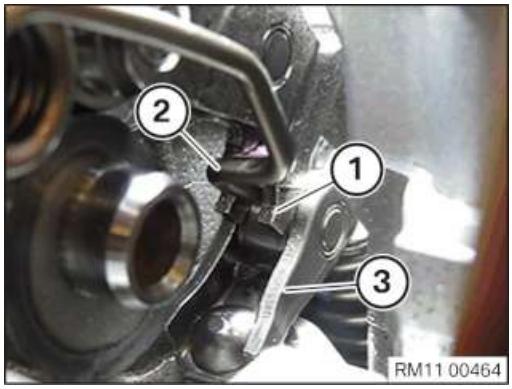
- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the lever (1) audibly engages.

  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.

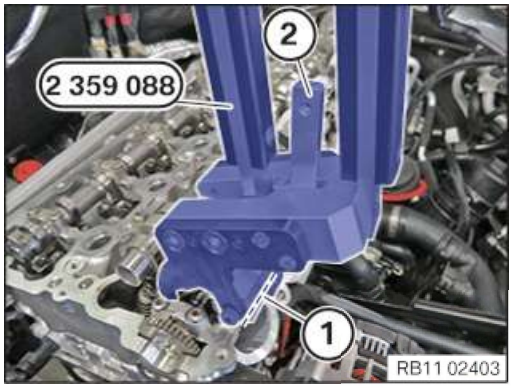


- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).

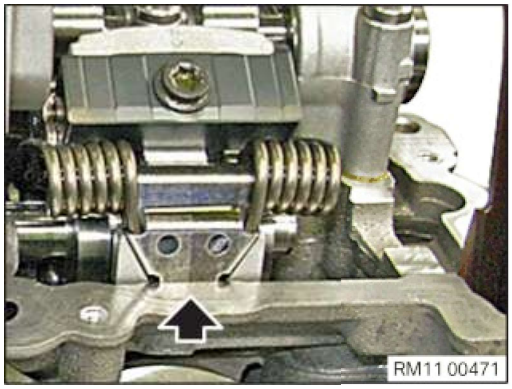
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- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.

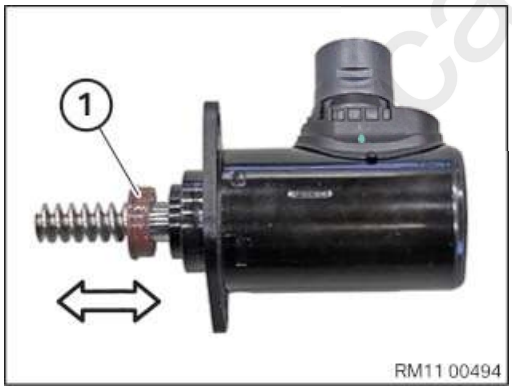


- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).
- Repeat the operations for the remaining torsion springs.

26 – Install the servomotor for the eccentric shaft (cylinder head removed)



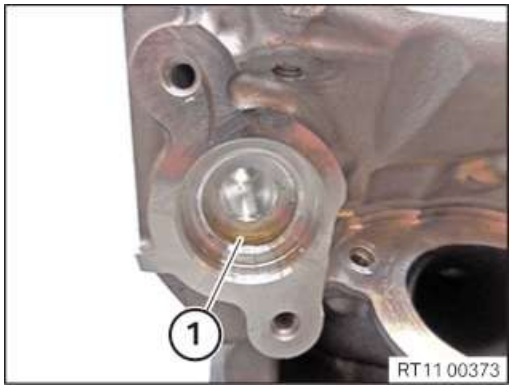
- Renew gasket (1).

  Parts: Gasket

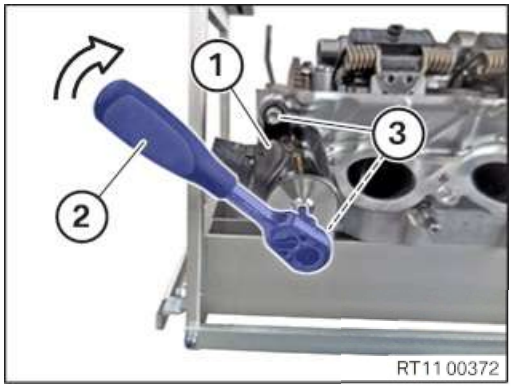


- Press the gasket (1) in to the limit position on the housing.

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- Clean sealing surface (1).



- Slide servomotor for the eccentric shaft (1) up to the limit position and install it.
- Turn servomotor for the eccentric shaft (1) using a standard hexagon socket wrench (2) of **4 mm** in the **direction of arrow** until the servomotor for the eccentric shaft (1) lies on the cylinder head.
- Tighten down screws (3).

Electrical servomotor to cylinder head

M6		Tightening torque	8 Nm

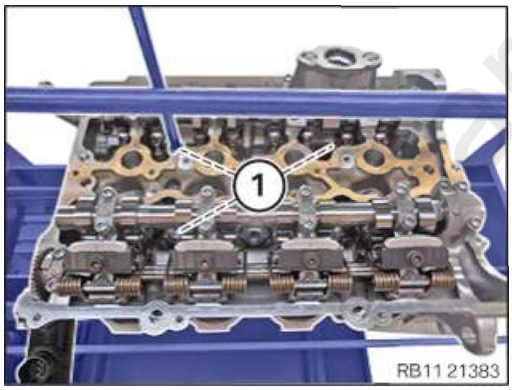
27 – Removing cylinder engine from assembly stand

CAUTION

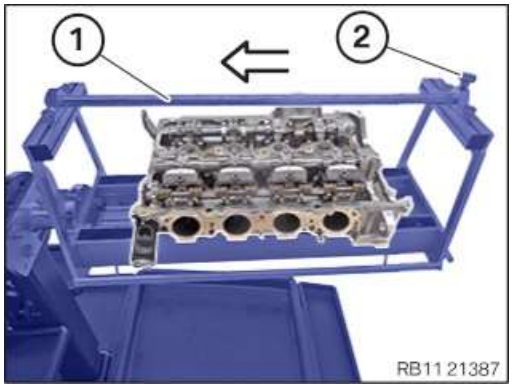
Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



- Release screws (1) from special tool .

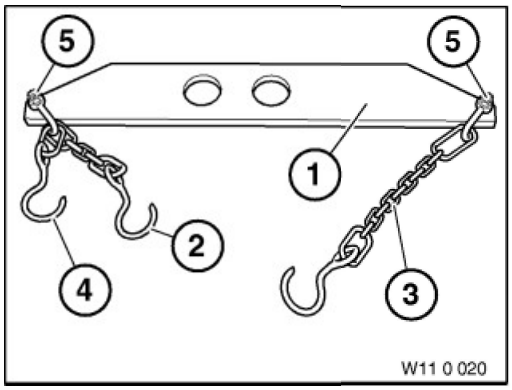


- Loosen screw (2).
- Pull out rod (1) in **direction of arrow** and set it aside.

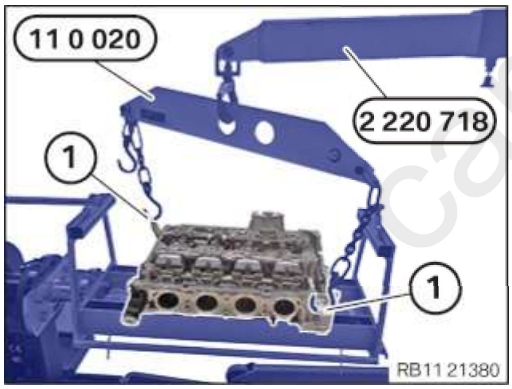
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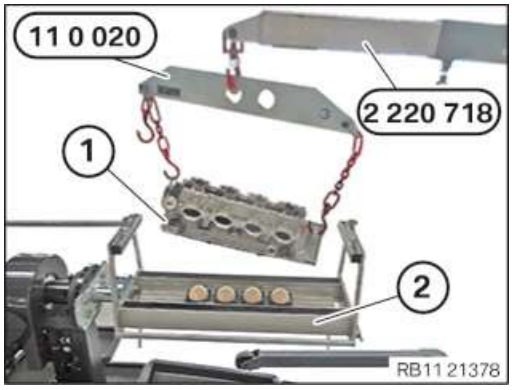
- Stage special tool (workshop crane) 2 220 718.



- Prepare the special tool .



- Thread in and install the special tool on the cylinder head (1).
- Attach the special tool to the workshop crane 2 220 718.



- Feed cylinder head (1) out of device (2) using workshop crane 2 220 718 and special tool and lift.

28 – Installing the exhaust turbocharger (cylinder head removed)

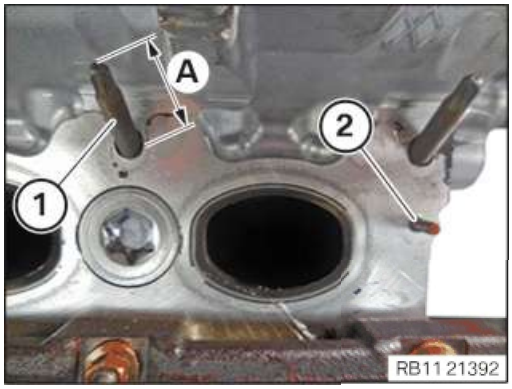
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RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.



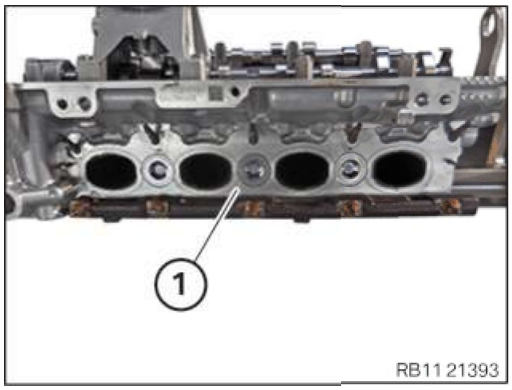
- Check stud bolt (1) for damage, renew stud bolt (1) if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1); if necessary screw in stud bolt further.

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm

- Check for correct fit of stud bolt (2).



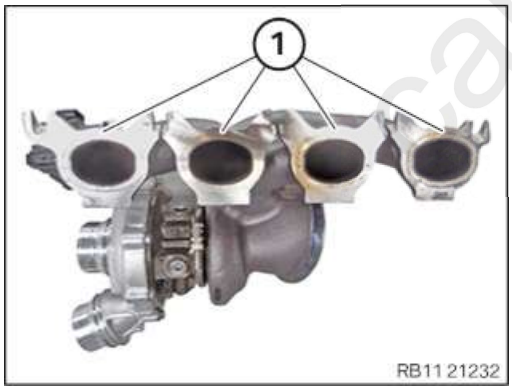
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the cylinder head (1) using the special tool 0 495 102 (11 4 470).



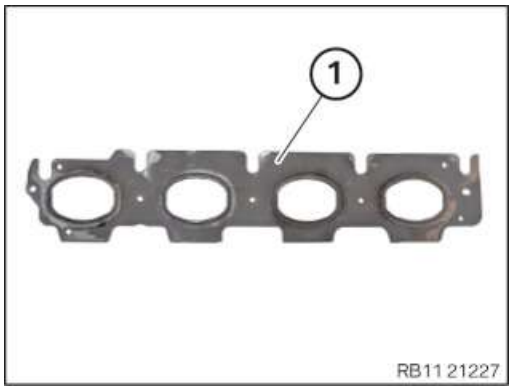
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

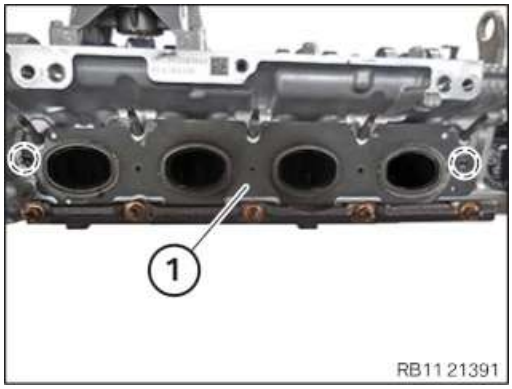
- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the exhaust turbocharger (1) using the special tool 0 495 102 (11 4 470).

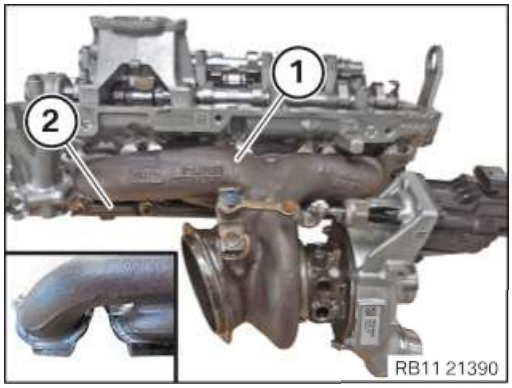


- Renew gasket (1).

  Parts: Seals



- Insert and install the gasket (1).
- Make sure the seal (1) has been **correctly** installed in the guide pins in the **marked** area.



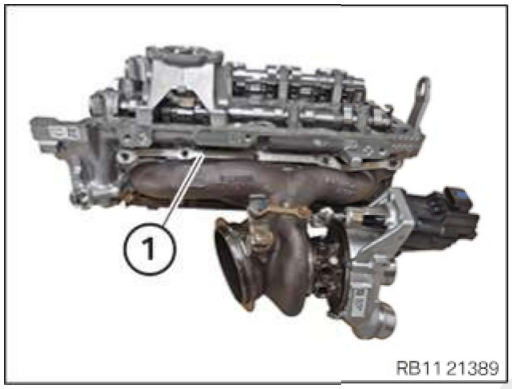
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide the exhaust turbocharger (1) toward the bottom into the clamping strip (2) and align it flush on the cylinder head.

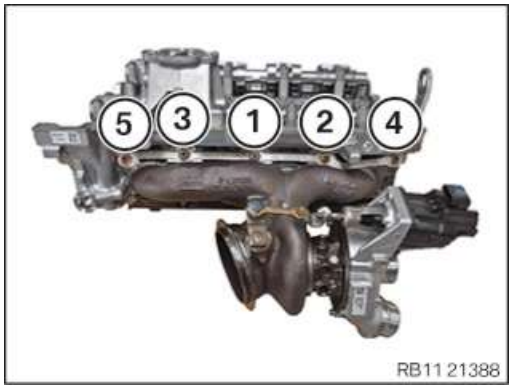


TECHNICAL INFORMATION

- Note the installation position of the component. The component may be installed in various installation positions.

- Mount sliding rail (1).
- The original BMW part number of the sliding rail (1) must be **legible** from the rear.

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Renew nuts (1) to (5).

  Parts: Nuts

- Tighten the nuts in sequence (1) to (5).

Exhaust turbocharger to cylinder head

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Additional Information

Overview of Tightening Torques

Flange to assembly stand — Used in step 2

M14X30		Tightening torque	135 Nm

Cylinder head on device — Used in step 2

M10X90x1.5		Tightening torque	30 Nm

Exhaust camshaft to cylinder head — Used in step 17

M6	***Observe tightening sequence.*** *Mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Eccentric shaft to bearing support/cylinder head — Used in step 18

M6			10 Nm

Intake camshaft to cylinder head — Used in step 19

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

Gate to bearing bracket — Used in step 23

M8			20 Nm

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Electrical servomotor to cylinder head Used in step 26

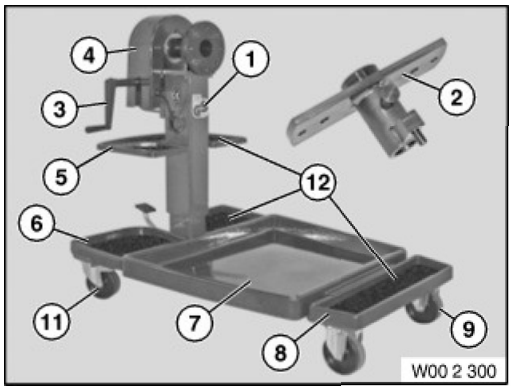
M6		Tightening torque	8 Nm

Exhaust turbocharger to cylinder head Used in step 28

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Overview of Special Tools

0 495 187 (00 2 300) Assembly stand



Common Used in step 2

Usage	Assembly stand with universal flange for mounting engines from S85
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 25 04 (155)

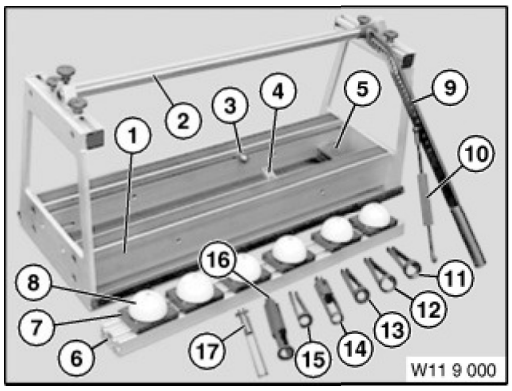
Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 188 (00 2 301)		**Assembly stand** available only as complete assembly stand 83 30 0 495 187.	
2	0 495 189 (00 2 302)	2 299 563	**Tool** (Universal flange). Do not use any more!!! Technically locked. Replaced with a new flange with material number 83 30 2 299 563. All flanges delivered until the end of 2011 will be replaced at no charge. From 2012, only the new flange will be supplied. Also applies to the complete engine mounting stand 00 2 300.	
3	0 495 200 (00 2 303)		**Crank**	
4	0 495 201 (00 2 304)		**Cover** (Protective hood)	
5	0 495 202 (00 2 305)		**oddments tray** (Oddments tray for small parts)	
6	0 495 203 (00 2 306)		**Shaped element** (Rear shaped pan)	

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7	0 495 204 (00 2 307)		**Collection pan** (Oil collection pan)	
8	0 495 205 (00 2 308)		**Shaped element** (Front shaped pan)	
9	0 495 206 (00 2 309)		**Wheel** (Front wheel (without stop))	
10	0 495 207 (00 2 311)		**Wheel** (Rear wheel (with stop))	
11	0 495 208 (00 2 312)		**Mat** (Checker mat set)	
2	2 299 563		**Adapter** New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.	

0 494 362 (11 9 000) Device



Common Used in step 213

Usage	(Cylinder head expander tool)
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	002300 = 0495187
SI-Number	01 03 02 (833)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 494 366 (11 9 001)		**Device**	
6	0 494 371 (11 9 006)		**Insert** (Aluminium strip)	
11	0 494 376 (11 9 012)		**Basket** (Valve spring cage) Engine M41, M51, S50	
17	0 495 028 (11 9 017)		**Basket** (Valve spring cage) Engine N52	
2	0 494 367 (11 9 002)		**Rod**	
3	0 494 368 (11 9 003)		**Adapter** (Sliding block)	
4	0 494 369 (11 9 004)		**Tab**	
5	0 494 370 (11 9 005)		**Quick fastener**	
7	0 494 372 (11 9 007)		**Shaped part** (shaped part)	

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8	0 494 373 (11 9 008)		**Shaped part** (Shaped part) Shaped part made of plastic	
9	0 494 374 (11 9 009)		**Lever**	
10	0 494 375 (11 9 011)		**Hook**	
12	0 494 377 (11 9 013)		**Basket** (Valve spring cage) Engine M43, M73	
13	0 494 378 (11 9 014)		**Basket** (Valve spring cage) Engine M44, M52, M54, M56, M62, S52, S54, S62	
14	0 494 379 (11 9 015)		**Basket** (Valve spring cage) Engine M47, M47TU, M57, M57TU, N40, N42, N62, N73	
15	0 494 380 (11 9 016)		**Basket** (Valve spring cage) Engine M21, M40	

2 220 718 Workshop crane



Common	Used in step 227
Usage	WSK 1000
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	06 01 11 (701)

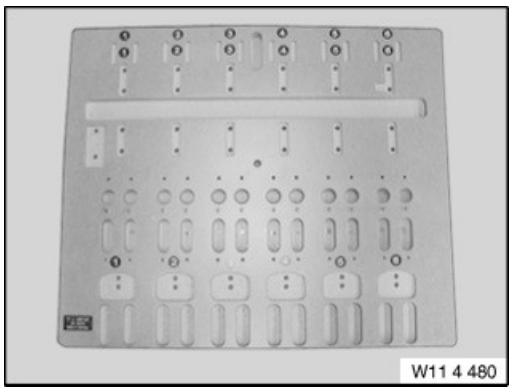
2 359 088 Device



Common	Used in step 525
Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 105 (11 4 480) oddments tray



Common Used in step 567810111213

Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

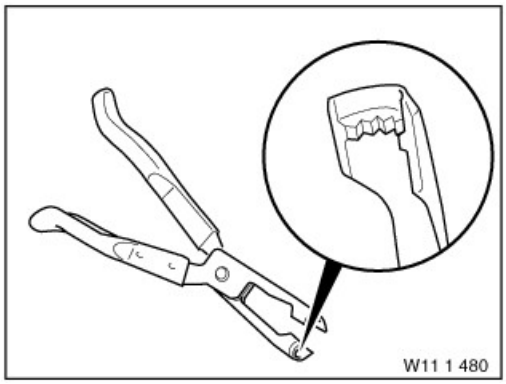
0 496 143 (11 8 840) Basket



Common Used in step 1315

Usage	(Valve spring cage) For removing and fitting the valves.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

0 490 796 (11 1 480) Pliers

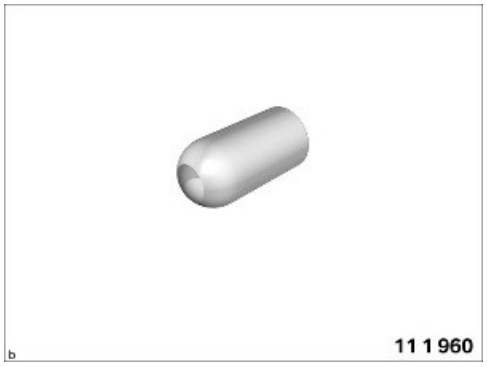


Common Used in step 14

Usage	For removing valve stem seal
Included in the tool or work	
Storage location	A10
Replaced by	
In connection with	
SI-Number	01 01 93 (621)

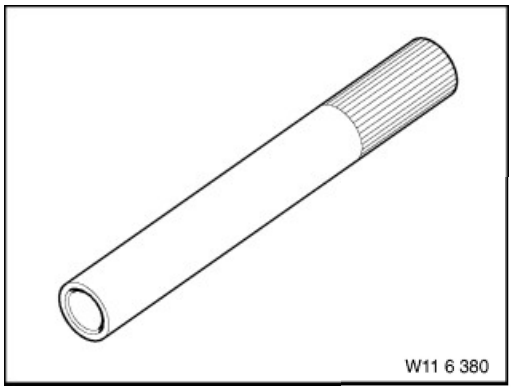
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0 490 797 (11 1 960) Holding sleeve



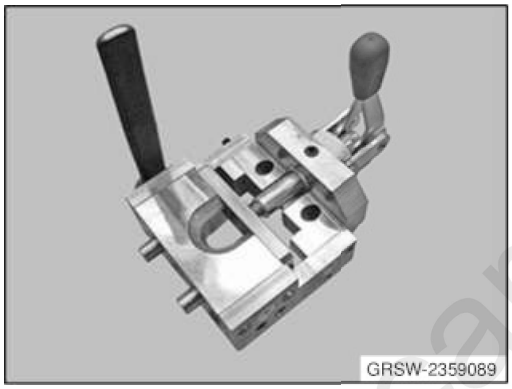
Common	Used in step 14
Usage	(Assembly sleeve) For fitting valve stem seals, 6 mm diameter
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	

0 493 249 (11 6 380) Bush



Common	Used in step 14
Usage	For fitting valve stem seal
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	01 06 98 (306)

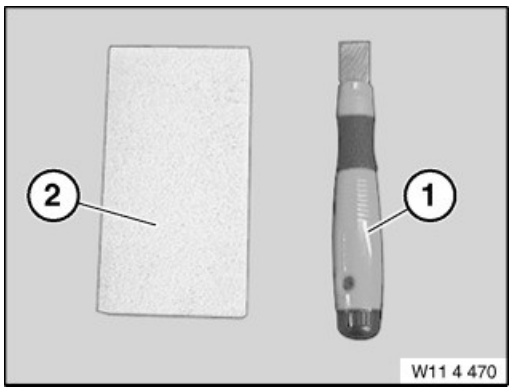
2 359 089 Device



Common	Used in step 23
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 102 (11 4 470) Tool



Common	Used in step 28
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

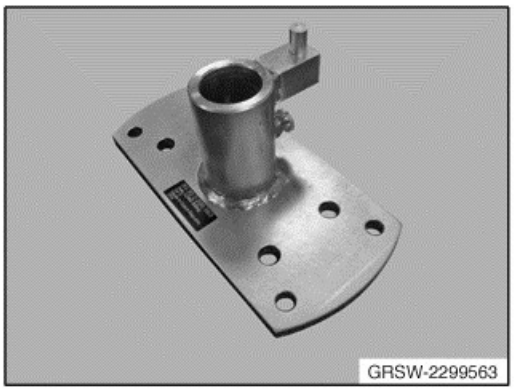
Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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Replacement tools:

2 299 563 Adapter



Common	Used in step 2
Usage	New adapter for the engine assembly stand. Replacement for 83 30 0 495 189 - 00 2 302.
Included in the tool or work	0 495 187
Storage location	
Replaced by	
In connection with	
SI-Number	

Overview Technical Data

Screw-in depth of upper stud bolt on cylinder head	Used in step 28
Dimension A	30 mm

Links

Repair instructions	**Used in step**
61 35 ... Notes on ESD protection (Electro Static Discharge)	9

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11 36 044 Remove and install/replace the exhaust camshaft adjuster

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

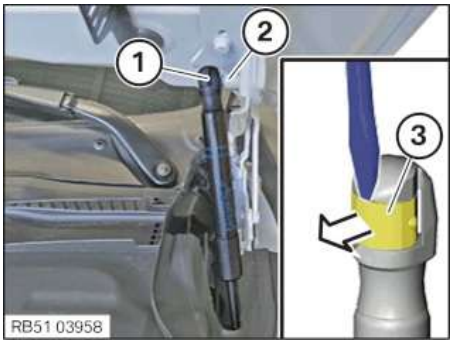
Engine compartment lid is open.

CAUTION

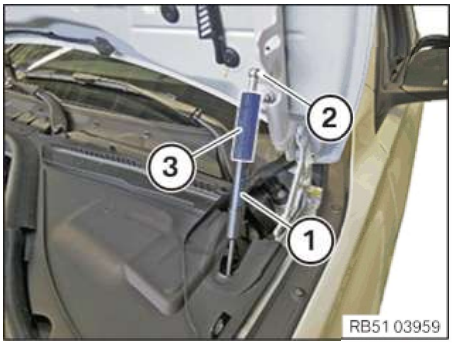
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

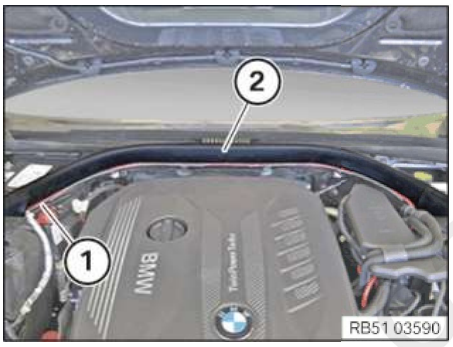


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

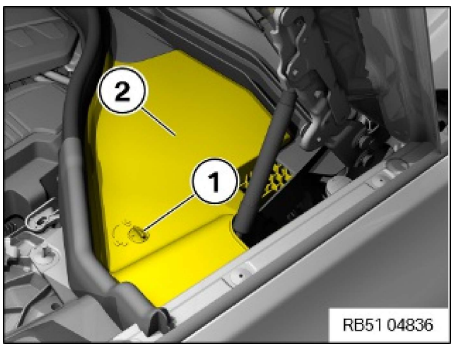
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

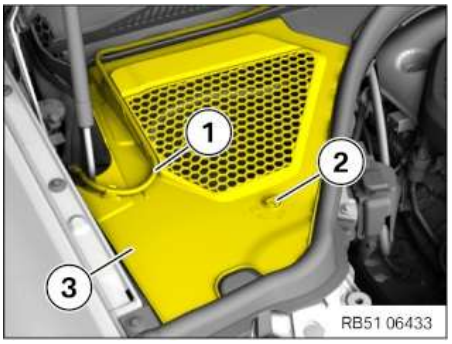
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

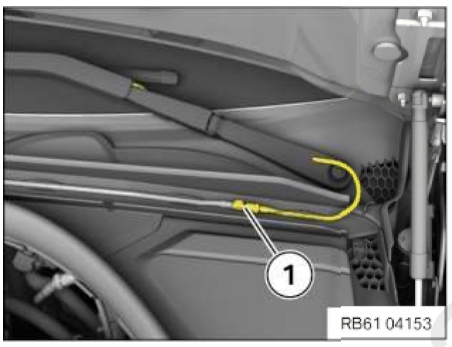
▶ **Remove the wiper arm**

RISK OF DAMAGE

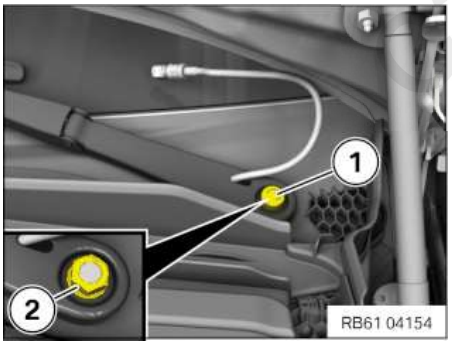
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

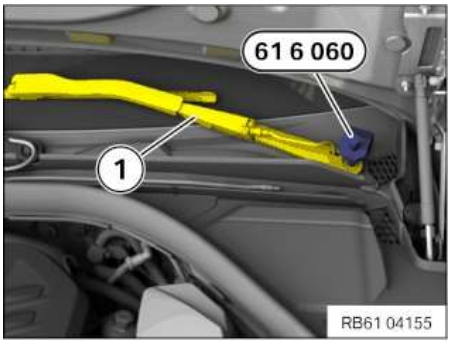
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



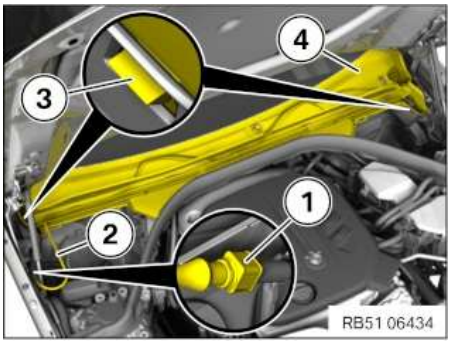
- Remove the protective cap (1).
- Loosen nut (2).



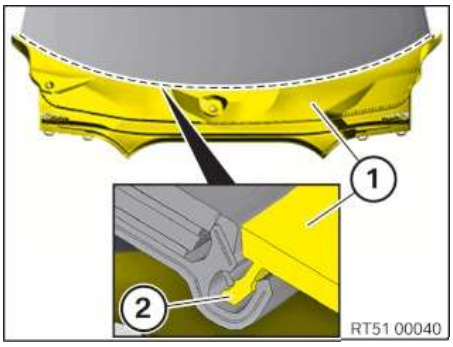
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

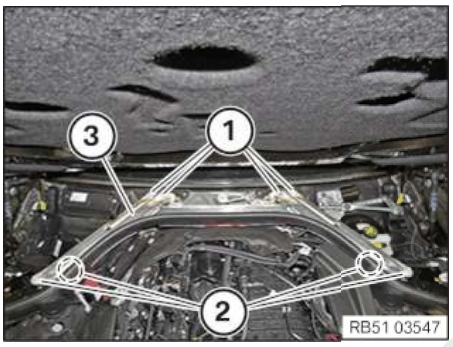


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

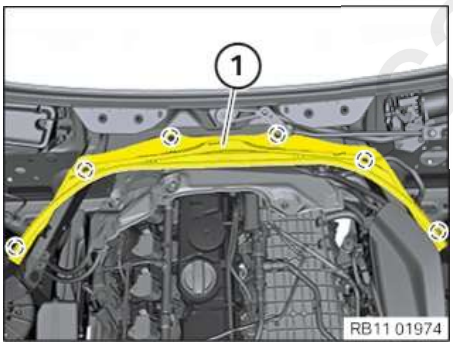
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

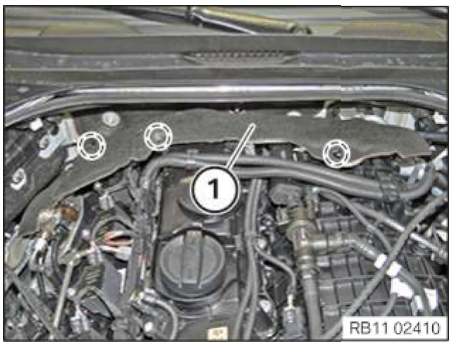
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



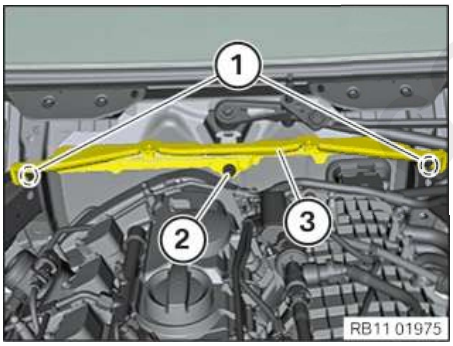
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

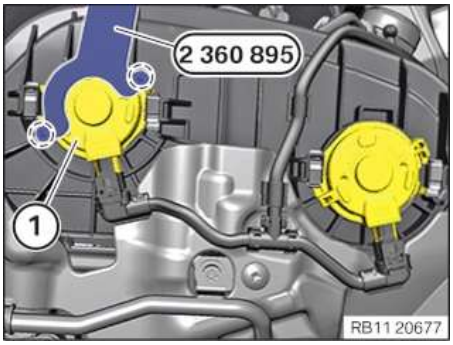
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

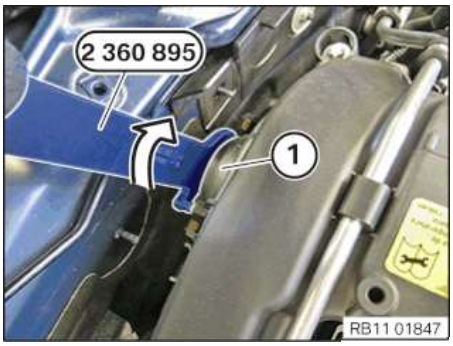
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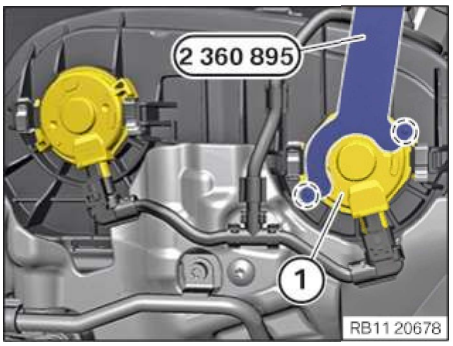
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



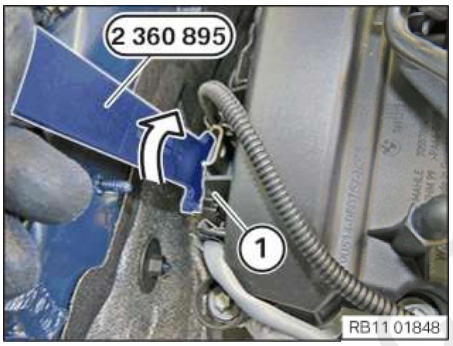
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



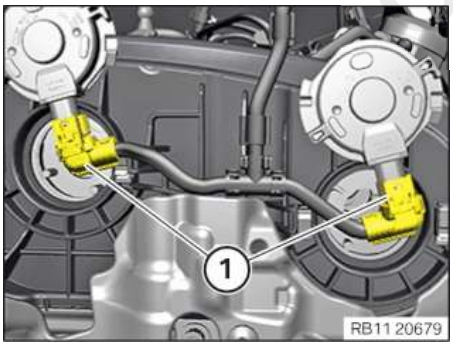
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

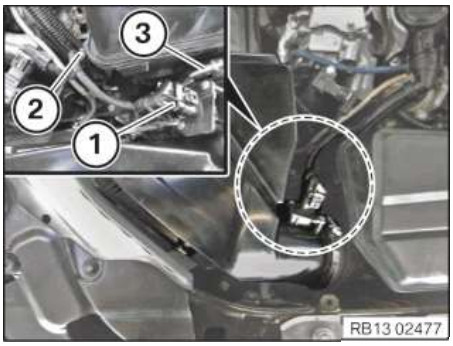
Risk of burning!

- Perform all work only on components that have cooled down.

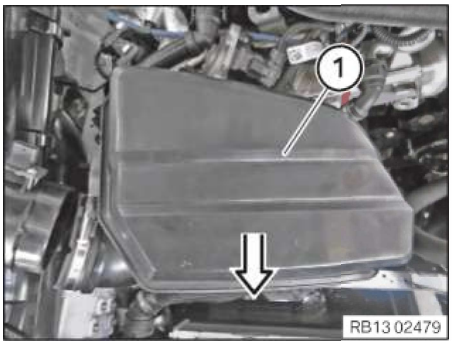
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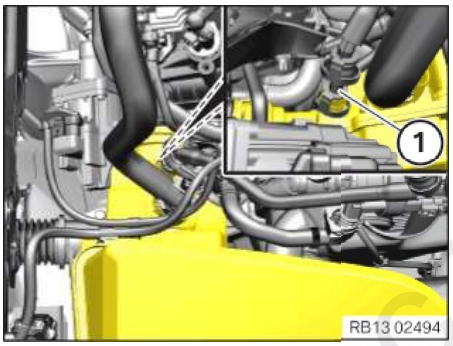
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



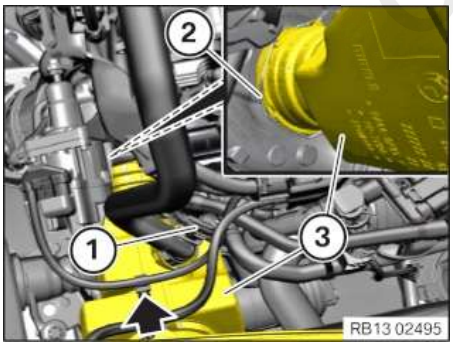
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



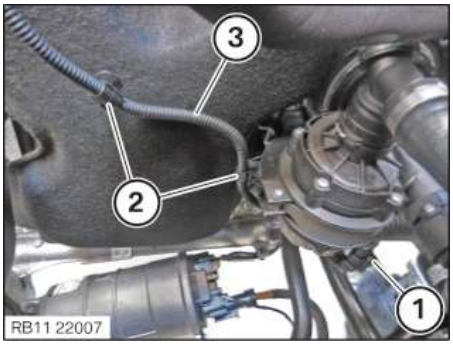
- Unlock and disconnect the tank ventilation line (1).



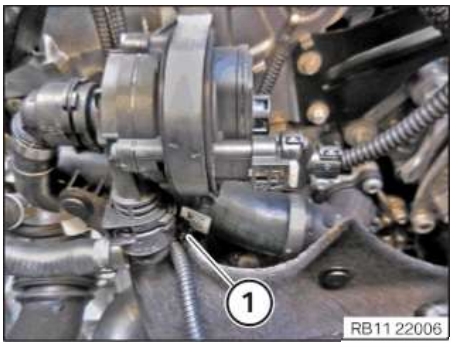
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

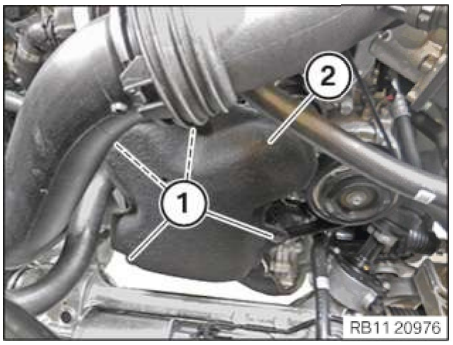
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

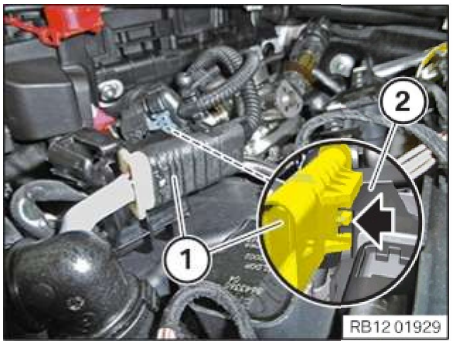
Electrostatic discharge.

Damage to or destruction of electrical components.

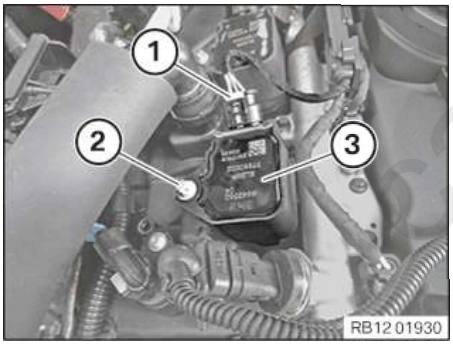
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

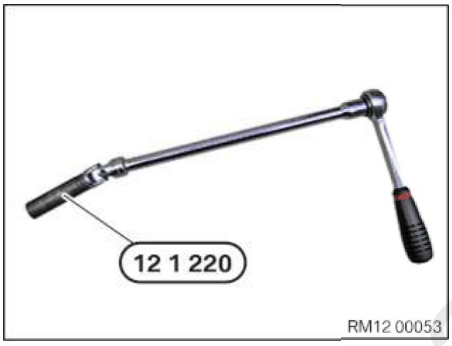
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

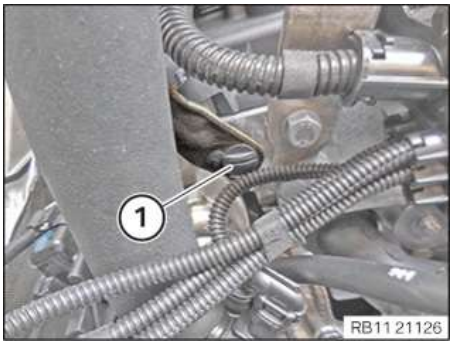
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

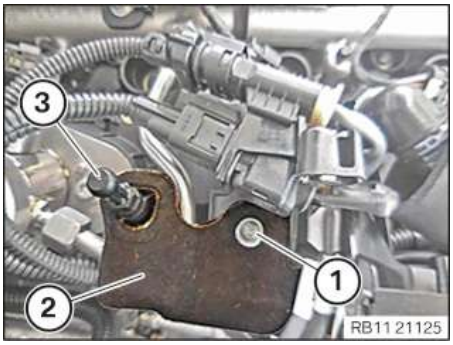


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

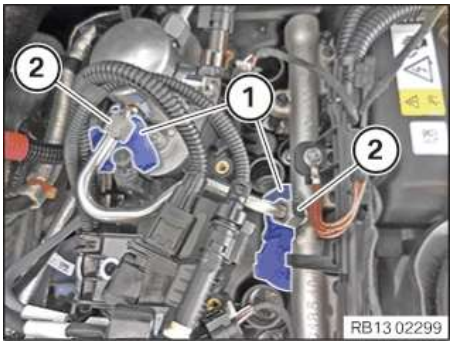
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

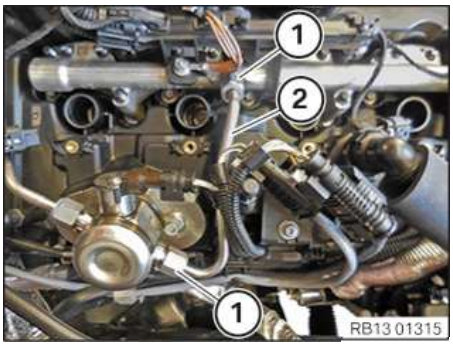


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

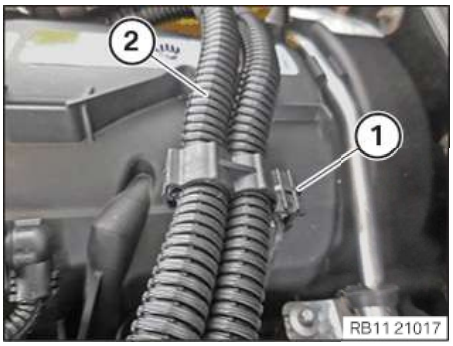
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

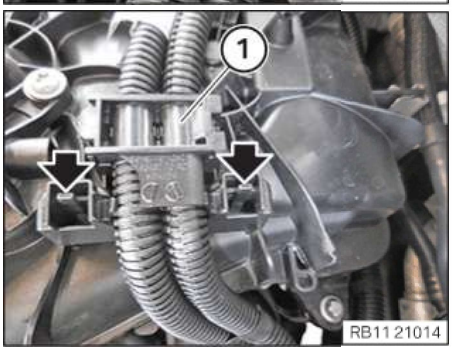
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

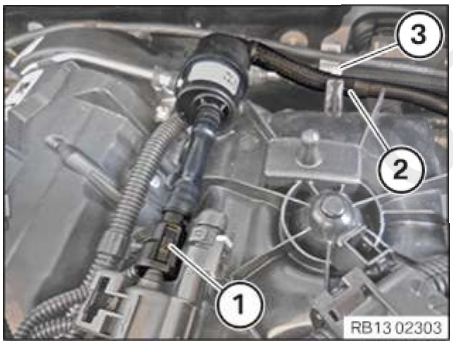
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



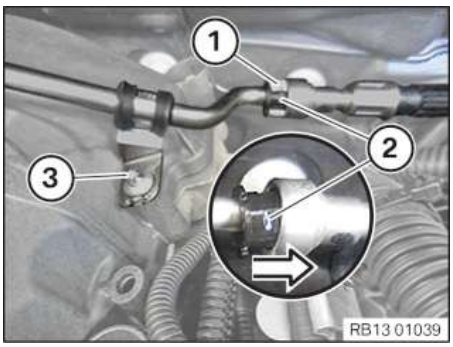
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

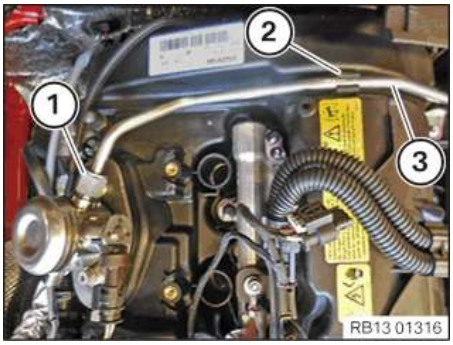


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

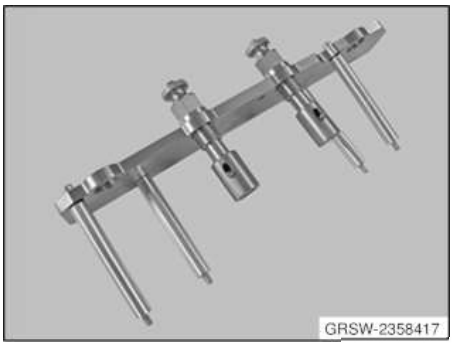
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



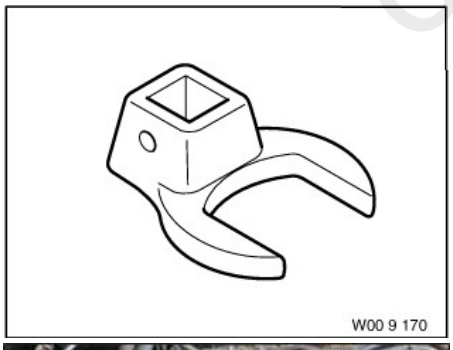
- Prepare special tool 2 358 417.



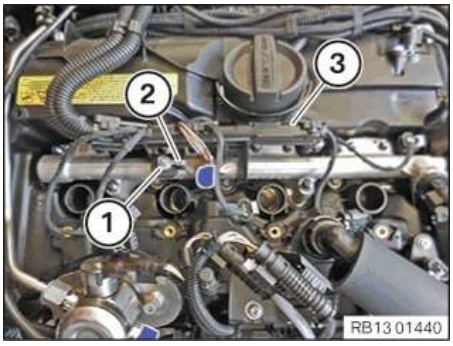
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

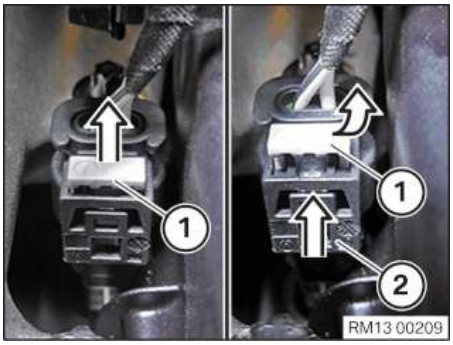


- Prepare special tool .

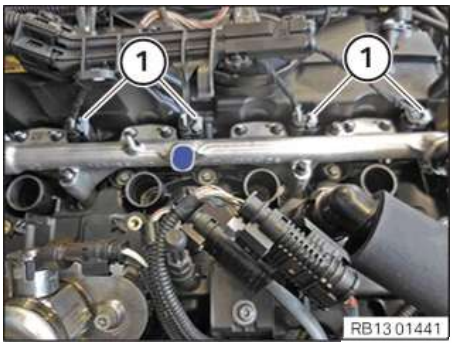


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



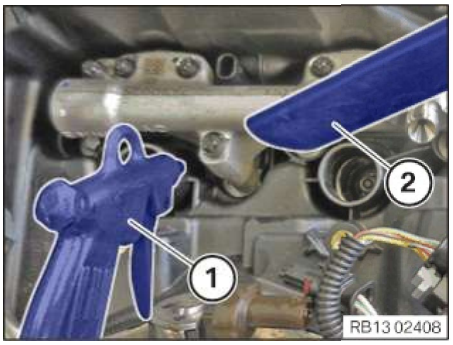
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

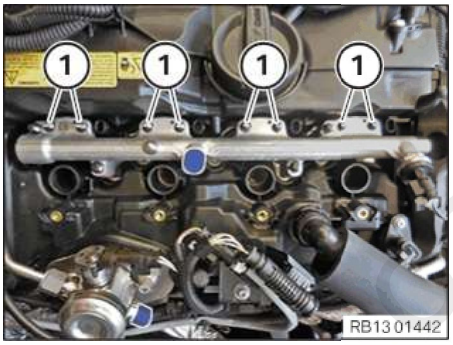


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

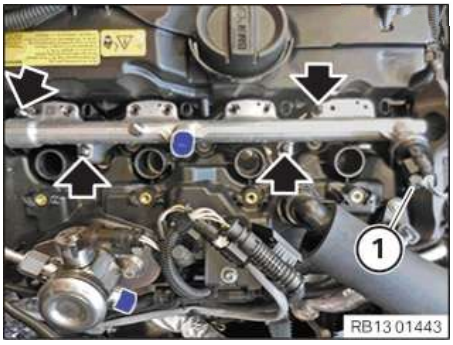
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



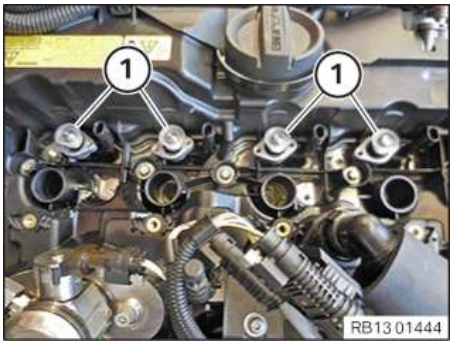
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

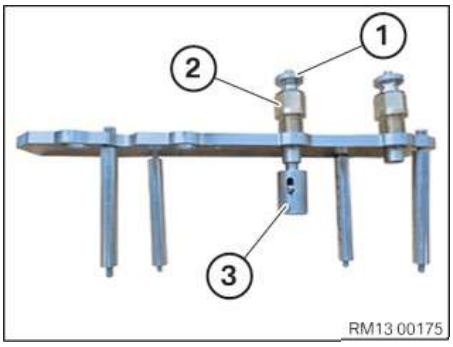
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

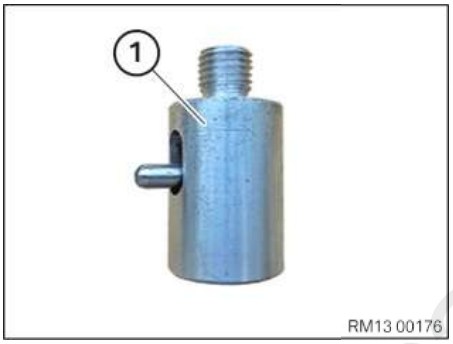
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

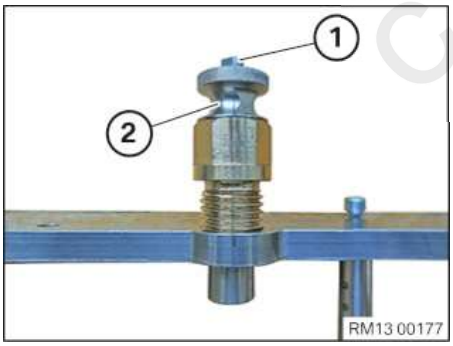
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

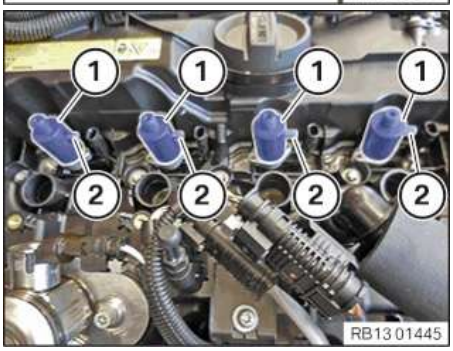
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



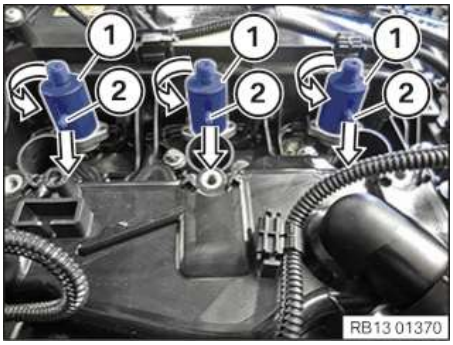
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



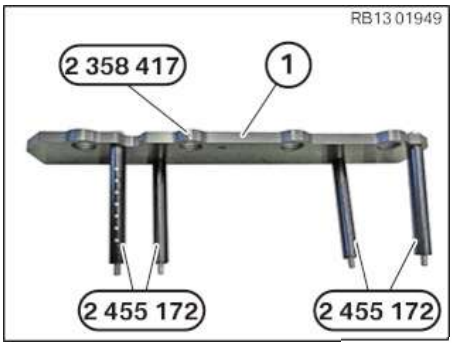
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

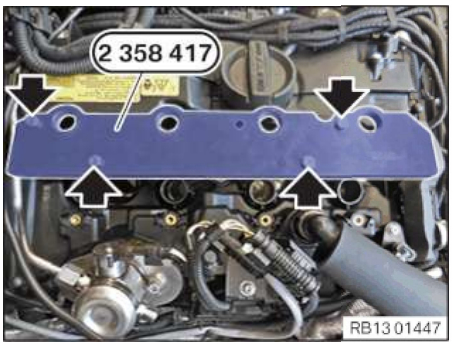
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



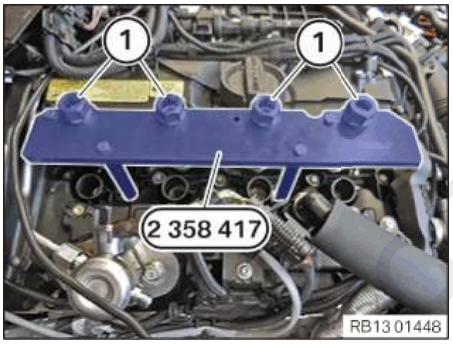
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

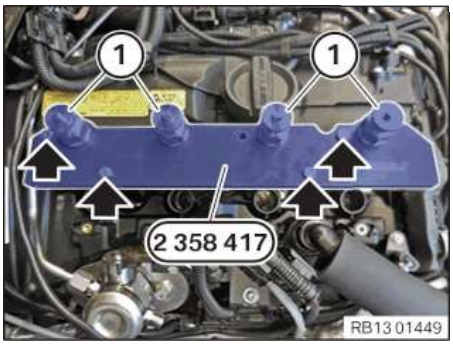
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

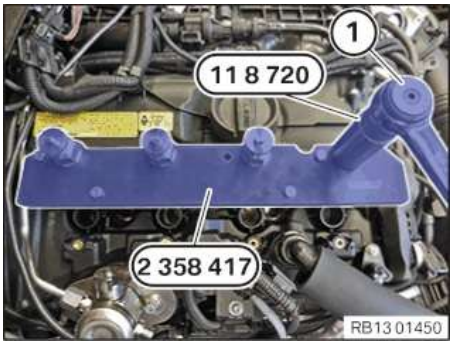
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

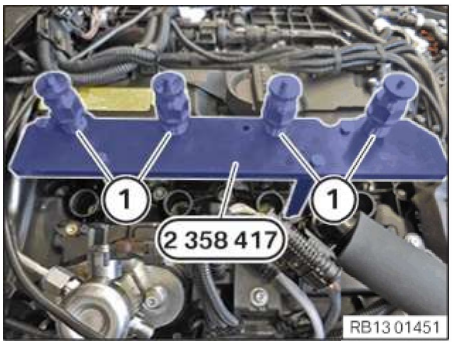


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

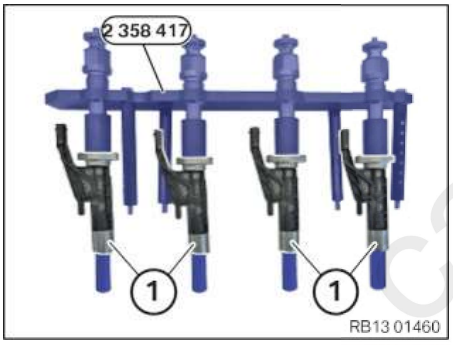
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

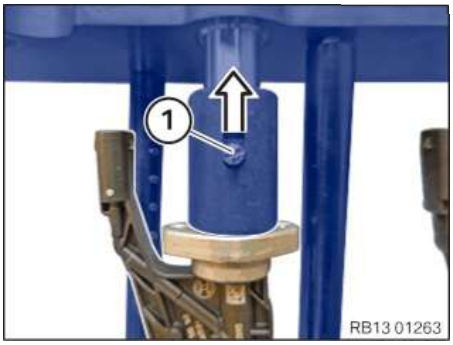


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

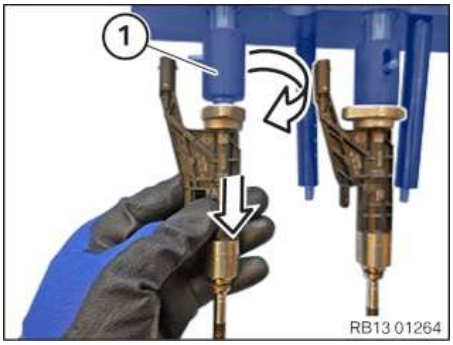


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

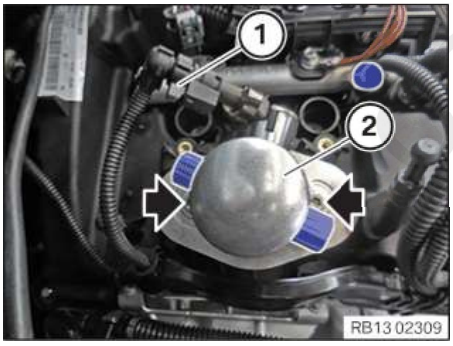
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

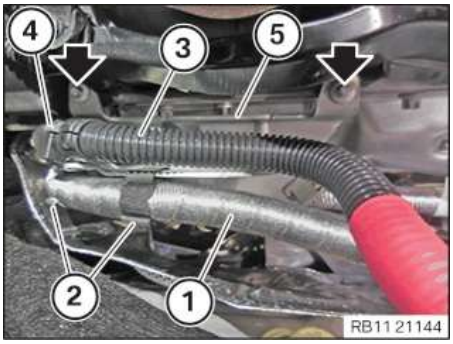
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

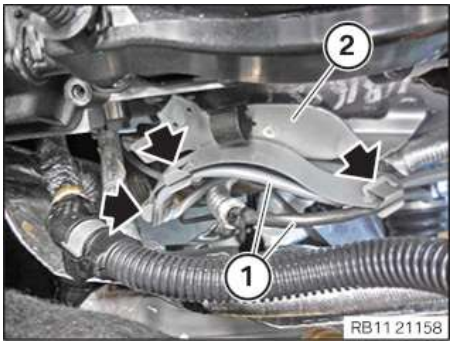


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

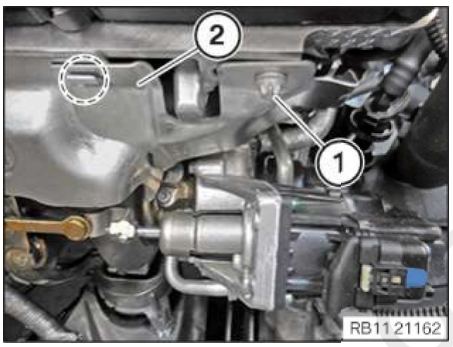
Hot surfaces.

Risk of burning!

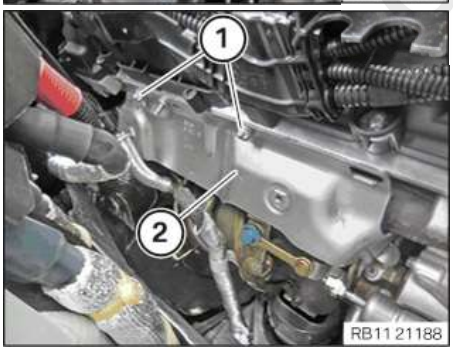
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

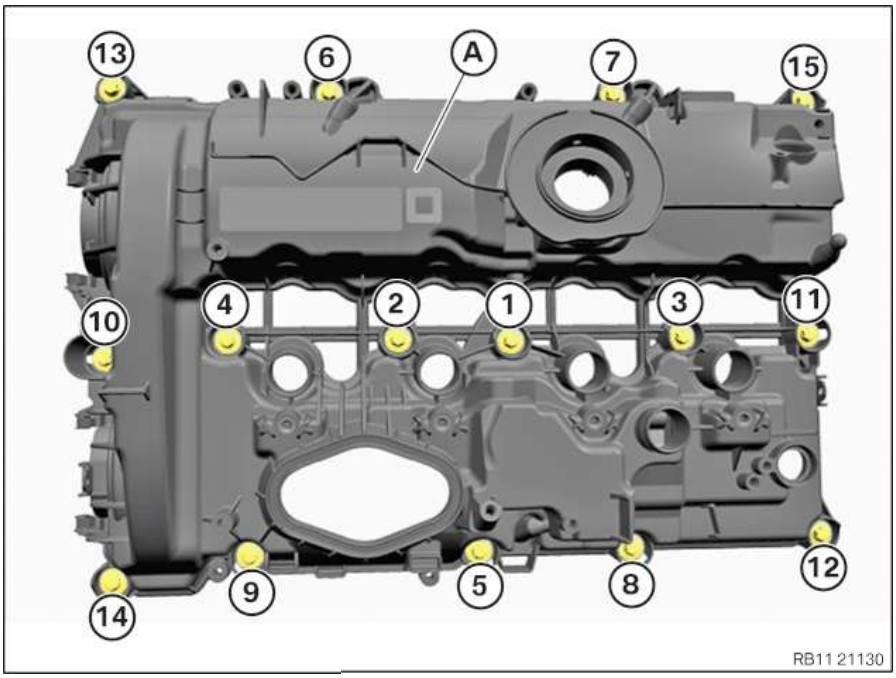


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

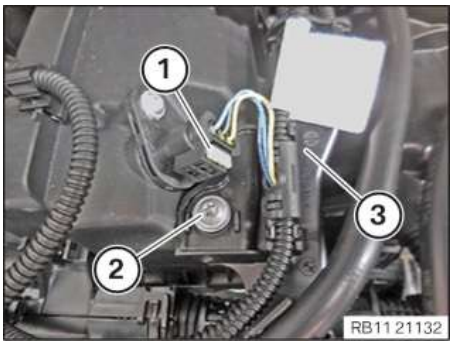
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

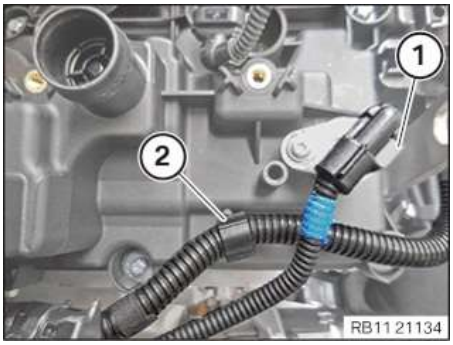
- Do not pull on the wires when disconnecting connectors and plug connections.



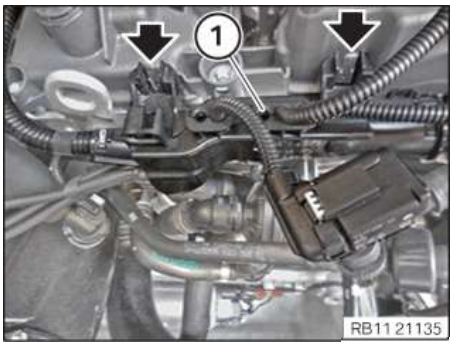
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



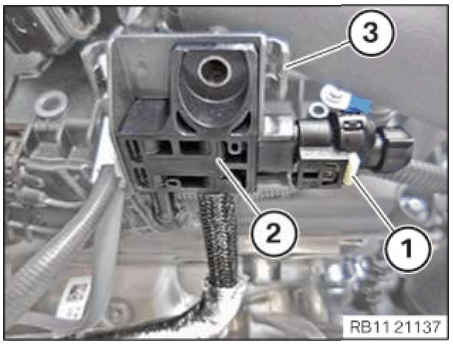
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



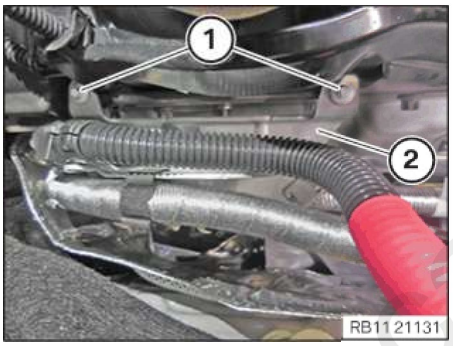
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



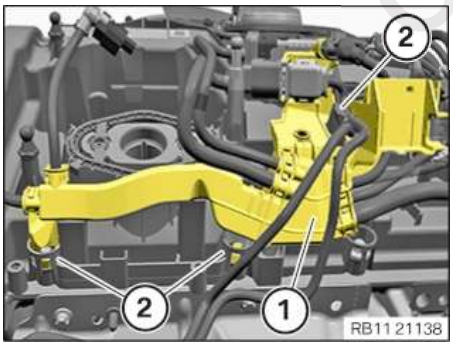
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



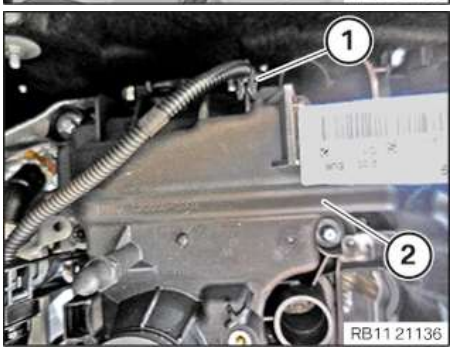
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

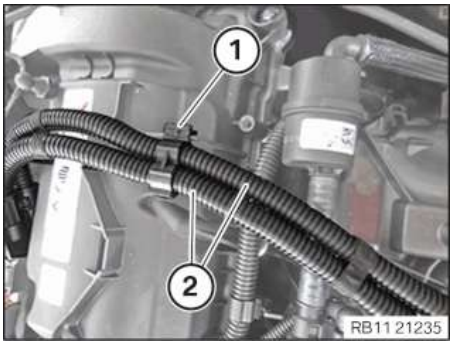


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

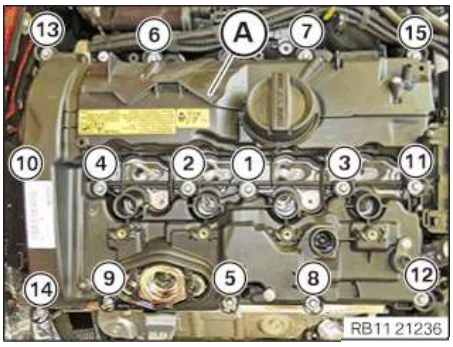


- Loosen clamp (1).

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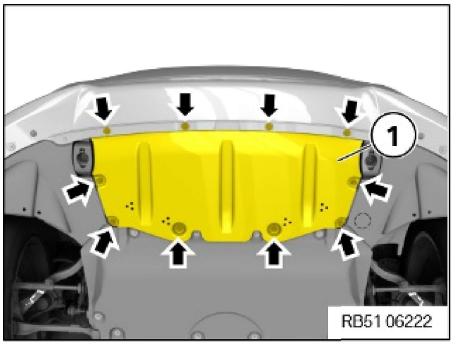


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

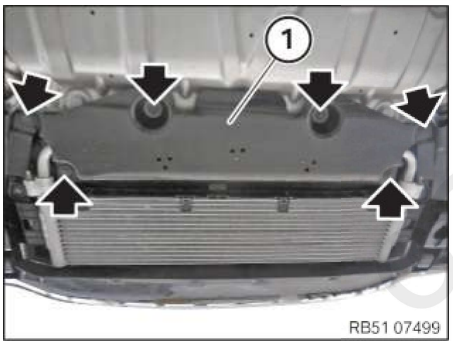
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

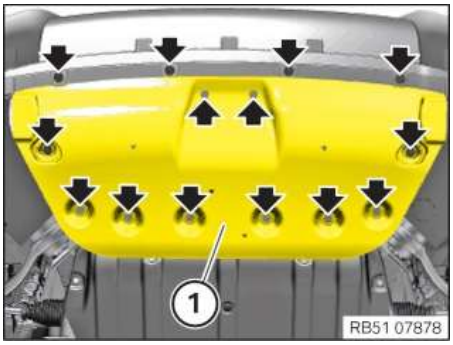
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

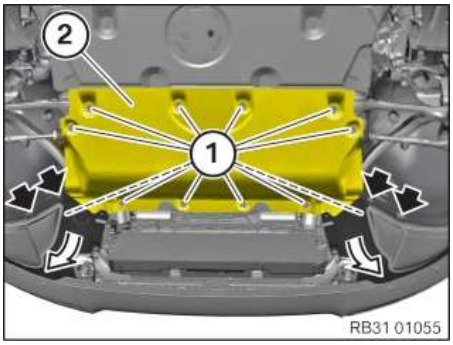


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



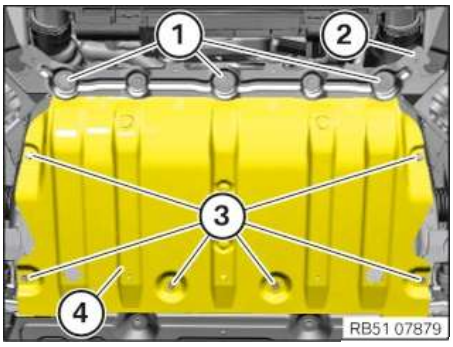
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

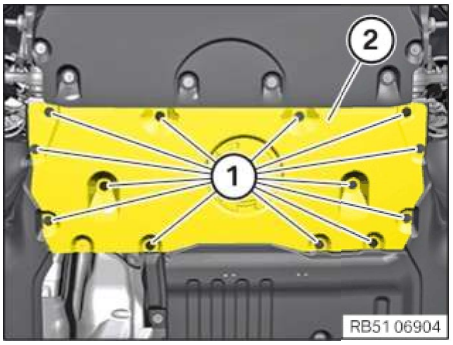
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

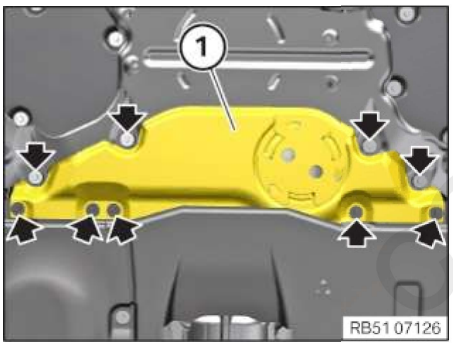
27 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

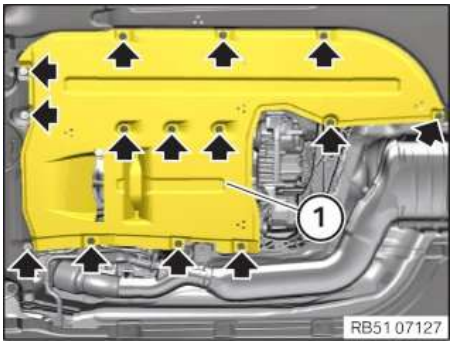


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

28 – Remove rear underbody protection

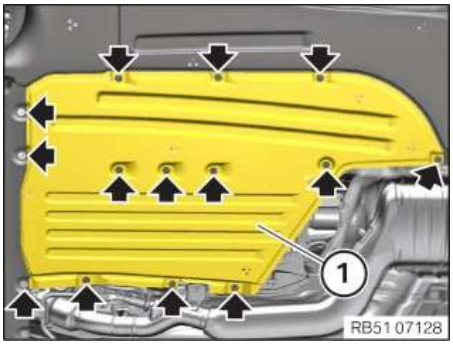


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

29 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



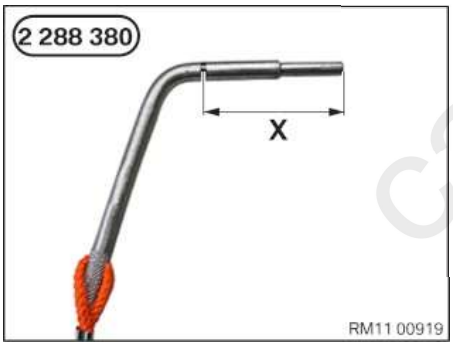
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

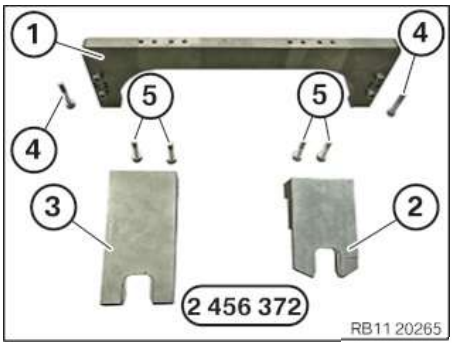
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- **Vehicles with automatic transmission:**

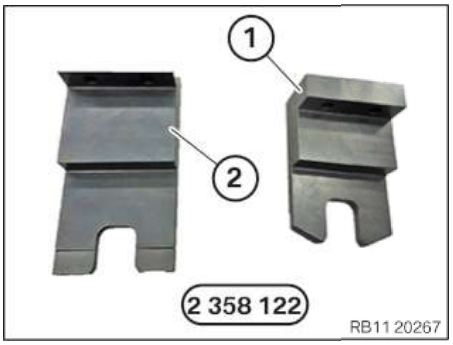
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



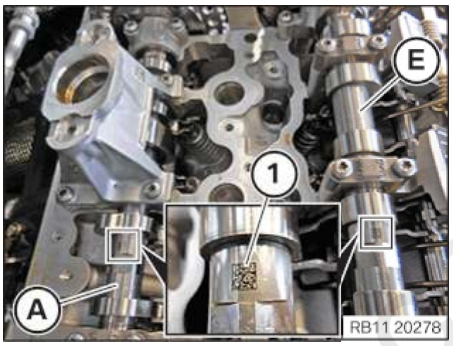
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

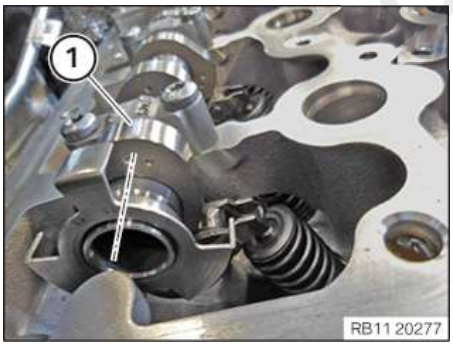


- Overview of the test gauges from the set of special tools 2 358 122:

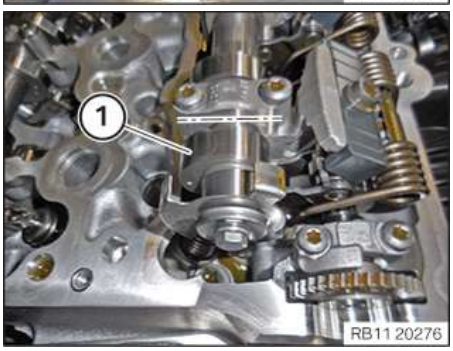
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

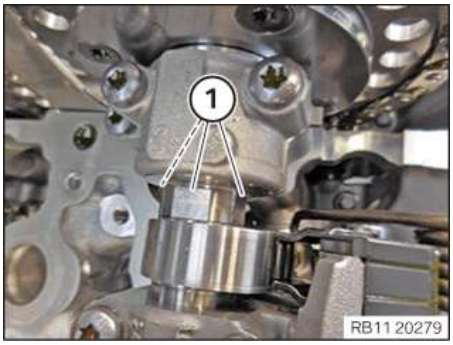


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

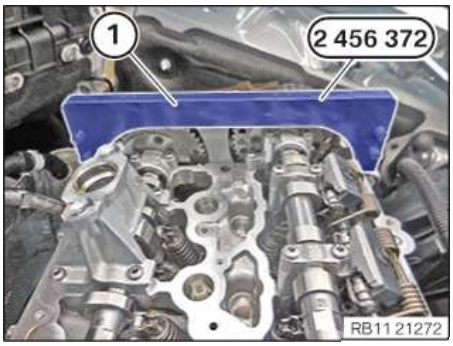


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

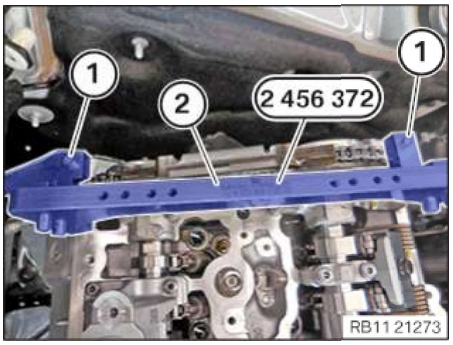
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- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



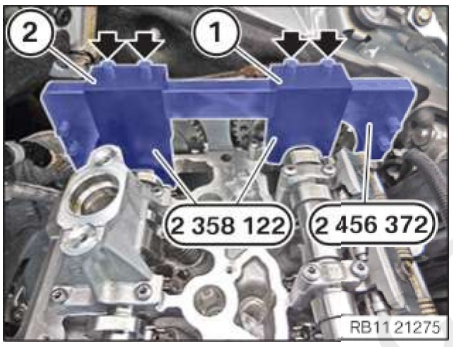
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

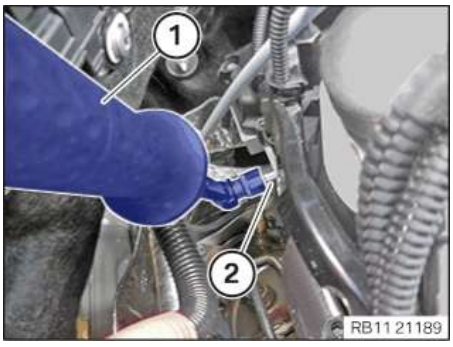
Test gauge to basic carrier

M6		Tightening torque	8 Nm

30 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

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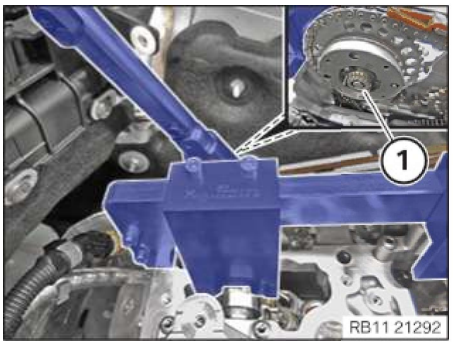
- Feed out and remove the chain tensioner (1).

MAIN WORK

31 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

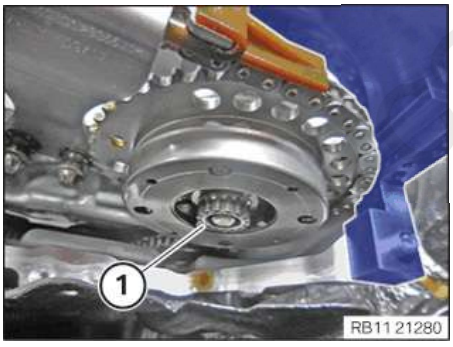


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

32 – Remove the VANOS central valve of the exhaust camshaft adjuster

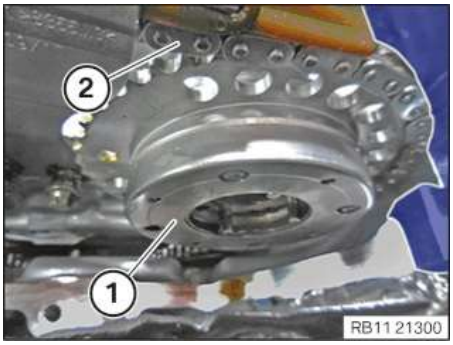


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

33 – Remove exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

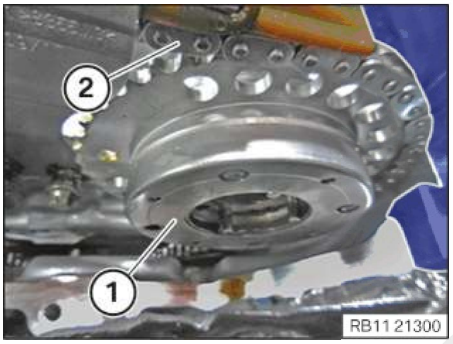
34 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.

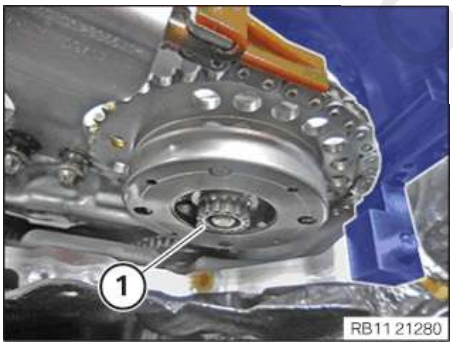


- Keep exhaust camshaft adjuster (1) marked EX ready.

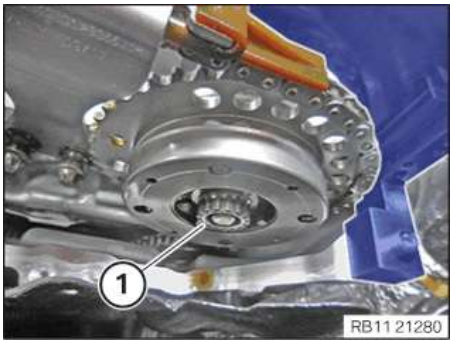


- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

35 – Installing the VANOS central valve of the exhaust camshaft adjuster

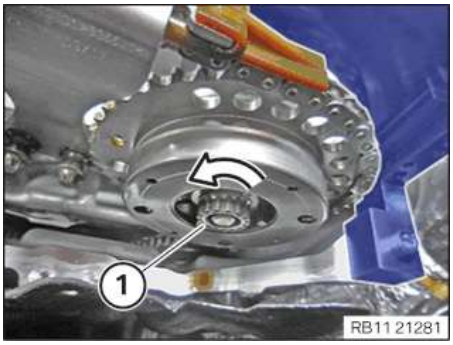


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

36 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

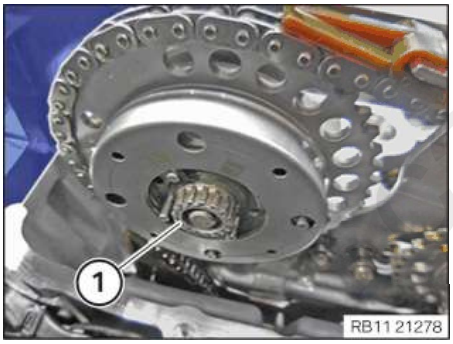


NOTICE

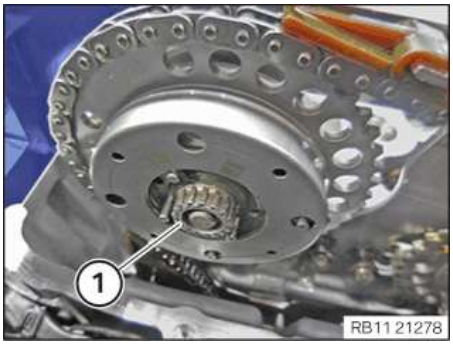
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

37 – Install the VANOS central valve of the intake adjuster

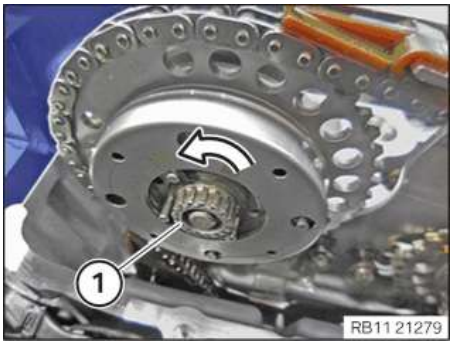


- Guide in the VANOS central valve (1) of the intake adjuster and install.



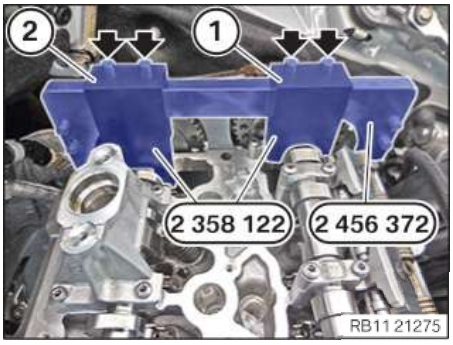
- Hand-tighten the VANOS central valve (1) of the intake adjuster.

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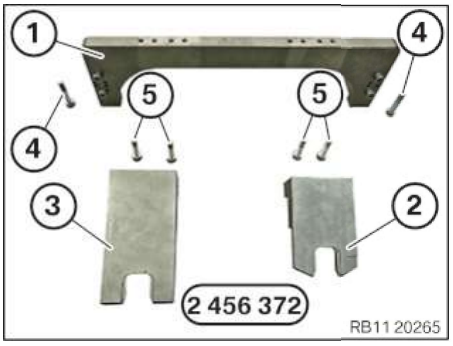
- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

38 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

39 – Adjust the camshafts with the special tool

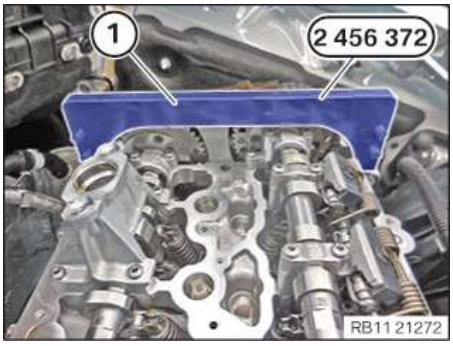


- Overview of the set of special tools 2 456 372:

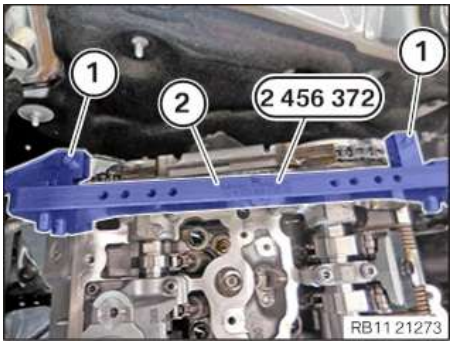
Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



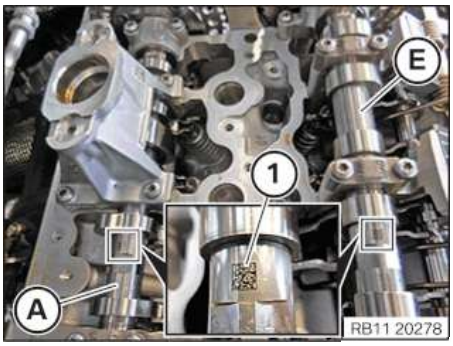
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



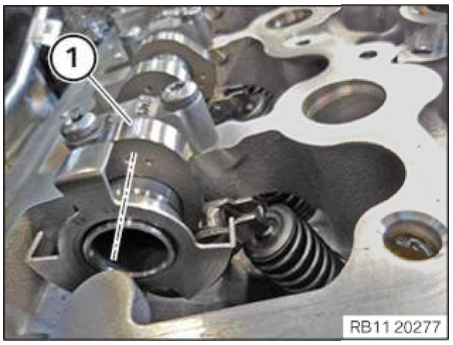
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

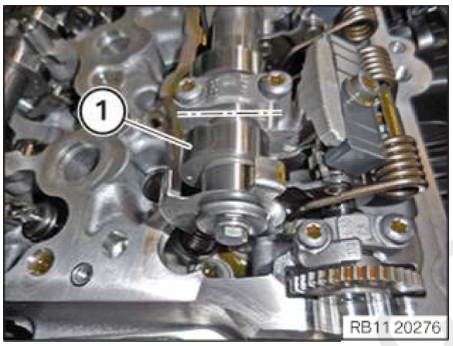
M6		Tightening torque	8 Nm



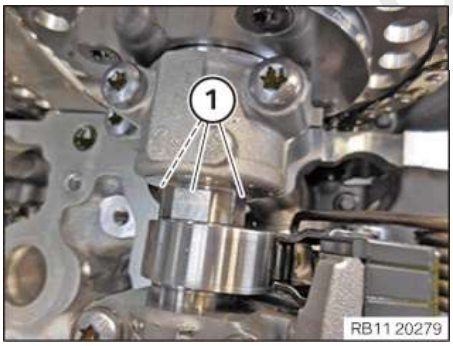
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



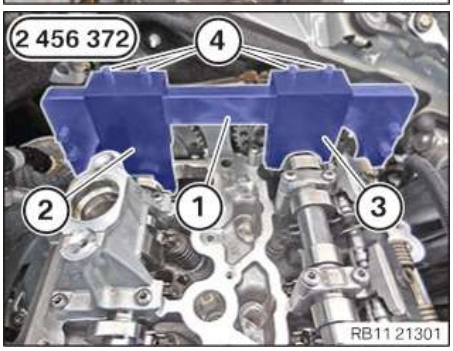
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



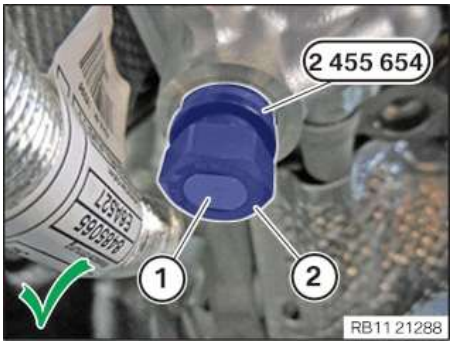
- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

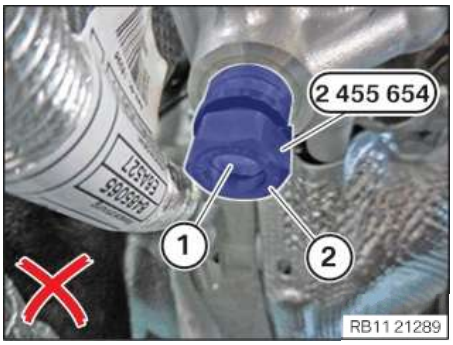
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40 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

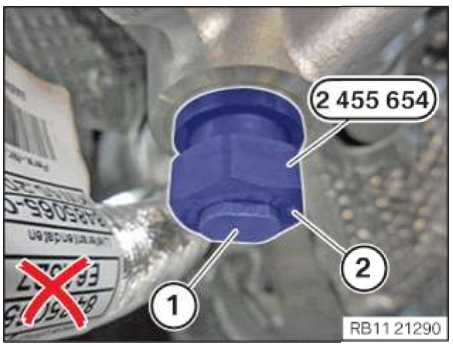
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

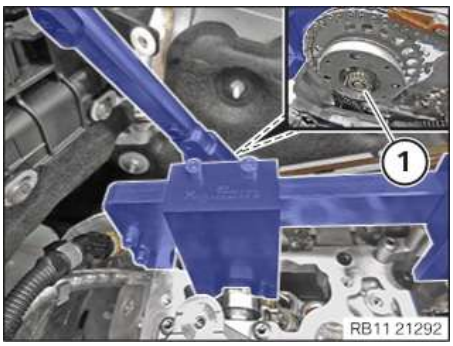
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

41 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

42 – Tightening the VANOS central valve of the intake adjuster

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- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



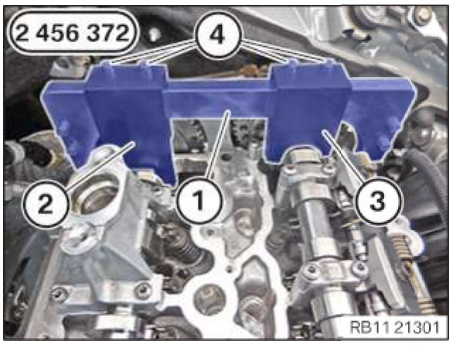
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

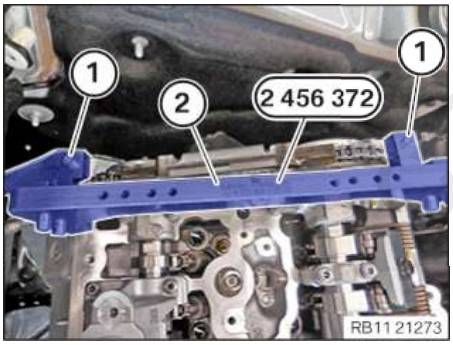
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

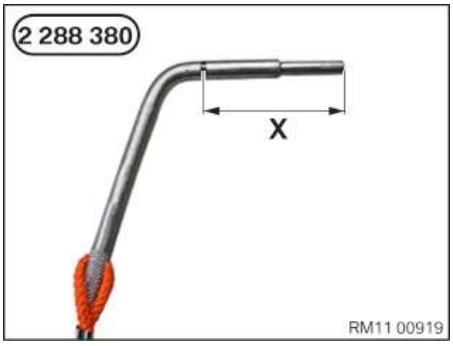
43 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

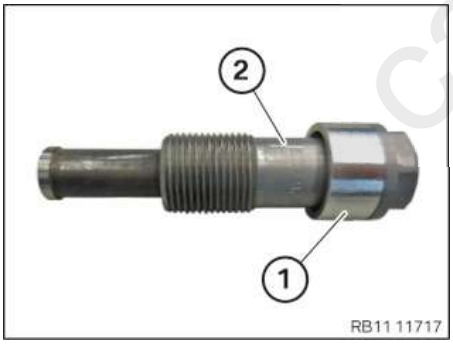
44 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



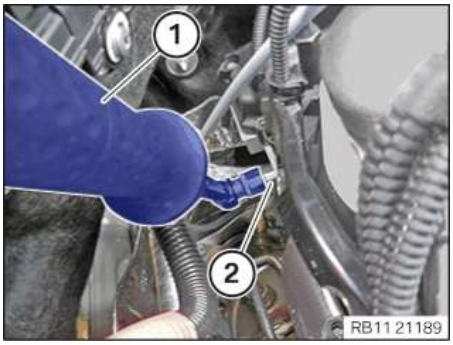
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

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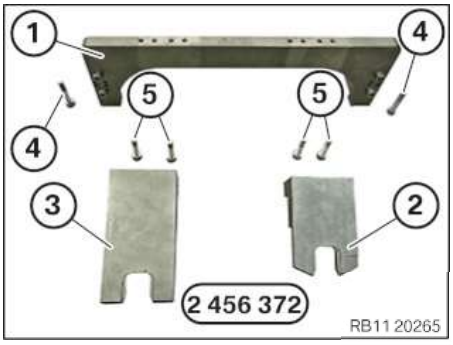


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

45 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



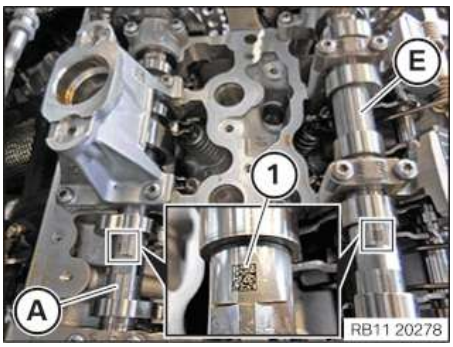
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

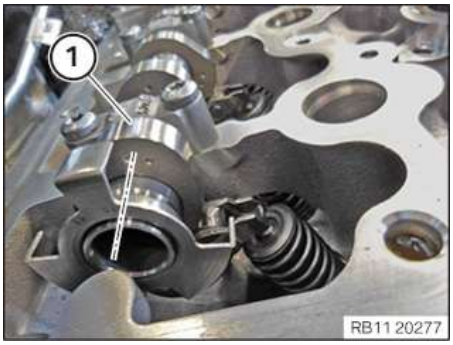
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

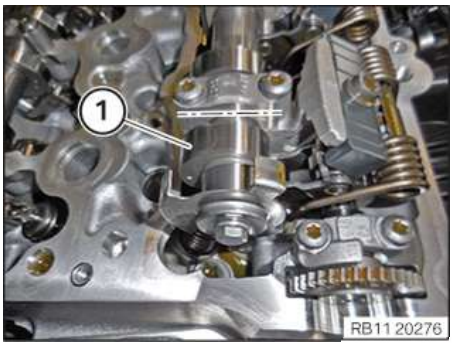


- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.

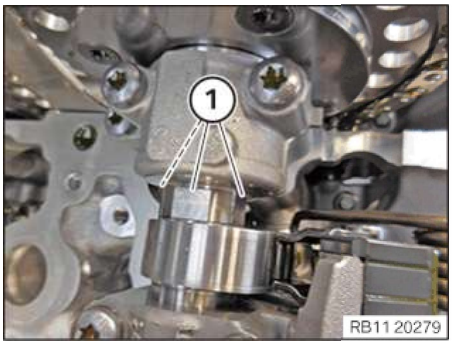
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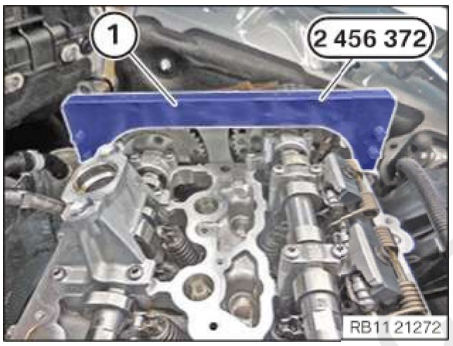
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



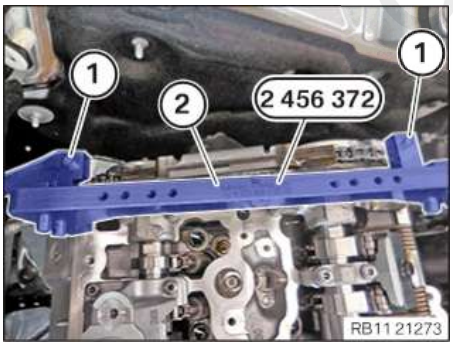
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



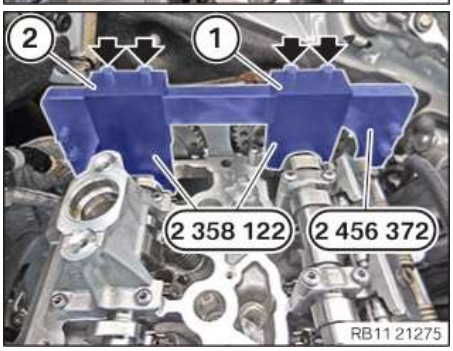
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

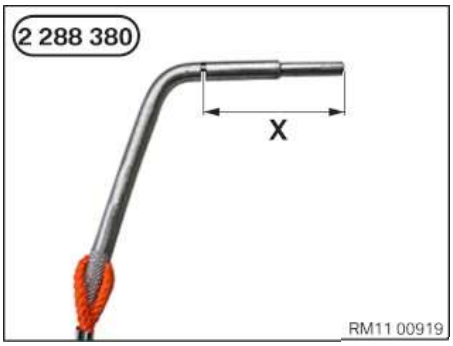
Test gauge to basic carrier

M6		Tightening torque	8 Nm

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- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

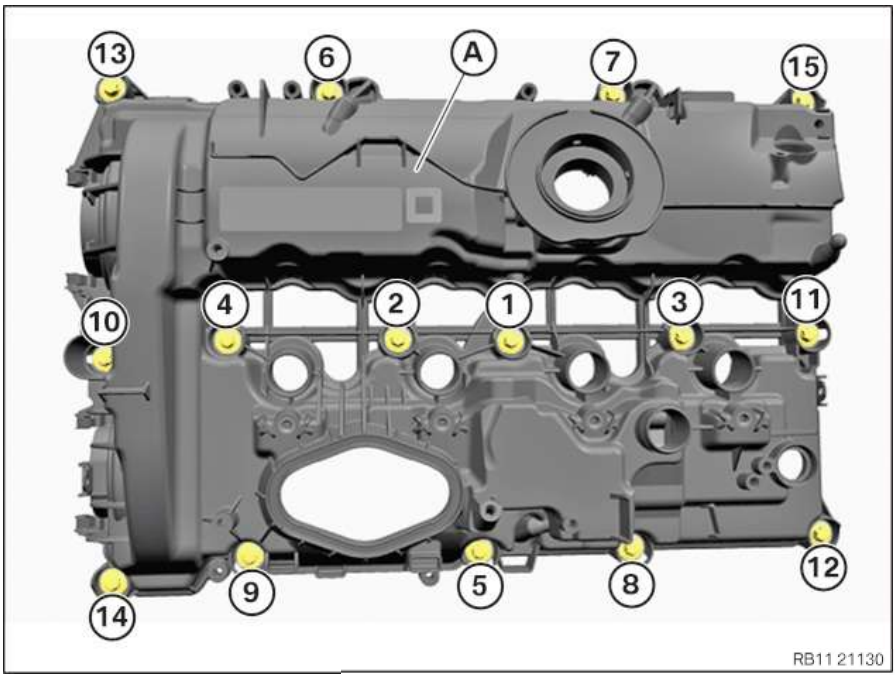
  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

46 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

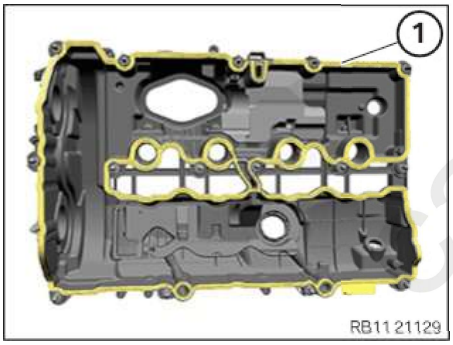
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

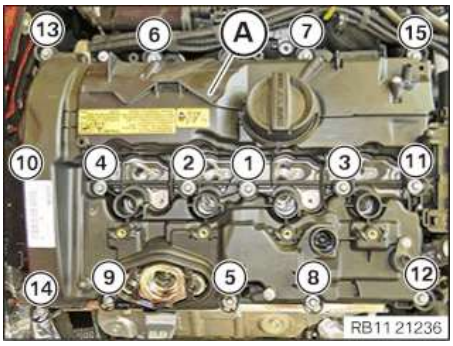
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

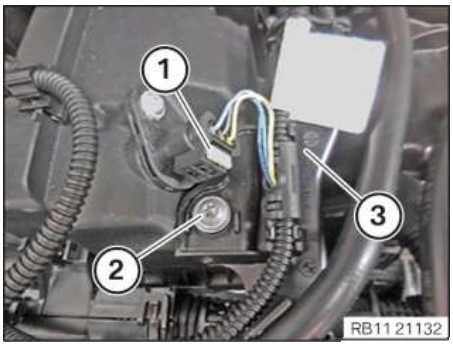
Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

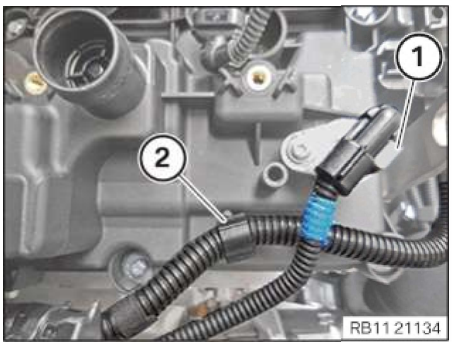


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

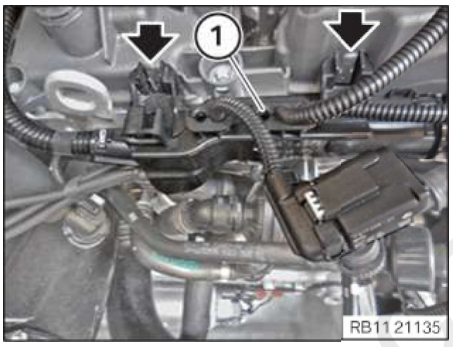
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

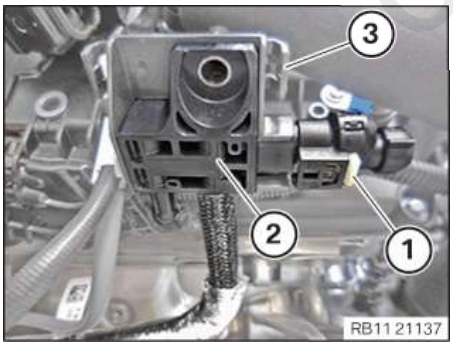
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

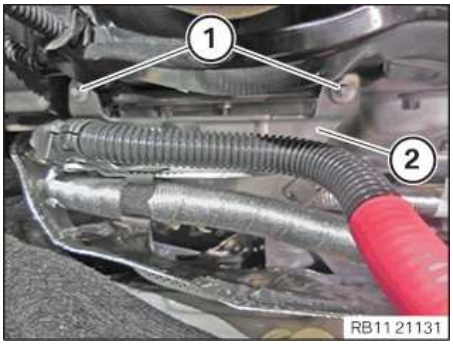


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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CAUTION

Improper routing of the positive battery cable.

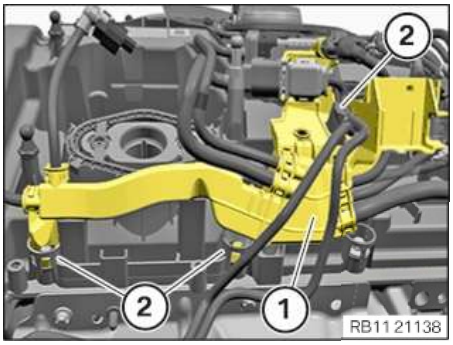
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

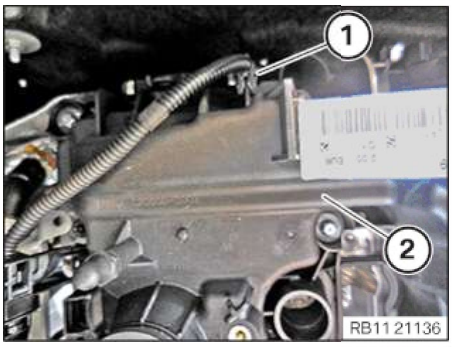
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

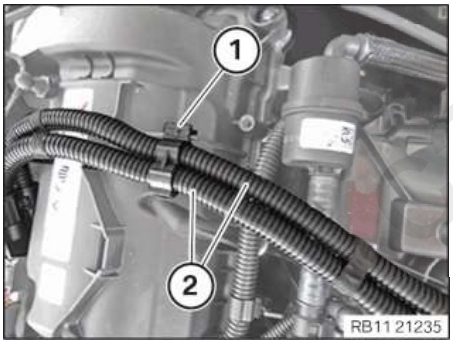
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

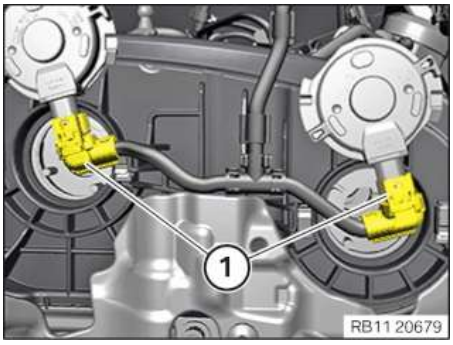


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

47 – Installing both actuators

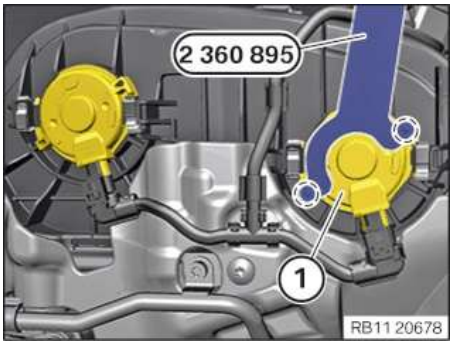


NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

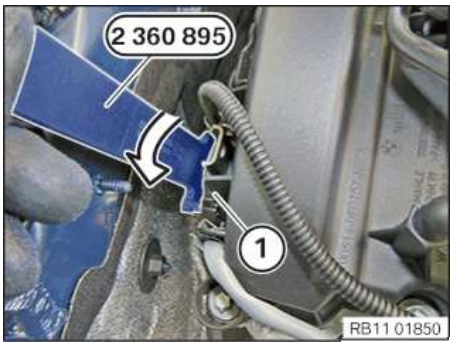
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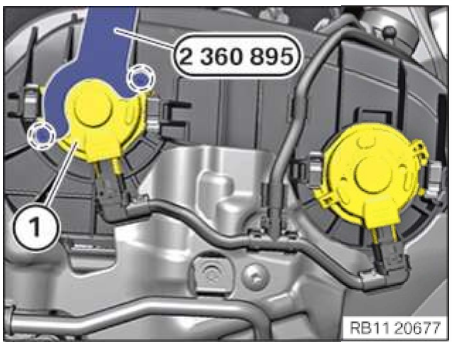
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



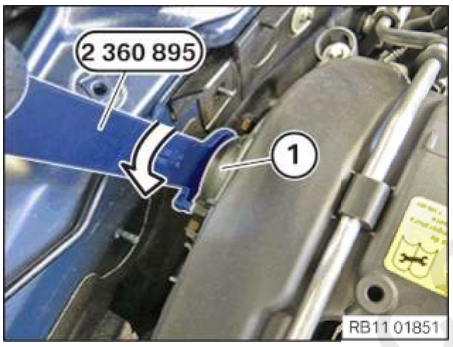
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

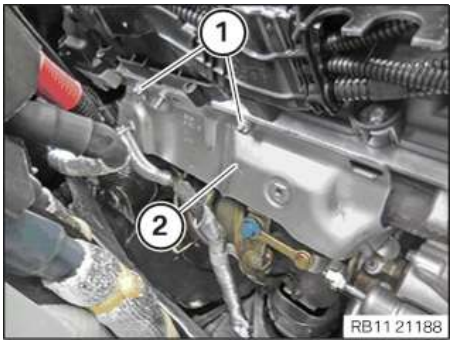
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

48 – Installing the heat shield on the cylinder head

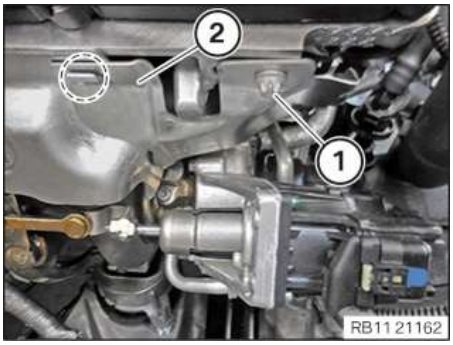


- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

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- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

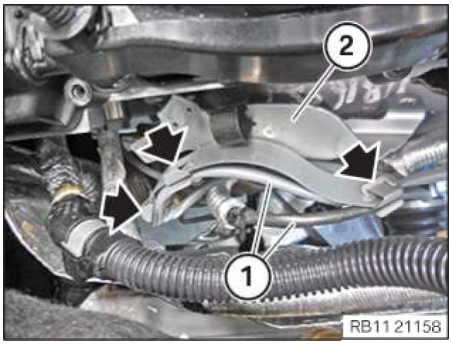


- Tighten down screw (1).

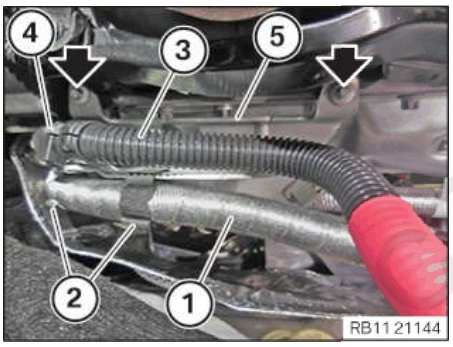
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

49 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

50 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

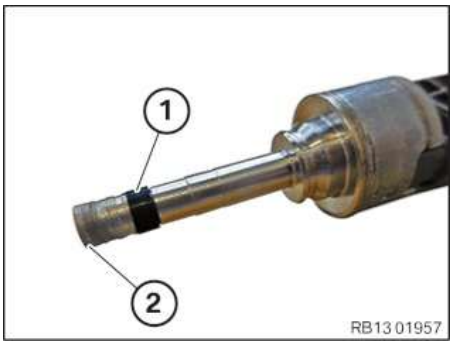
- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

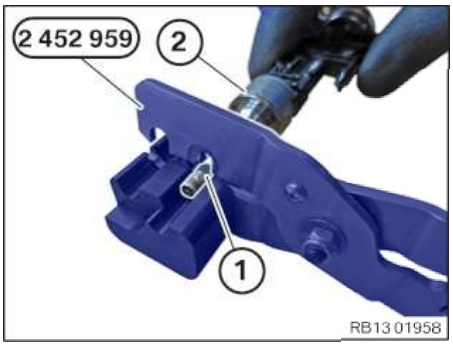
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

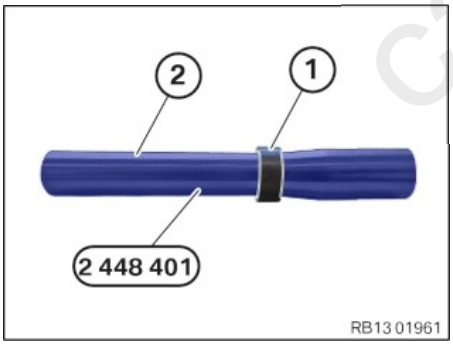


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

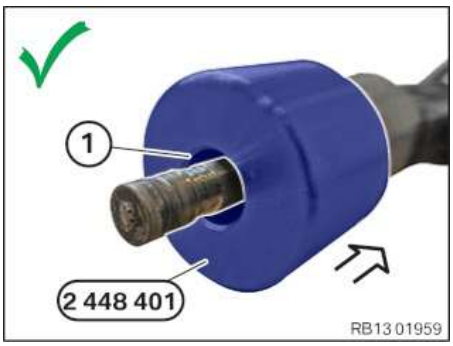
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

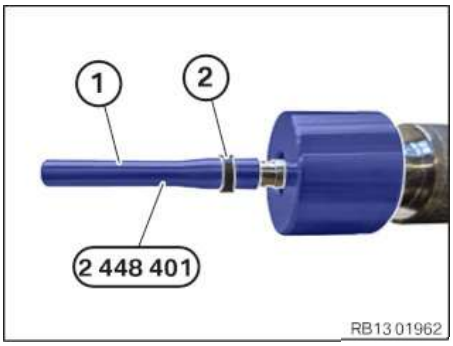
  The larger diameter of the assembly sleeve (1) must point to the injector tip.

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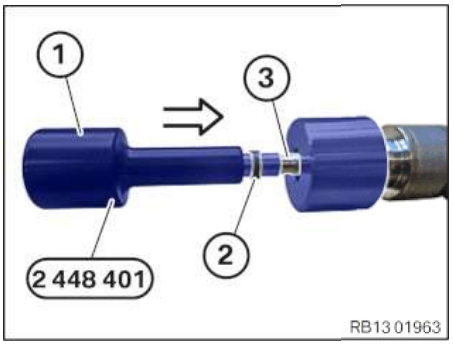


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

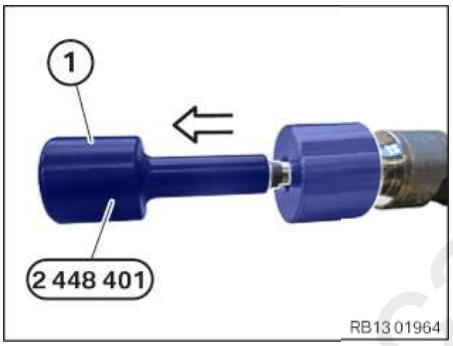
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



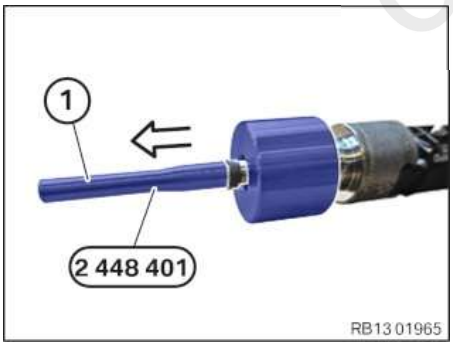
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



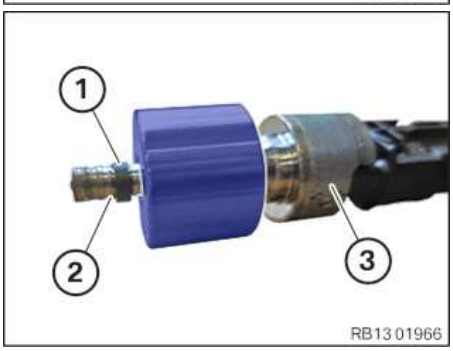
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

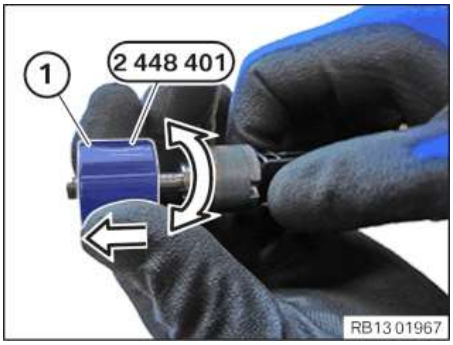


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



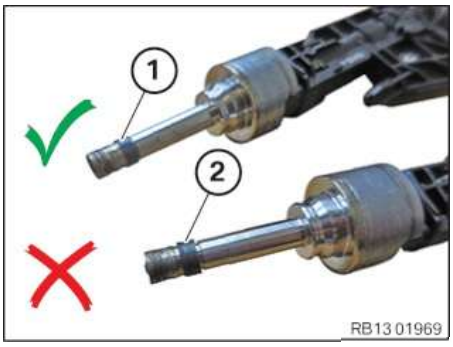
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

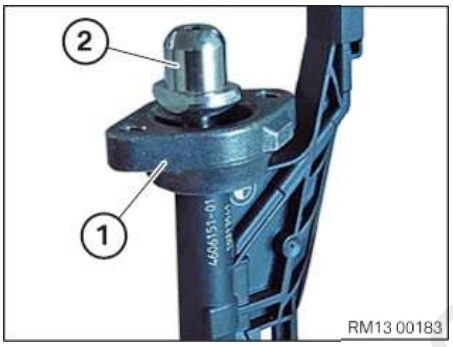


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

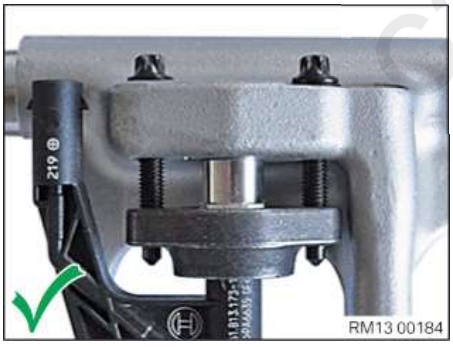
51 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

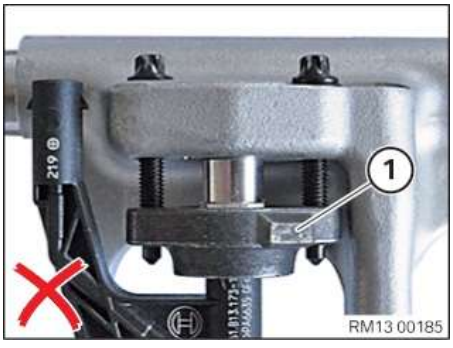


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

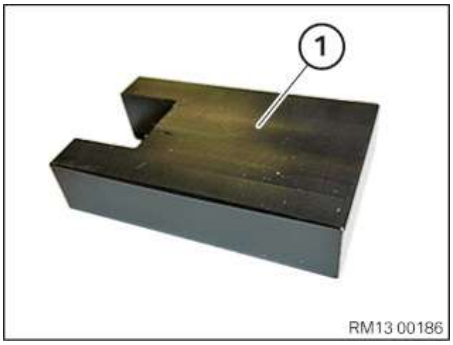
  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.

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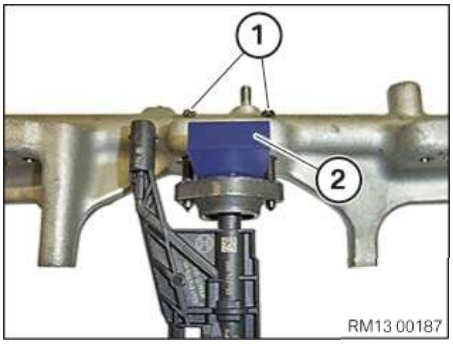
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)

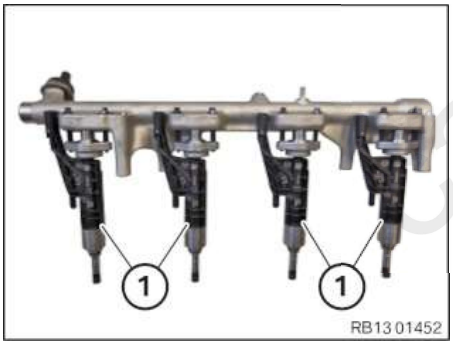
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.

- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



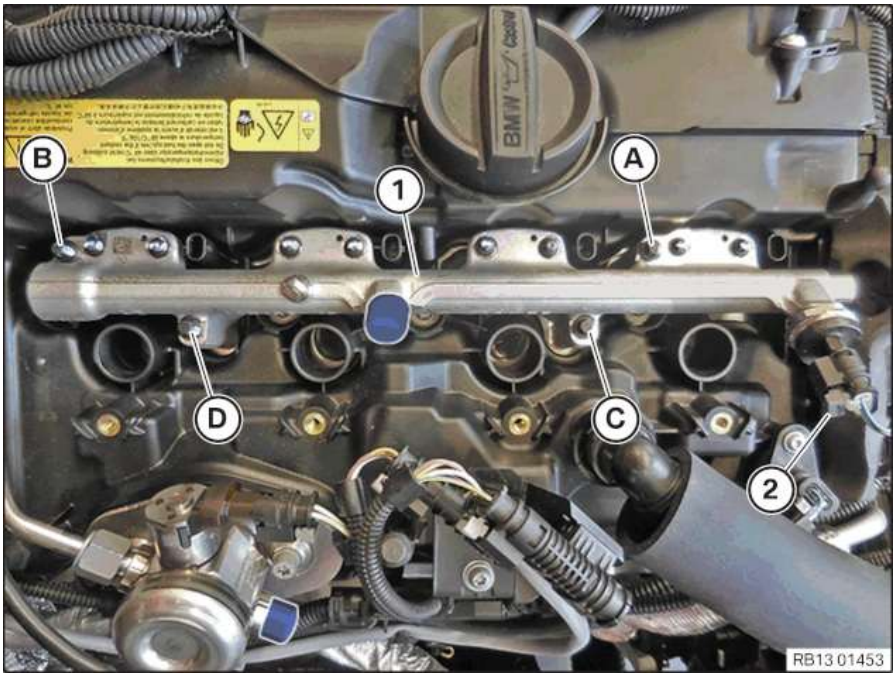
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

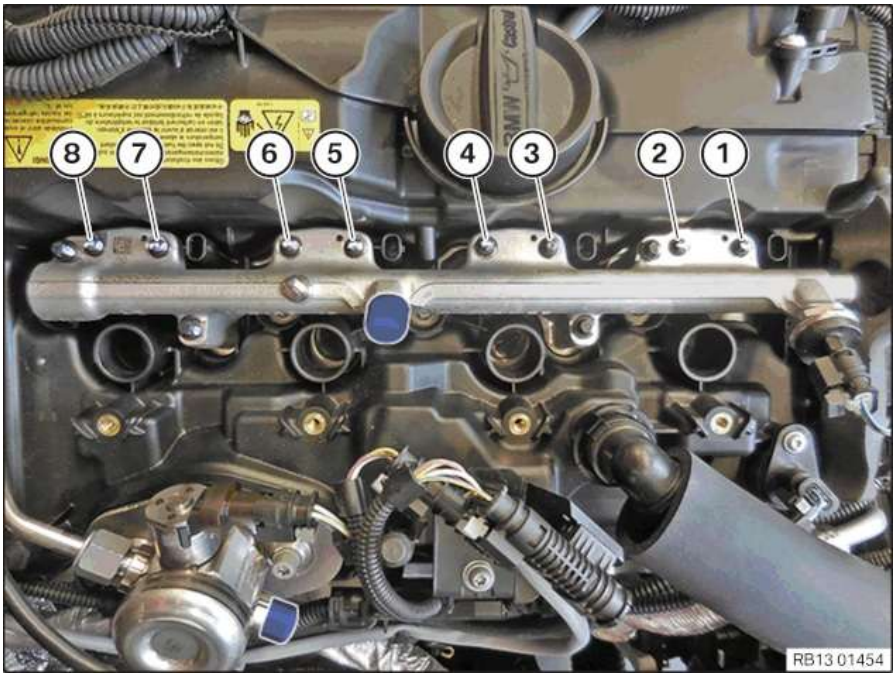
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

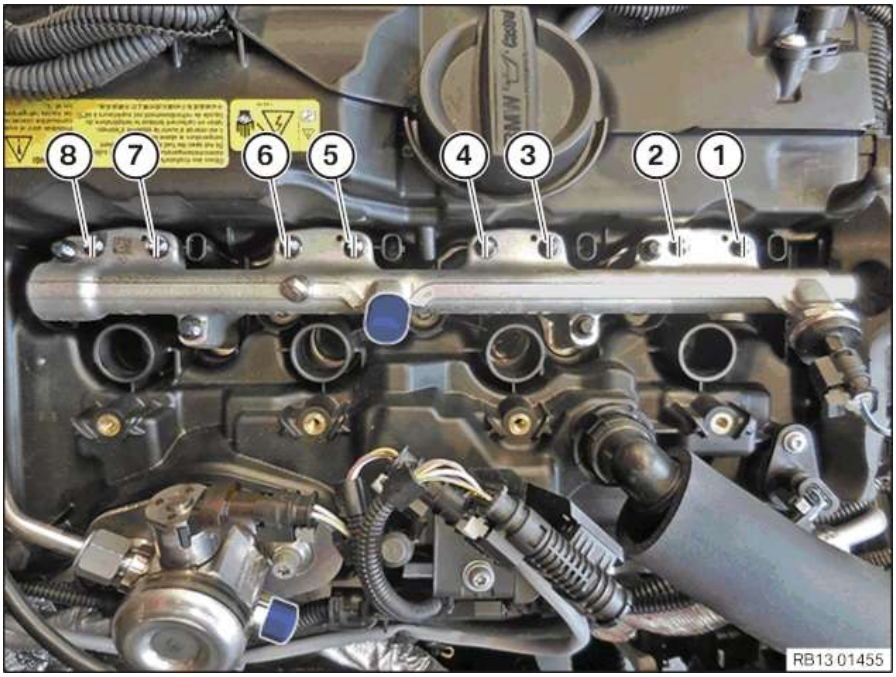
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

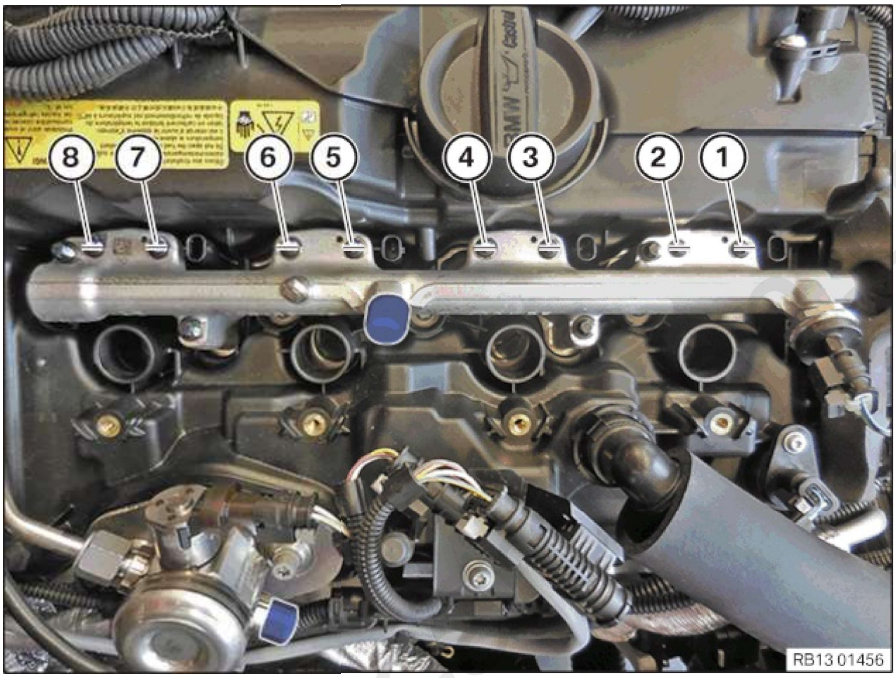
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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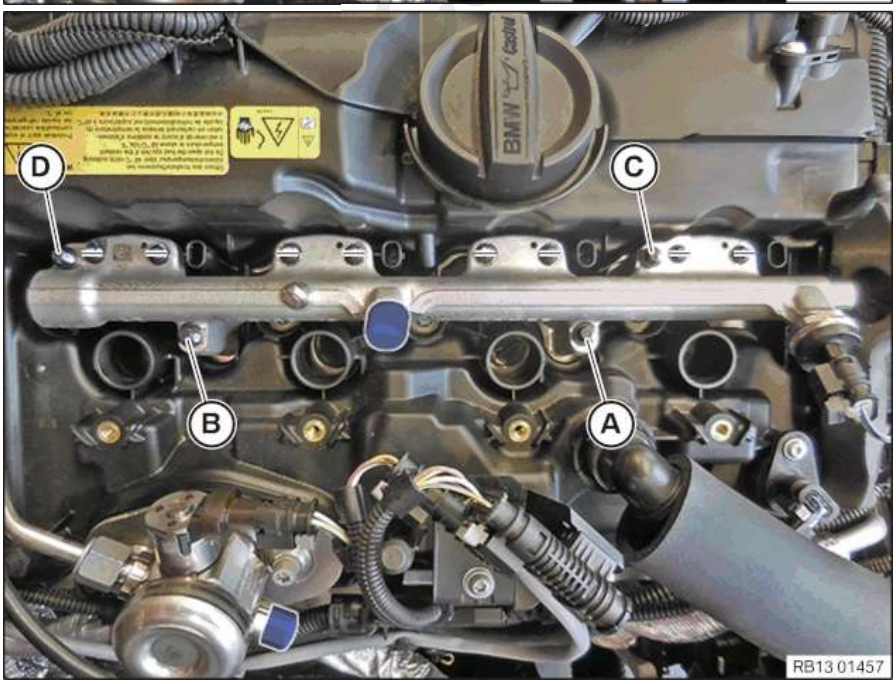


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

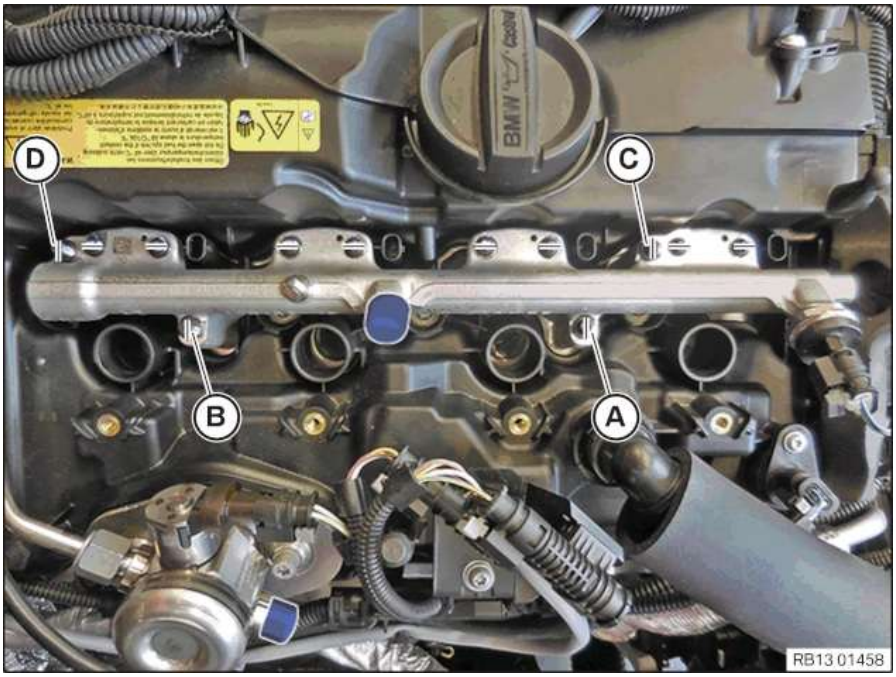
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

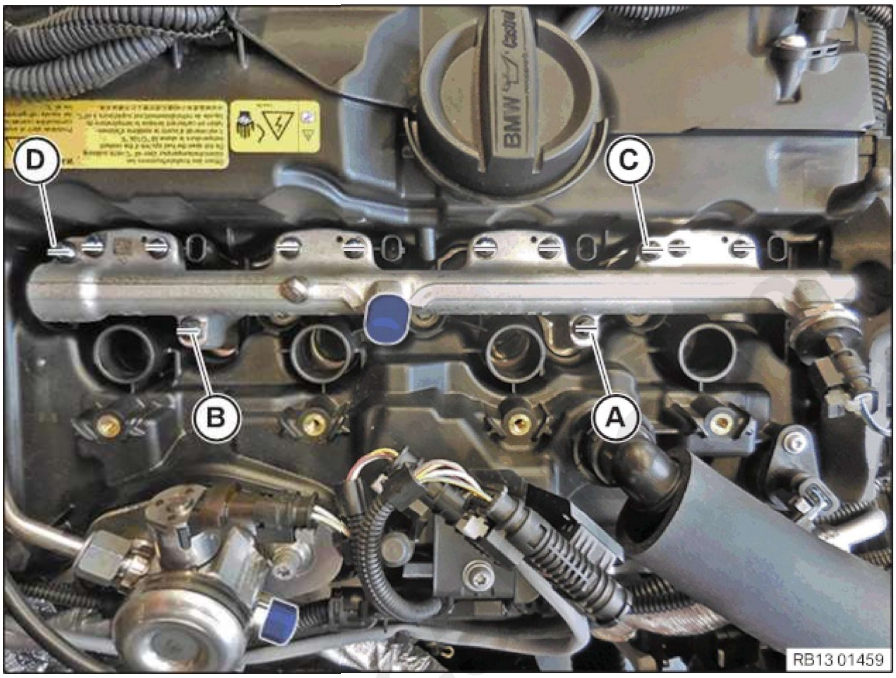
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

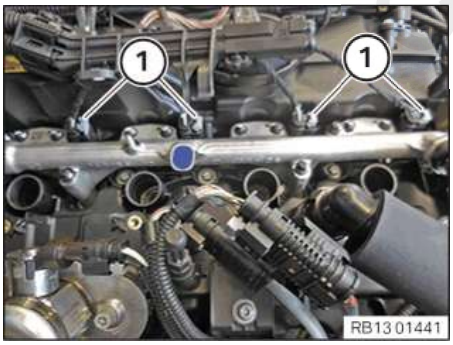


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



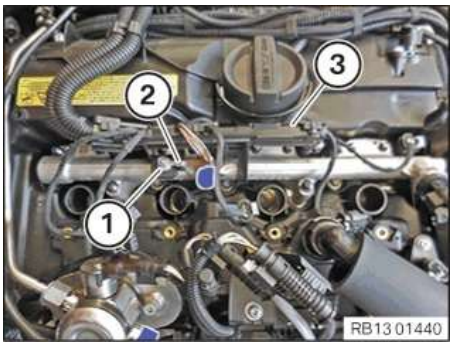
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

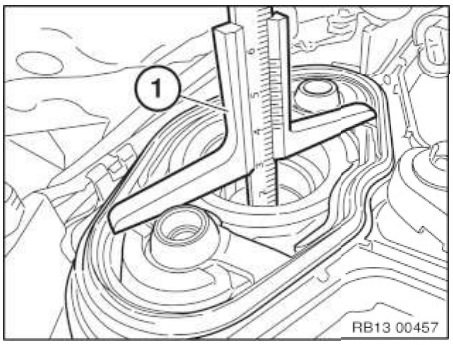
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

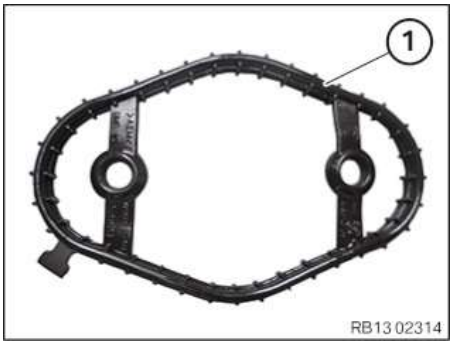
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

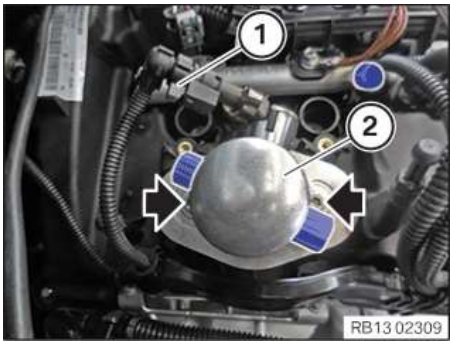
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

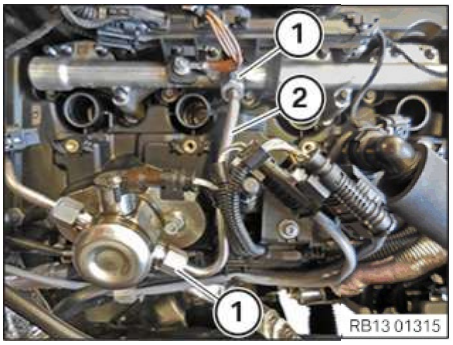
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

53 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

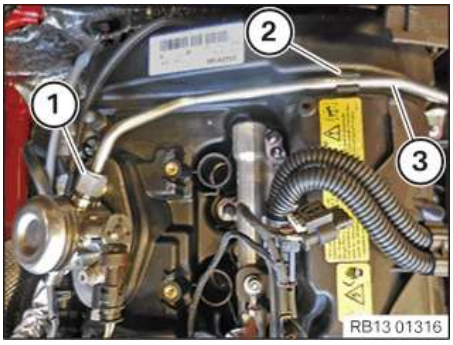
54 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

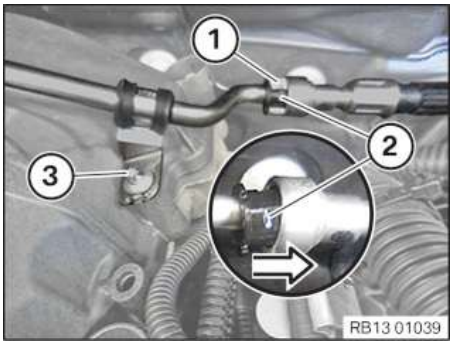


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

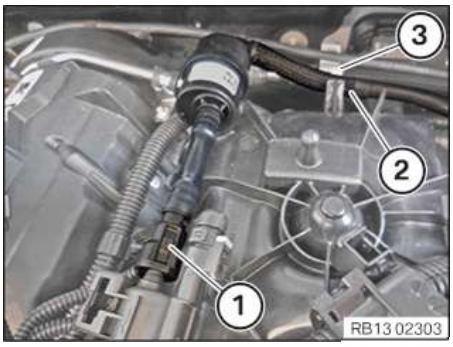
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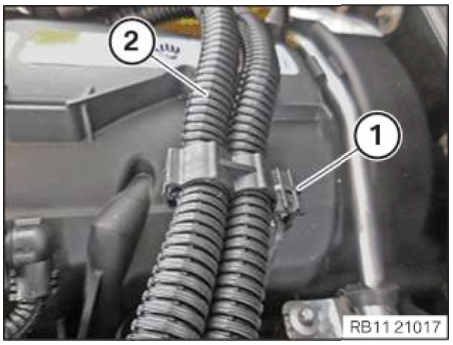
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

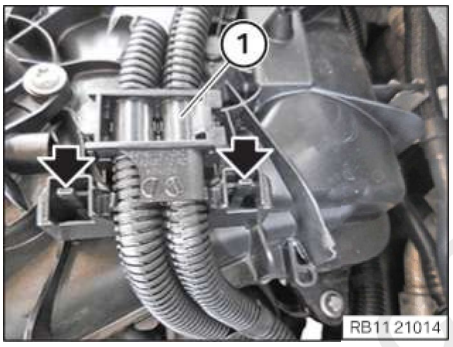
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

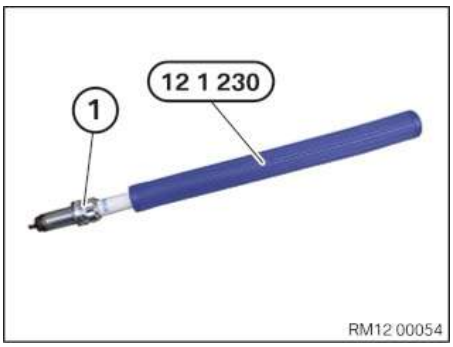


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

55 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

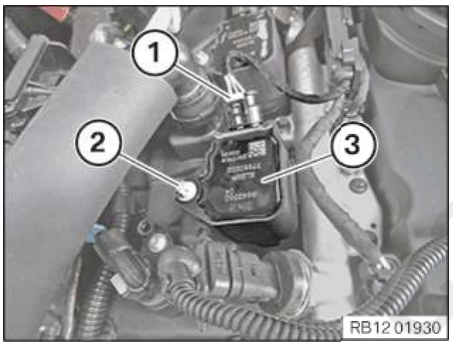
M12x1.25		Tightening torque	23 Nm

56 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



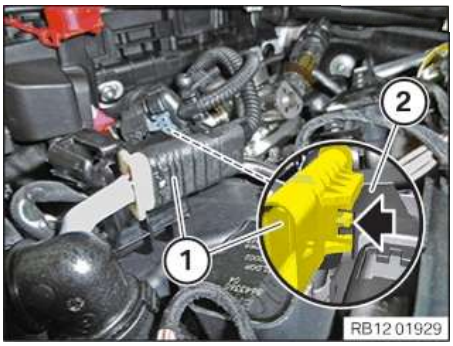
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

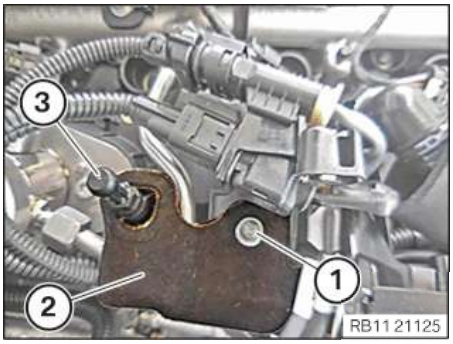
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

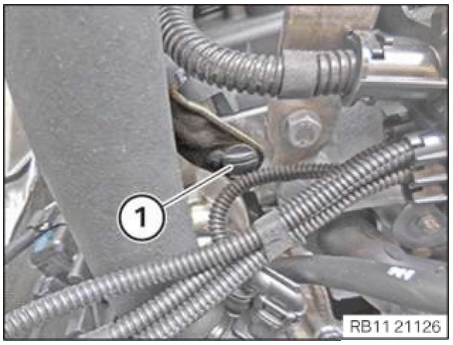
57 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

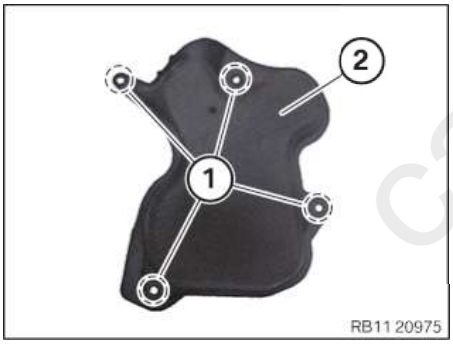
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



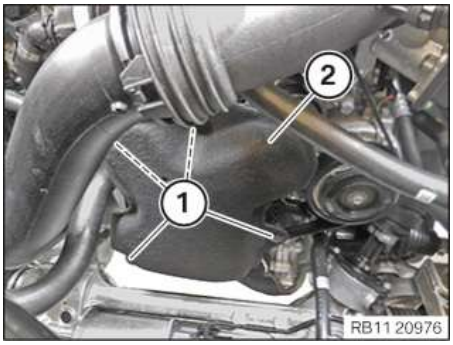
- Secure the clip (1).

58 – Install the acoustic cover for the engine at the front



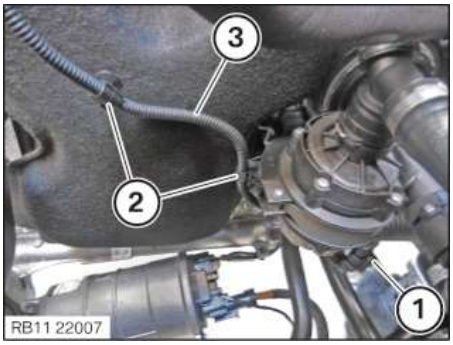
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



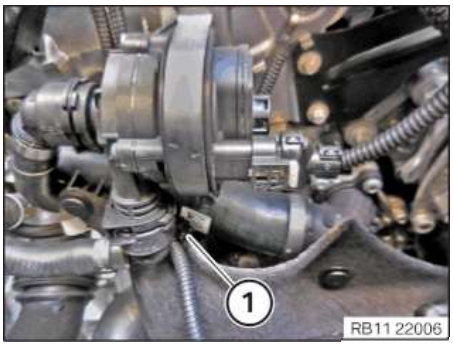
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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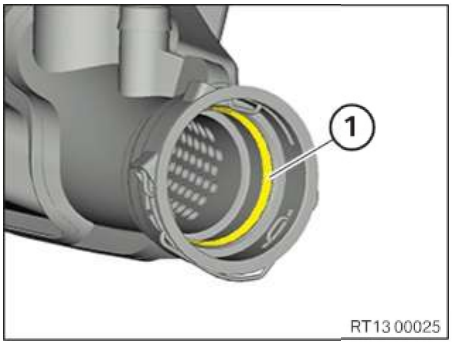
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

59 – Installing the clean air pipe with resonator

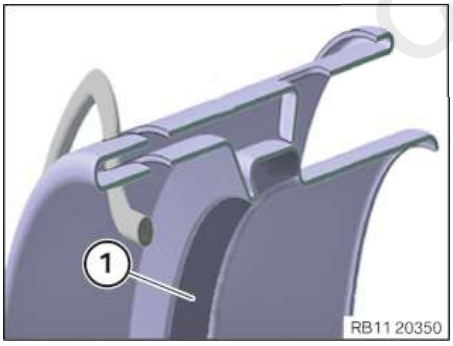


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

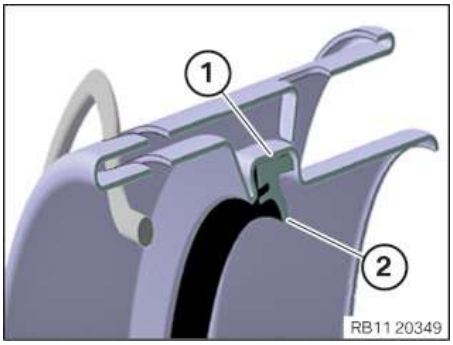
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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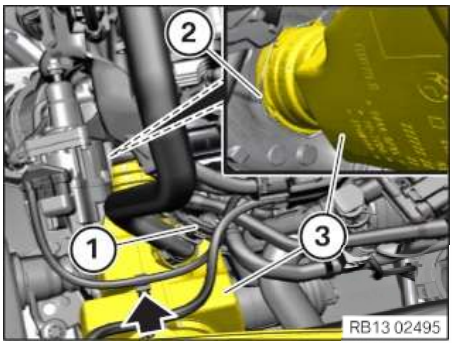
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

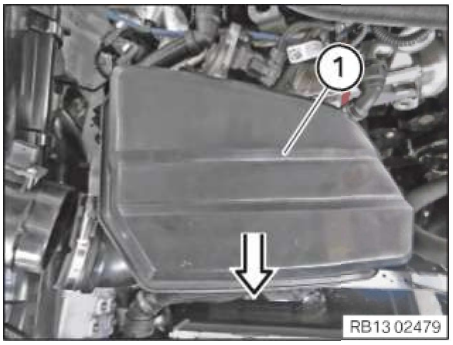
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



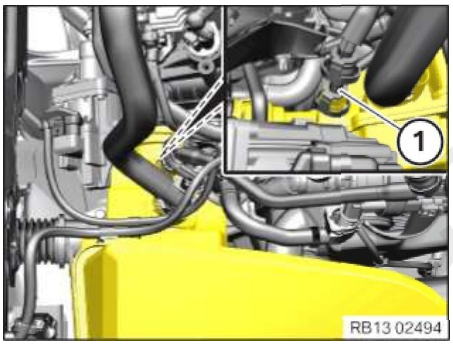
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

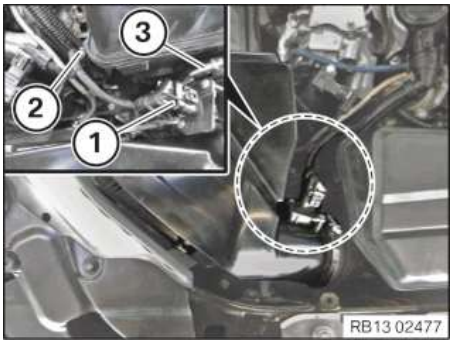
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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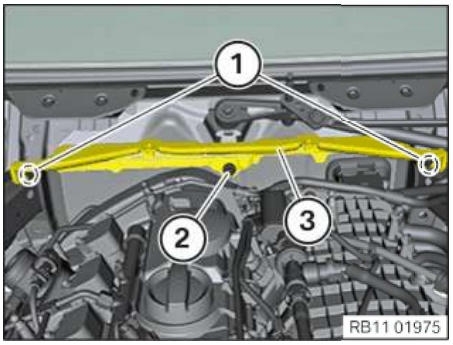
- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

60 – Disconnecting all battery earth leads



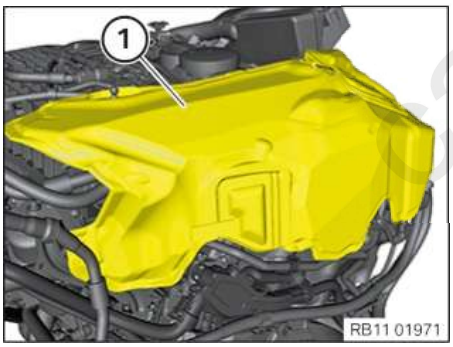
- See additional information.

61 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

62 – Installing acoustic cover at rear



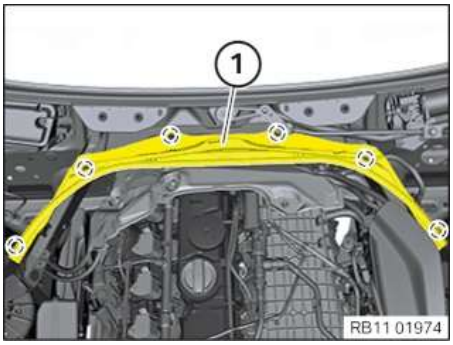
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

63 – Installing the centre bulkhead upper part

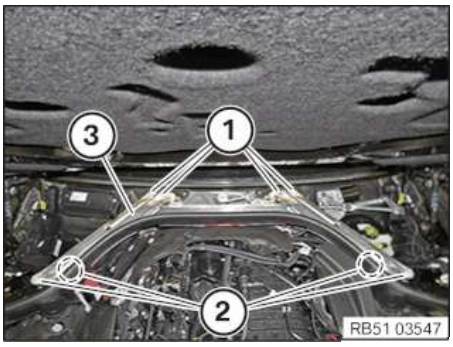
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- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

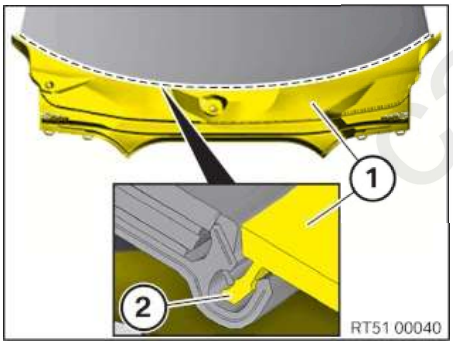
64 – Installing cowl panel cover

RISK OF DAMAGE

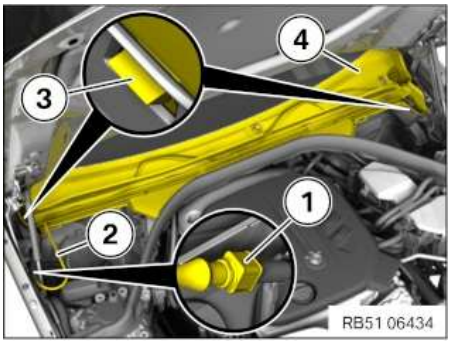
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

65 – Installing both wiper arms

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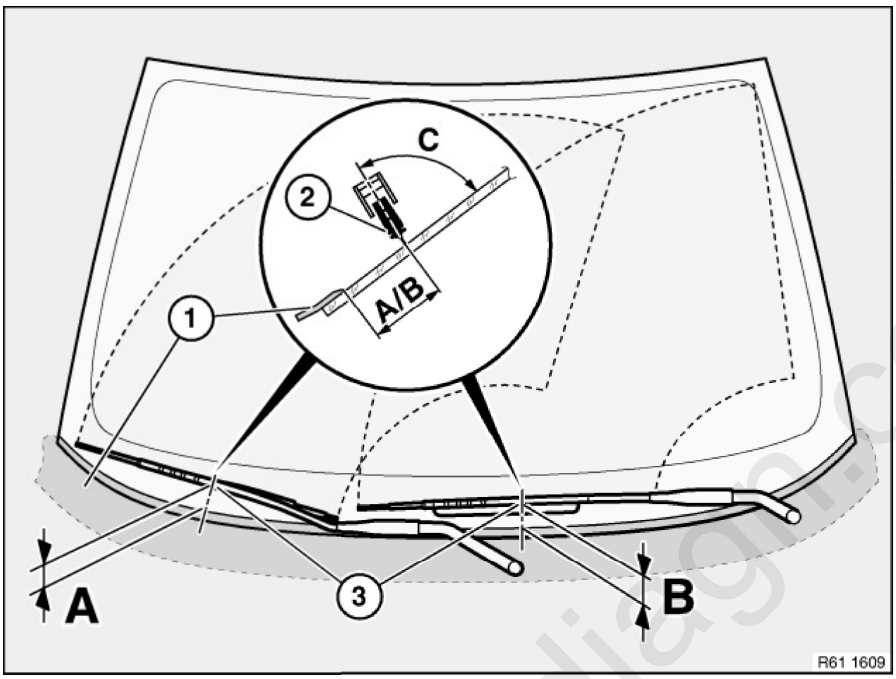
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

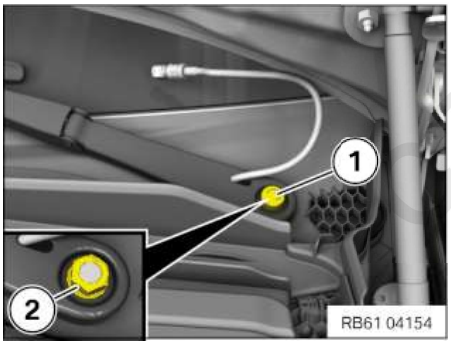
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

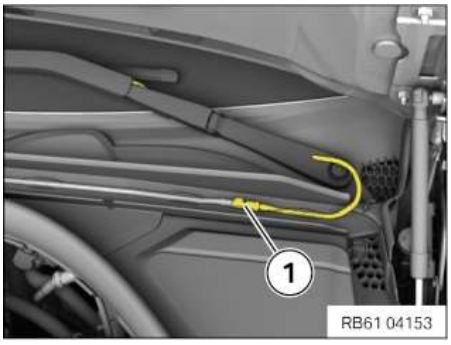


- Tighten nut (2).

Windscreen wiper arm

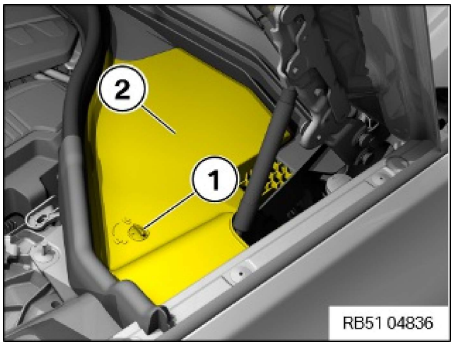
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



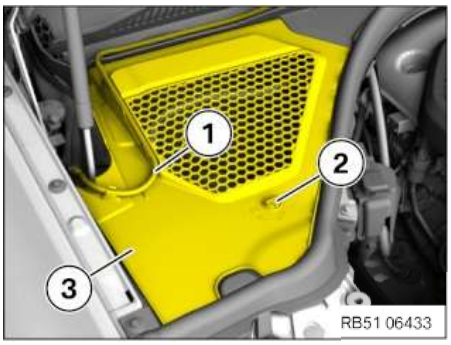
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

66 – Install the cover of the engine compartment on the rear left



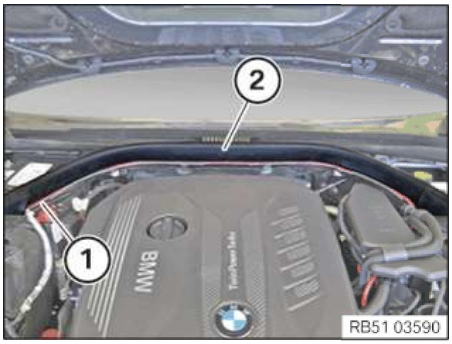
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

67 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

68 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

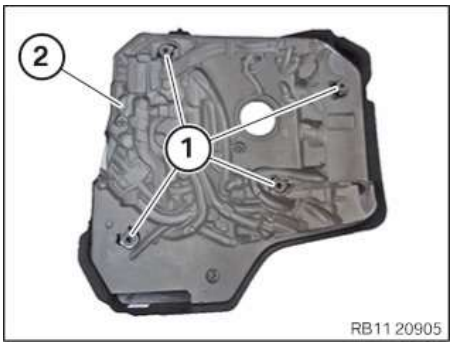
69 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

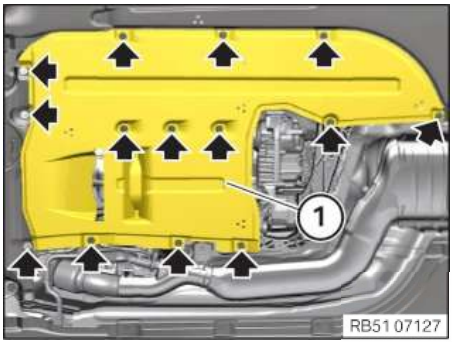
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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

70 – Installing underbody protection at rear



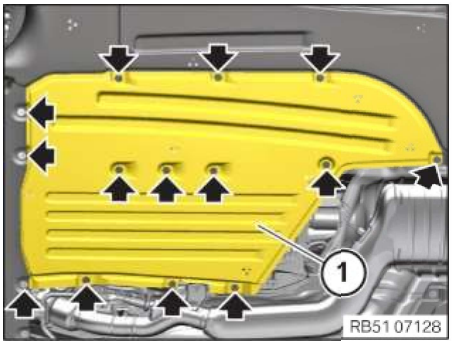
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

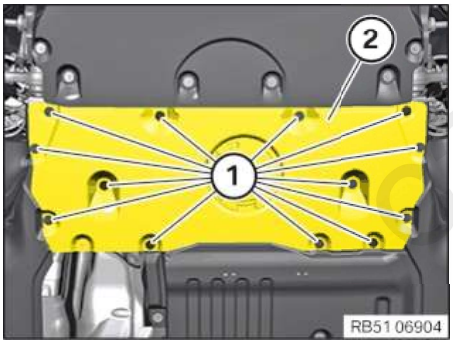
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

71 – Installing the centre underbody protection



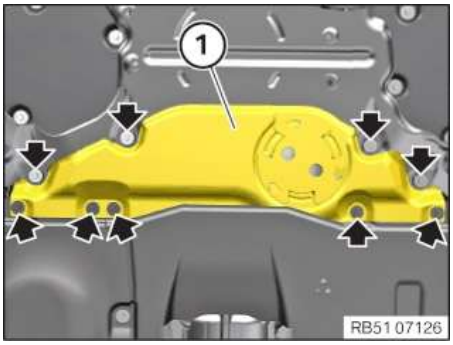
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

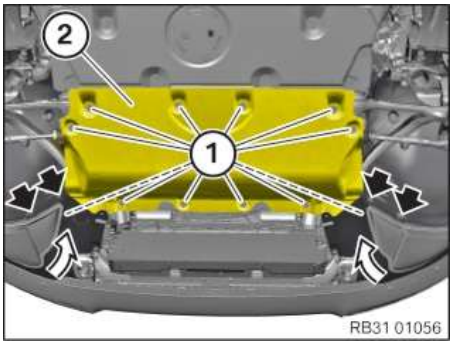
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

72 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

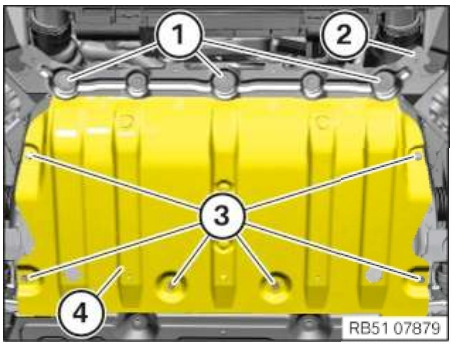
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

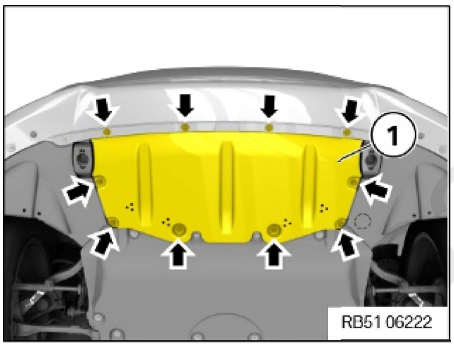
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

73 – Installing the front underbody protection



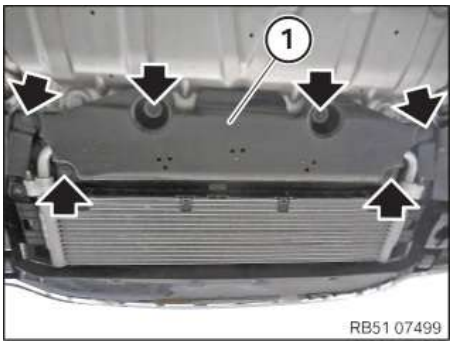
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



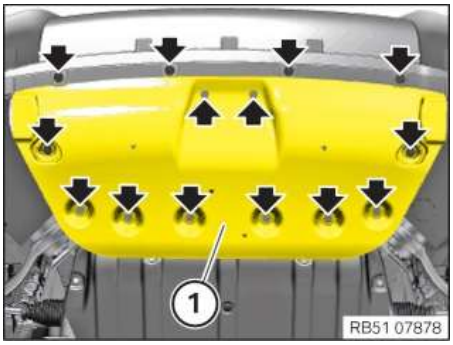
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

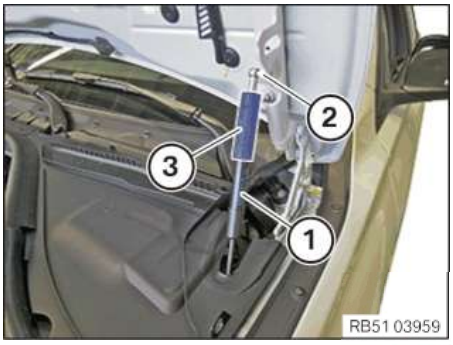
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

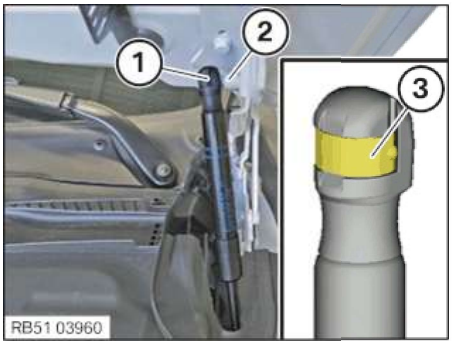
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

74 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head — Used in step 293945

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 293945

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4142

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 44

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Cylinder head cover to cylinder head — Used in step 46

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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Wiring harness section of engine to cylinder head cover — Used in step 46

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 4649

6X18		Tightening torque	6 Nm

Heat shield to cylinder head — Used in step 48

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 48

M6 x 12		Tightening torque	8 Nm

Ground cable to rail — Used in step 51

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 52

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 53

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 54

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 54

M6 screw		Tightening torque	6,5 Nm

Spark plugs — Used in step 55

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 56

Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover — Used in step 57

TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 59

Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead — Used in step 63

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 63

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 63

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 65

Combination hexagon nut		Tightening torque	35 Nm

Underbody protection — Used in step 7071

Hexagon screw		Tightening torque	3 Nm

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Underbody protection of the steering gear Used in step 72

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) Used in step 72

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support Used in step 72

M10		Tightening torque	56 Nm

Underbody protection front Used in step 73

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

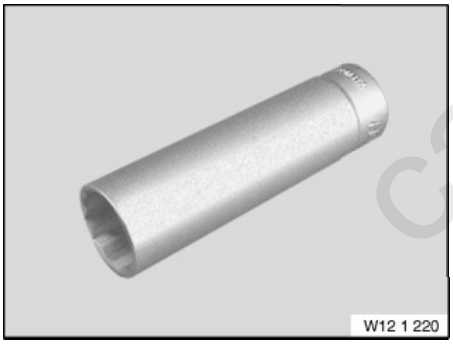
2 360 895 Pin wrench



Common Used in step 1247

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

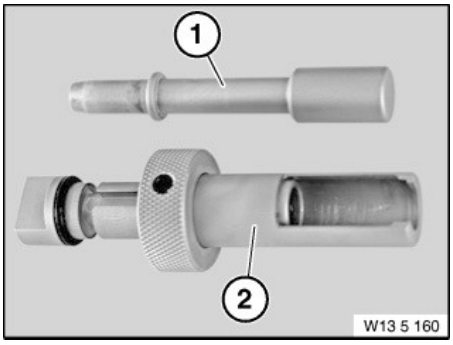
0 495 560 (12 1 220) Socket



Common Used in step 1655

Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 496 567 (13 5 161) Fastener

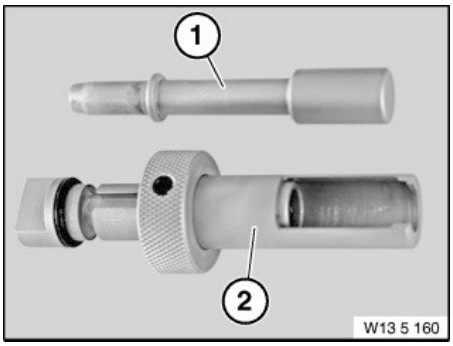


Common Used in step 19

Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

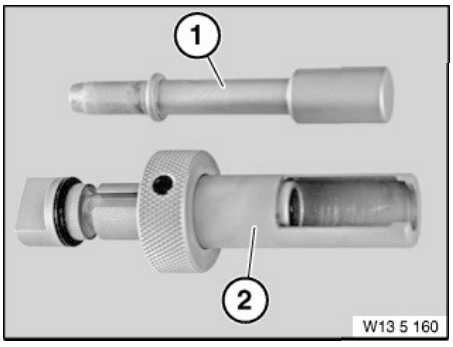
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0 496 568 (13 5 162) Fastener



Common	Used in step 19
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener

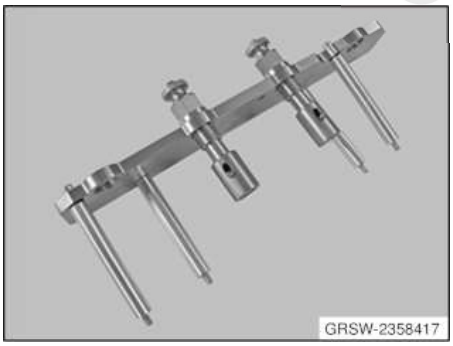


Common	Used in step 19
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

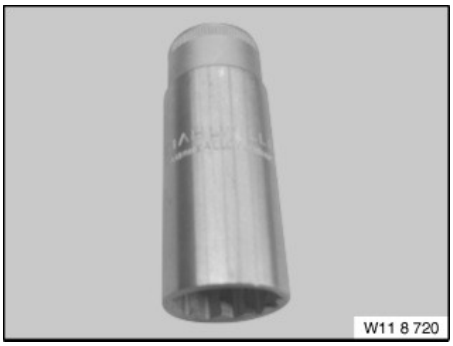
2 358 417 Device



Common	Used in step 20
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

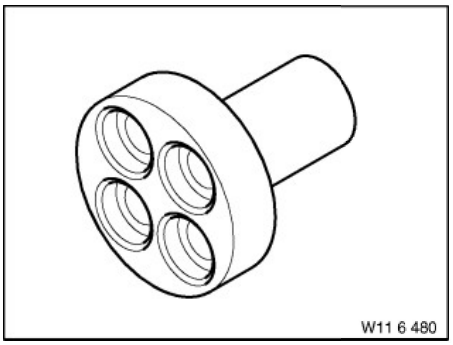
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0 496 106 (11 8 720) Socket WAF 46



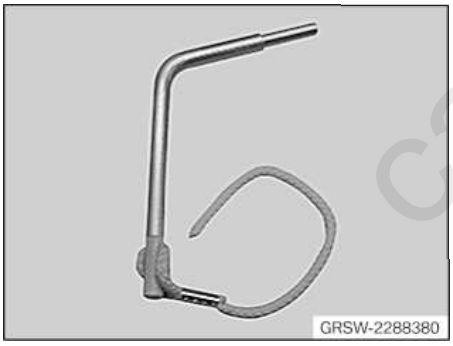
Common	Used in step 20
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 493 380 (11 6 480) Connector



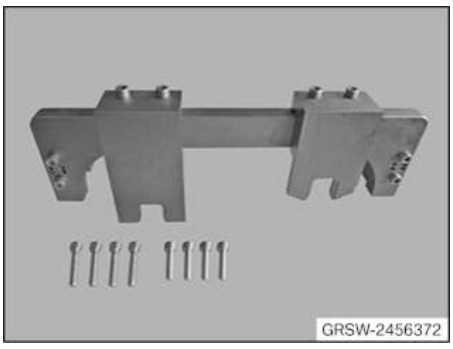
Common	Used in step 29434552
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 294345
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 2938394345
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 358 122 Gauge



Common Used in step 293845

Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



Common Used in step 31364142

Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common Used in step 31364142

Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

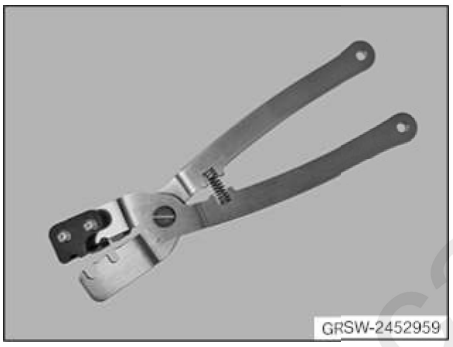
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2 455 654 Tensioning tool



Common	Used in step 4043
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 50
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 448 401 Fitting aid



Common	Used in step 50
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

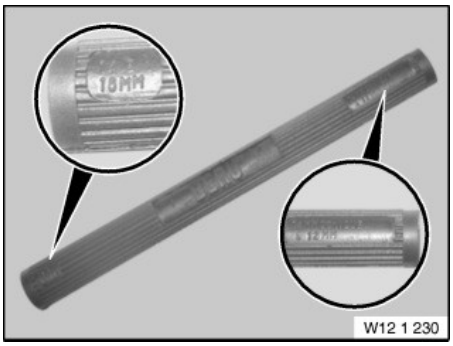
2 358 022 Gauge



Common	Used in step 51
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 065 (12 1 230) Fitting aid



Common	Used in step 55
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 65
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	160
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	160
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
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61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 35 ... Notes on ESD protection (Electro Static Discharge)	12
61 35 ... Notes on ESD protection (Electro Static Discharge)	121520
13 53 ... Clean the cylinder head around the injectors due to grit / dust	20
61 13 ... Unlocking and disconnecting different plug connections	202446

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11 36 658 Removing and installing / replacing both actuators

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

PRELIMINARY WORK

1 – Bring front compartment lid in the service position

Prerequisite

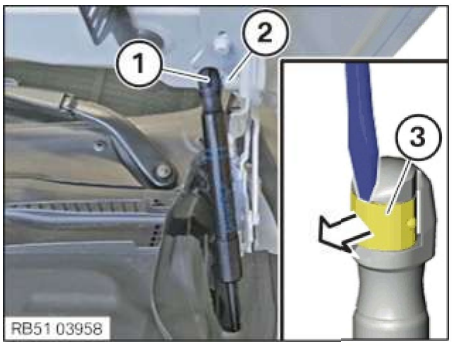
Engine compartment lid is open.

CAUTION

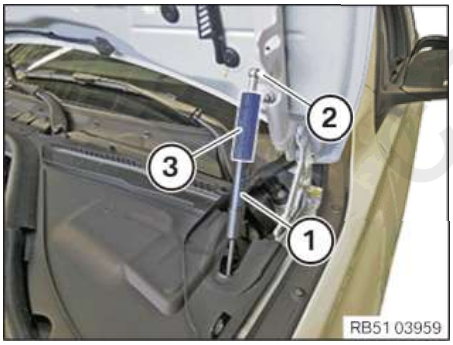
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

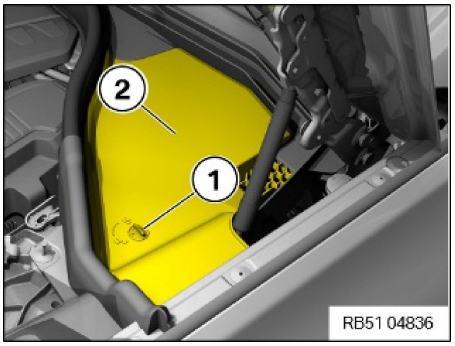
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

2 – Remove the seal for the rear bonnet



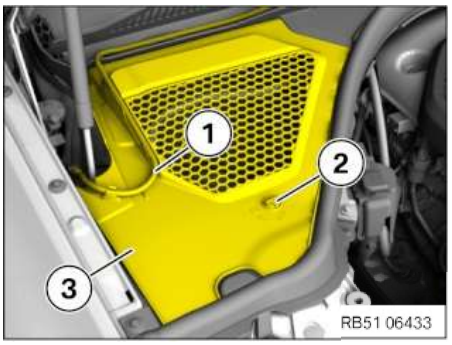
- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

3 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

4 – Remove the cover of the rear right engine compartment



- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

5 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

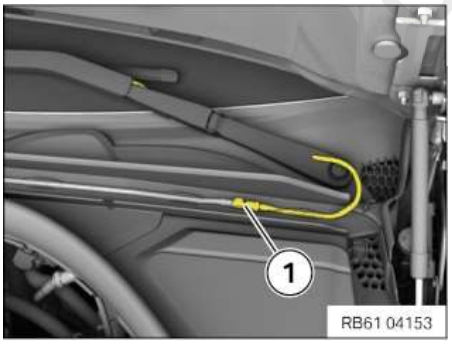
▸ **Remove the wiper arm**

RISK OF DAMAGE

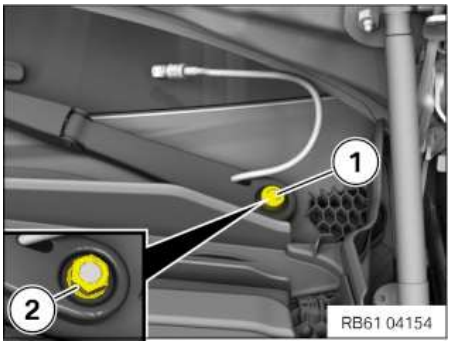
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.

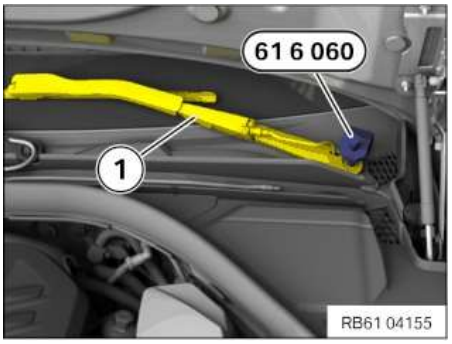


- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



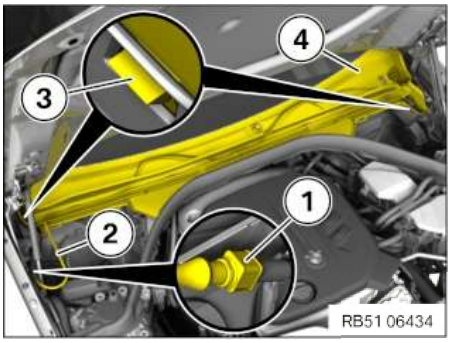
- Remove the protective cap (1).
- Loosen nut (2).

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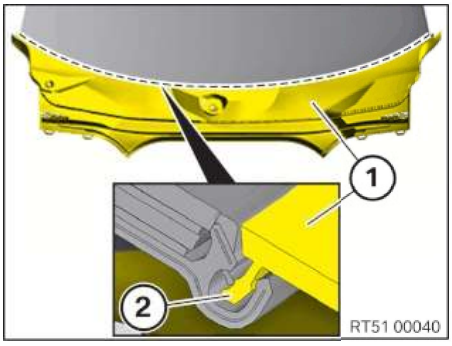


- Pull off the wiper arm (1) using special tool .

6 – Remove cowl panel cover



- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).



- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

7 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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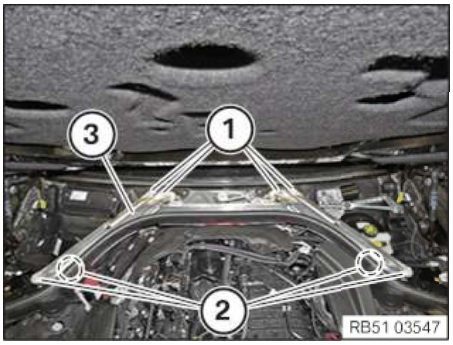


- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

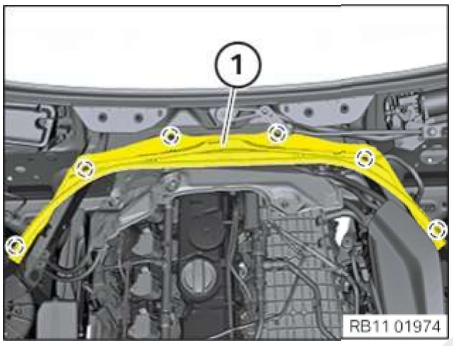
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



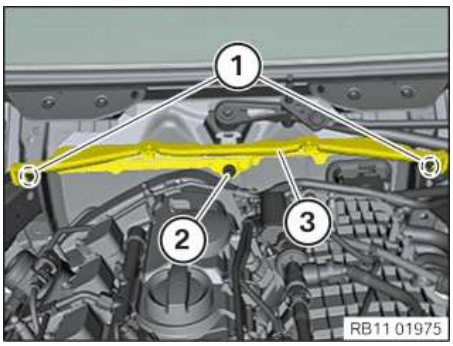
- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

10 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

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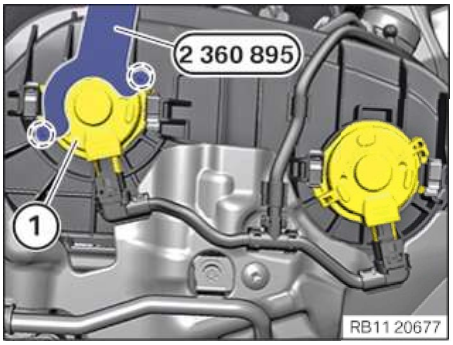
11 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

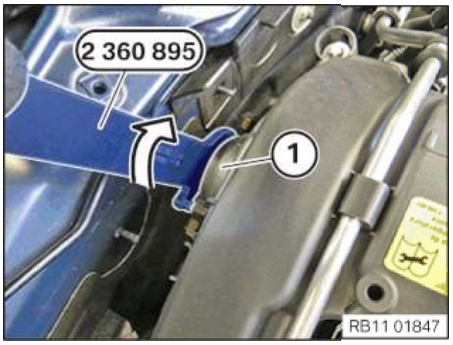
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



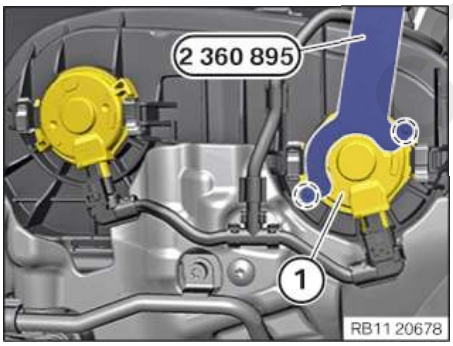
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



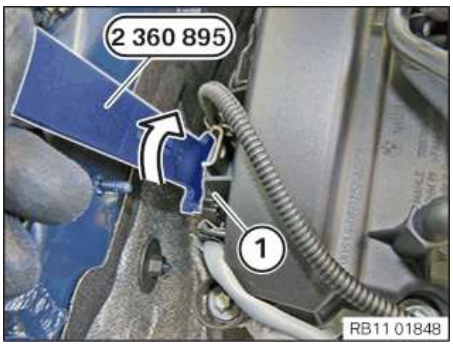
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



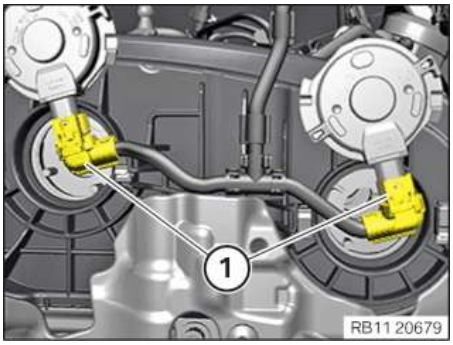
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.

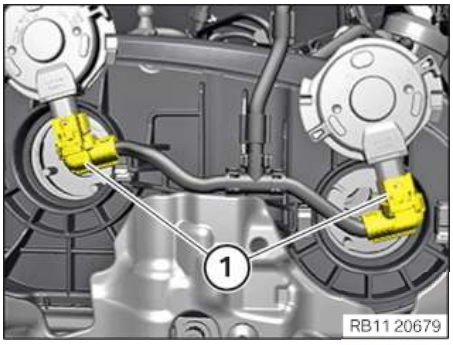


NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

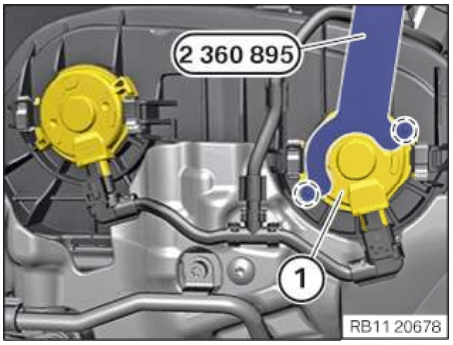
12 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

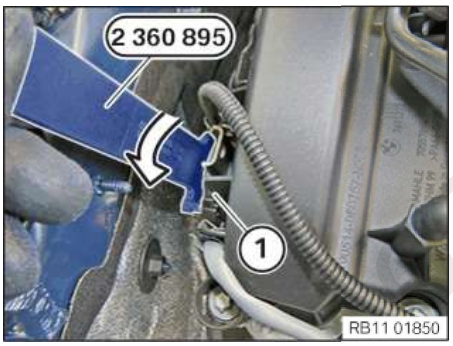
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



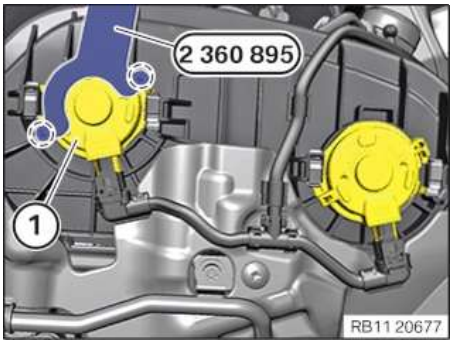
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

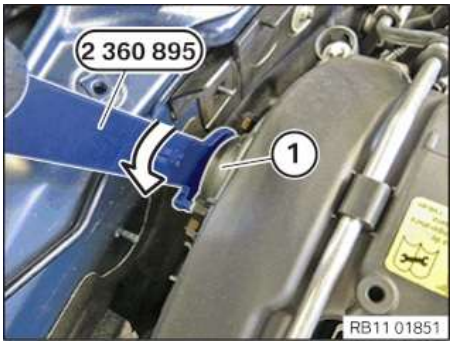


NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.

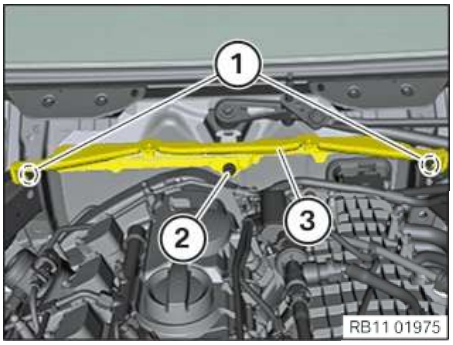
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- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

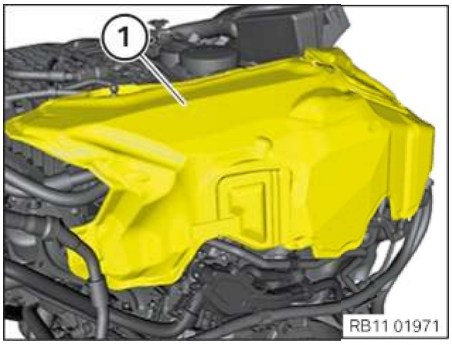
POSTPROCESSES

13 – Installing centre bulkhead lower section

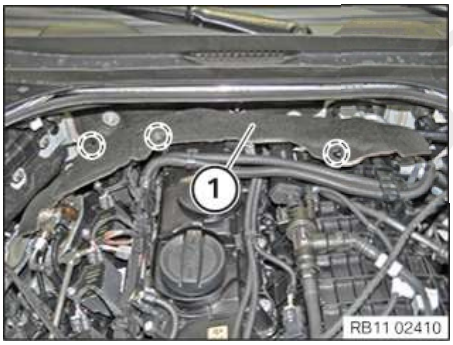


- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

14 – Installing acoustic cover at rear

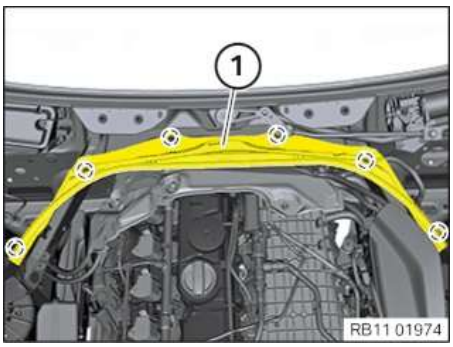


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

15 – Installing the centre bulkhead upper part

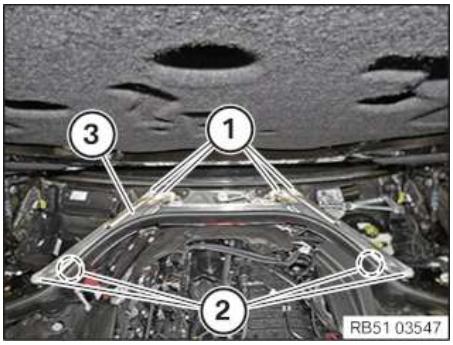


- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

	Tightening torque	3 Nm

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- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

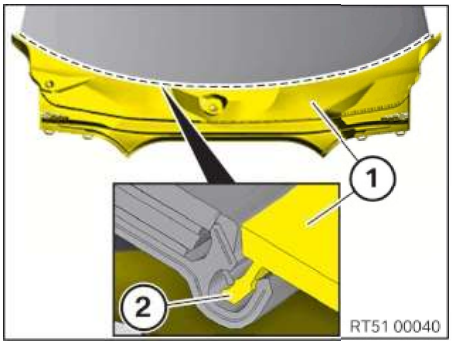
16 – Installing cowl panel cover

RISK OF DAMAGE

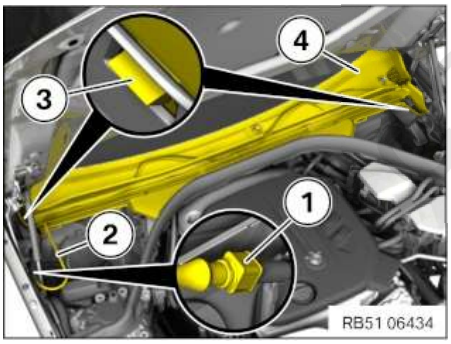
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

17 – Installing both wiper arms

NOTICE

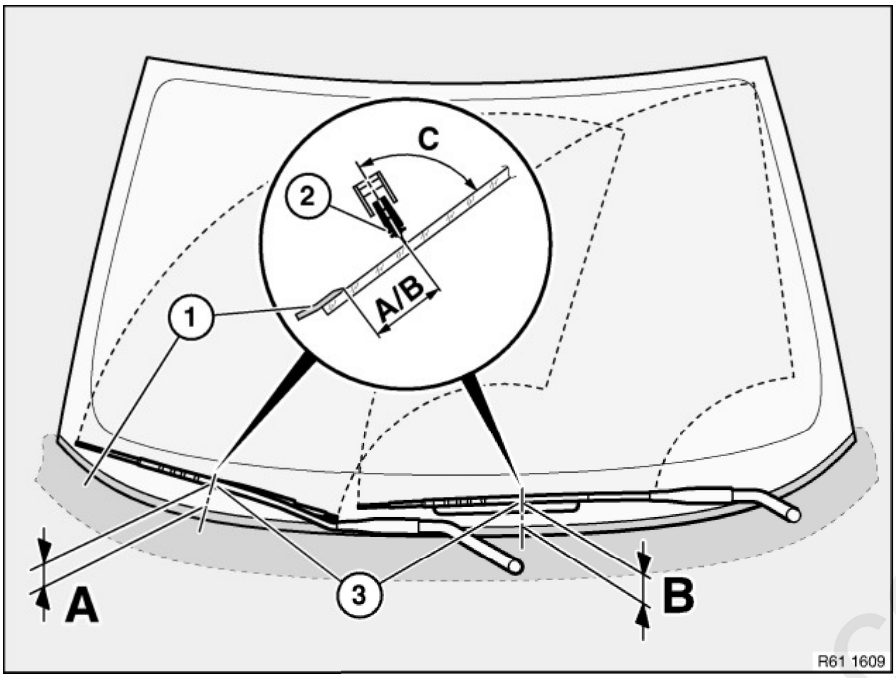
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

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TECHNICAL INFORMATION

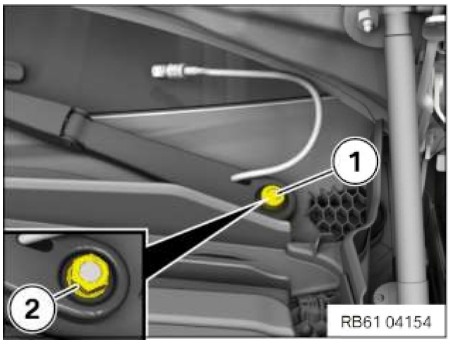
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

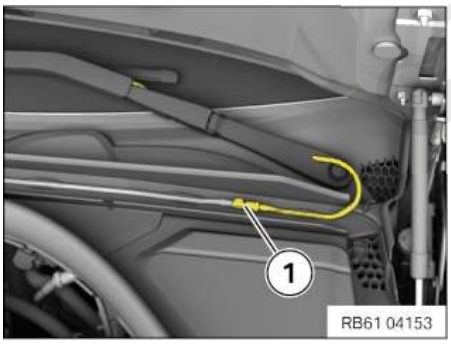


- Tighten nut (2).

Windscreen wiper arm

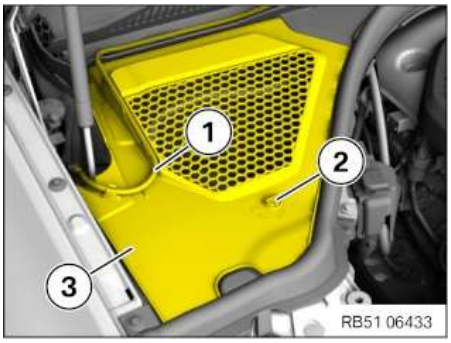
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

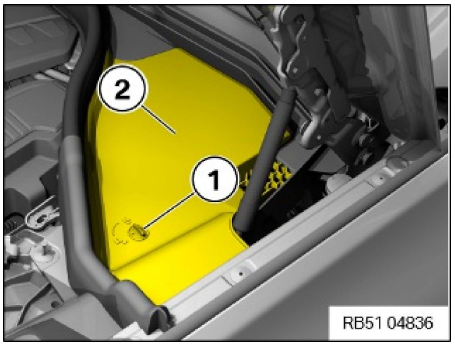
18 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

19 – Install the cover of the engine compartment on the rear left

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- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

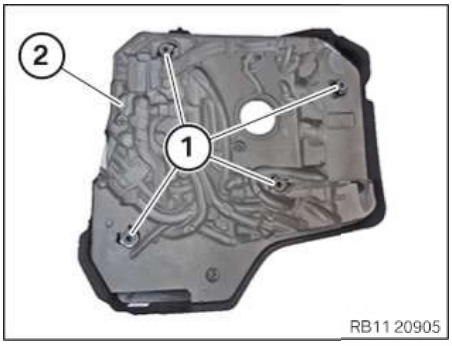
20 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

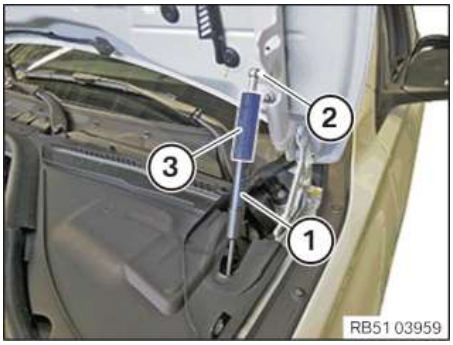
21 – Install the seal for the bonnet



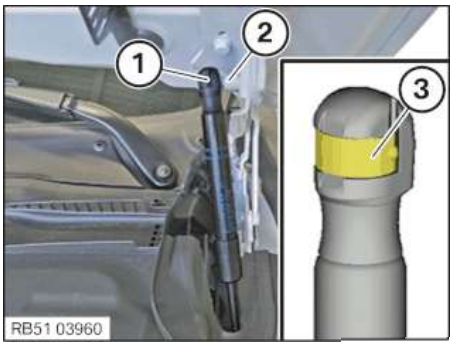
- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

22 – Take bonnet out of the service position

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- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Bulkhead upper part to bottom bulkhead — Used in step 15

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 15

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 15

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 17

Combination hexagon nut		Tightening torque	35 Nm

Overview of Special Tools

2 360 895 Pin wrench



Common — Used in step 1112

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

Overview Technical Data

Distance from window pane edge to wiper blade — Used in step 17

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Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	11
61 35 ... Notes on ESD protection (Electro Static Discharge)	11

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11 36 127 Removing and installing/replacing both Vanos central valves

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

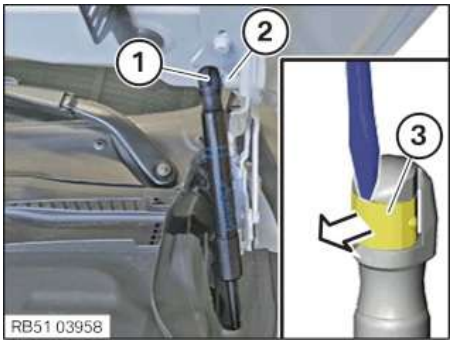
Engine compartment lid is open.

CAUTION

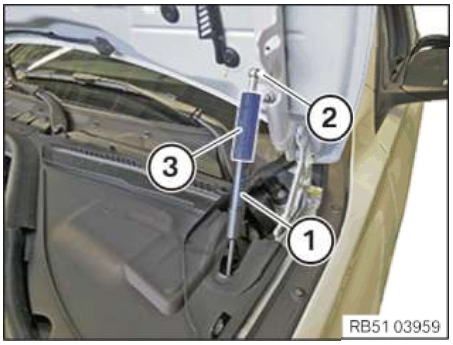
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

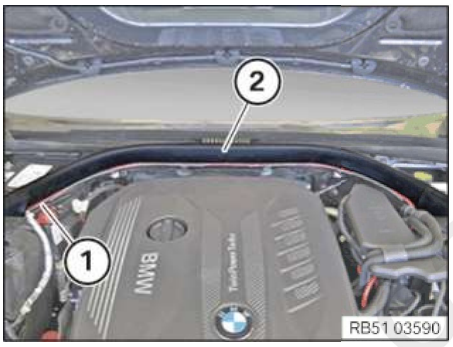


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

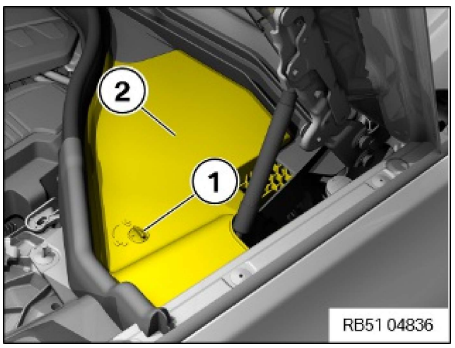
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

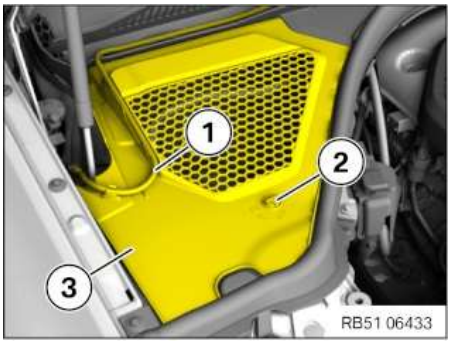
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

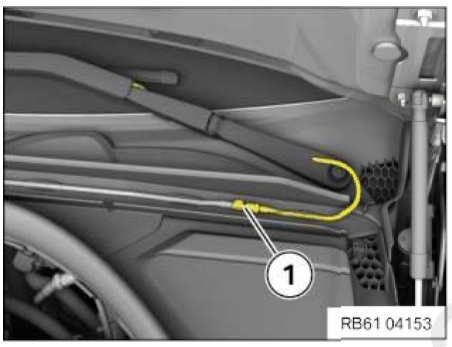
▶ **Remove the wiper arm**

RISK OF DAMAGE

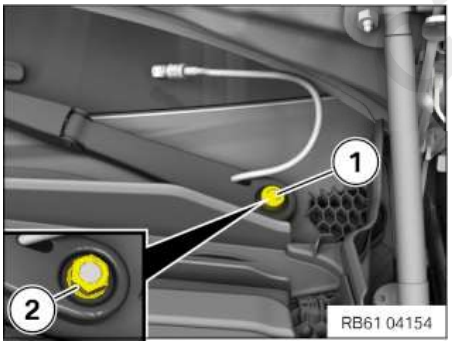
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

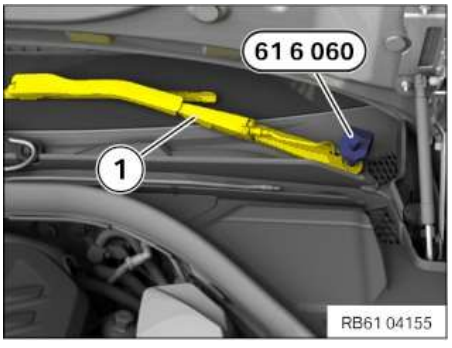
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



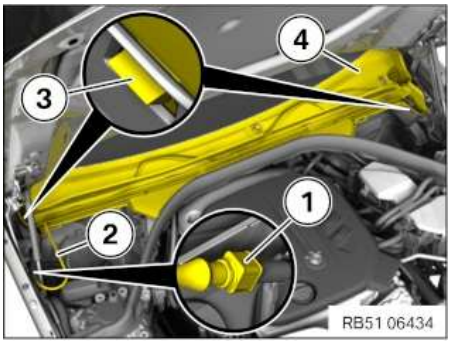
- Remove the protective cap (1).
- Loosen nut (2).



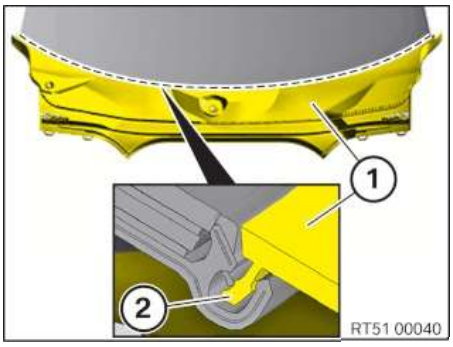
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

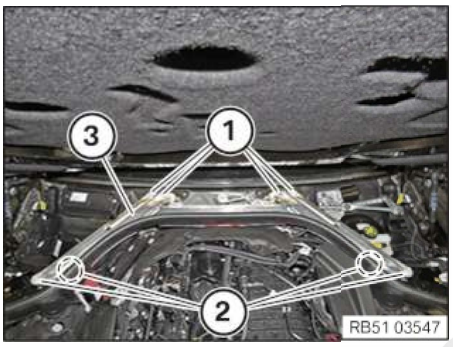


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

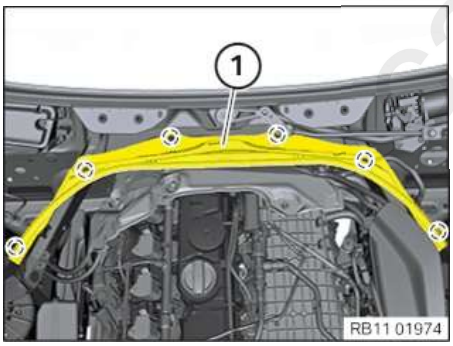
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

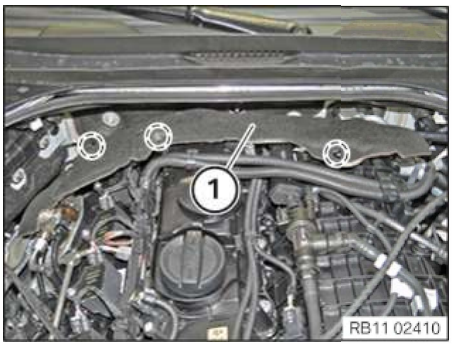
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



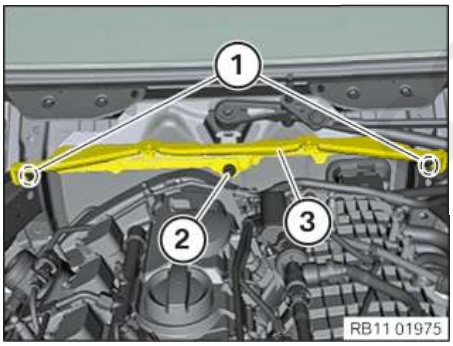
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

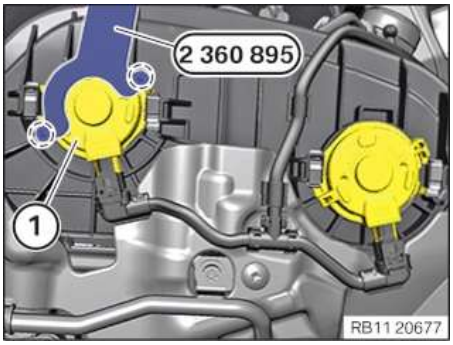
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

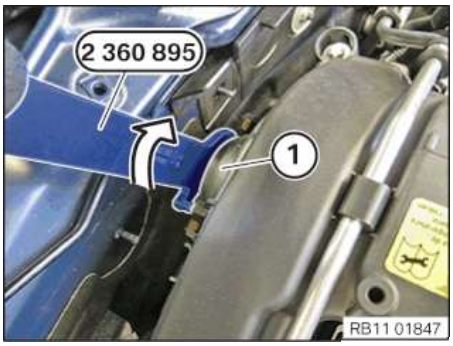
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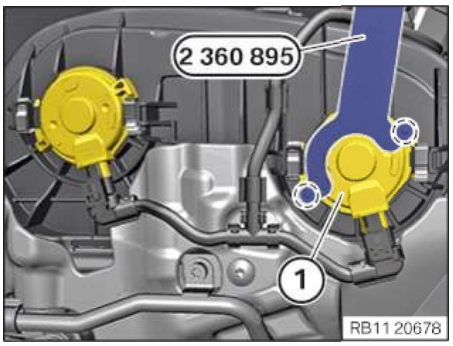
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



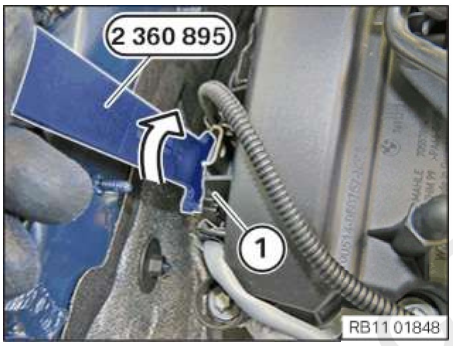
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



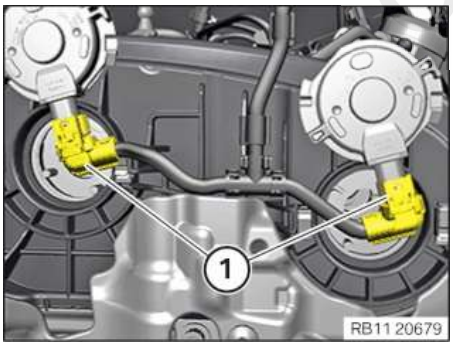
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

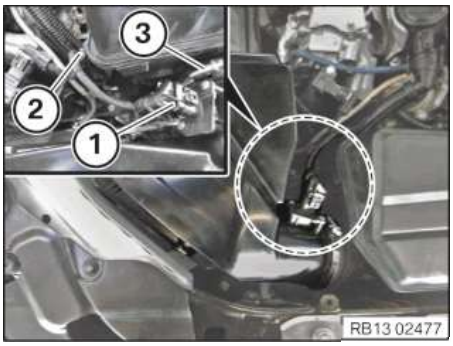
Risk of burning!

- Perform all work only on components that have cooled down.

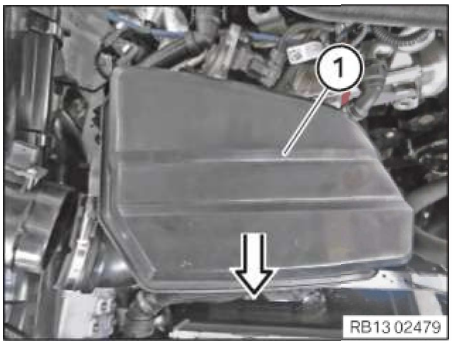
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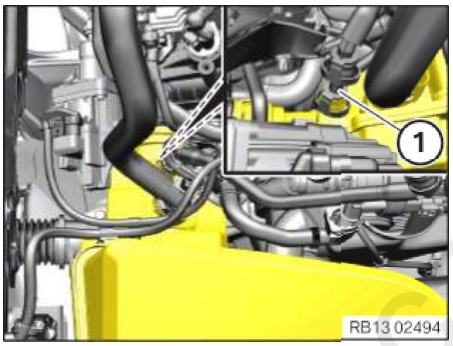
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



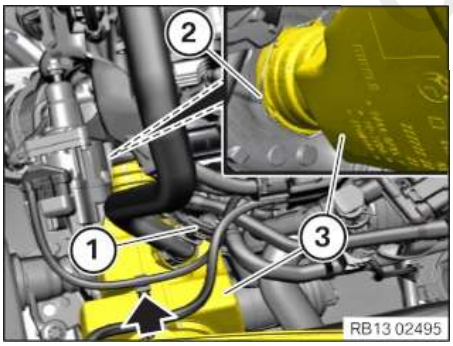
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



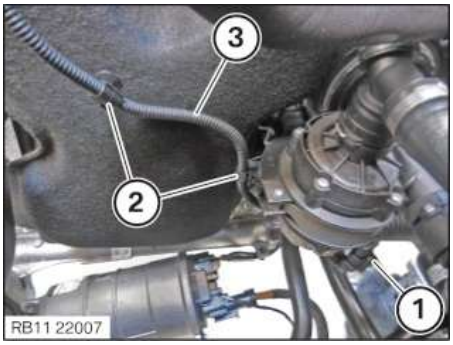
- Unlock and disconnect the tank ventilation line (1).



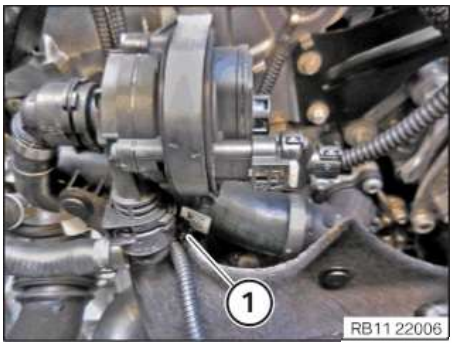
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

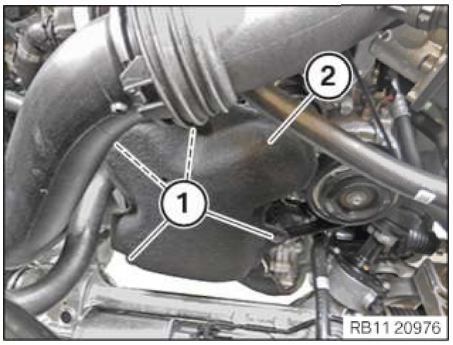
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

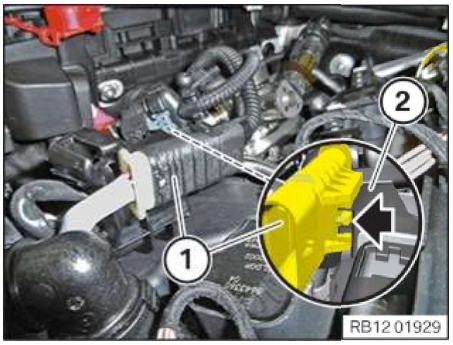
Electrostatic discharge.

Damage to or destruction of electrical components.

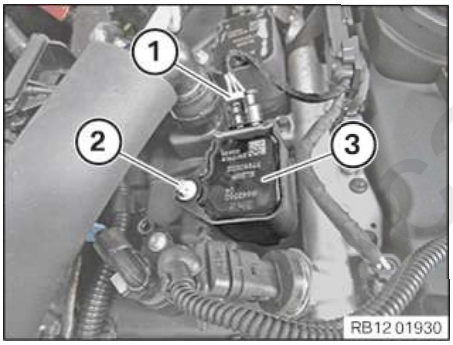
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

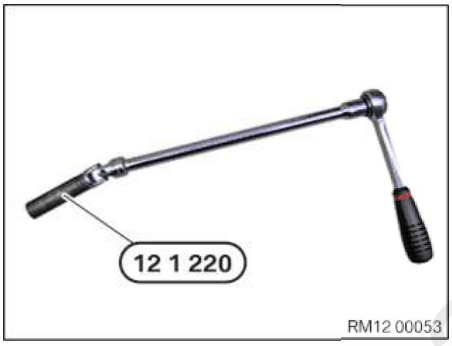
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

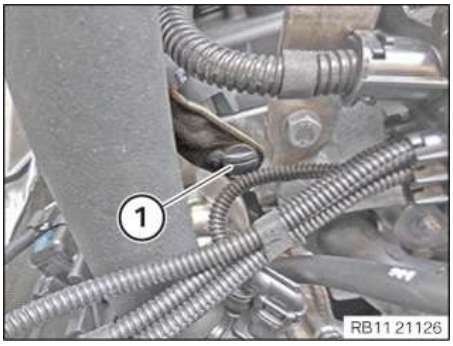
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

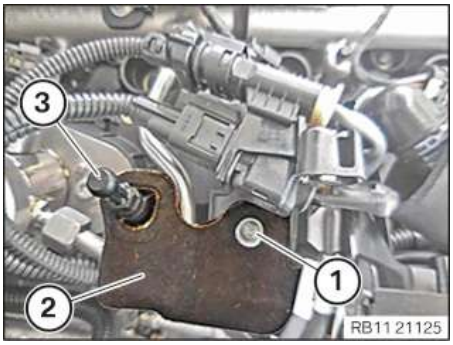


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

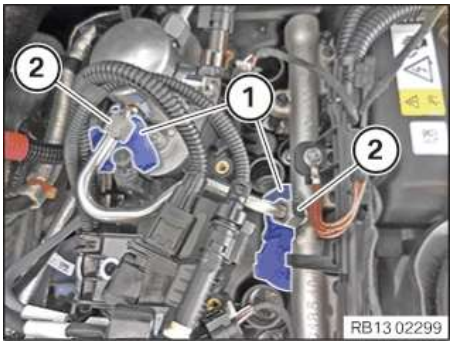
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

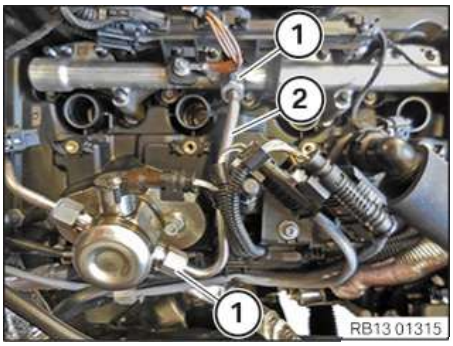


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

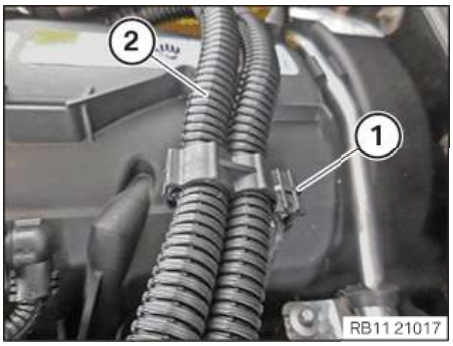
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

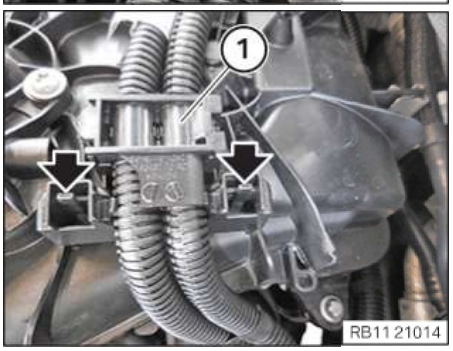
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

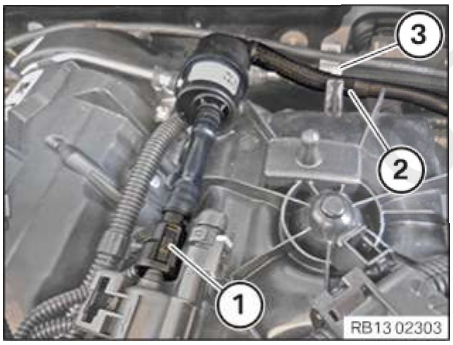
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



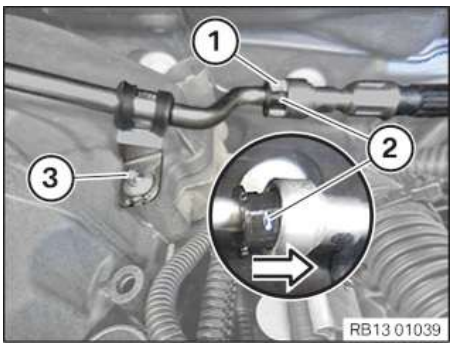
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

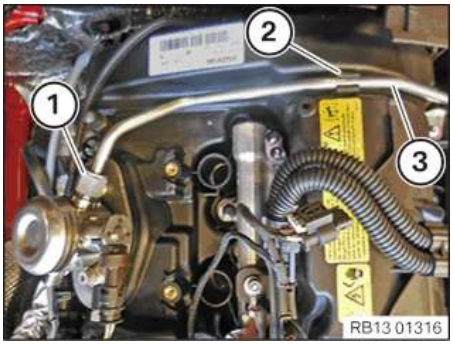


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

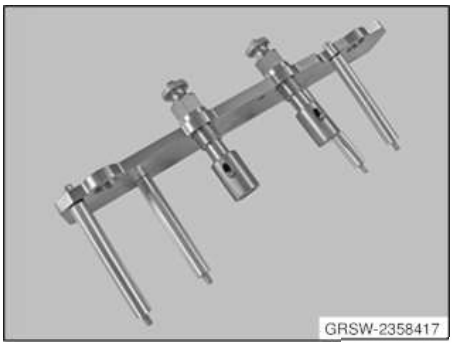
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



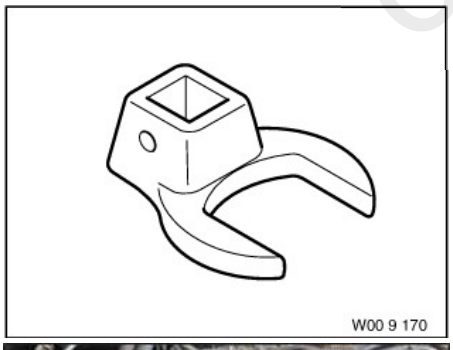
- Prepare special tool 2 358 417.



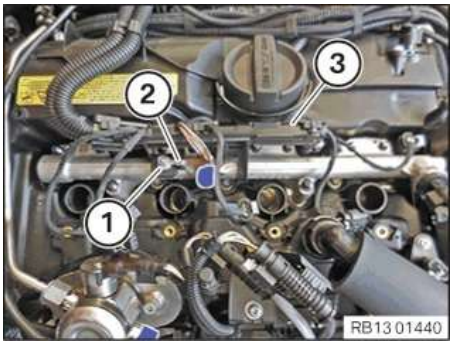
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

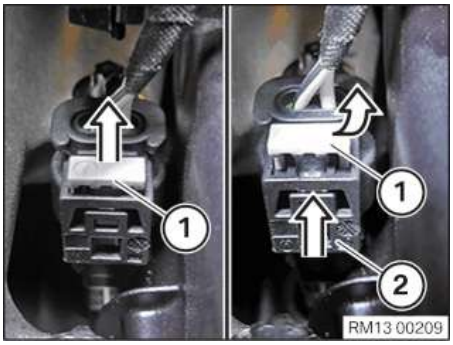


- Prepare special tool .

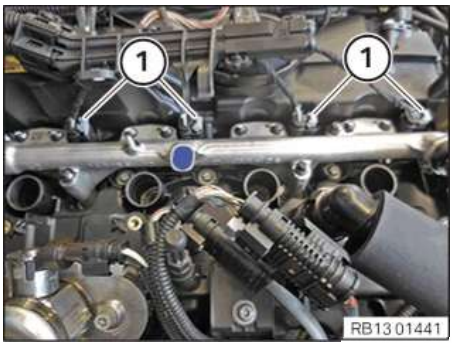


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



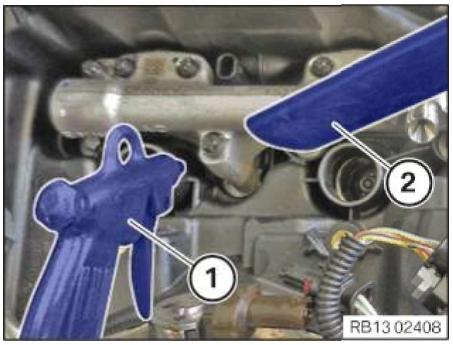
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

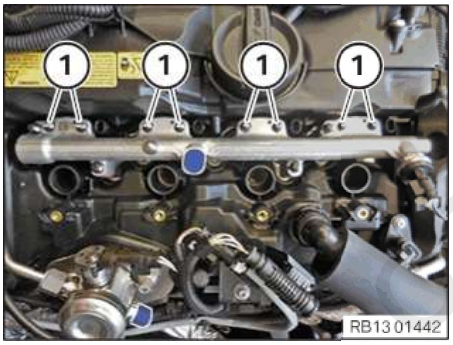


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

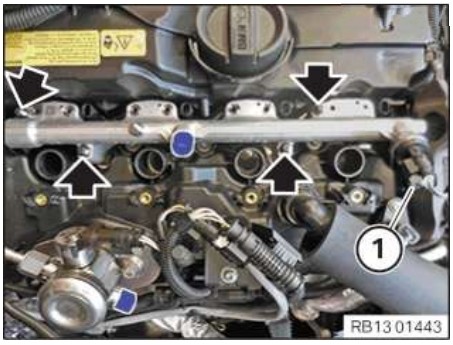
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



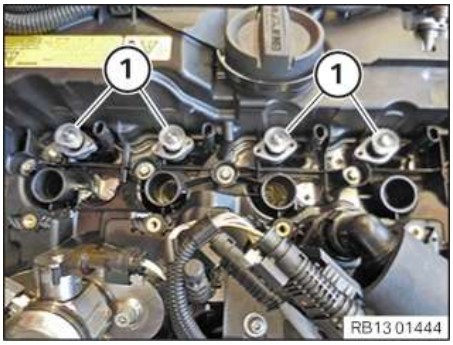
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

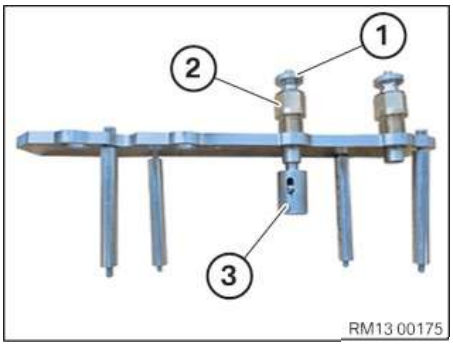
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

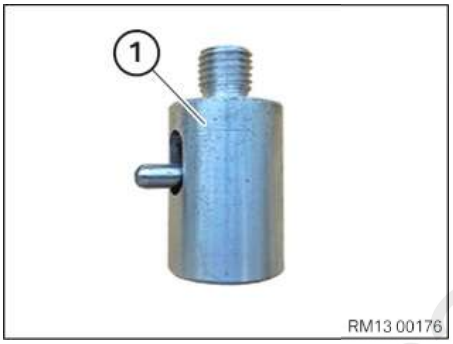
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

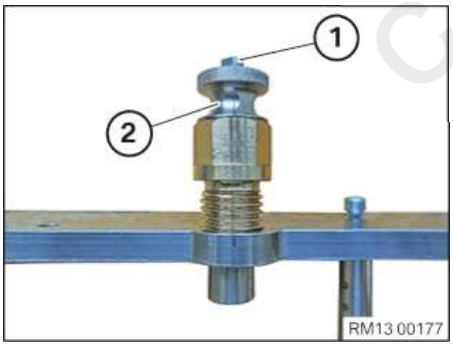
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

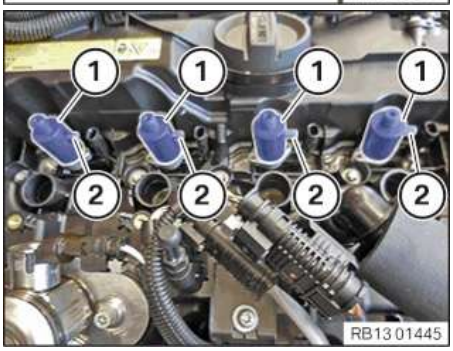
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



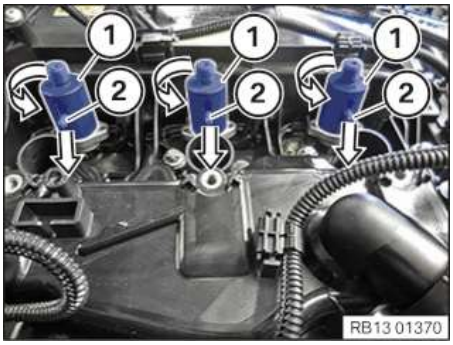
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



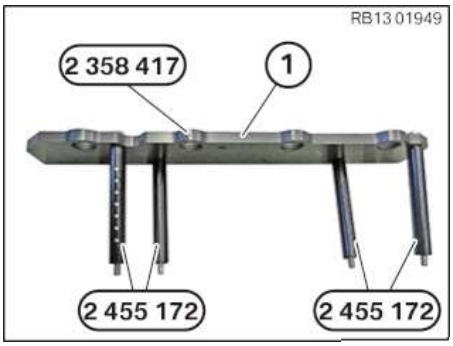
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

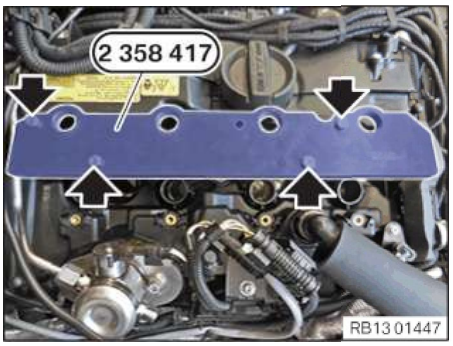
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



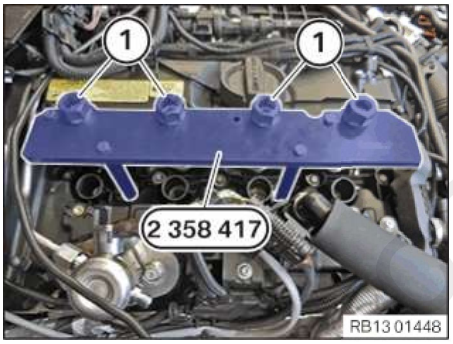
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

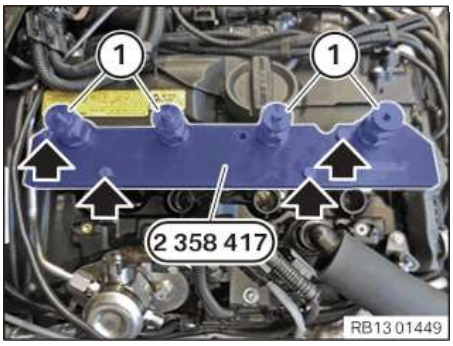
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

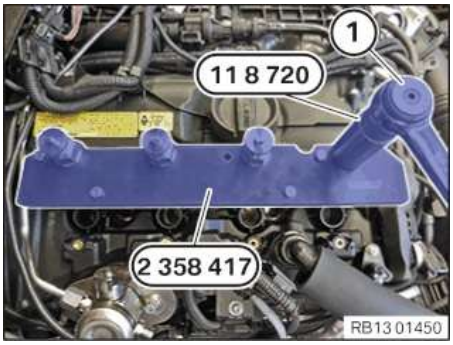
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

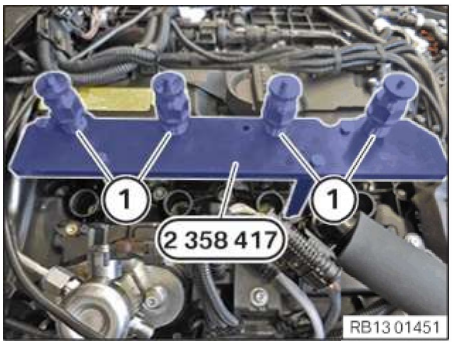


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

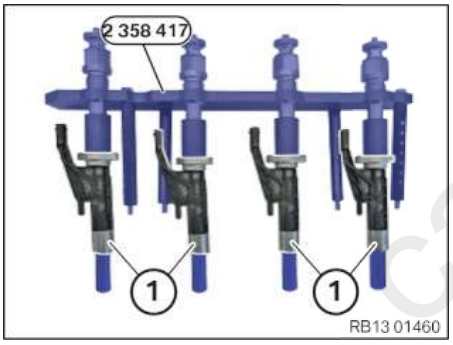
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

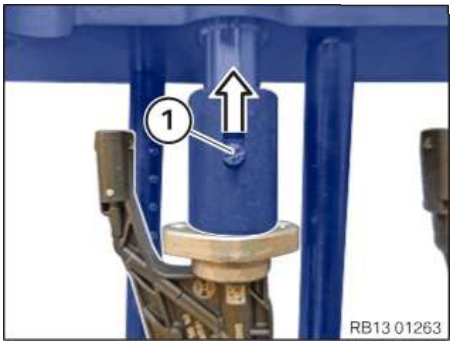


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

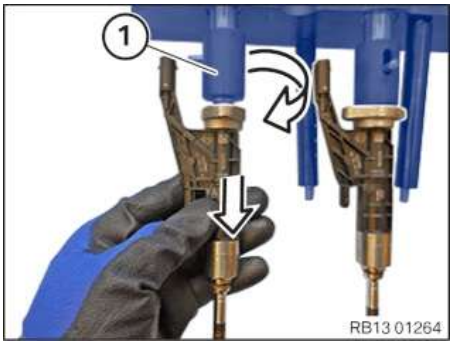


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

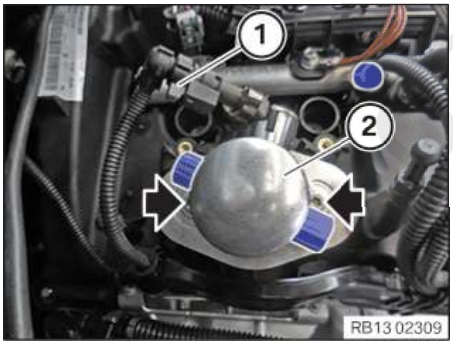
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

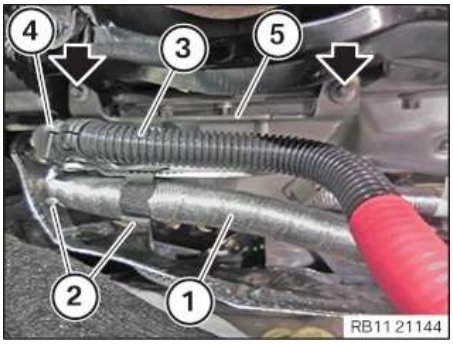
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

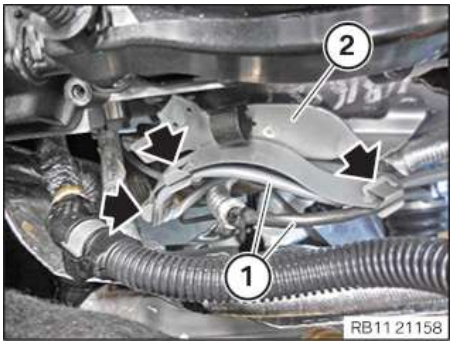


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

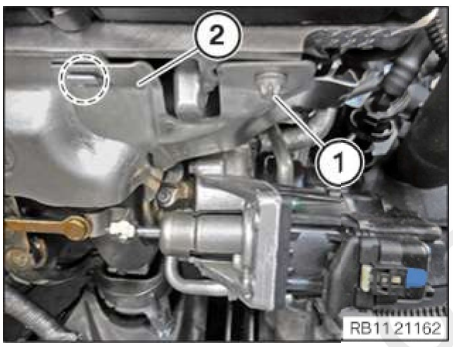
Hot surfaces.

Risk of burning!

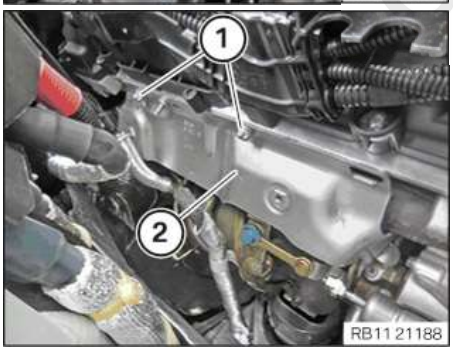
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

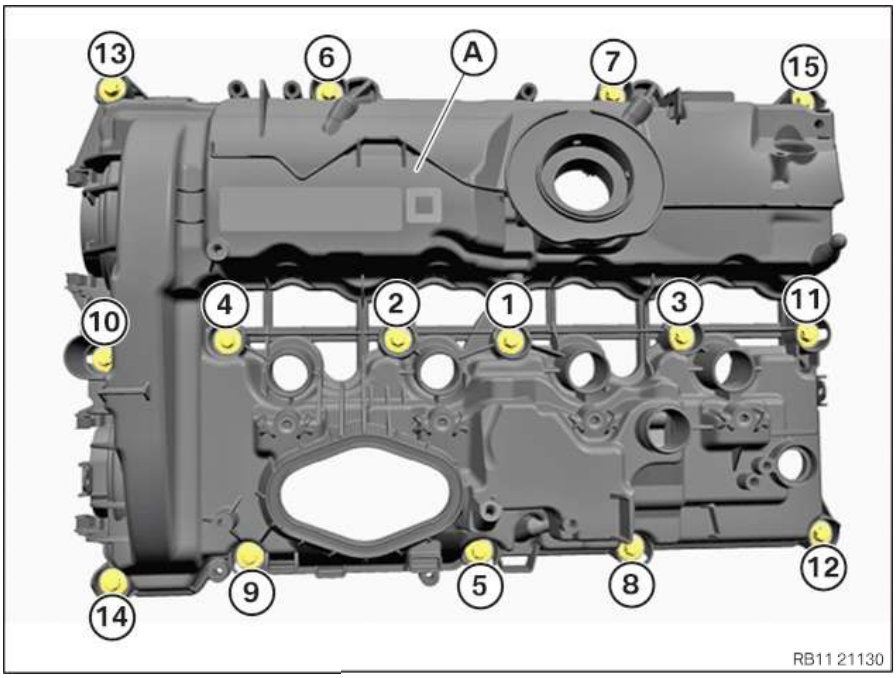


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

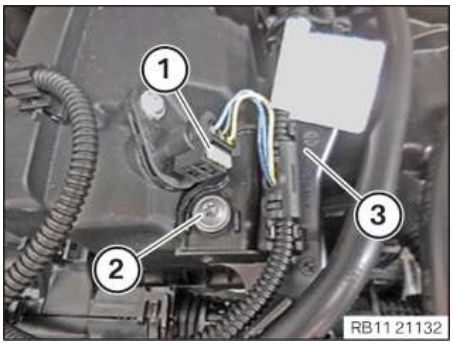
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

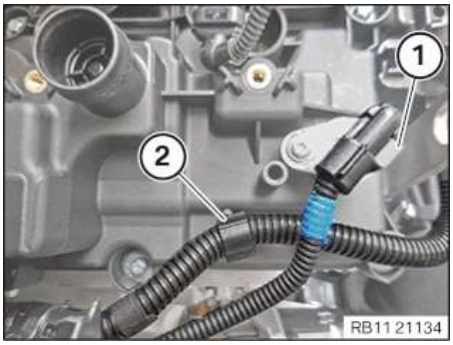
- Do not pull on the wires when disconnecting connectors and plug connections.



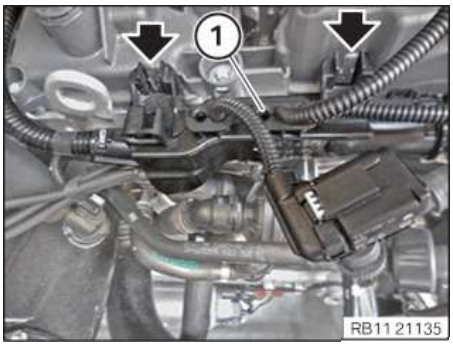
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



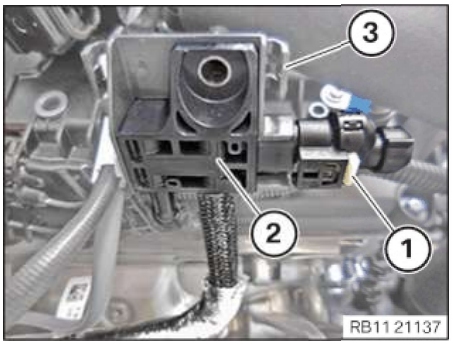
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



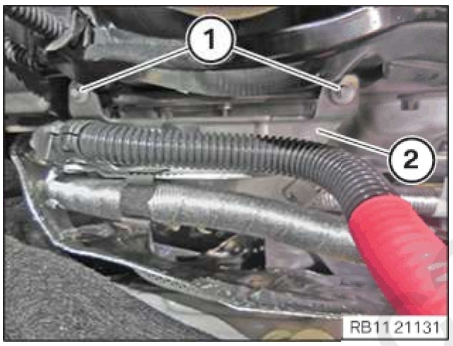
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



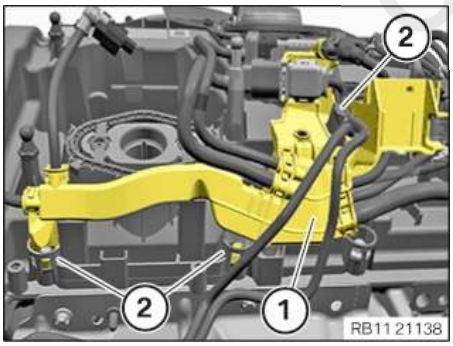
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



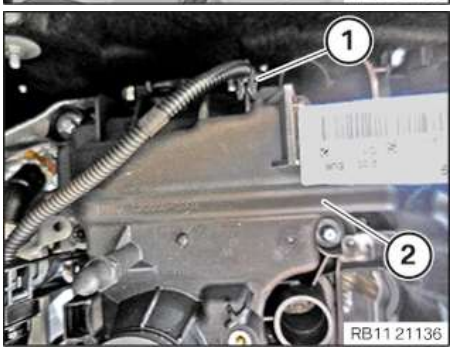
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

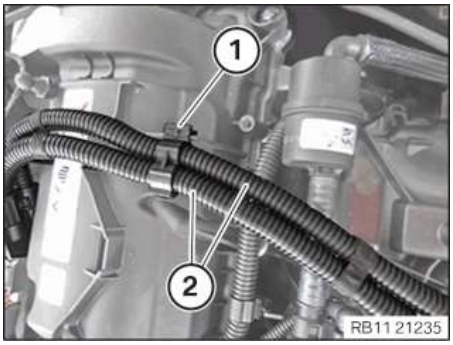


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

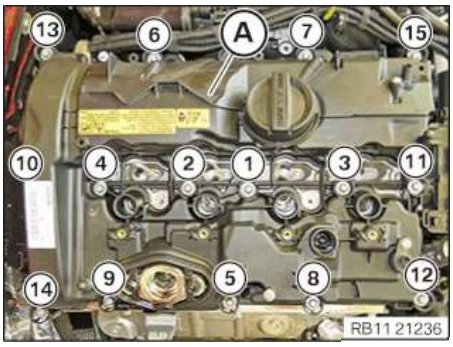


- Loosen clamp (1).

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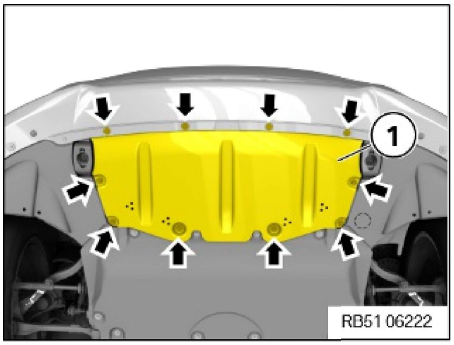


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

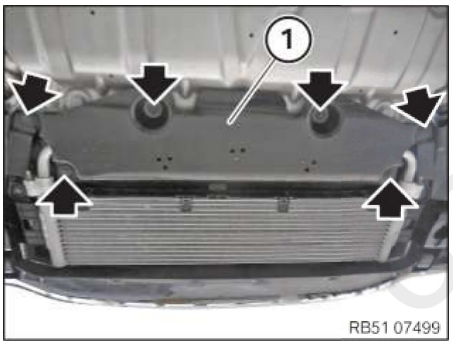
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

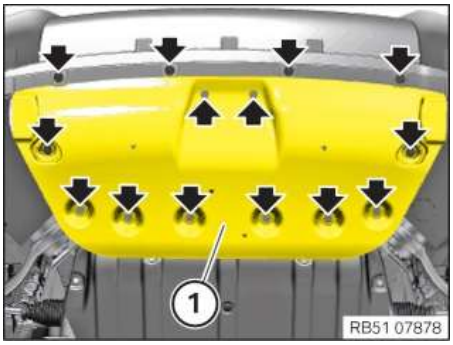
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

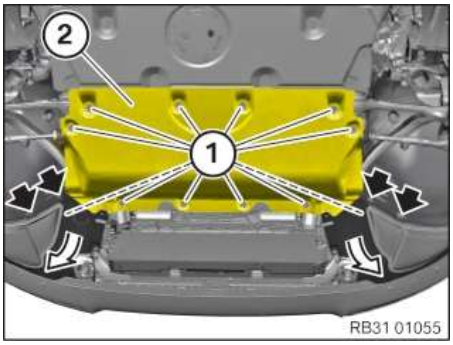


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



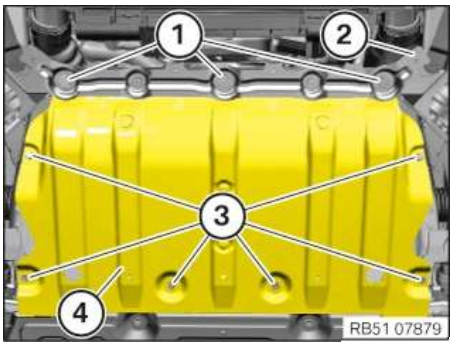
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

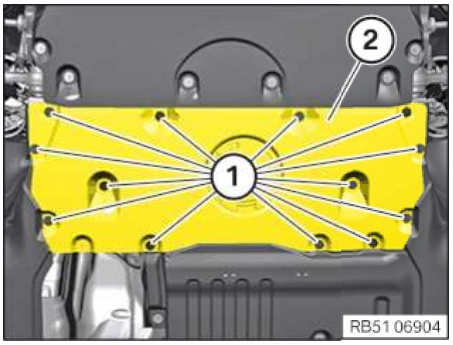
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

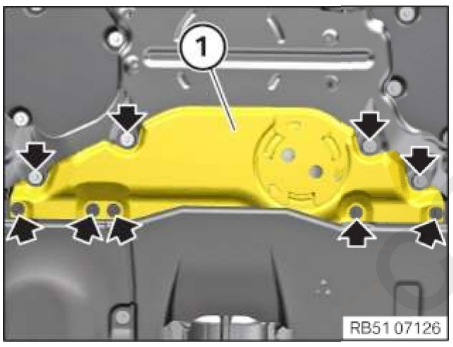
27 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

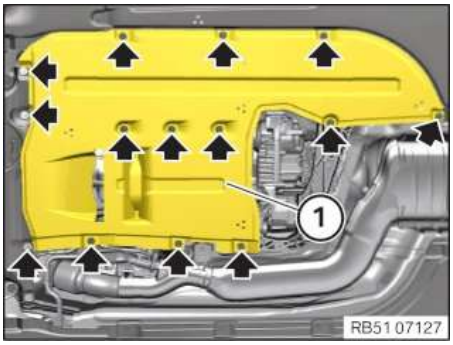


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

28 – Remove rear underbody protection

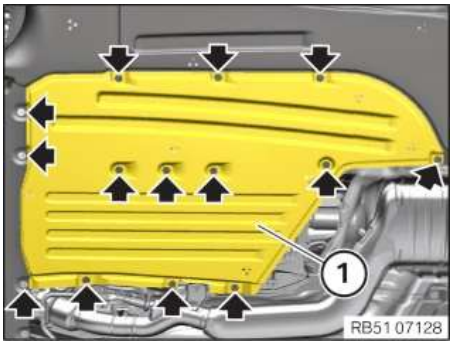


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

29 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



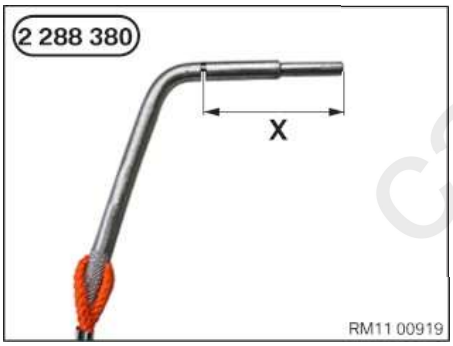
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

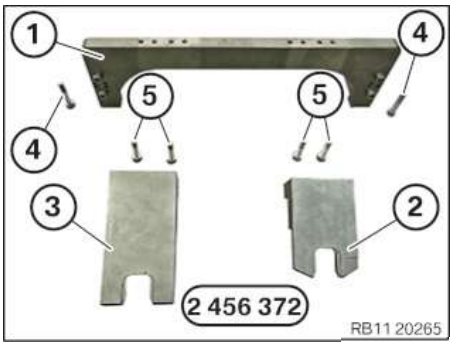
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- **Vehicles with automatic transmission:**

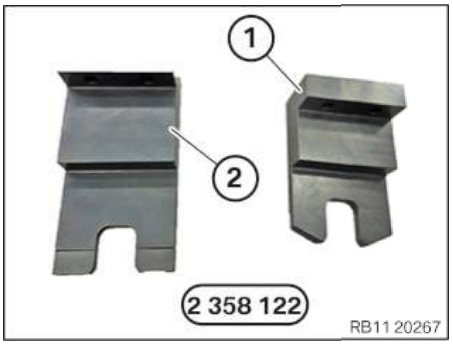
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



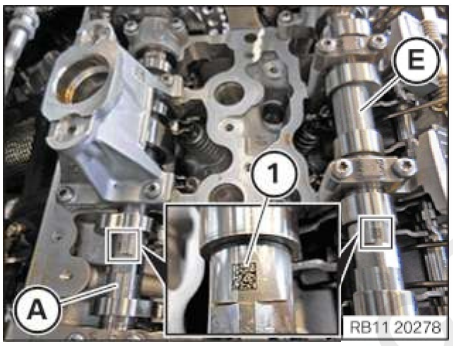
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

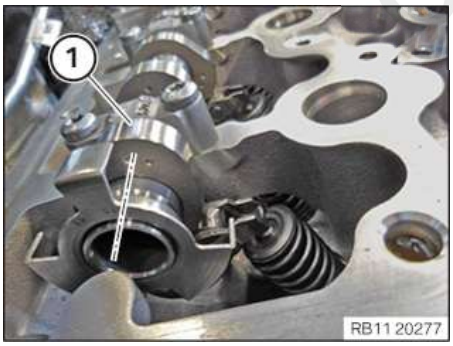


- Overview of the test gauges from the set of special tools 2 358 122:

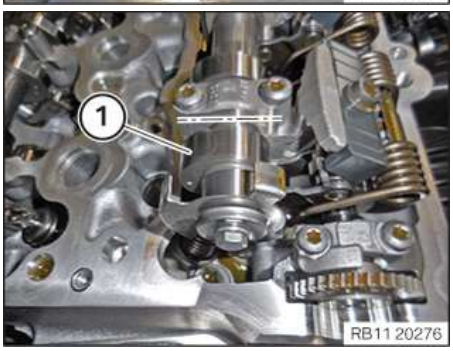
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

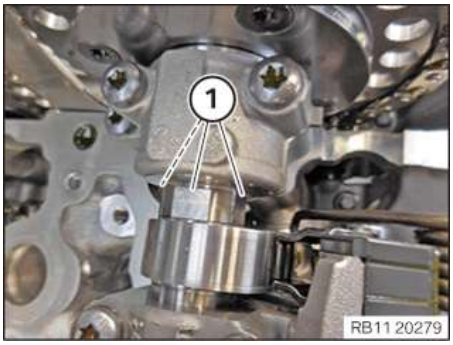


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

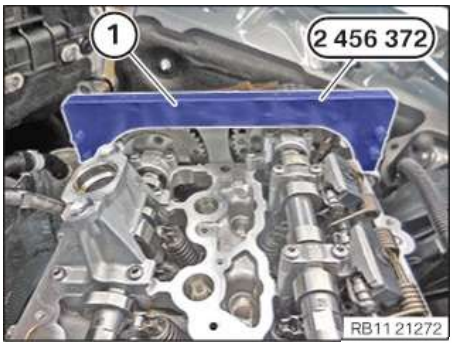


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

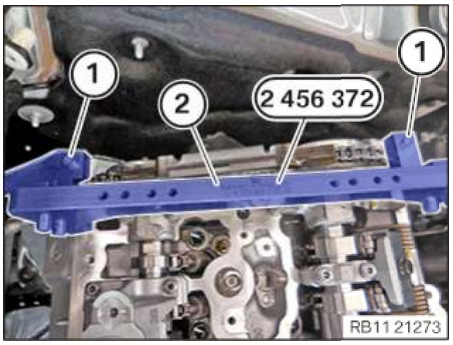
cardiagn.com



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



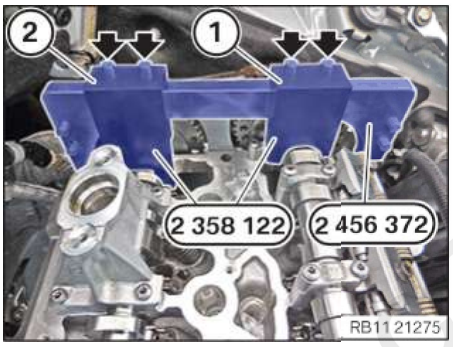
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

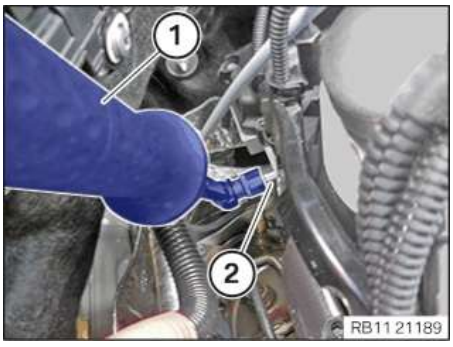
Test gauge to basic carrier

M6		Tightening torque	8 Nm

30 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

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- Feed out and remove the chain tensioner (1).

MAIN WORK

31 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

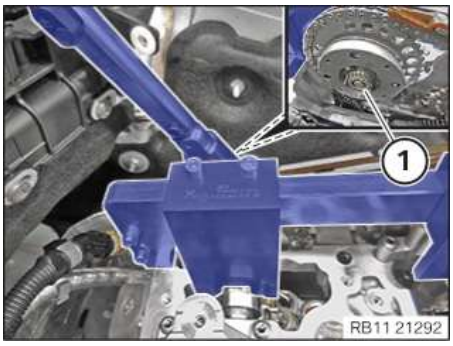
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

32 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



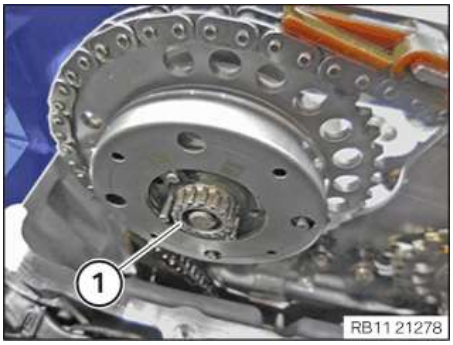
NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

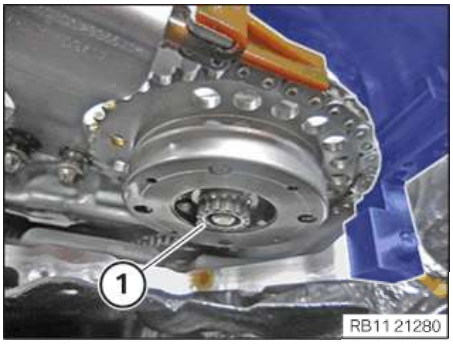
33 – Removing the VANOS central valve of the intake adjuster

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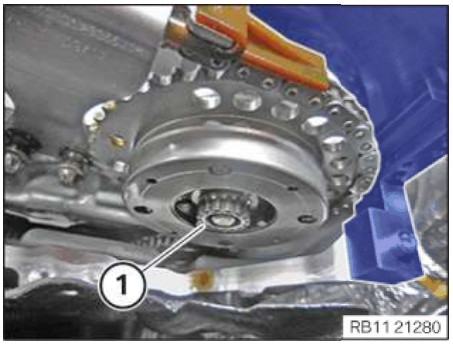
- Guide out and remove the VANOS central valve (1) of the intake adjuster.

34 – Remove the VANOS central valve of the exhaust camshaft adjuster

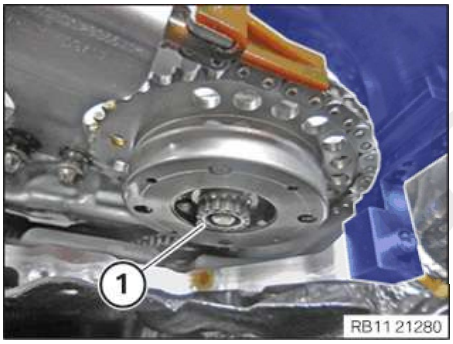


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

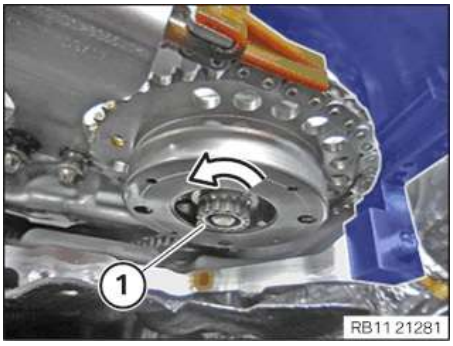
35 – Installing the VANOS central valve of the exhaust camshaft adjuster



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



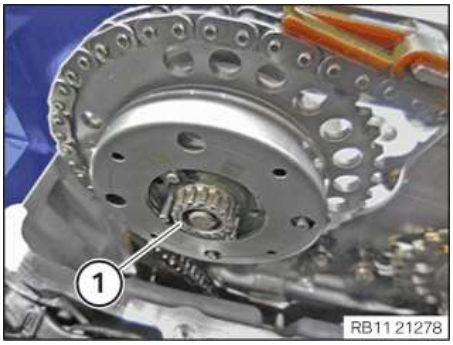
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



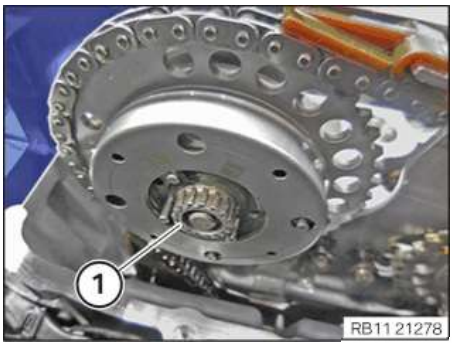
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

36 – Install the VANOS central valve of the intake adjuster

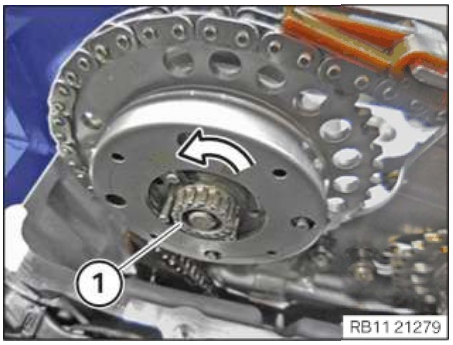
bardiagn.com



- Guide in the VANOS central valve (1) of the intake adjuster and install.

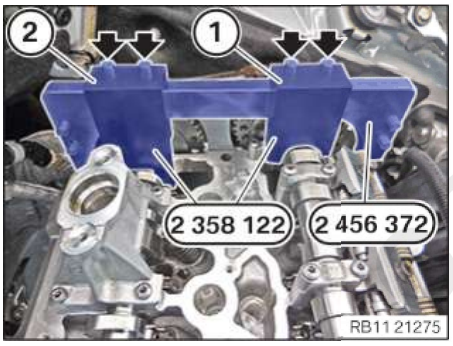


- Hand-tighten the VANOS central valve (1) of the intake adjuster.



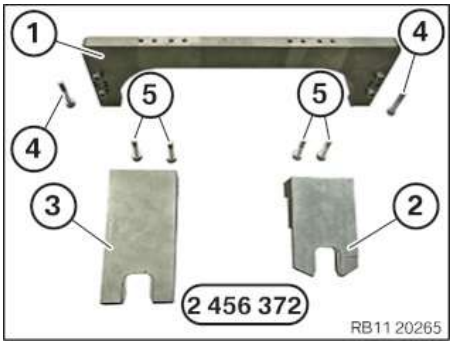
- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

37 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

38 – Adjust the camshafts with the special tool



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

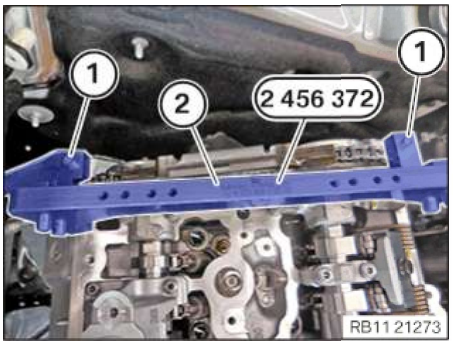
bardiagn.com



- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



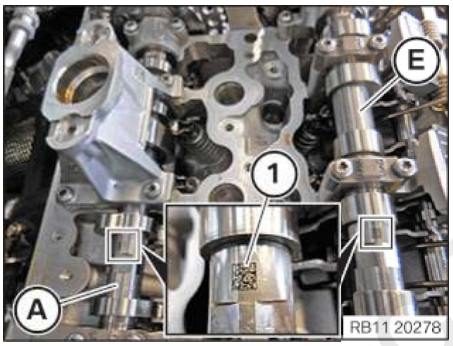
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



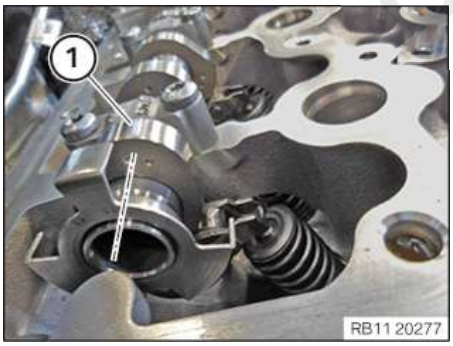
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

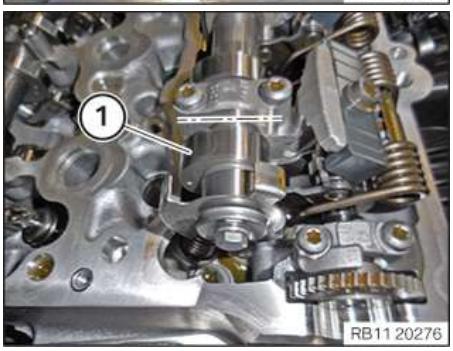
M6		Tightening torque	8 Nm



- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.

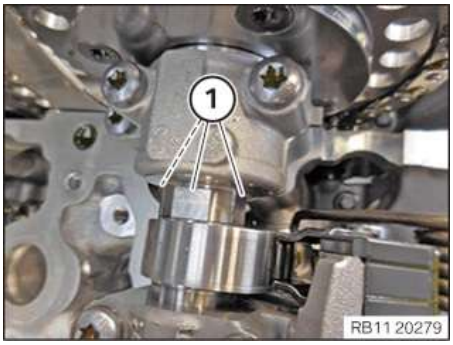


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

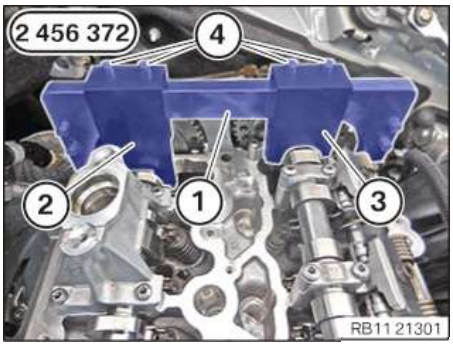


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

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- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

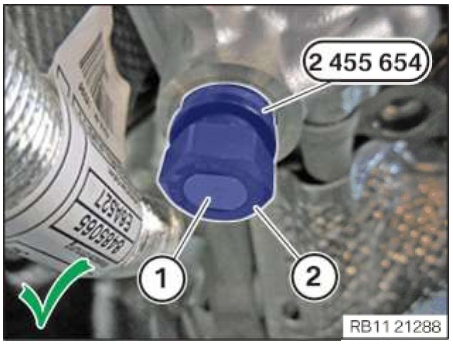


- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

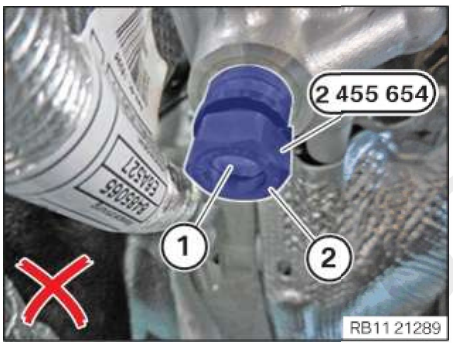
M6		Tightening torque	8 Nm

39 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

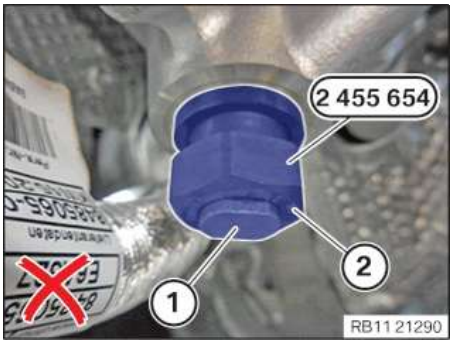
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

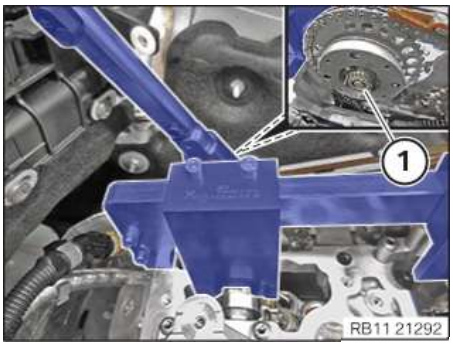
  The timing chain is **not correctly** pre-tensioned.

40 – Tightening the VANOS central valve of the exhaust camshaft adjuster

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- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

41 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



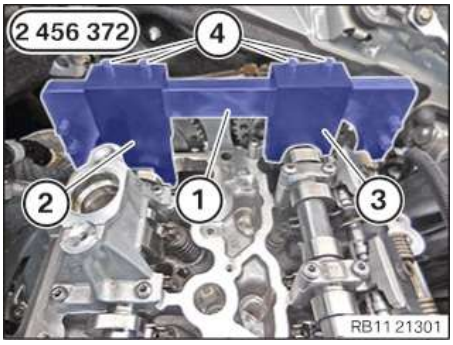
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

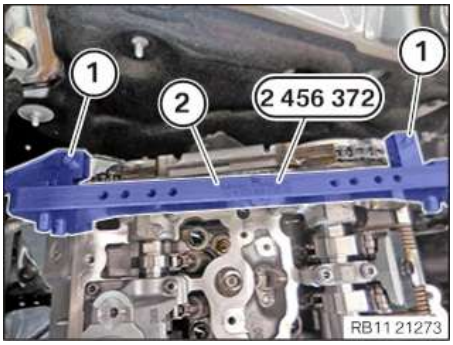
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

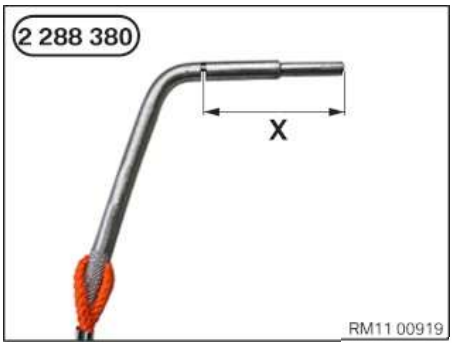
42 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



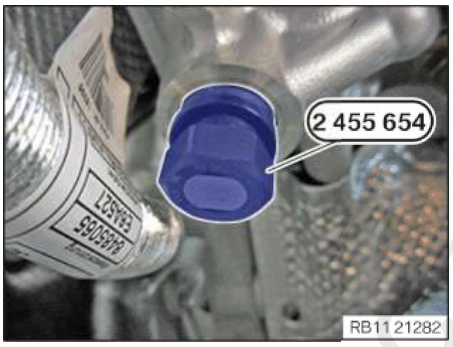
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

43 – Install chain tensioner

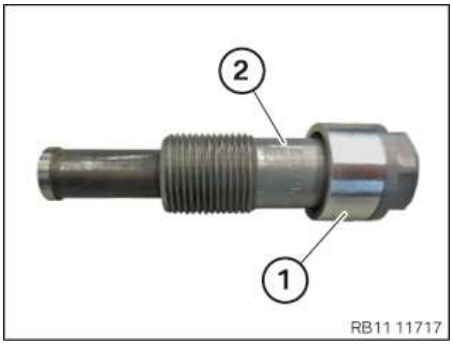
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

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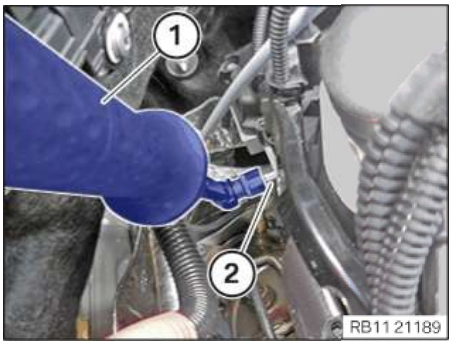


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

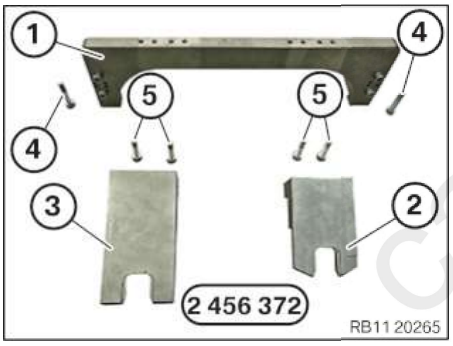


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

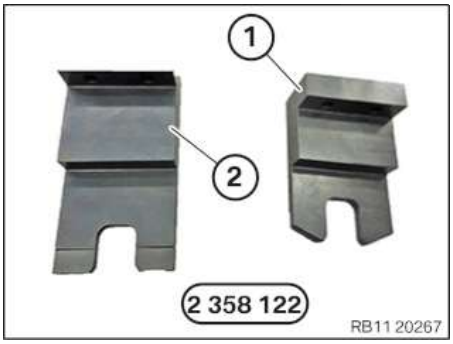
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

44 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft

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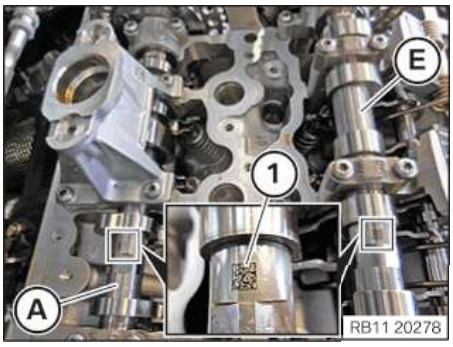
RISK OF DAMAGE

Damage to the engine.

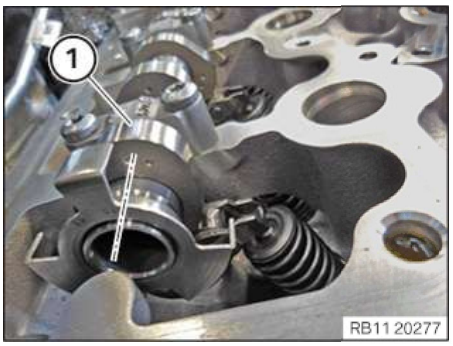
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

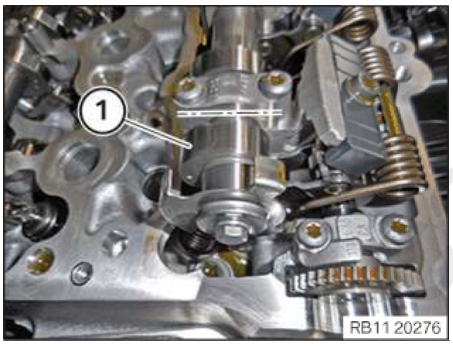
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



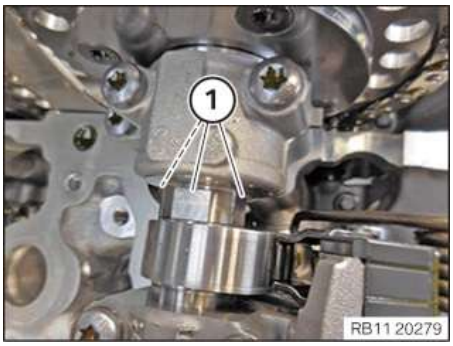
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

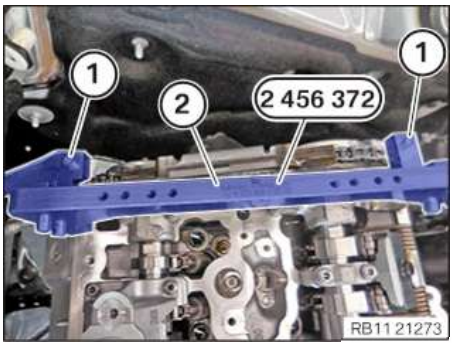


- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.

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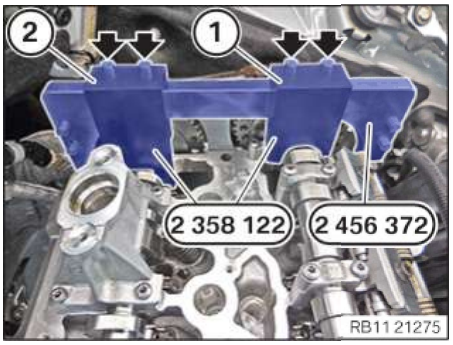
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

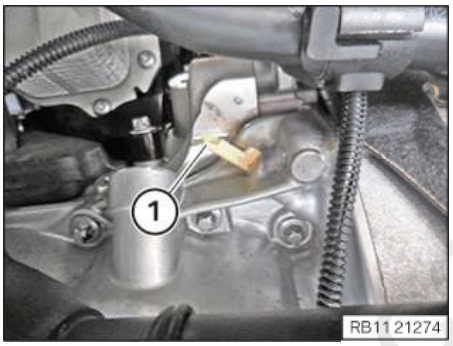
M6		Tightening torque	8 Nm



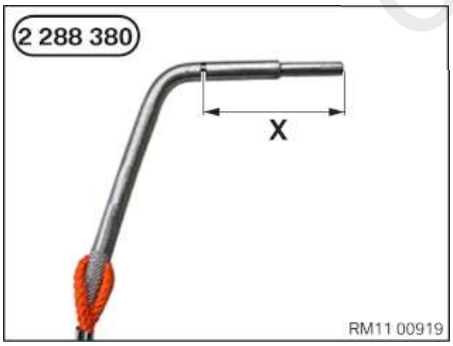
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

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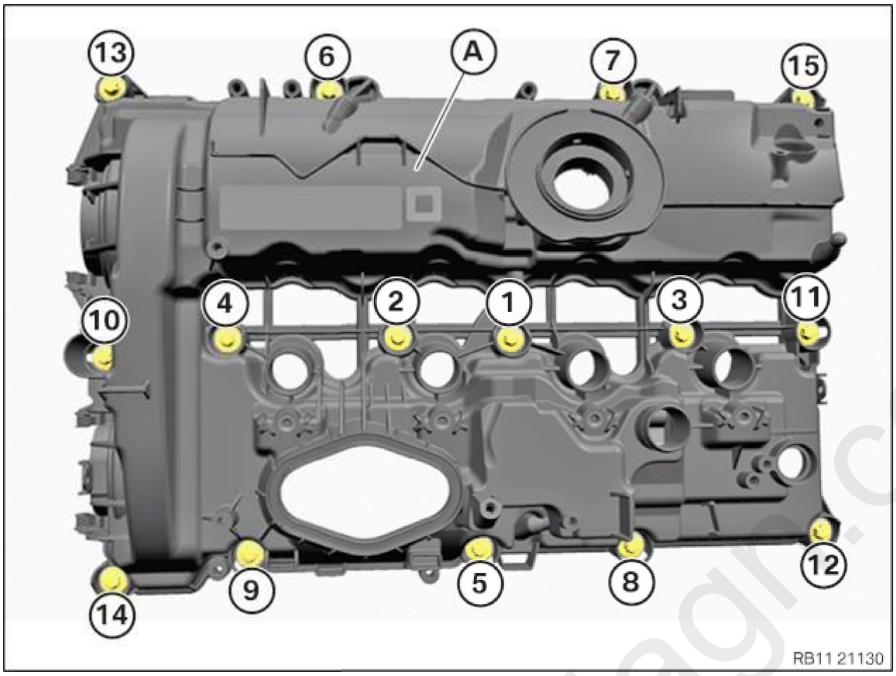
- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

45 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

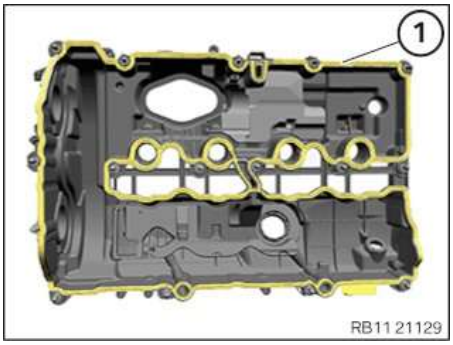
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

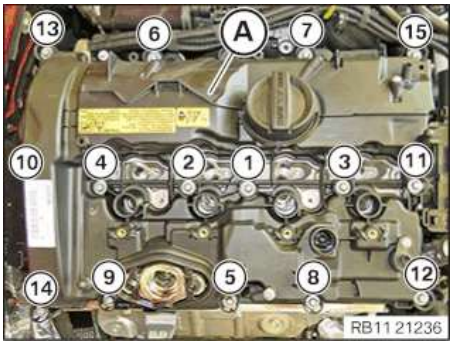


- Renew the profile seal (1).

  Parts: Profile seal

- Insert and install the profile seal (1).

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

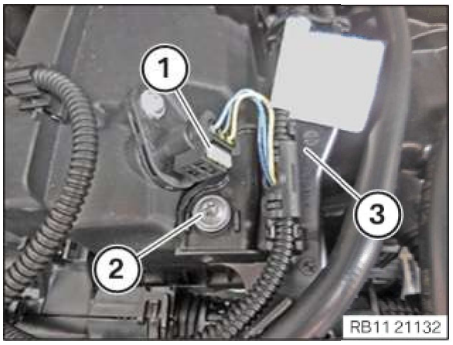
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

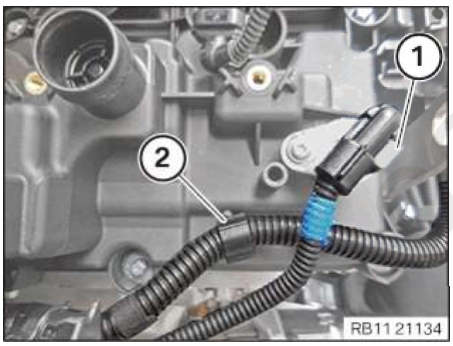


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

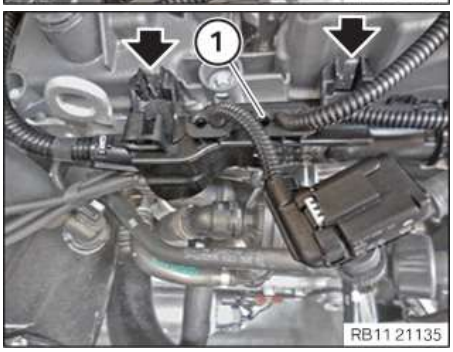
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

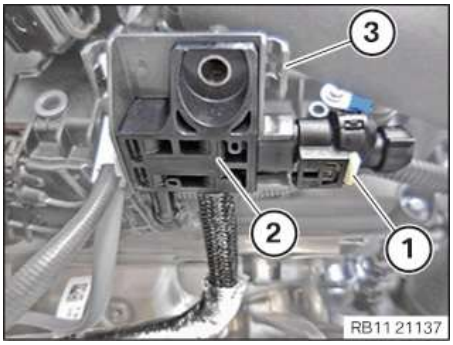


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

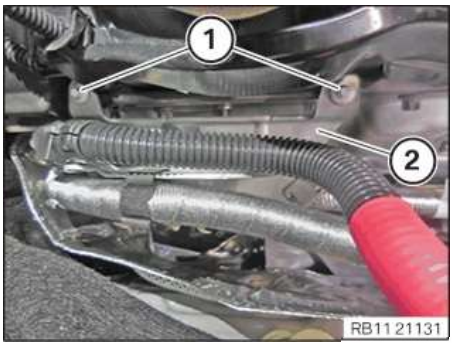


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

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- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

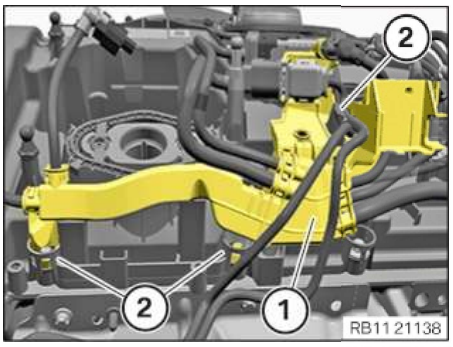
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

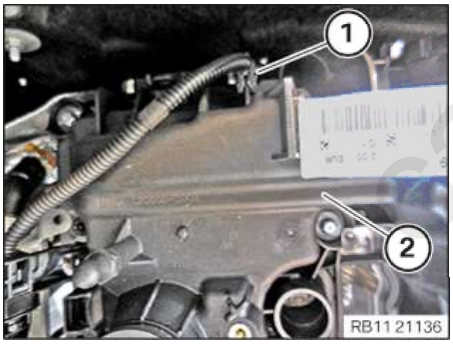
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

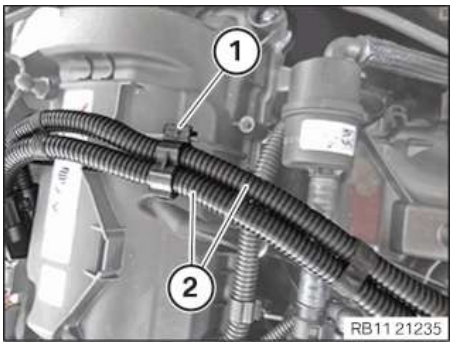
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.



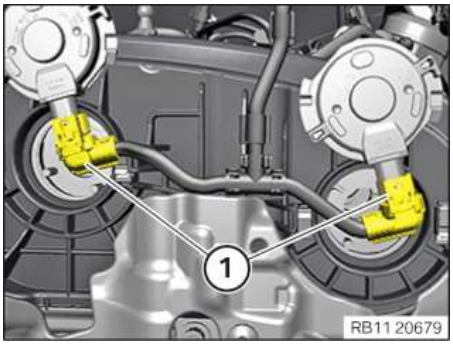
- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

46 – Installing both actuators

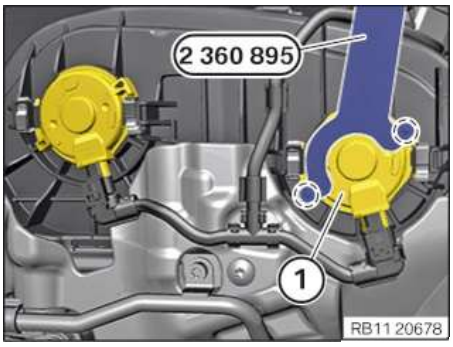
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NOTICE

The figure shows the rear side of the engine.

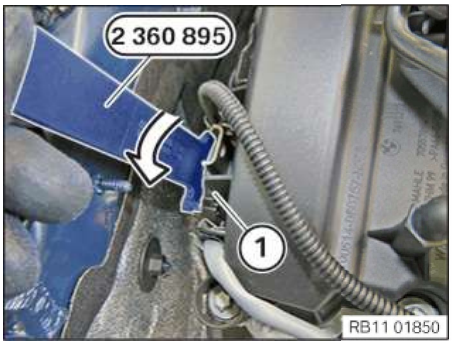
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



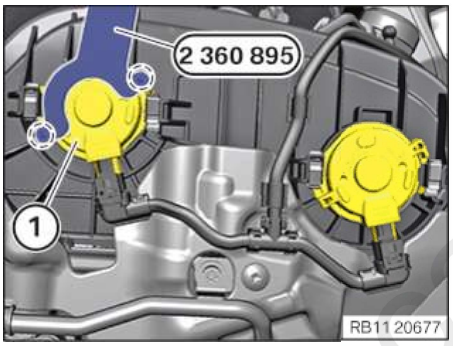
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



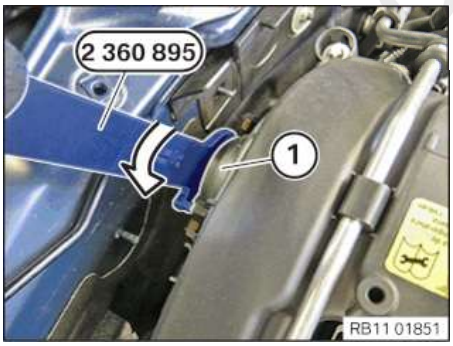
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

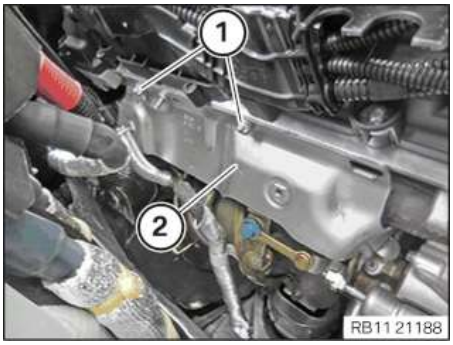
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

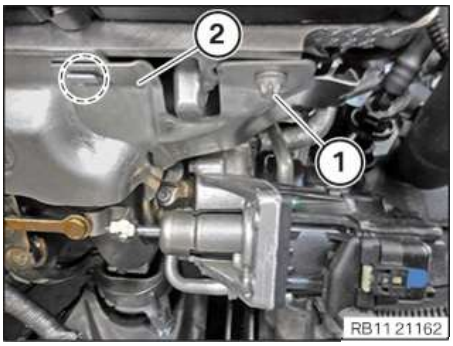
47 – Installing the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

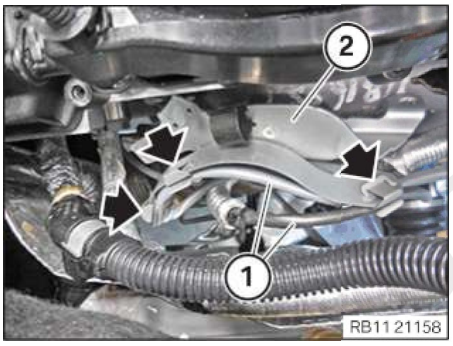


- Tighten down screw (1).

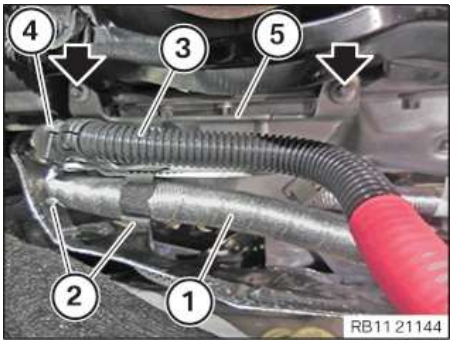
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

48 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

49 – Prepare the injectors for installation

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RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

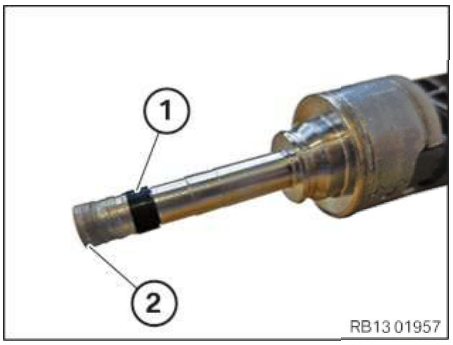
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

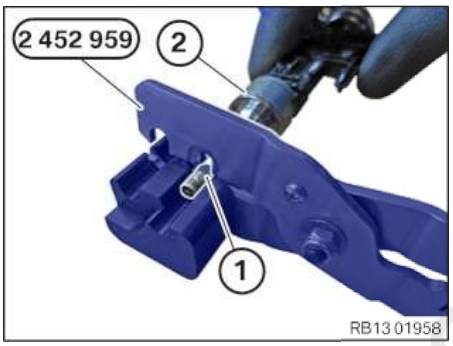
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

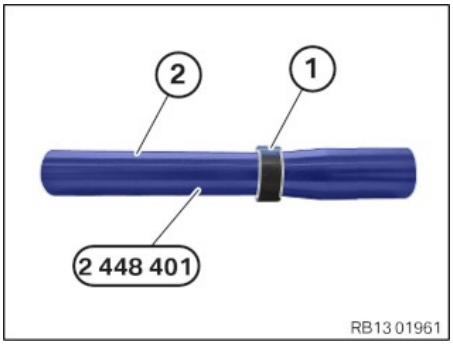


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

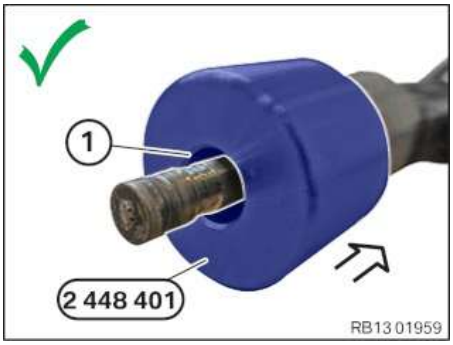
  (2) Sliding sleeve

  (3) Assembly sleeve



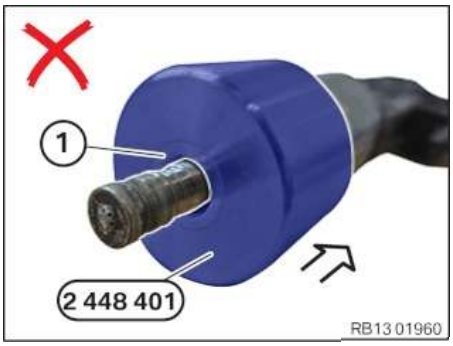
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.

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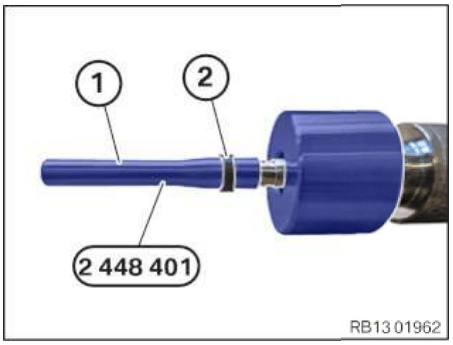
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

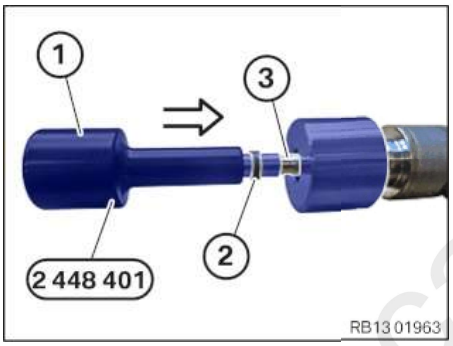


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

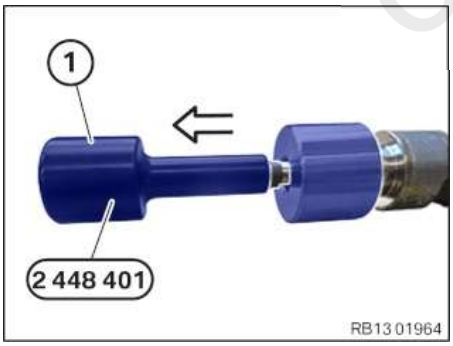
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



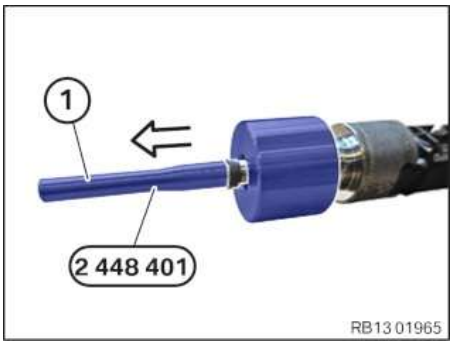
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

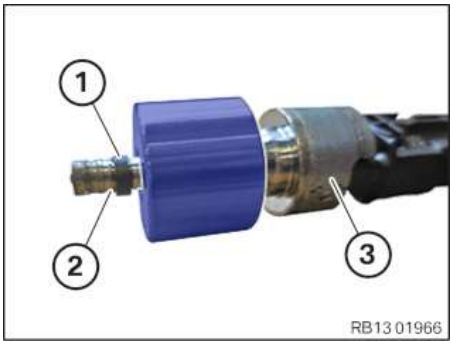


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

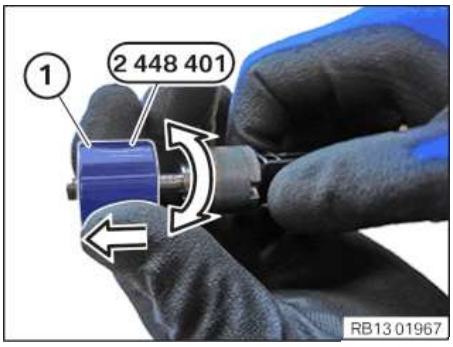


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

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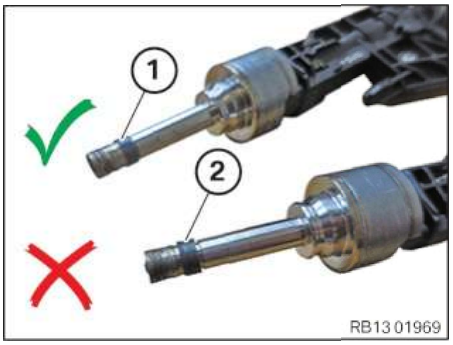


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

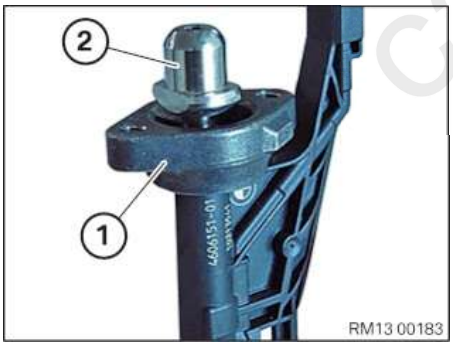


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

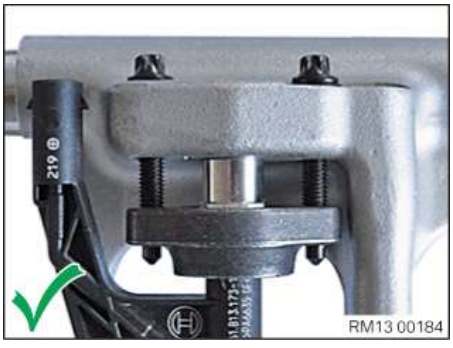
50 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



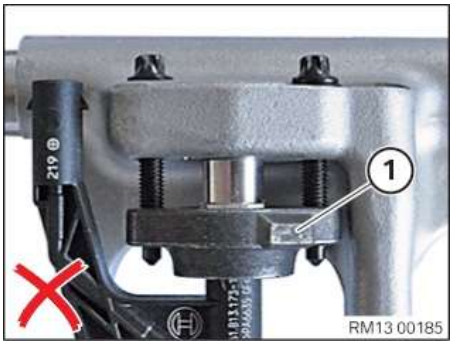
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

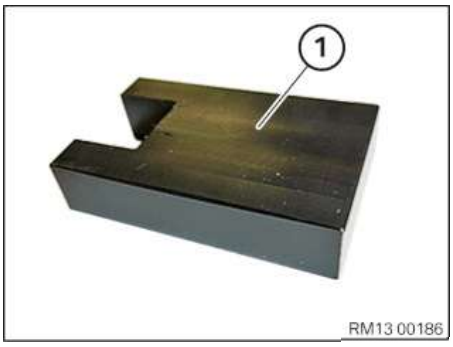
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



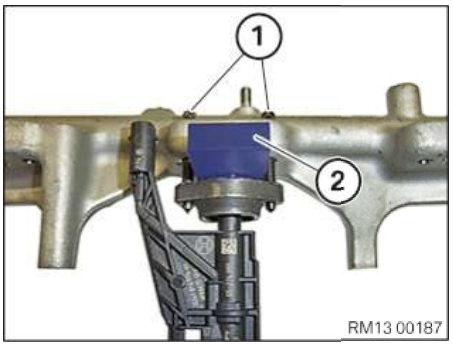
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)

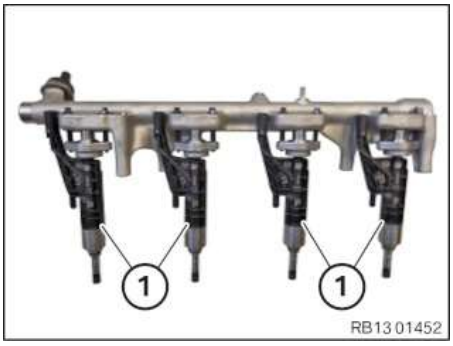
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.

- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



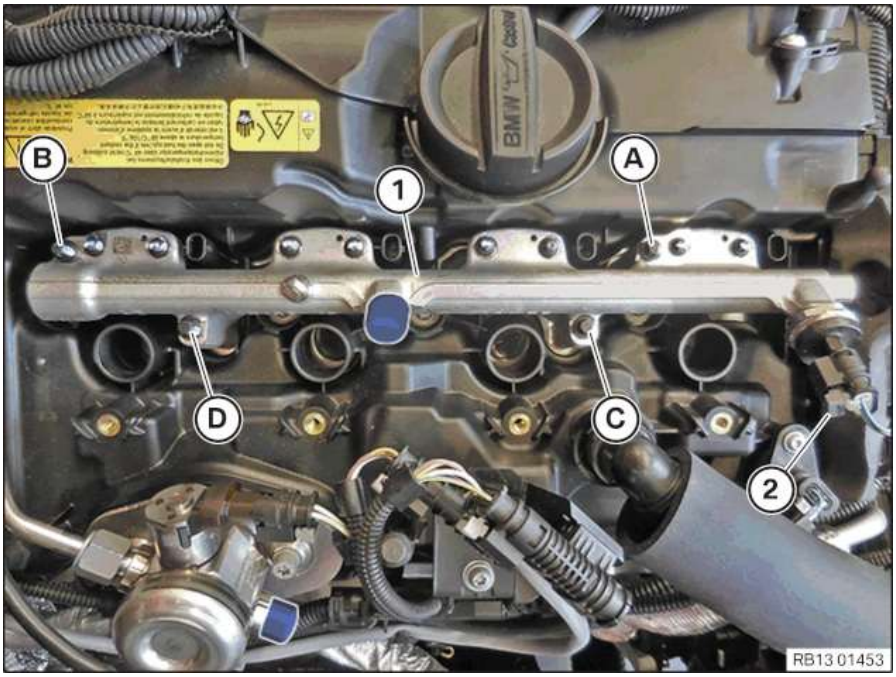
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

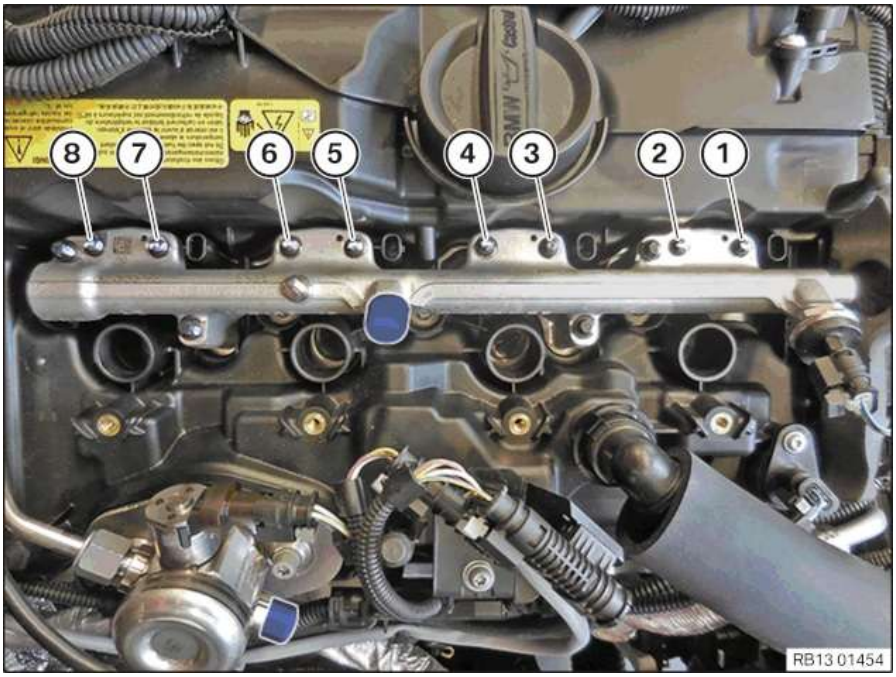
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

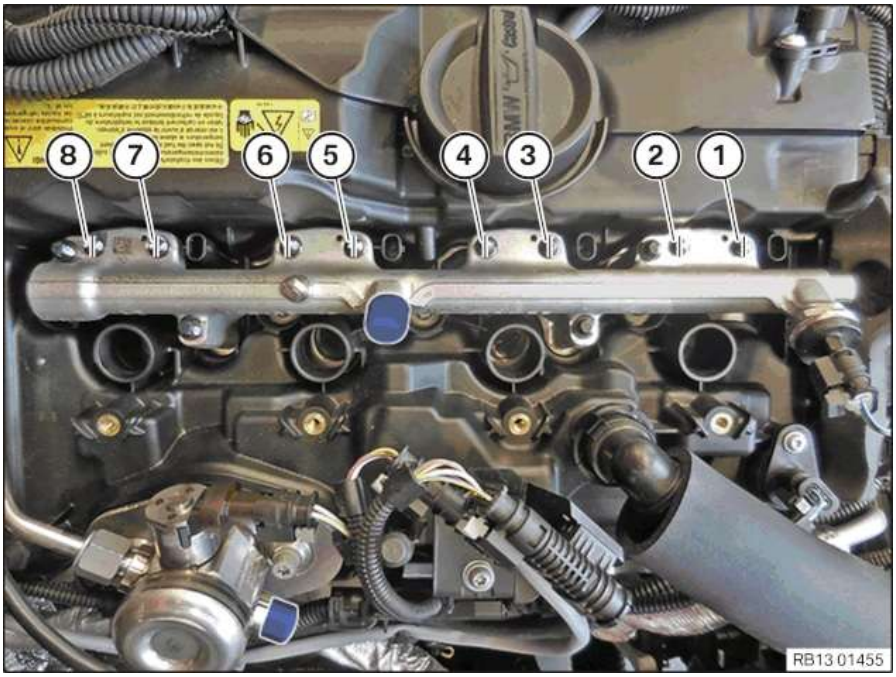
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

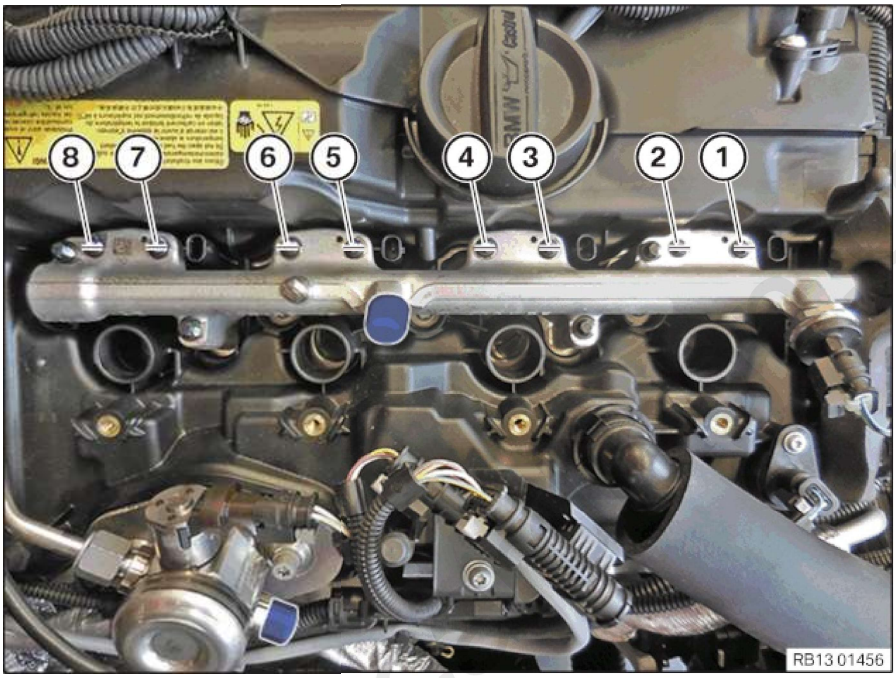
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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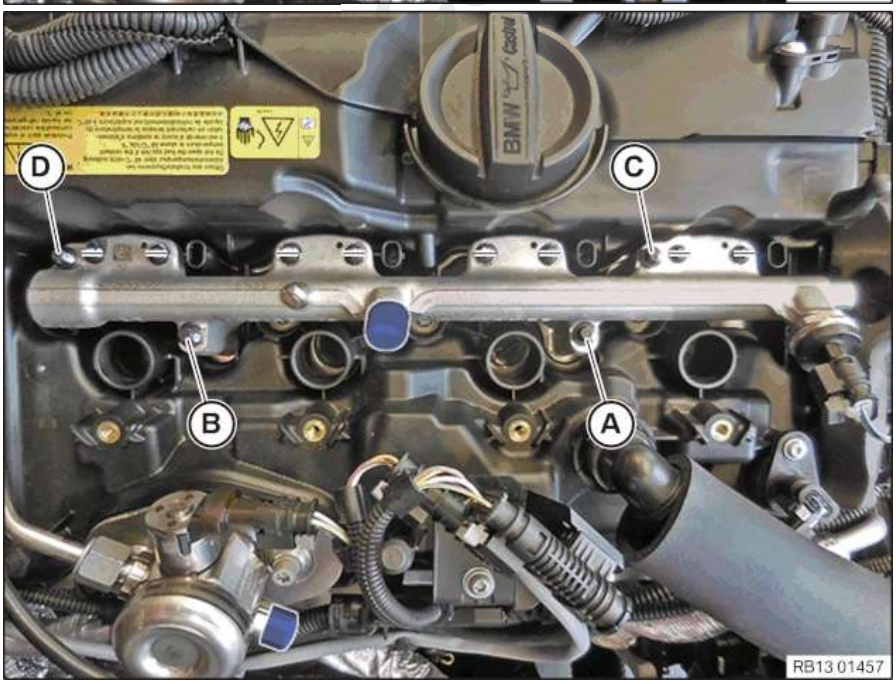


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

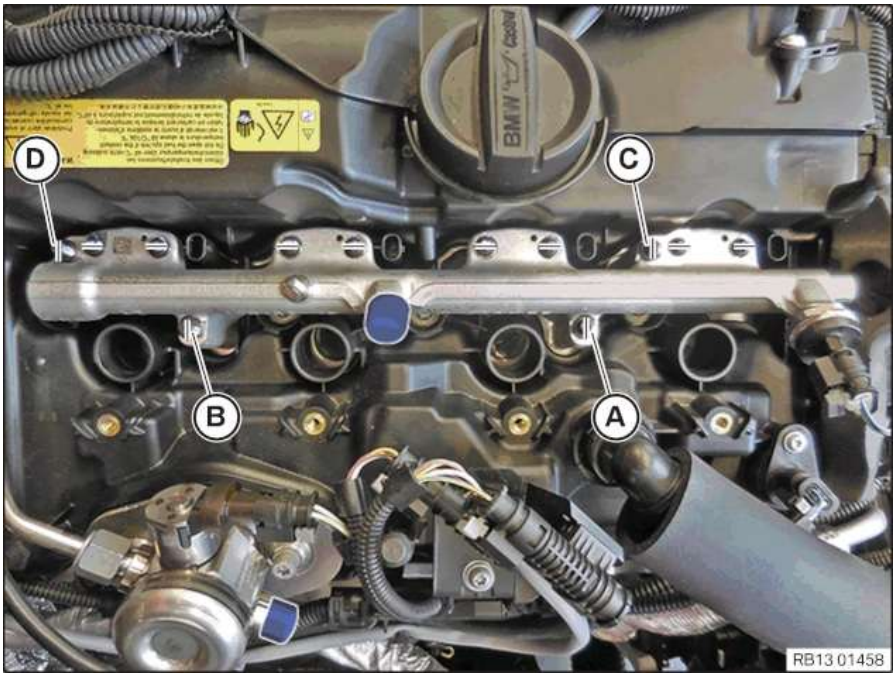
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

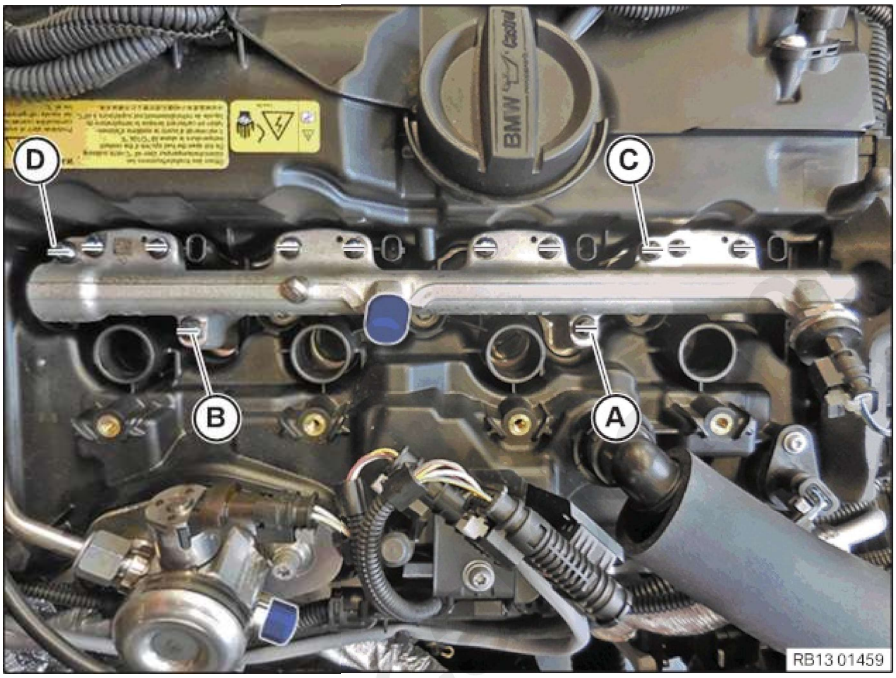
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

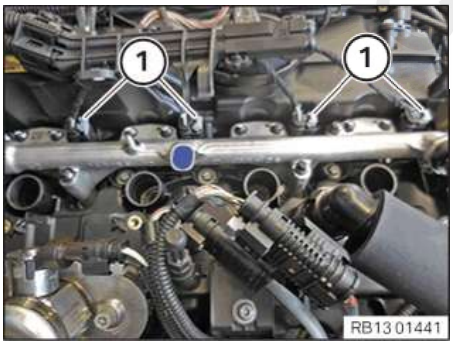


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



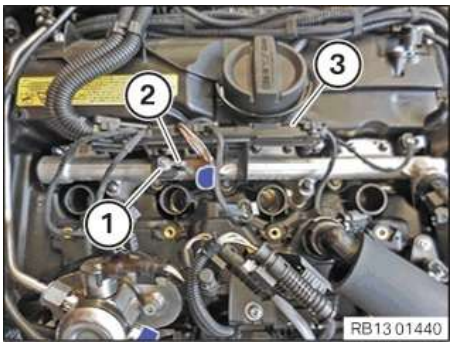
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

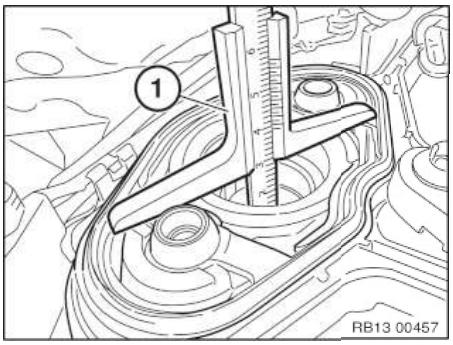
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

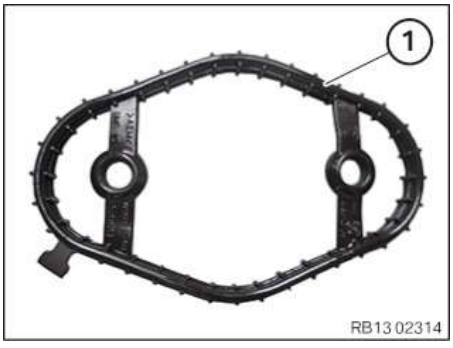
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

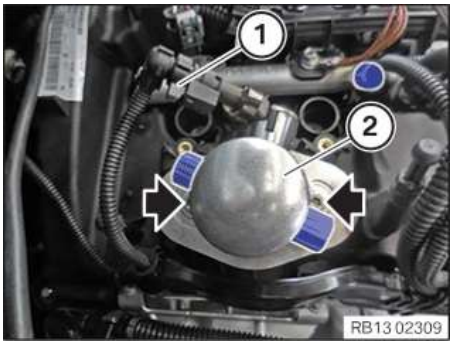
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

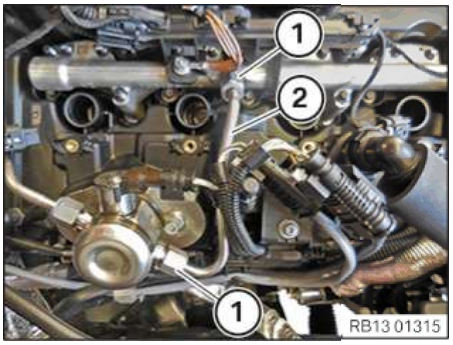
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

52 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

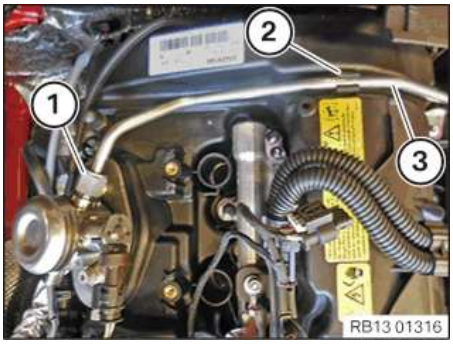
53 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

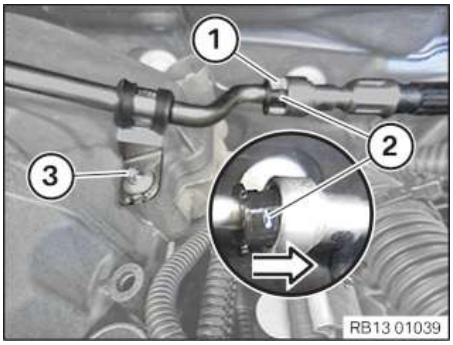


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

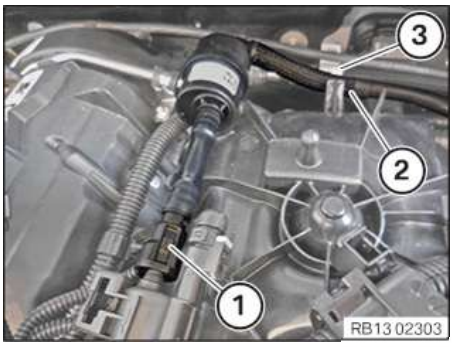
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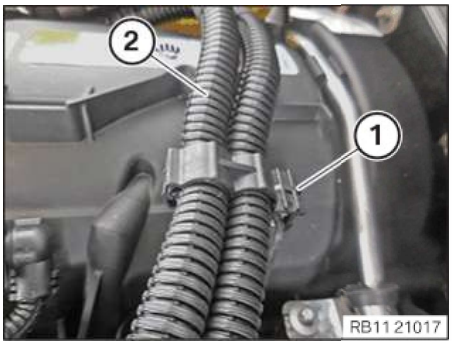
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

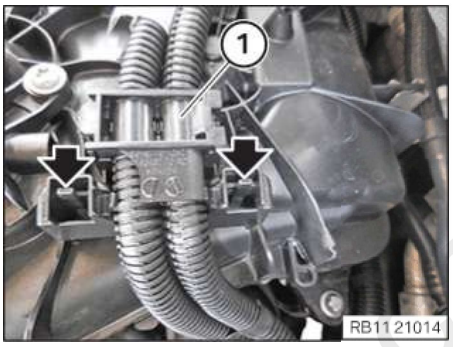
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

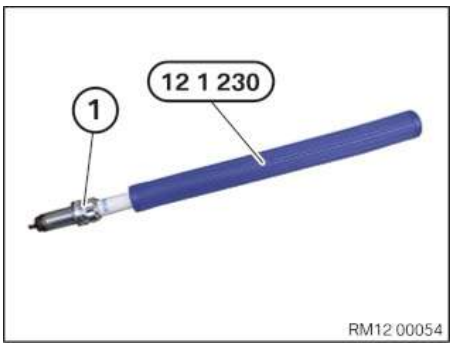


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

54 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

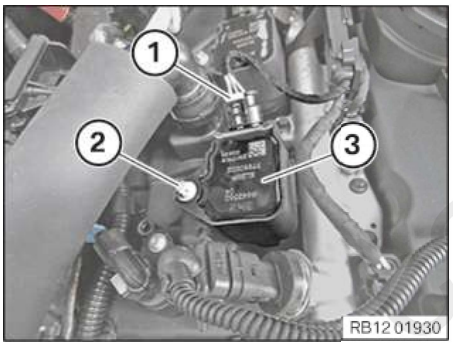
M12x1.25		Tightening torque	23 Nm

55 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Install ignition coil.**



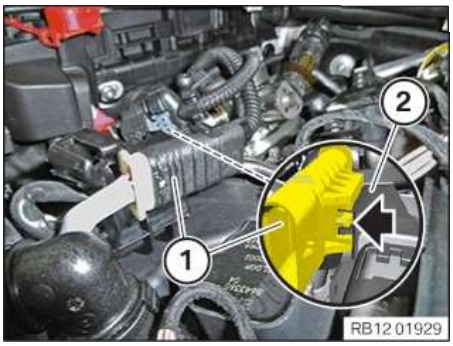
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

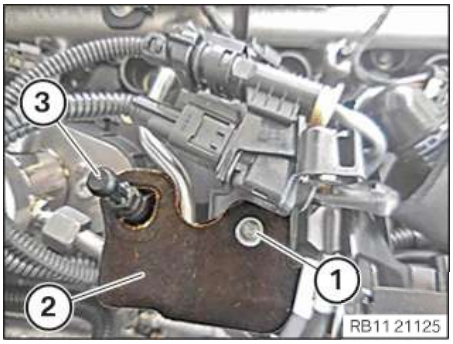
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

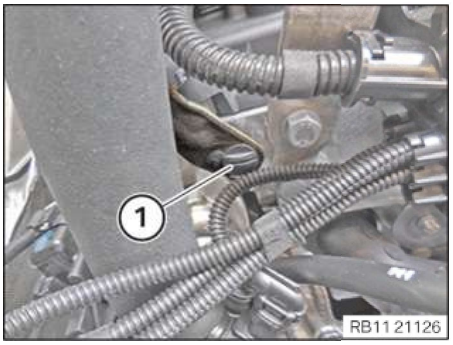
56 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

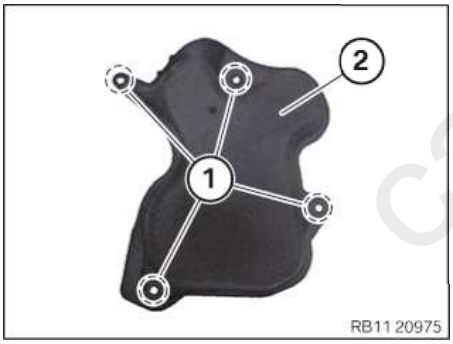
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



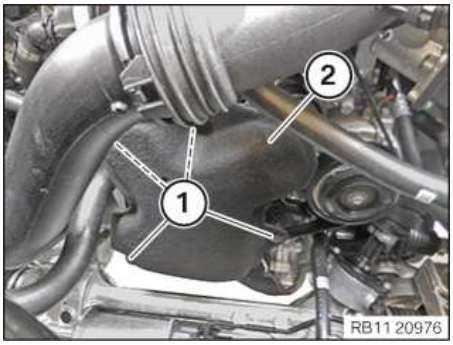
- Secure the clip (1).

57 – Install the acoustic cover for the engine at the front



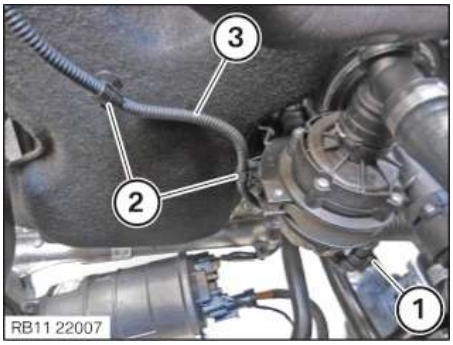
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



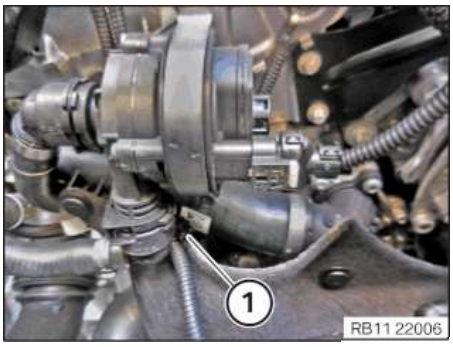
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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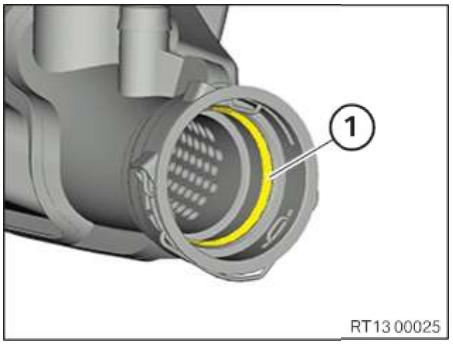
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

58 – Installing the clean air pipe with resonator

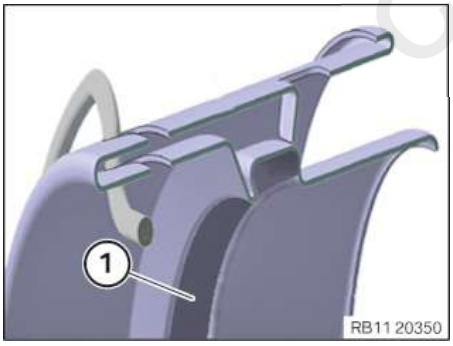


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

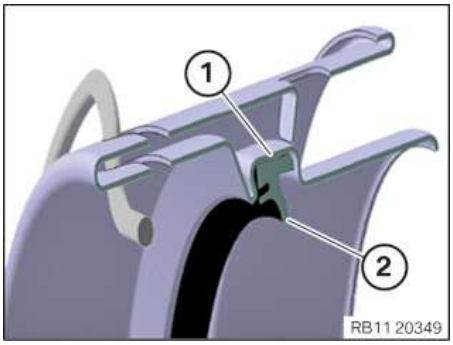
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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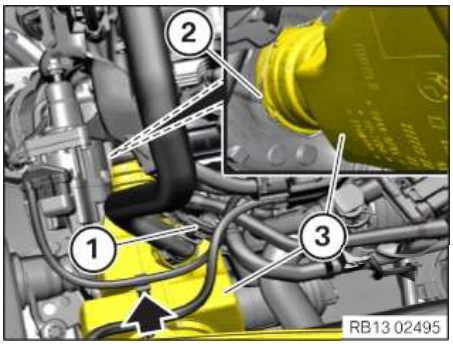
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

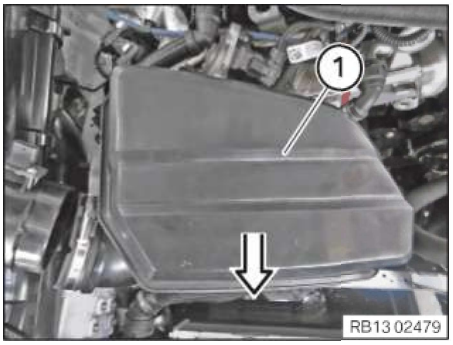
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



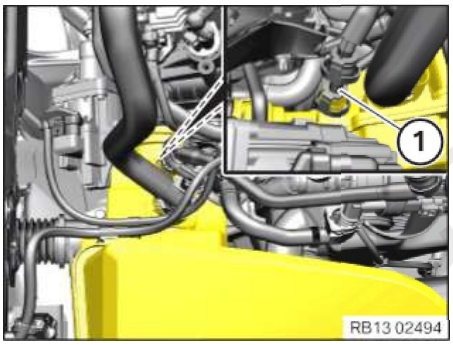
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

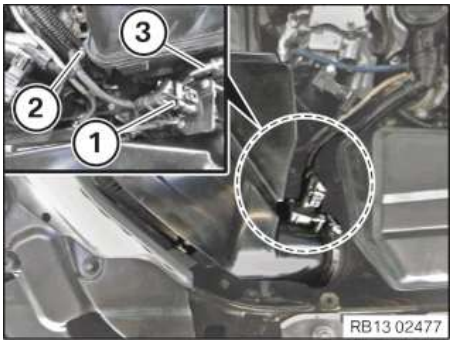
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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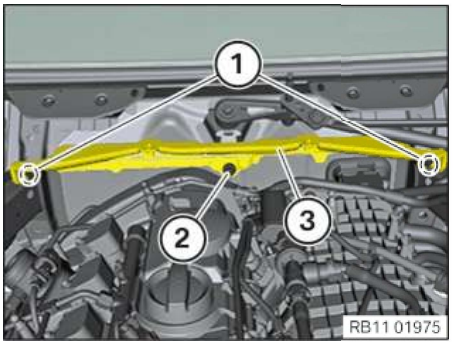
- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

59 – Disconnecting all battery earth leads



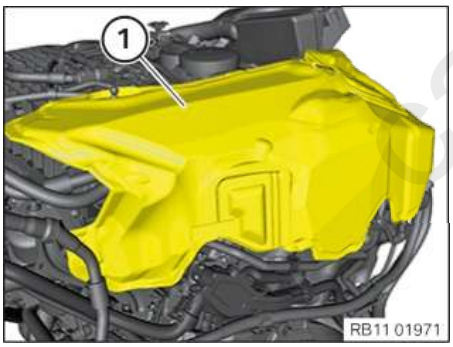
- See additional information.

60 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

61 – Installing acoustic cover at rear



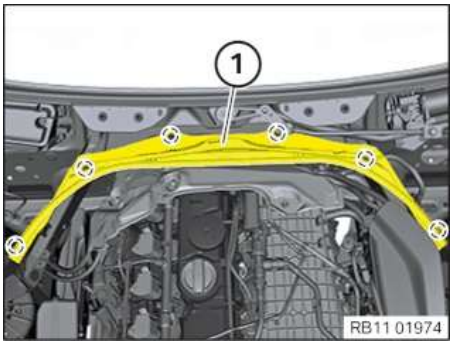
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

62 – Installing the centre bulkhead upper part

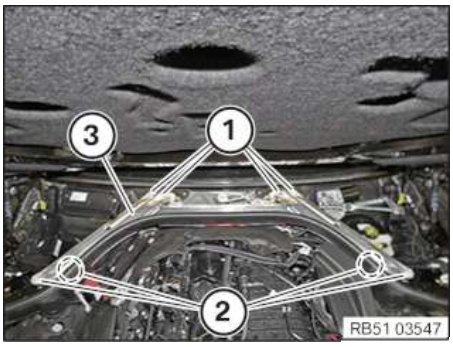
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- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

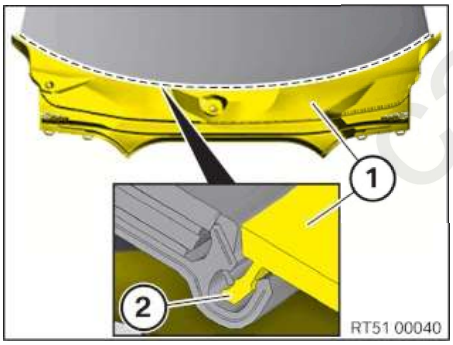
63 – Installing cowl panel cover

RISK OF DAMAGE

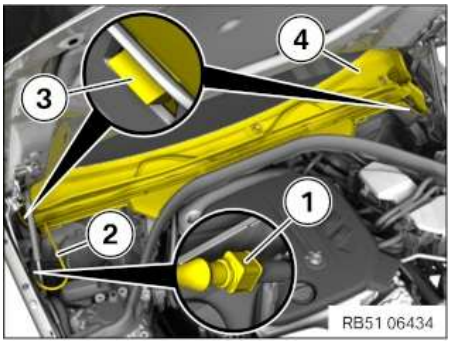
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

64 – Installing both wiper arms

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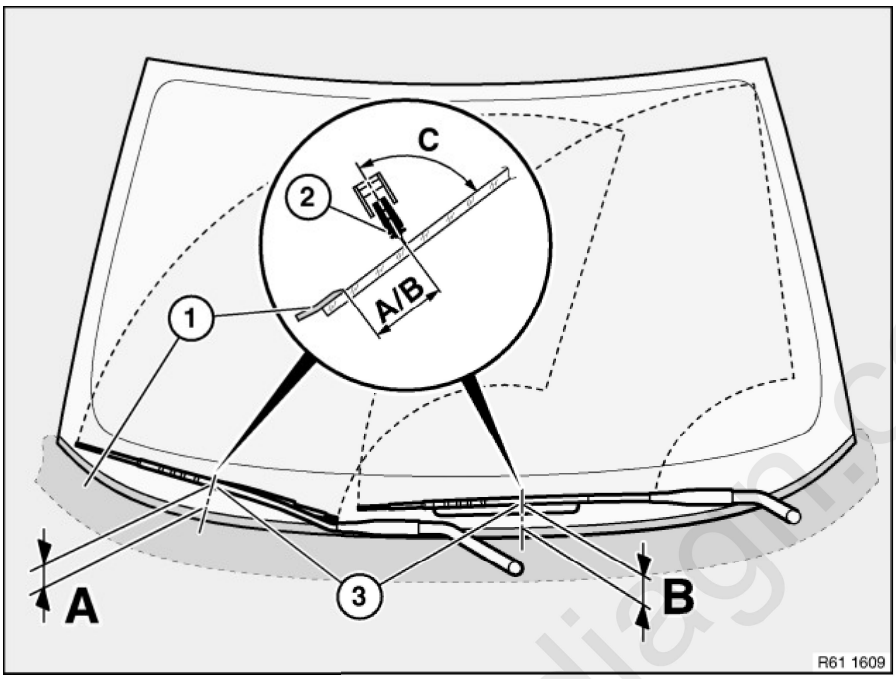
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

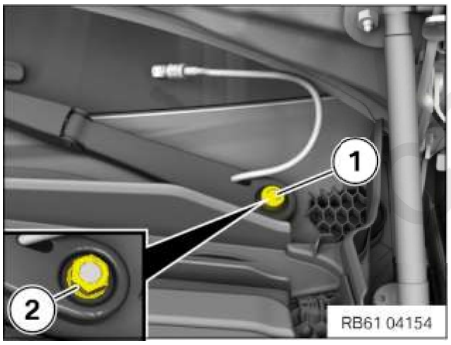
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

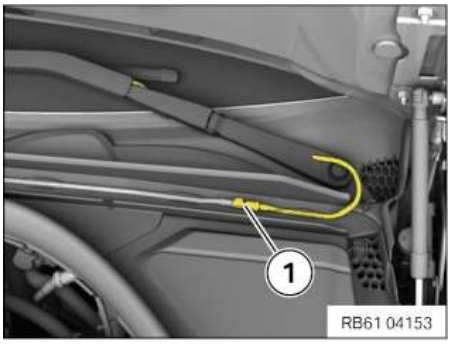


- Tighten nut (2).

Windscreen wiper arm

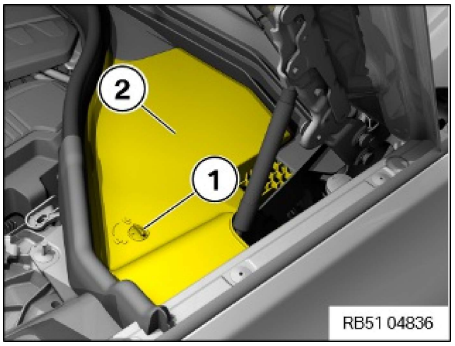
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



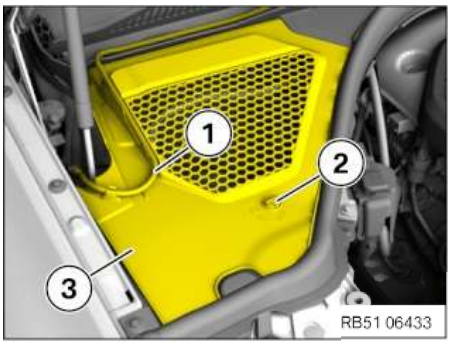
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

65 – Install the cover of the engine compartment on the rear left



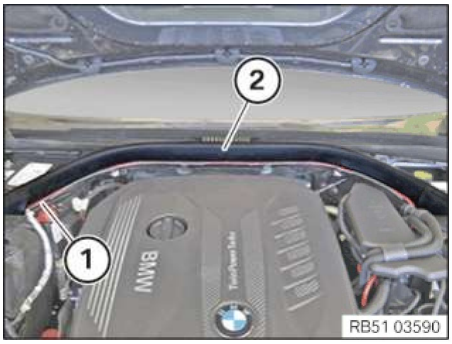
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

66 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

67 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

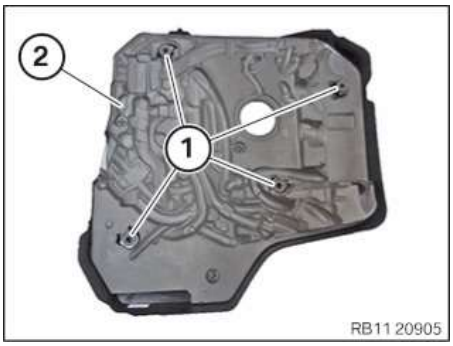
68 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

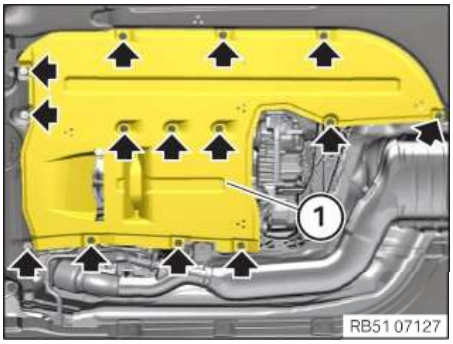
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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

69 – Installing underbody protection at rear



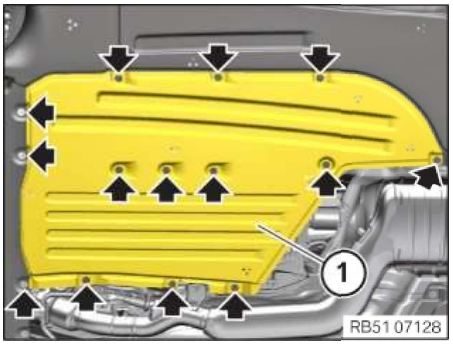
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

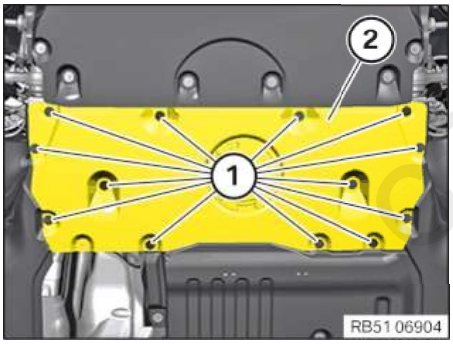
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

70 – Installing the centre underbody protection



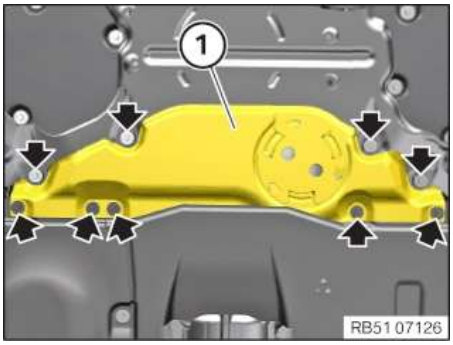
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

  Guide in and install the centre of underbody protection (1).

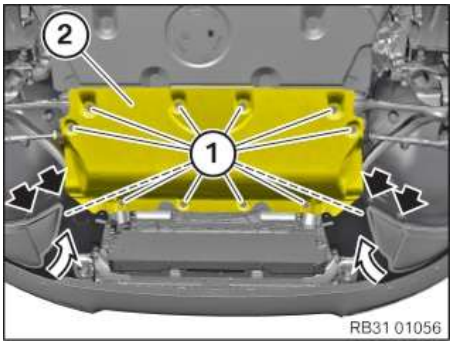
  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

71 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

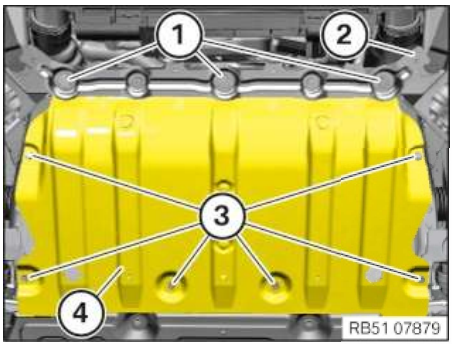
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

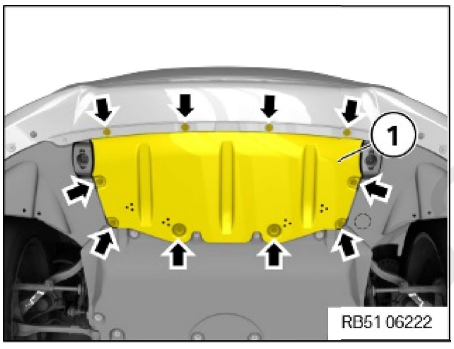
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

72 – Installing the front underbody protection



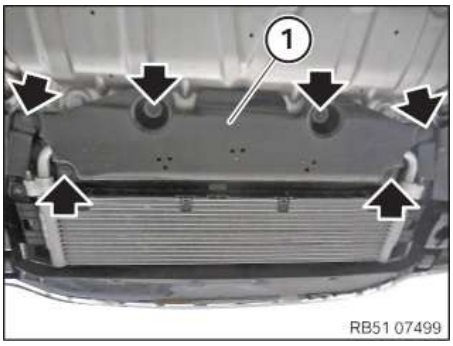
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



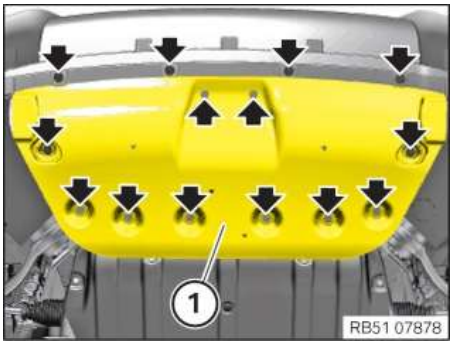
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

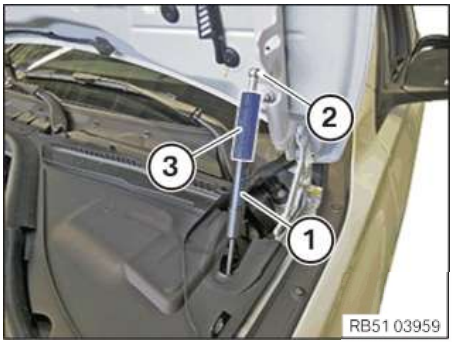
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

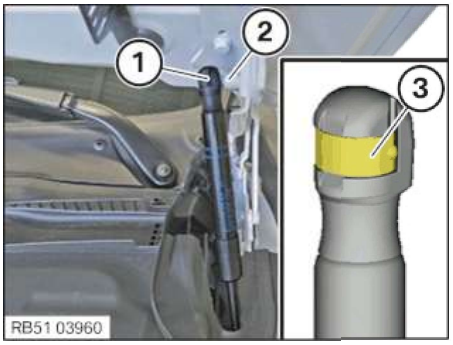
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

73 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head — Used in step 293844

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 293844

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4041

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 43

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Cylinder head cover to cylinder head — Used in step 45

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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Wiring harness section of engine to cylinder head cover — Used in step 45

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 4548

6X18		Tightening torque	6 Nm

Heat shield to cylinder head — Used in step 47

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 47

M6 x 12		Tightening torque	8 Nm

Ground cable to rail — Used in step 50

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 51

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 52

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 53

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 53

M6 screw		Tightening torque	6,5 Nm

Spark plugs — Used in step 54

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 55

Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover — Used in step 56

TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 58

Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead — Used in step 62

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 62

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 62

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 64

Combination hexagon nut		Tightening torque	35 Nm

Underbody protection — Used in step 6970

Hexagon screw		Tightening torque	3 Nm

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Underbody protection of the steering gear — Used in step 71

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 71

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 71

M10		Tightening torque	56 Nm

Underbody protection front — Used in step 72

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

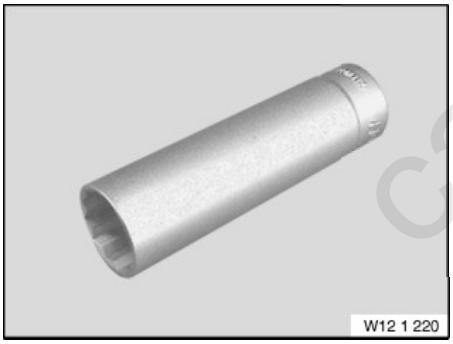
2 360 895 Pin wrench



Common — Used in step 1246

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

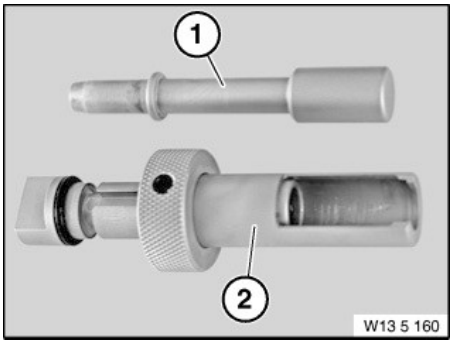
0 495 560 (12 1 220) Socket



Common — Used in step 1654

Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 496 567 (13 5 161) Fastener

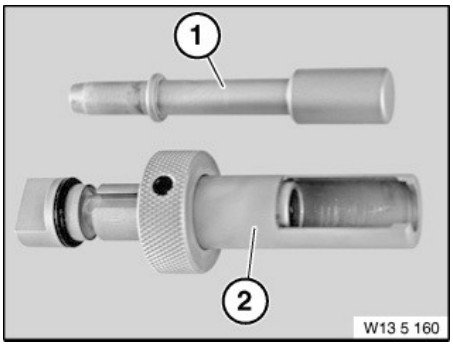


Common — Used in step 19

Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

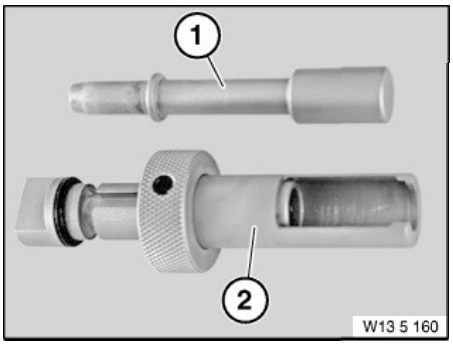
cardiagn.com

0 496 568 (13 5 162) Fastener



Common	Used in step 19
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener

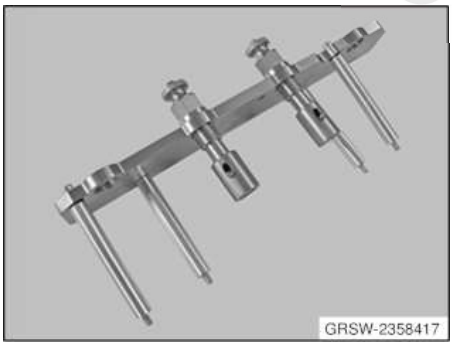


Common	Used in step 19
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

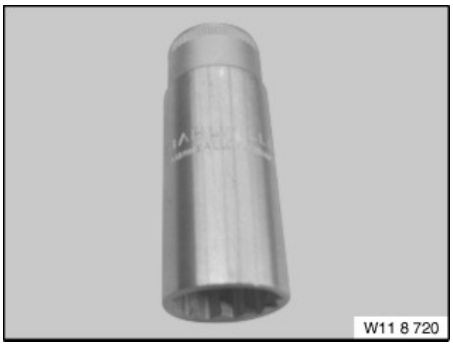
2 358 417 Device



Common	Used in step 20
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

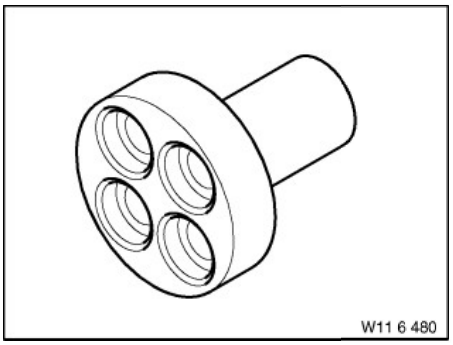
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0 496 106 (11 8 720) Socket WAF 46



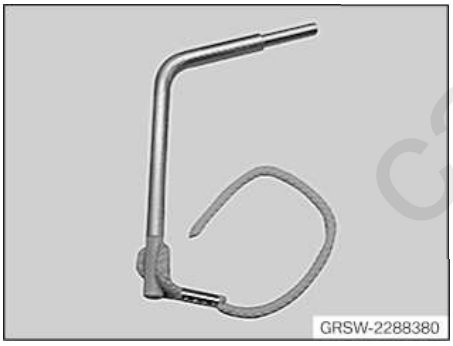
Common	Used in step 20
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 493 380 (11 6 480) Connector



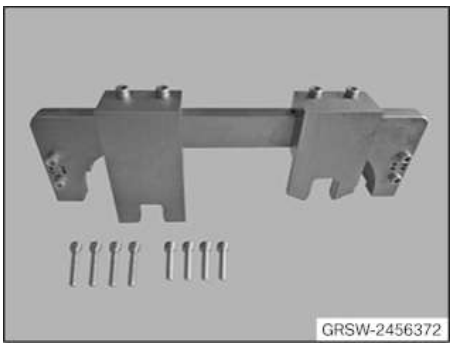
Common	Used in step 29424451
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 294244
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 2937384244
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 358 122 Gauge



Common	Used in step 293744
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



Common	Used in step 31324041
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common	Used in step 31324041
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

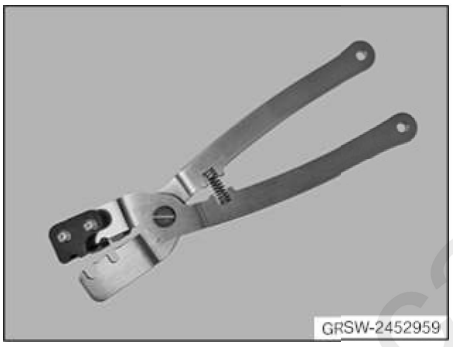
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2 455 654 Tensioning tool



Common	Used in step 3942
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 49
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 448 401 Fitting aid



Common	Used in step 49
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

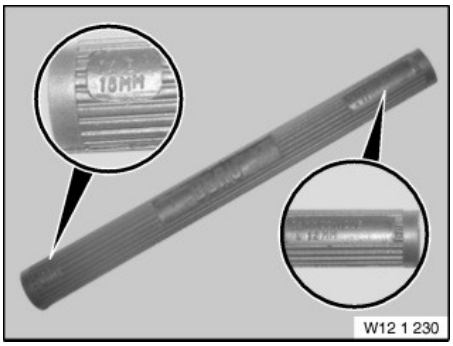
2 358 022 Gauge



Common	Used in step 50
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 065 (12 1 230) Fitting aid



Common	Used in step 54
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 64
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	159
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	159
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
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61 20 900 Disconnecting and connecting battery earth lead	159

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61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 20 900 Disconnecting and connecting battery earth lead	159
61 35 ... Notes on ESD protection (Electro Static Discharge)	12
61 35 ... Notes on ESD protection (Electro Static Discharge)	121520
13 53 ... Clean the cylinder head around the injectors due to grit / dust	20
61 13 ... Unlocking and disconnecting different plug connections	202445

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11 36 042 Removing and installing/replacing intake adjuster

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

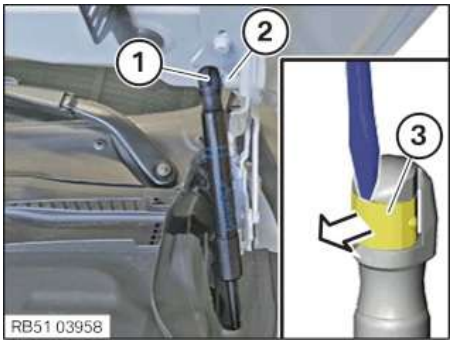
Engine compartment lid is open.

CAUTION

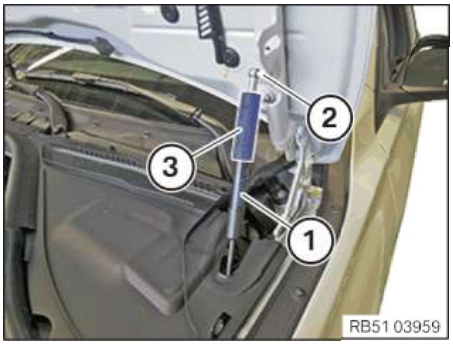
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

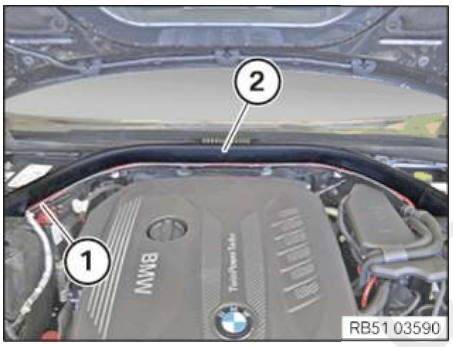


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

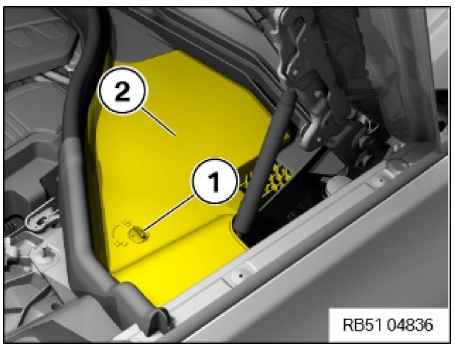
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

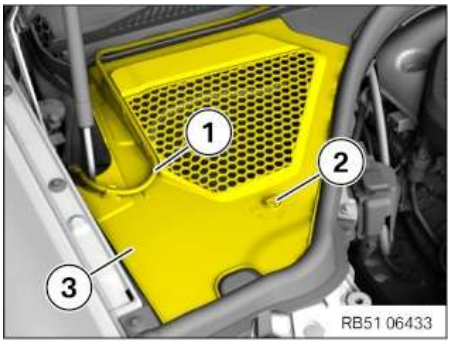
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

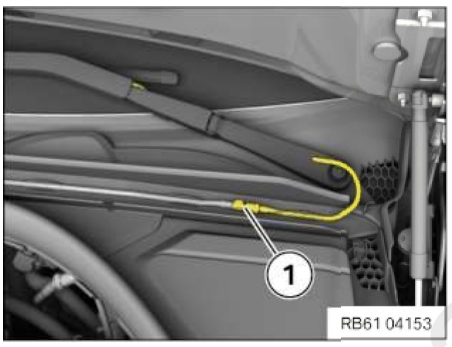
▶ **Remove the wiper arm**

RISK OF DAMAGE

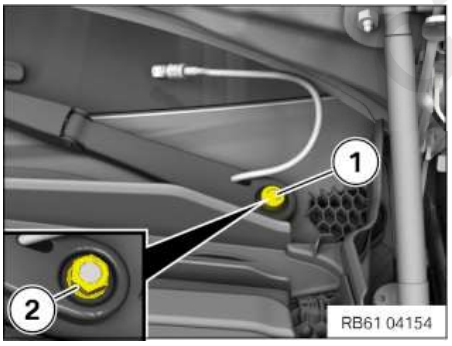
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

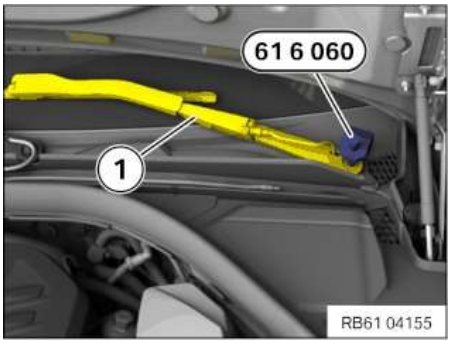
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



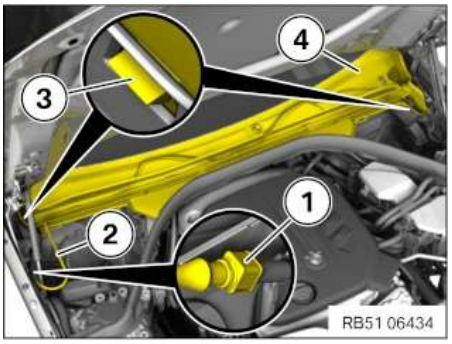
- Remove the protective cap (1).
- Loosen nut (2).



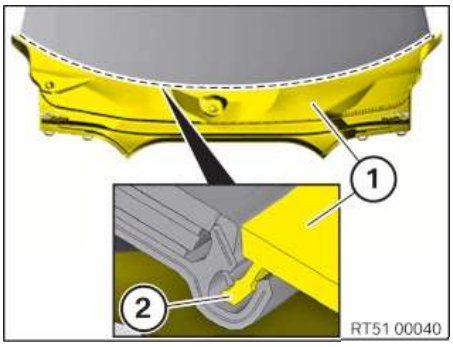
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

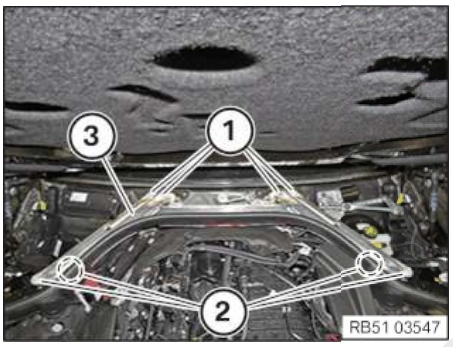


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

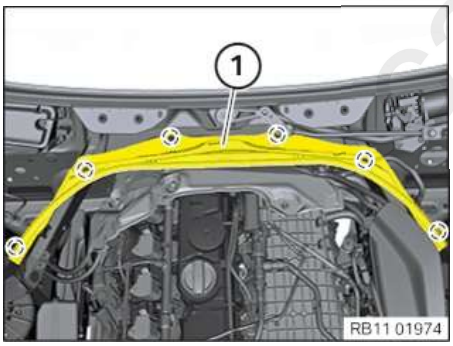
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

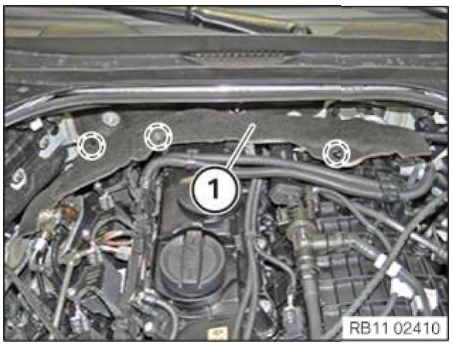
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



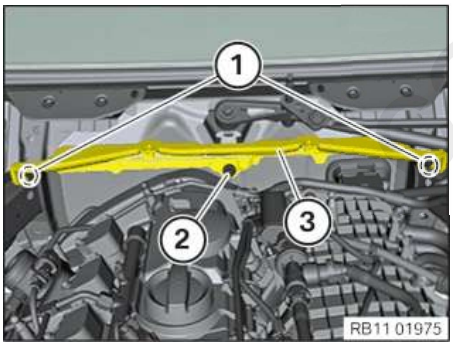
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

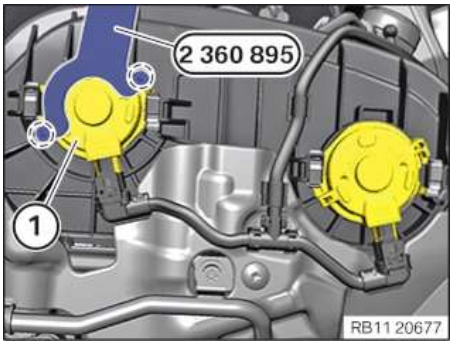
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

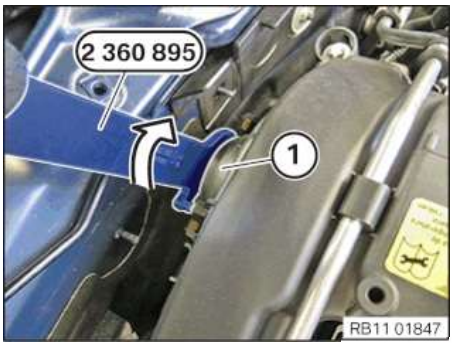
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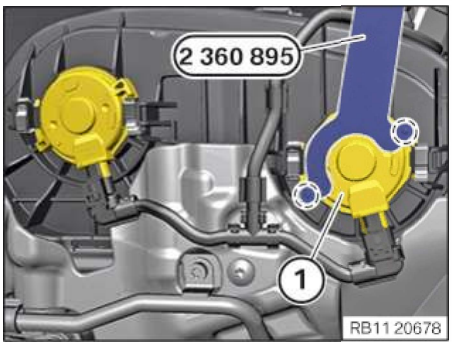
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



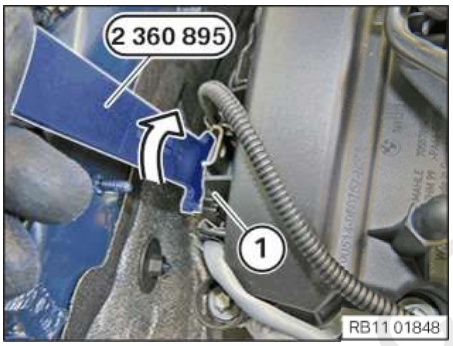
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



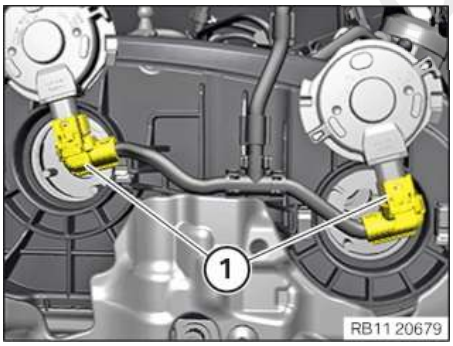
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

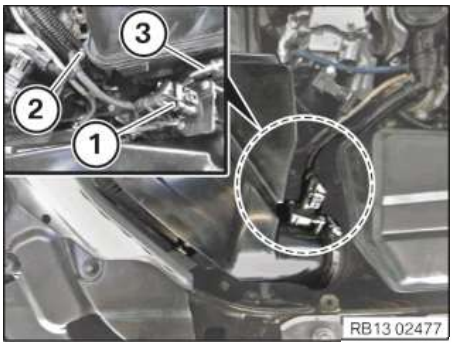
Risk of burning!

- Perform all work only on components that have cooled down.

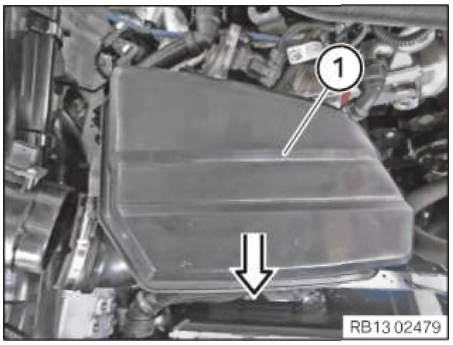
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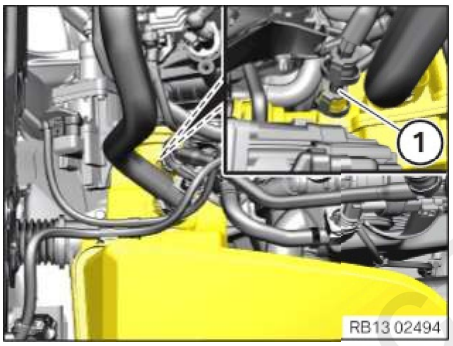
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



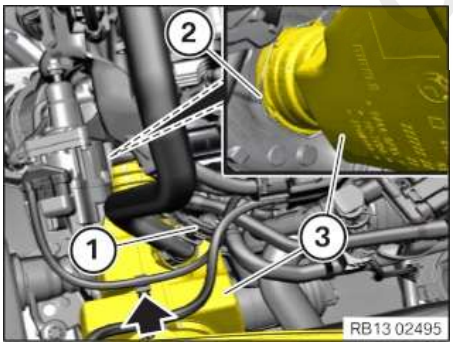
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



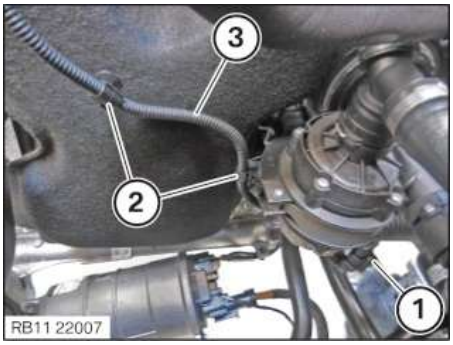
- Unlock and disconnect the tank ventilation line (1).



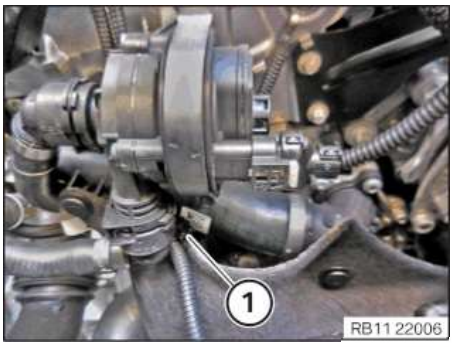
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

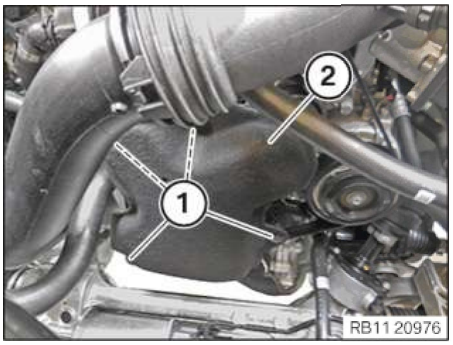
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

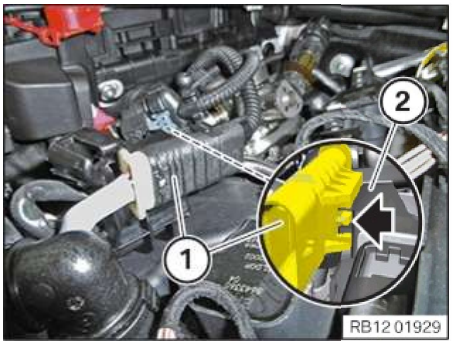
Electrostatic discharge.

Damage to or destruction of electrical components.

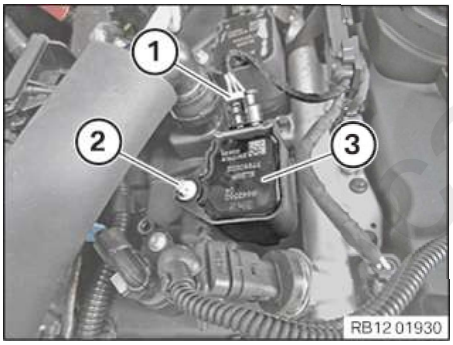
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

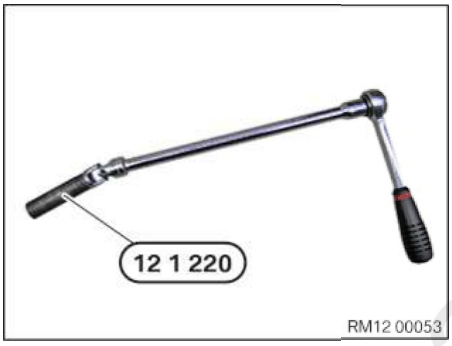
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

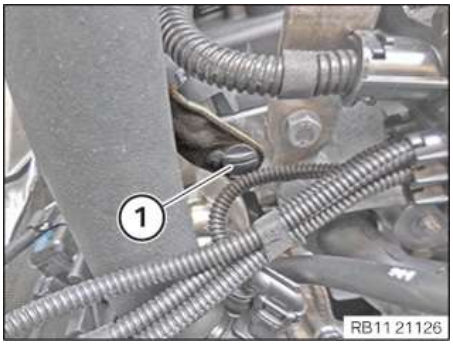
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

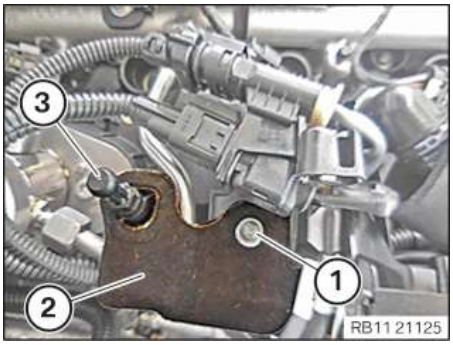


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

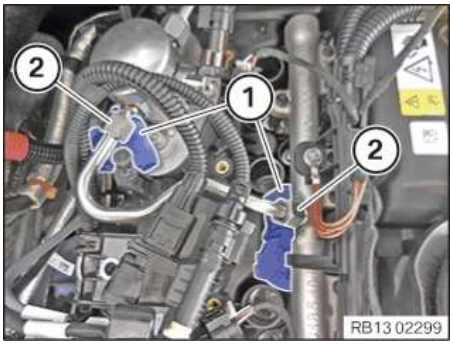
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

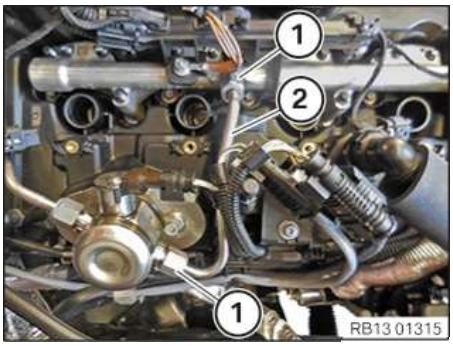


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

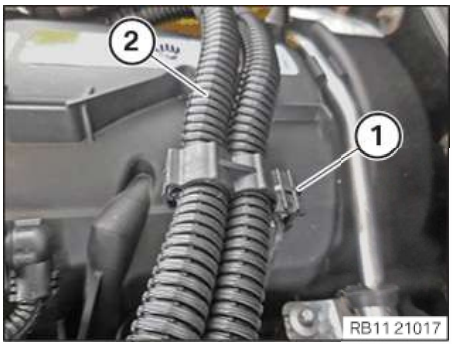
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

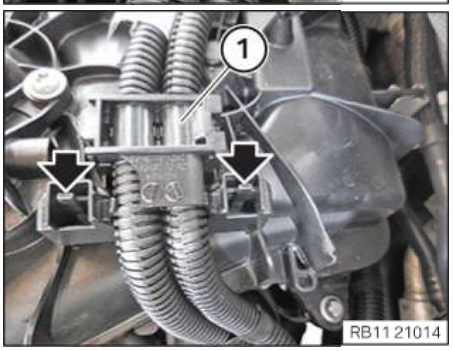
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

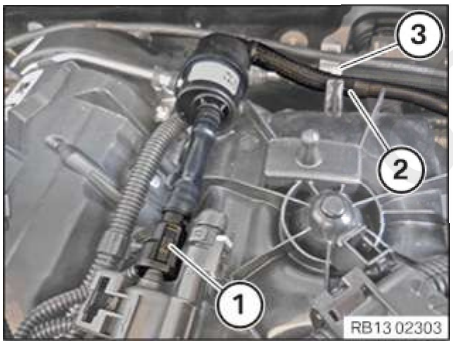
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



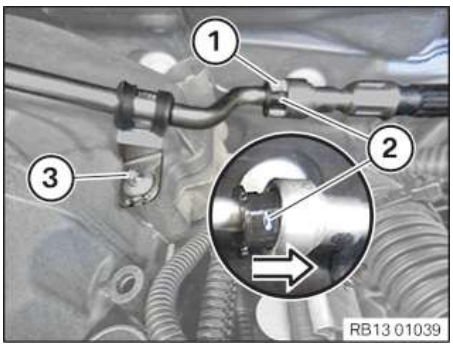
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

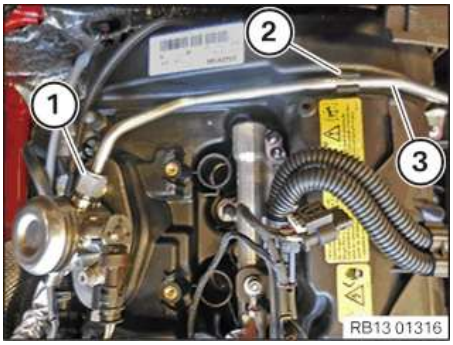


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

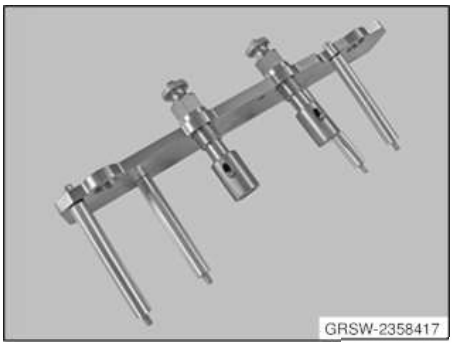
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



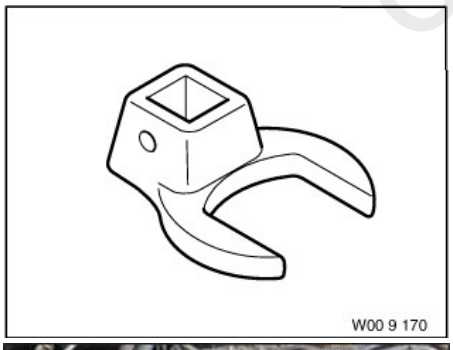
- Prepare special tool 2 358 417.



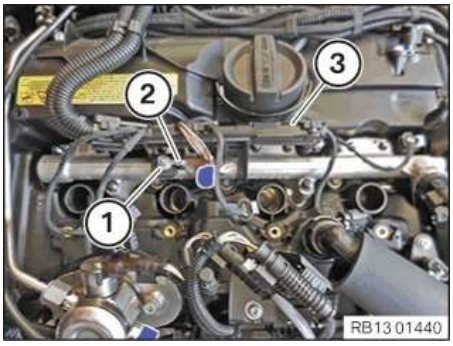
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

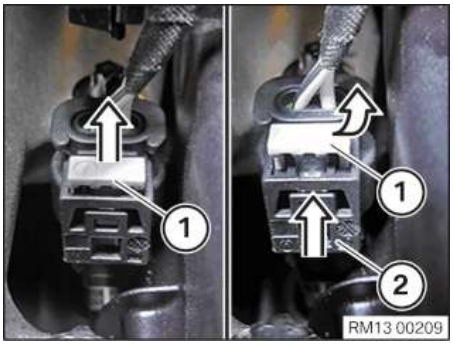


- Prepare special tool .

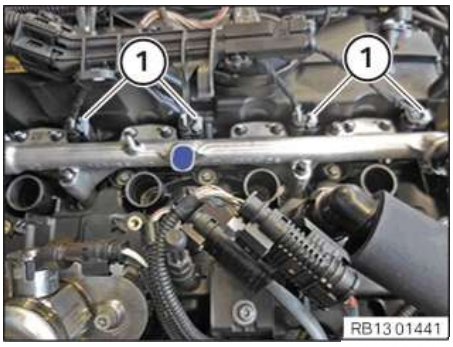


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



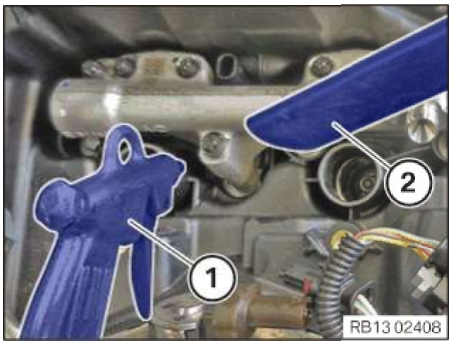
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

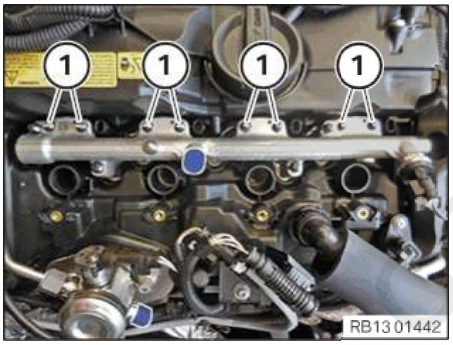


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

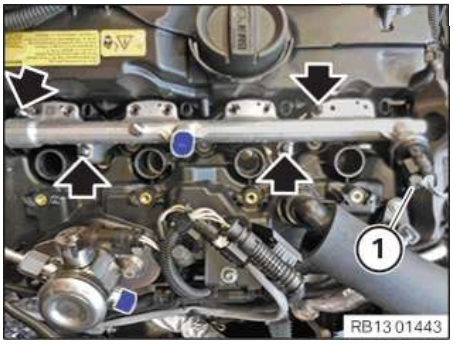
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



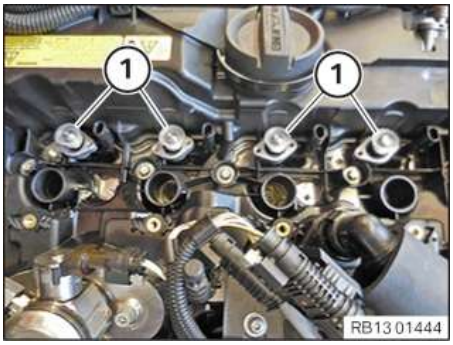
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

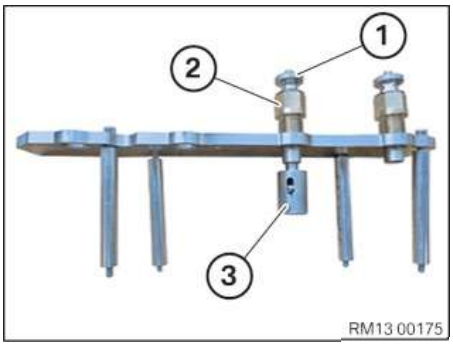
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

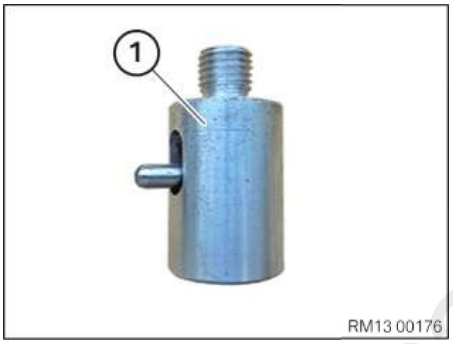
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

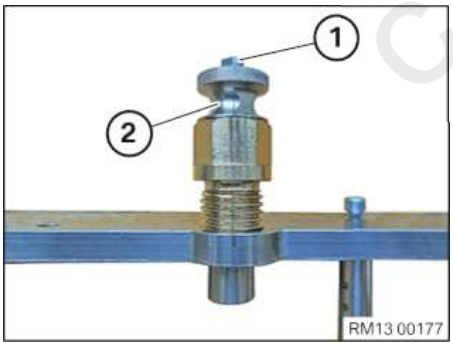
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

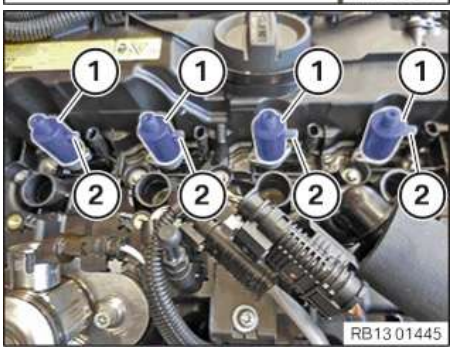
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



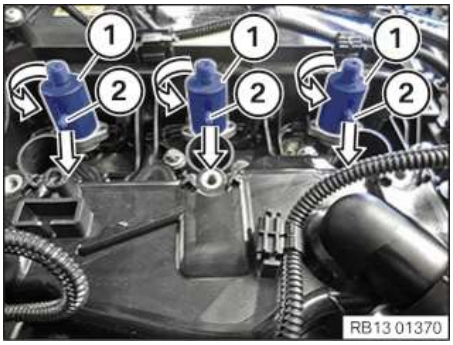
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



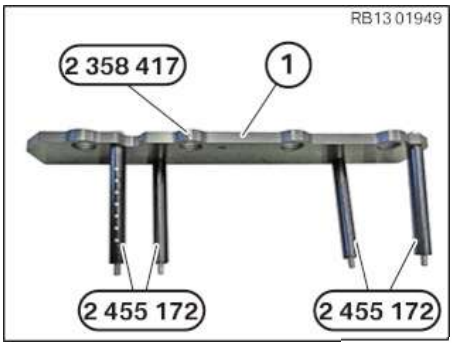
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

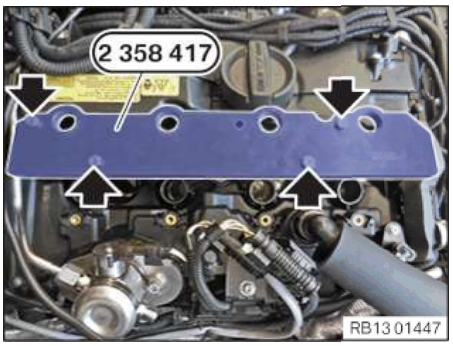
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



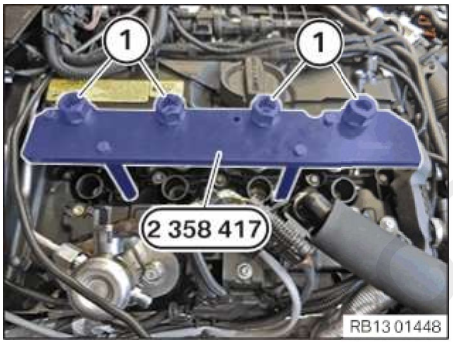
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

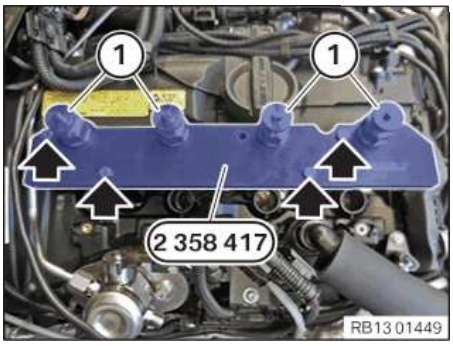
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

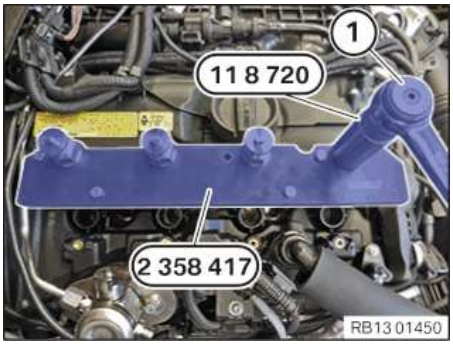
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

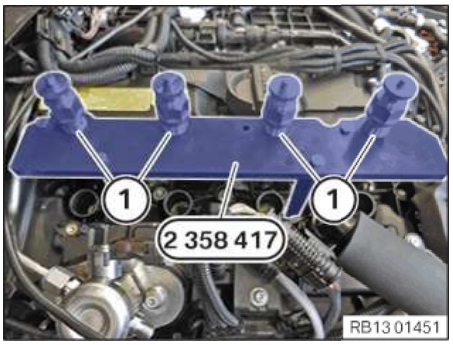


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

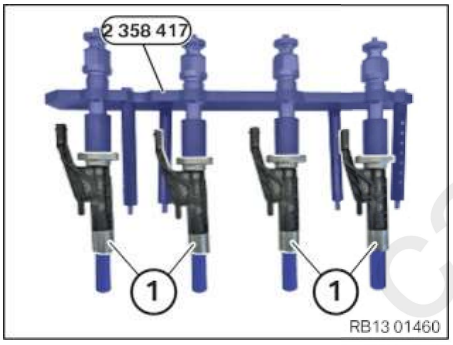
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

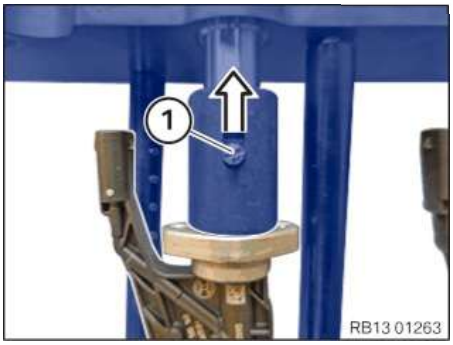


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

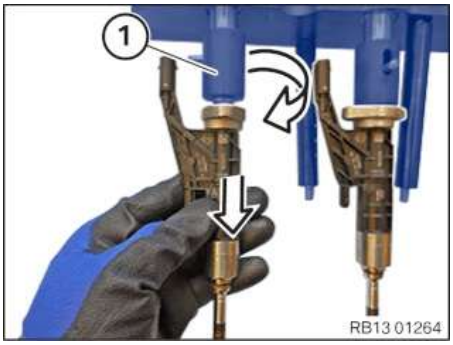


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

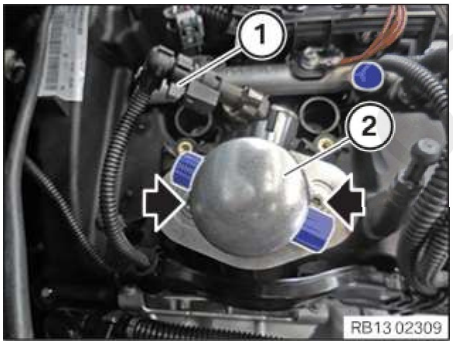
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

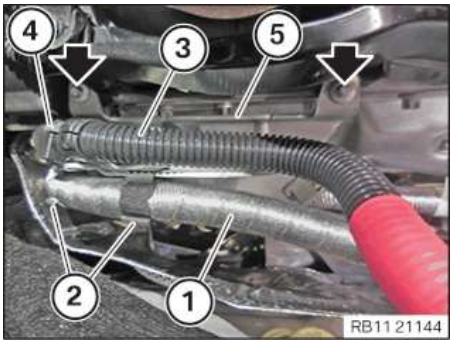
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

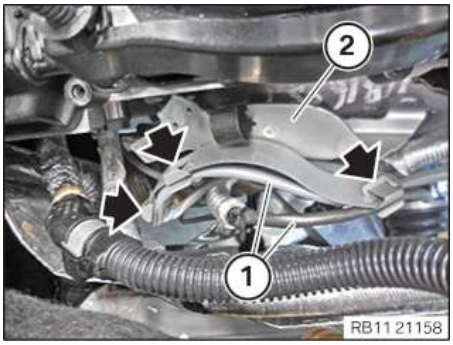


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

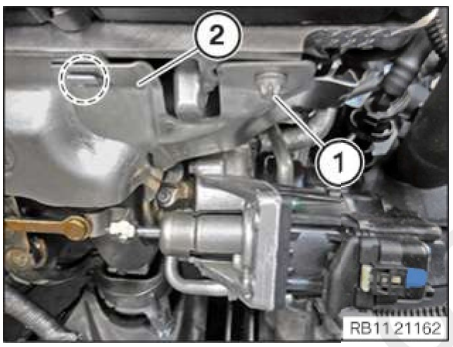
Hot surfaces.

Risk of burning!

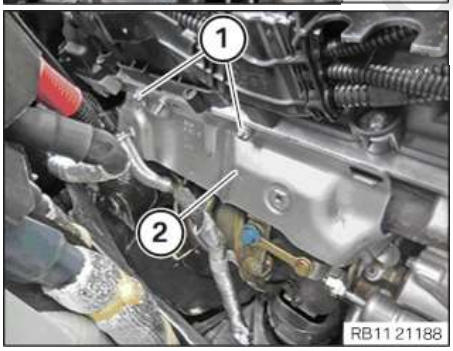
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

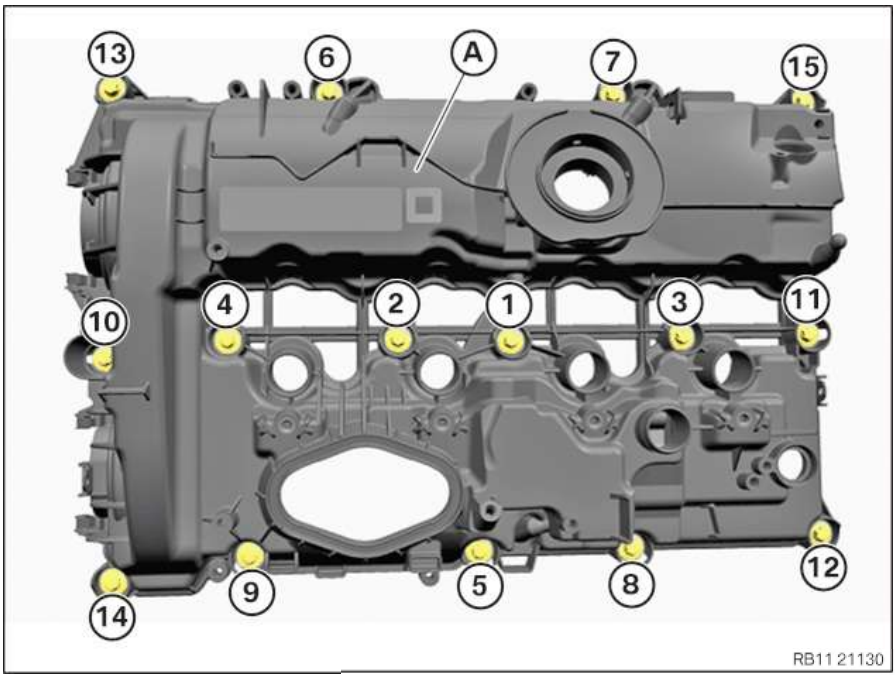


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

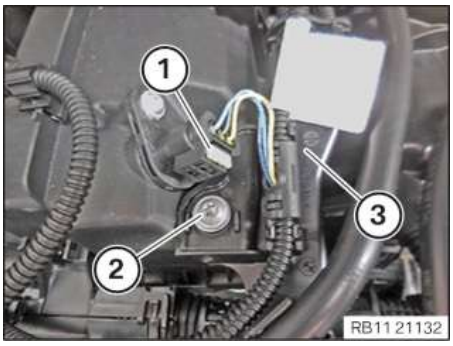
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

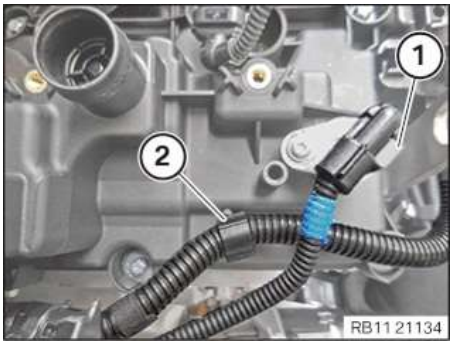
- Do not pull on the wires when disconnecting connectors and plug connections.



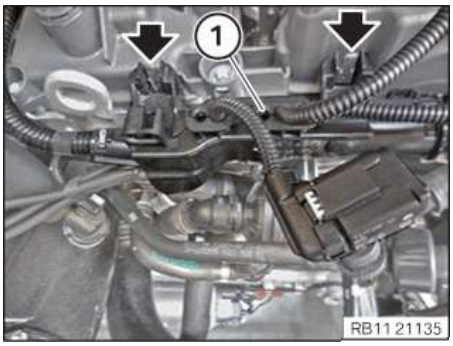
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



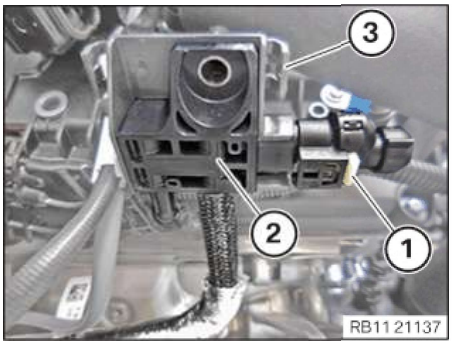
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



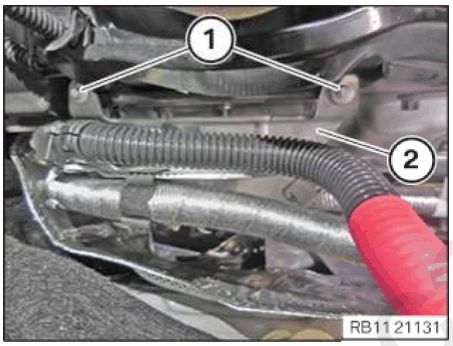
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



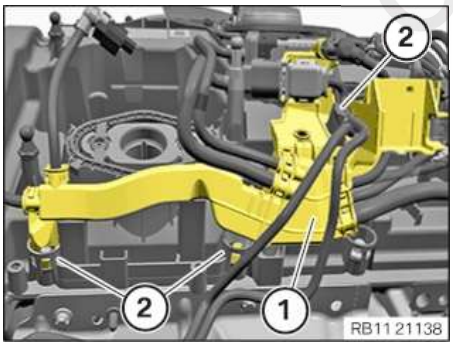
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



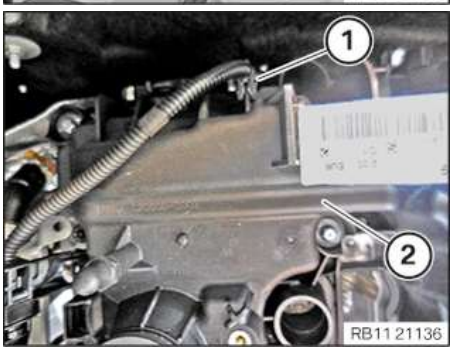
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

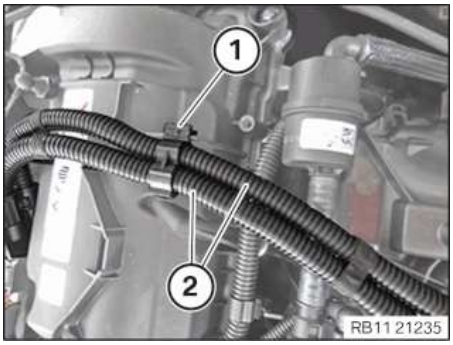


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

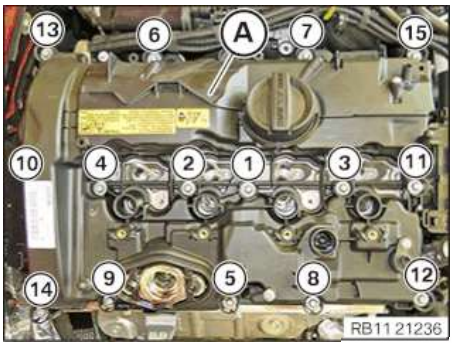


- Loosen clamp (1).

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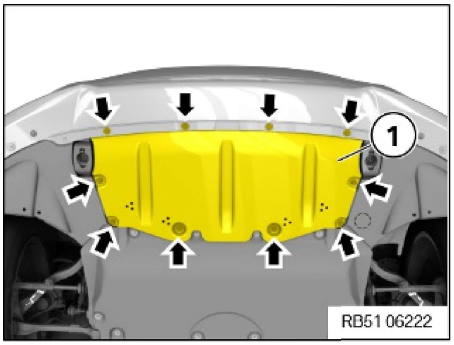


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

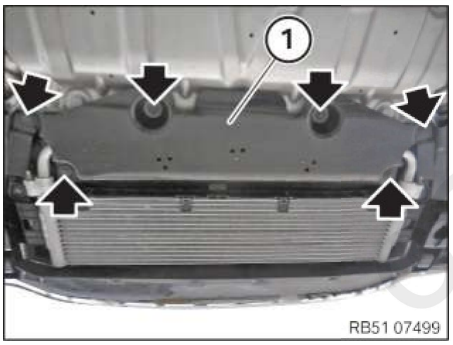
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

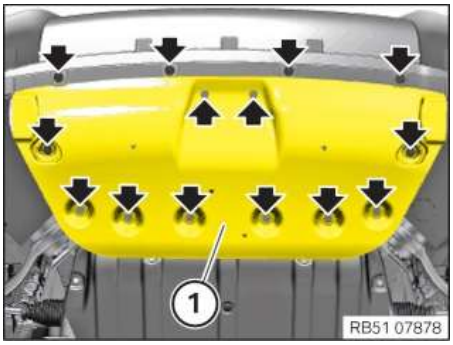
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

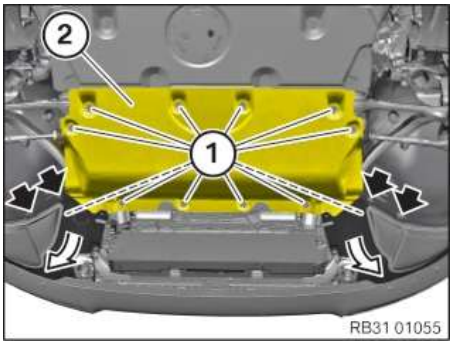


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



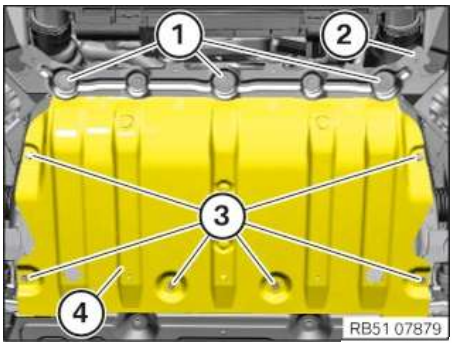
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

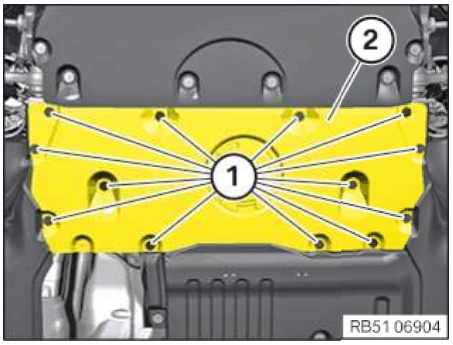
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

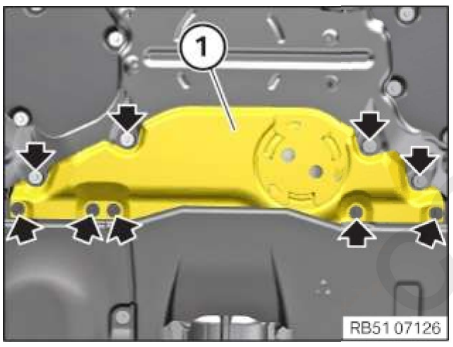
27 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

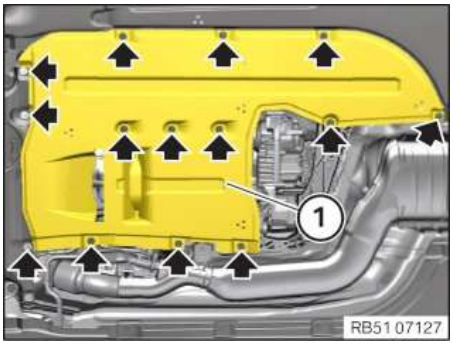


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

28 – Remove rear underbody protection

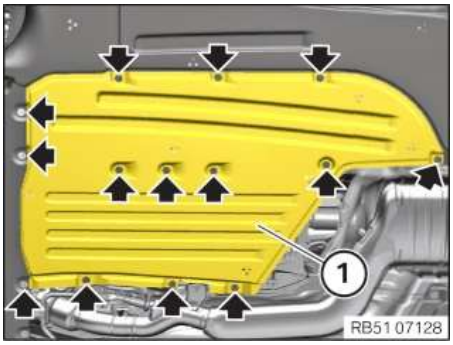


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

29 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



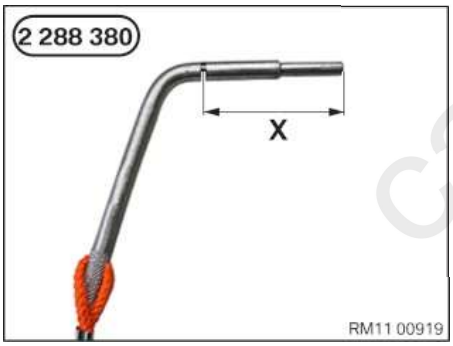
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

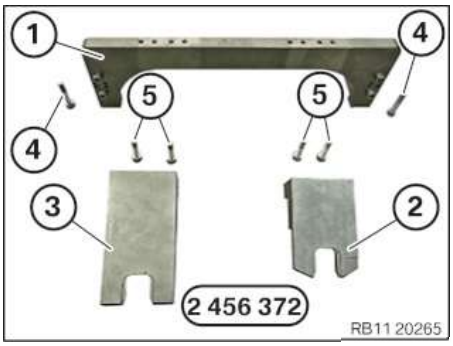
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- **Vehicles with automatic transmission:**

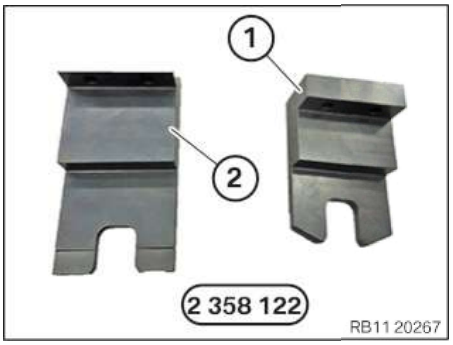
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



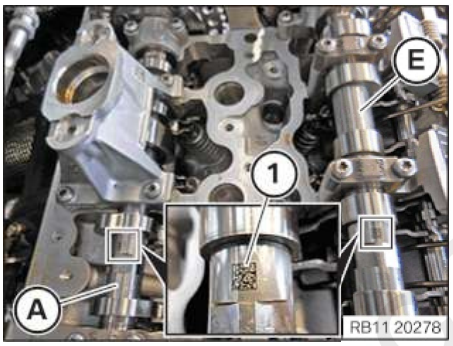
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

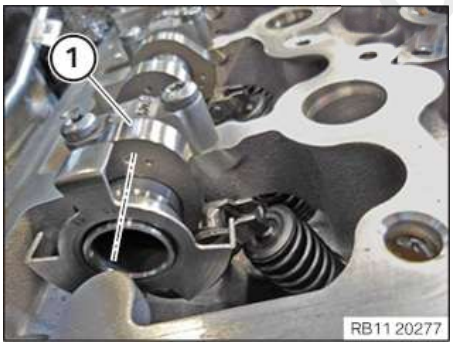


- Overview of the test gauges from the set of special tools 2 358 122:

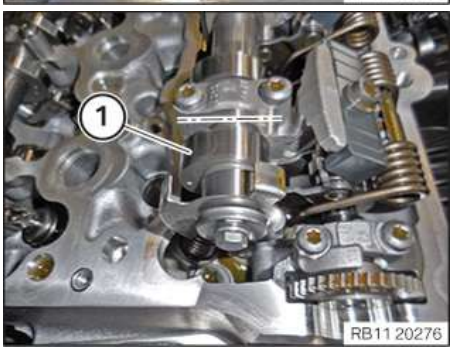
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

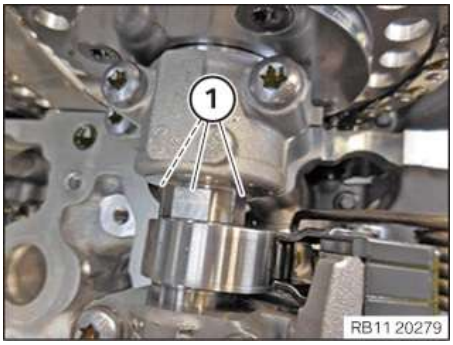


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

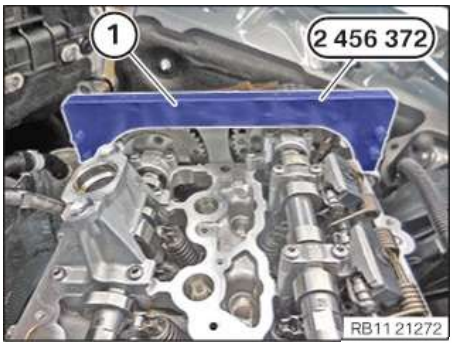


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

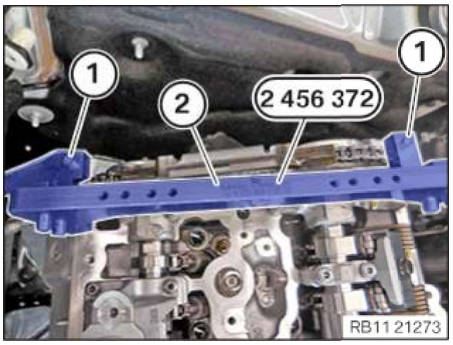
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- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



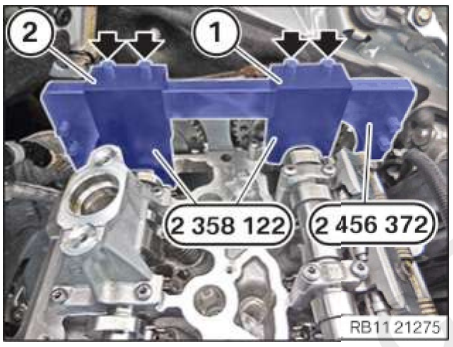
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

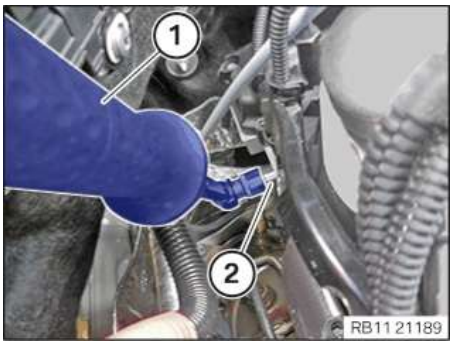
Test gauge to basic carrier

M6		Tightening torque	8 Nm

30 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

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- Feed out and remove the chain tensioner (1).

MAIN WORK

31 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

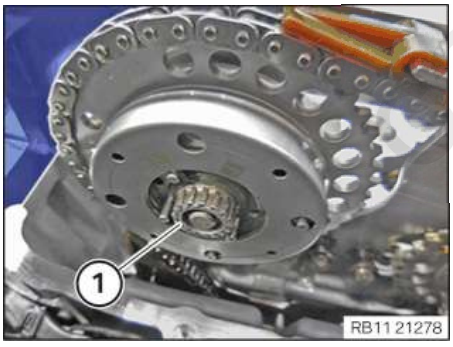


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

32 – Removing the VANOS central valve of the intake adjuster

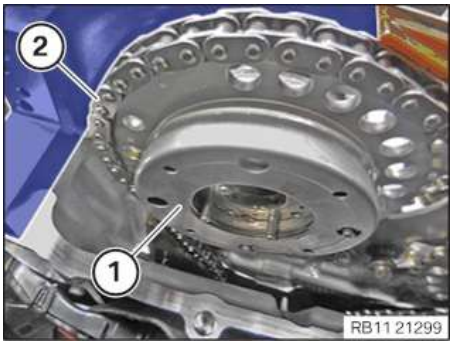


- Guide out and remove the VANOS central valve (1) of the intake adjuster.

33 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.



- Guide out the intake adjuster (1) from the timing chain (2) and remove.

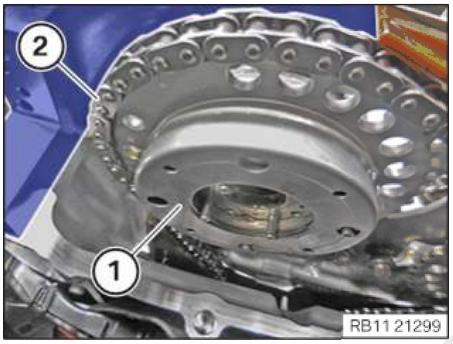
34 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

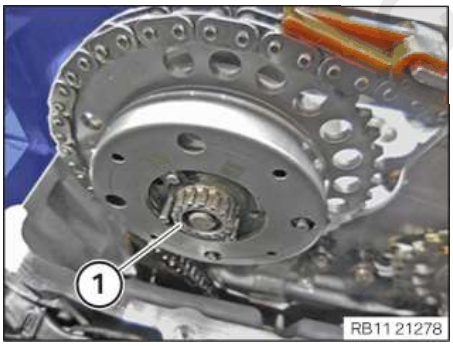


- Keep intake adjuster (1) marked IN ready.

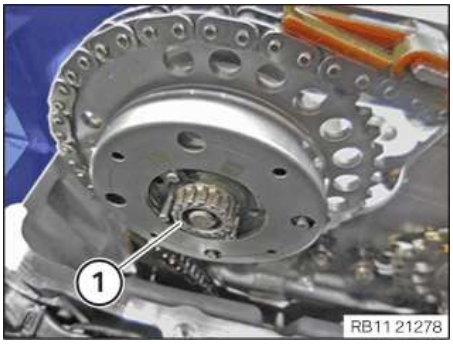


- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

35 – Install the VANOS central valve of the intake adjuster

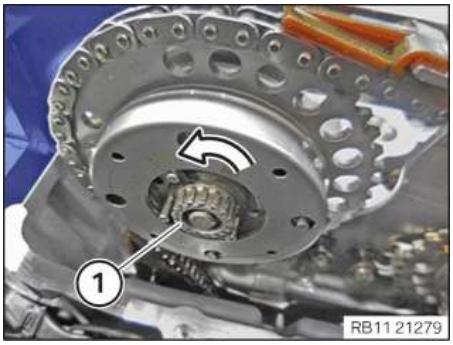


- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.

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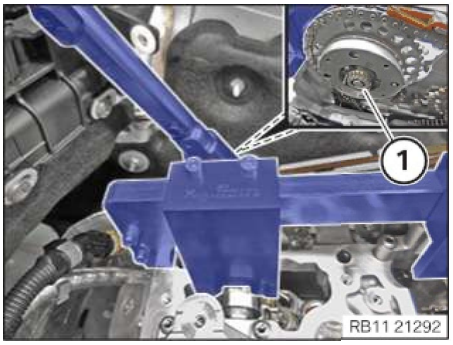


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

36 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

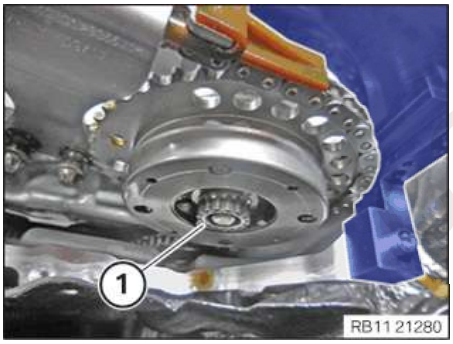


NOTICE

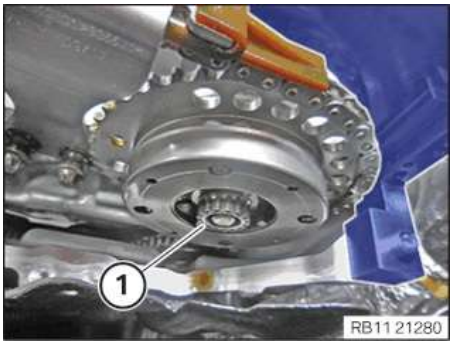
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

37 – Installing the VANOS central valve of the exhaust camshaft adjuster

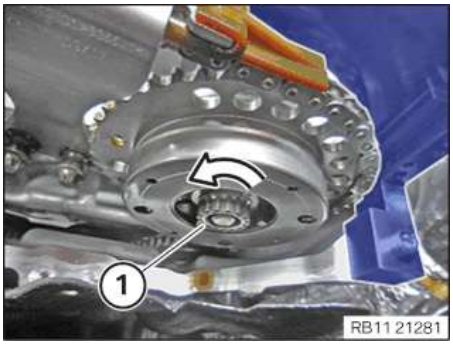


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



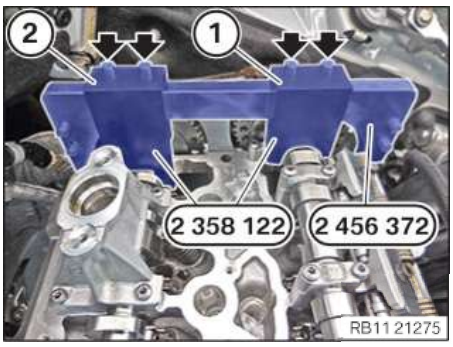
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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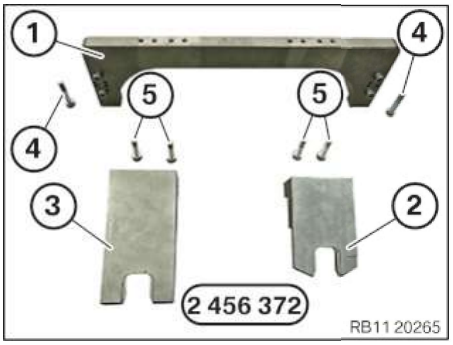
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

38 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

39 – Adjust the camshafts with the special tool

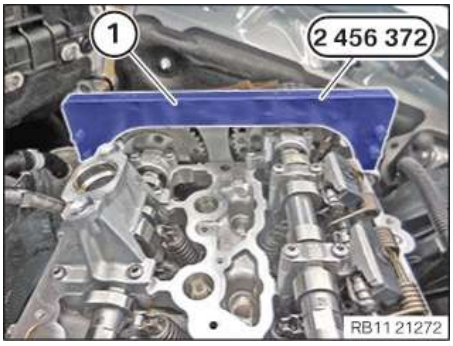


- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

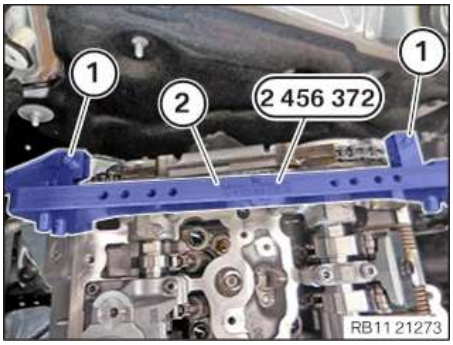


- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

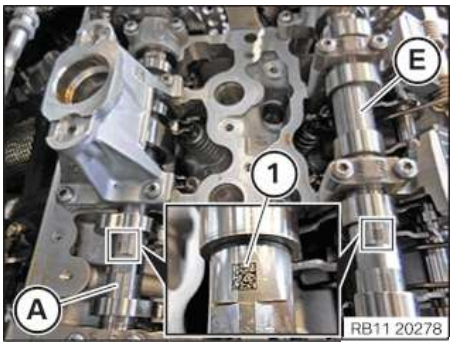
carliagh.com



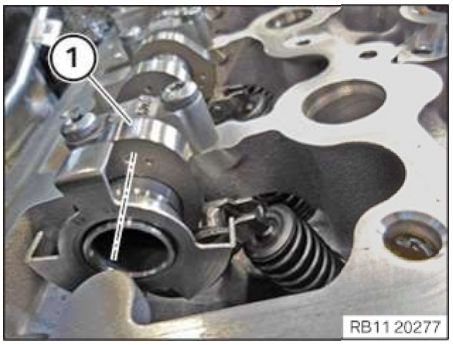
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

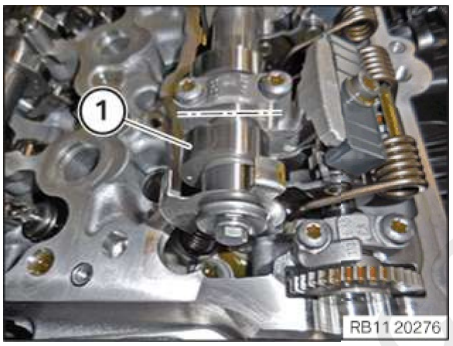
M6		Tightening torque	8 Nm



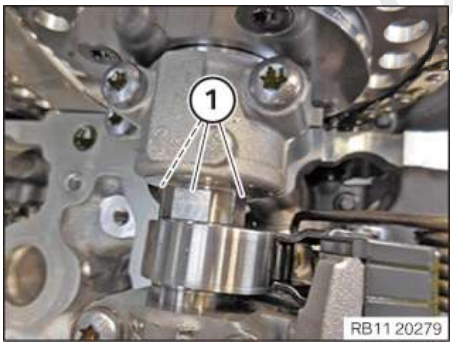
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



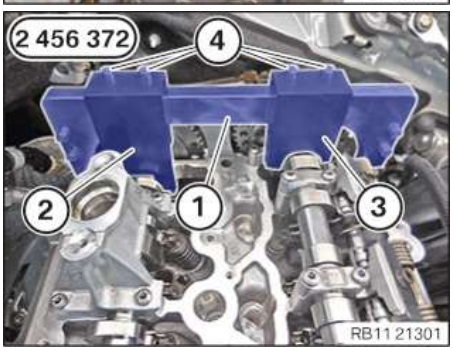
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



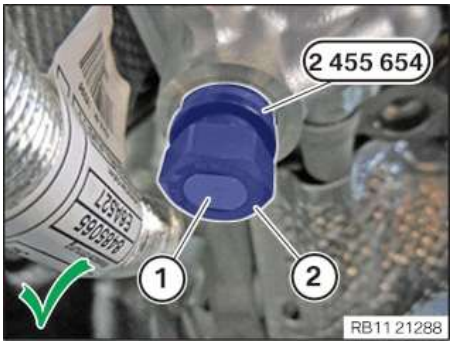
- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

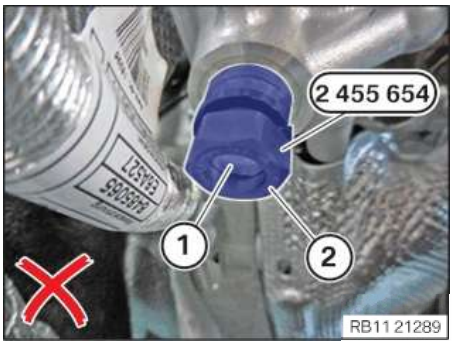
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40 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

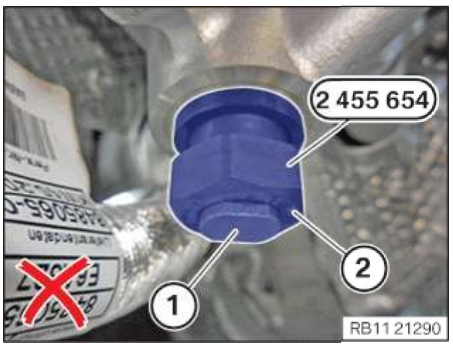
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

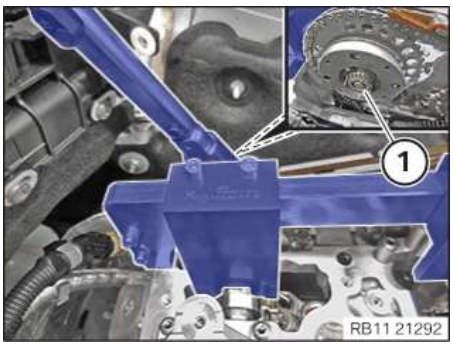
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

41 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

42 – Tightening the VANOS central valve of the intake adjuster

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- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



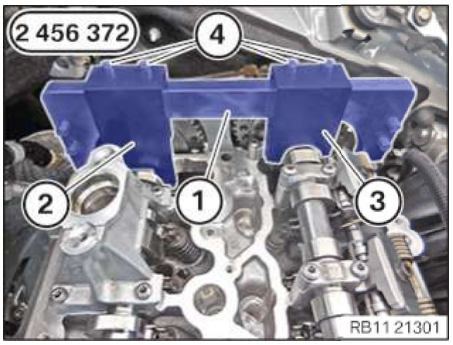
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

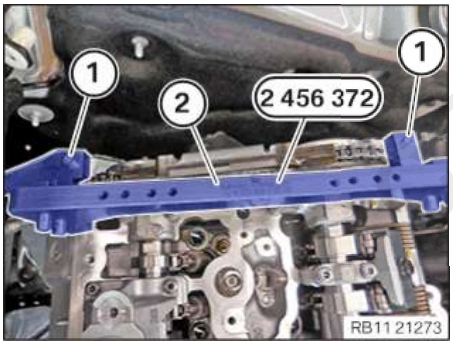
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

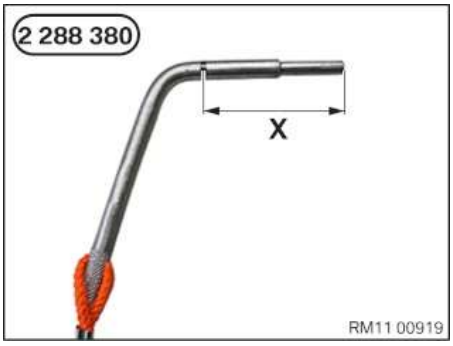
43 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

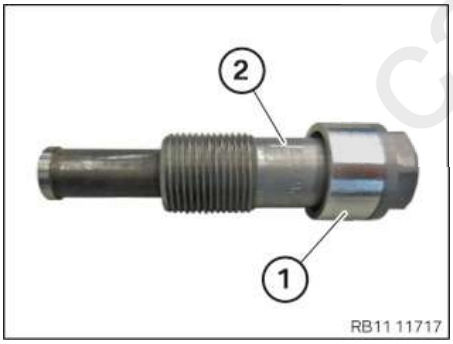
44 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



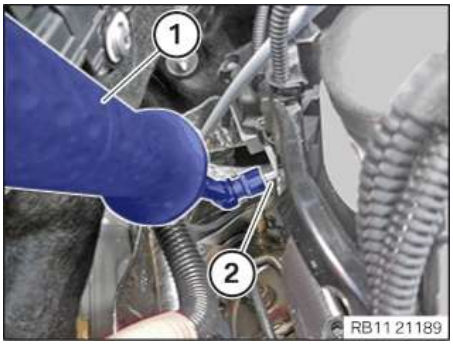
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

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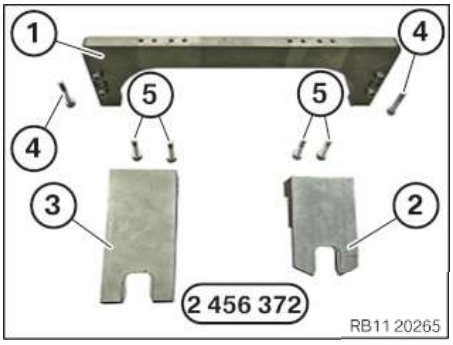


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

45 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



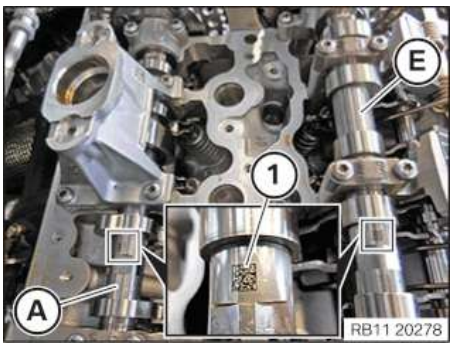
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

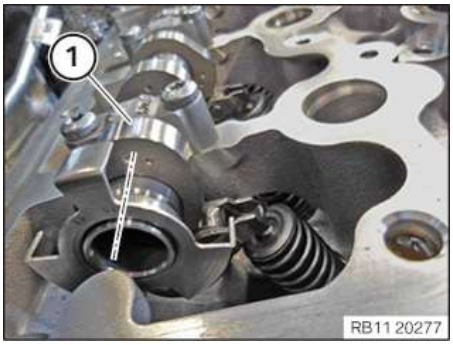
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

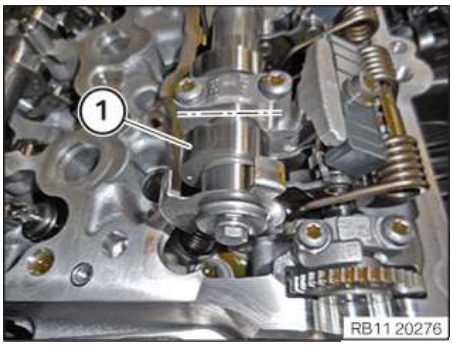


- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.

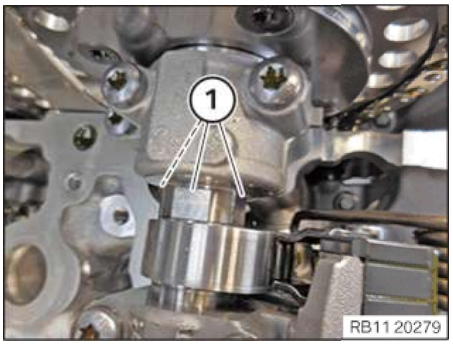
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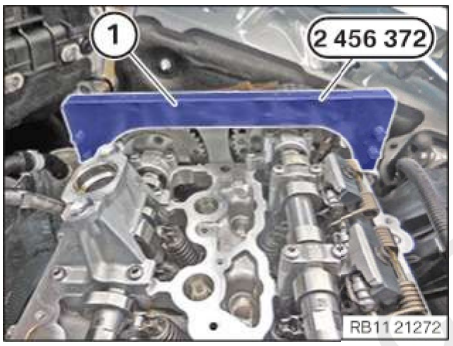
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



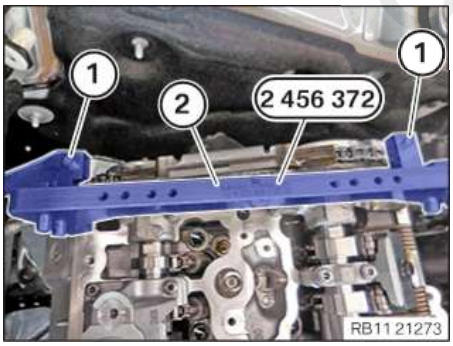
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



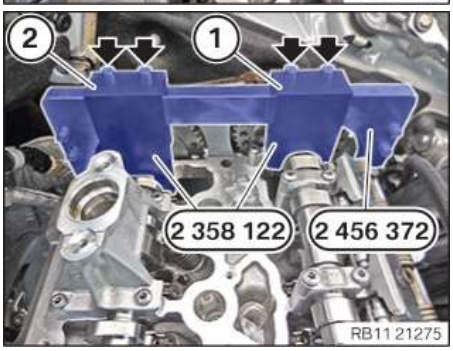
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

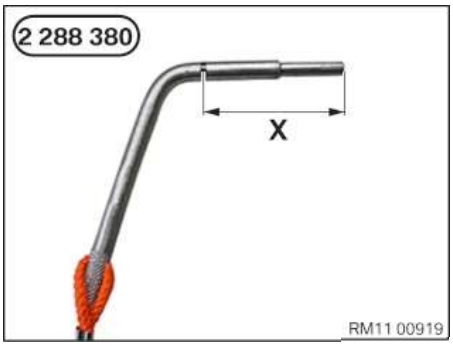
Test gauge to basic carrier

M6		Tightening torque	8 Nm

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- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

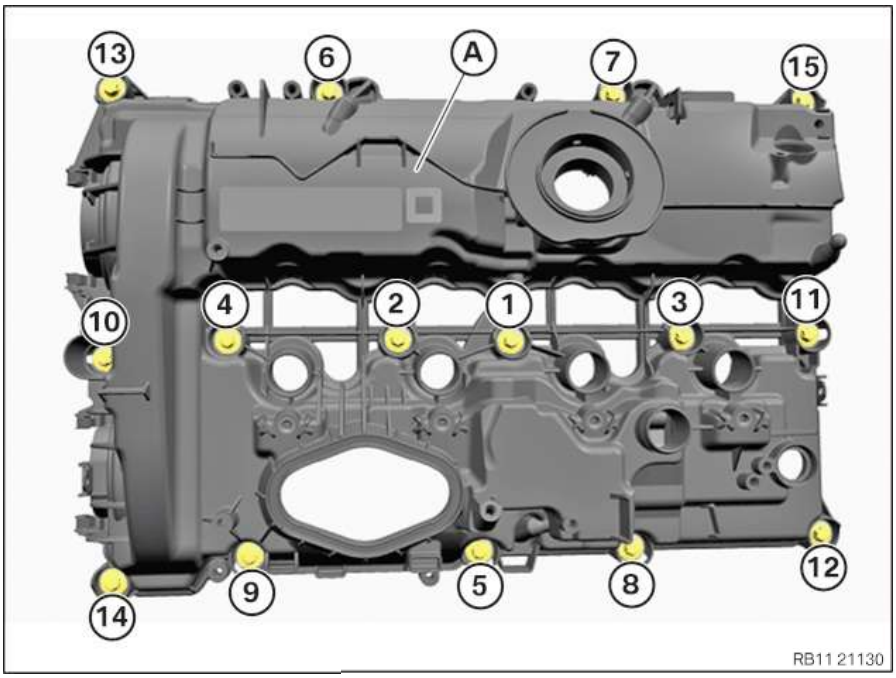
  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

46 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

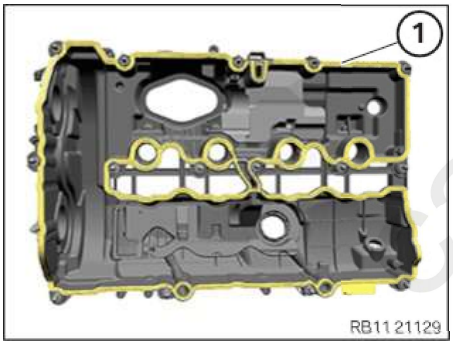
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

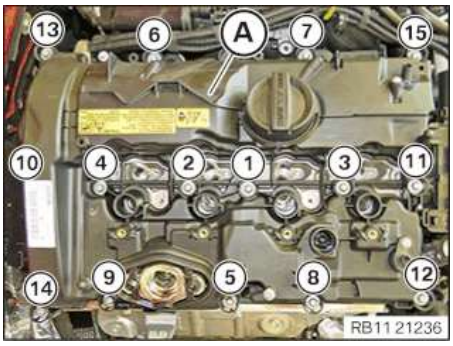
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

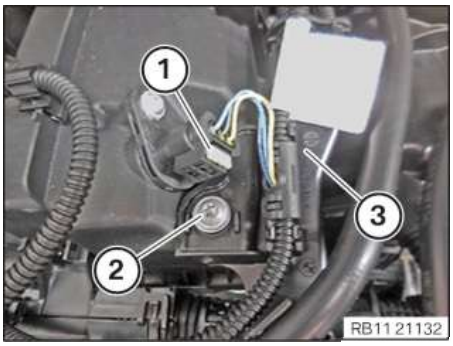
Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

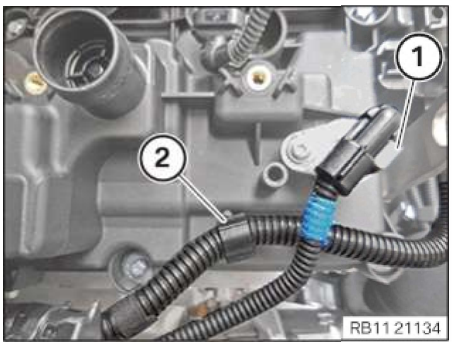


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

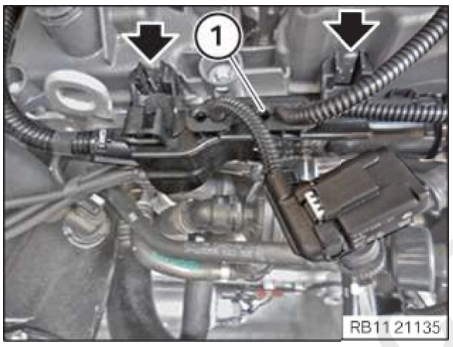
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

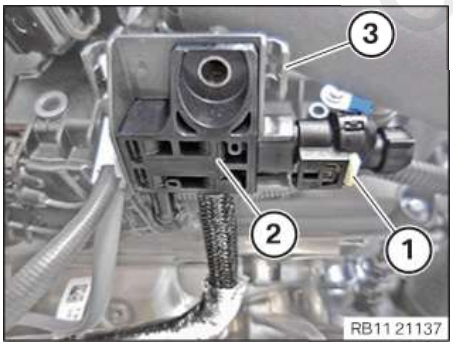
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

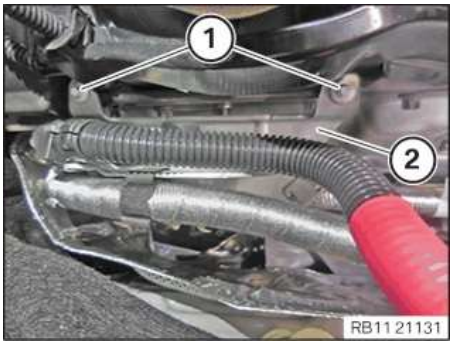


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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CAUTION

Improper routing of the positive battery cable.

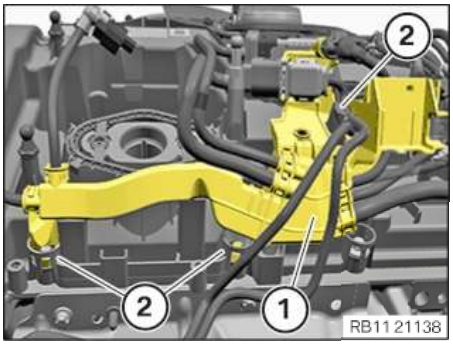
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

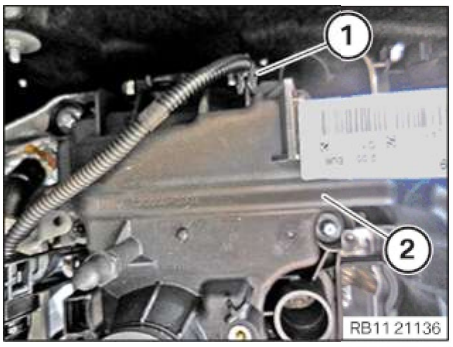
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

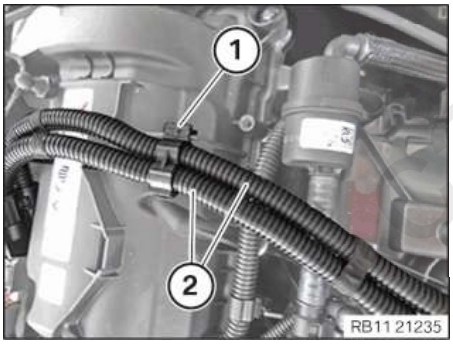
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

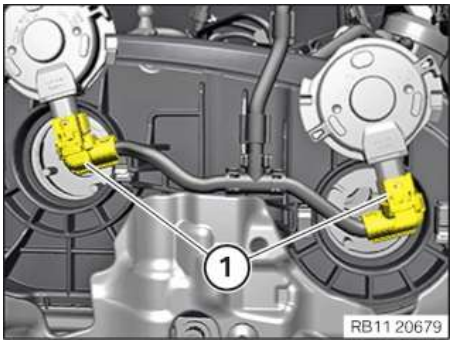


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

47 – Installing both actuators

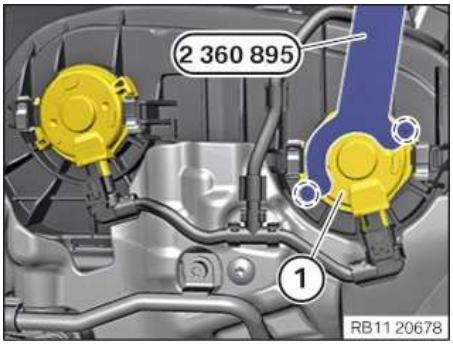


NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

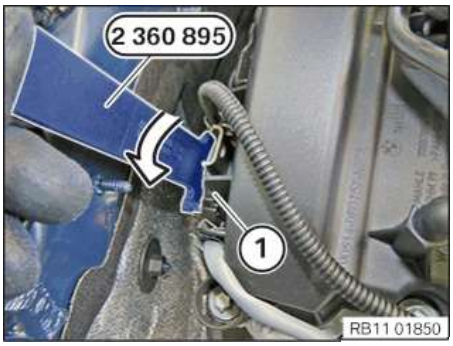
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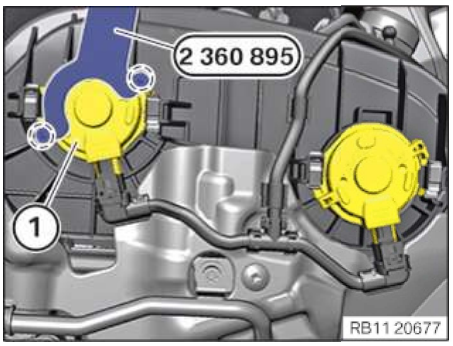
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



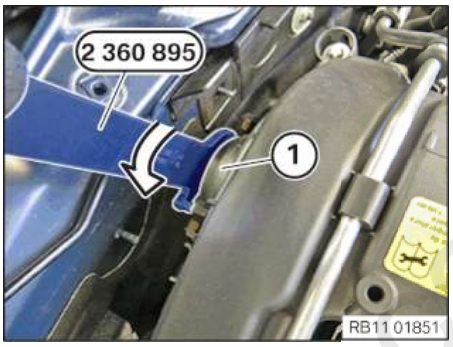
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

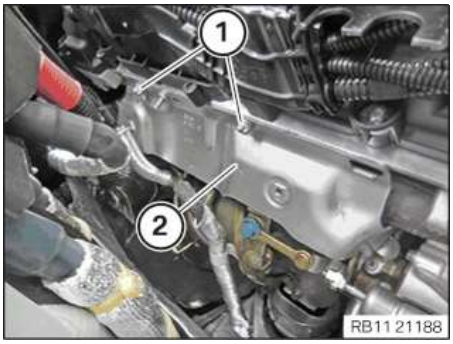
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

48 – Installing the heat shield on the cylinder head

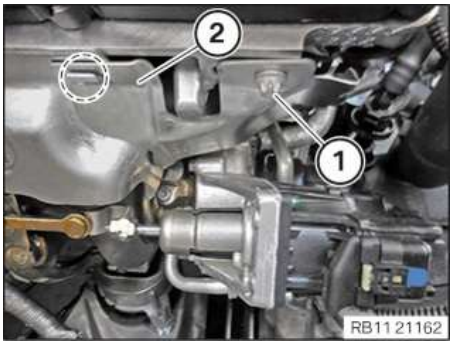


- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

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- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

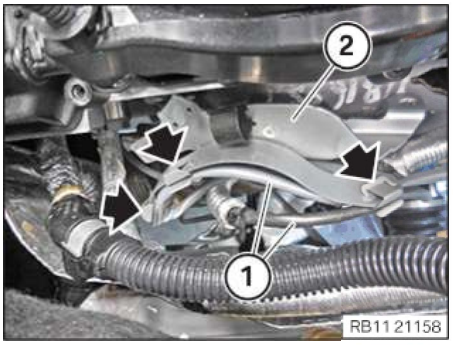


- Tighten down screw (1).

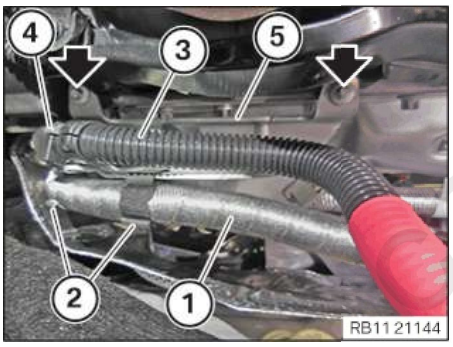
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

49 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

50 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

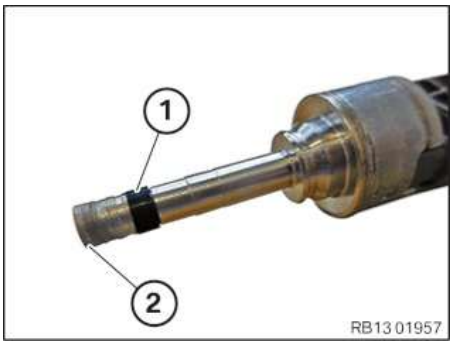
- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

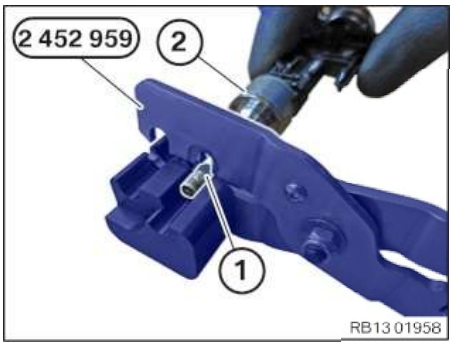
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

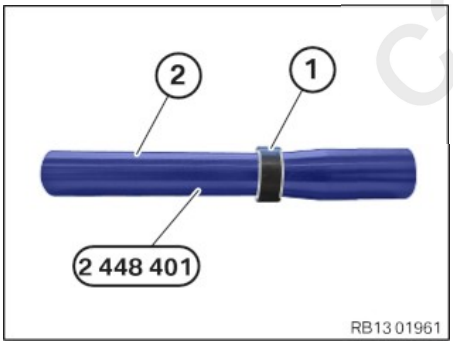


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

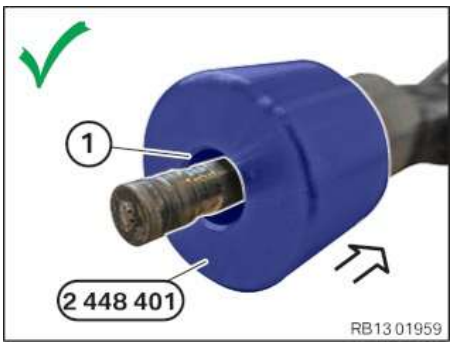
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

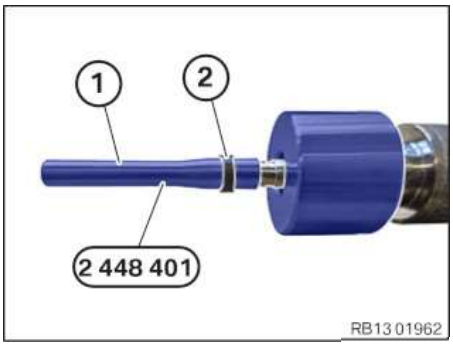
  The larger diameter of the assembly sleeve (1) must point to the injector tip.

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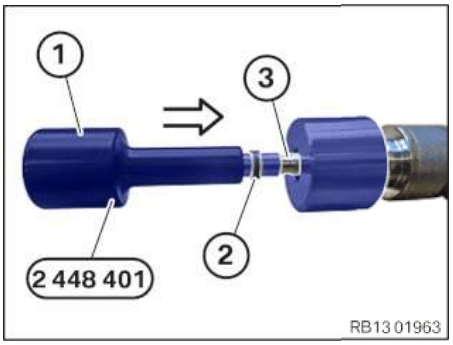


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

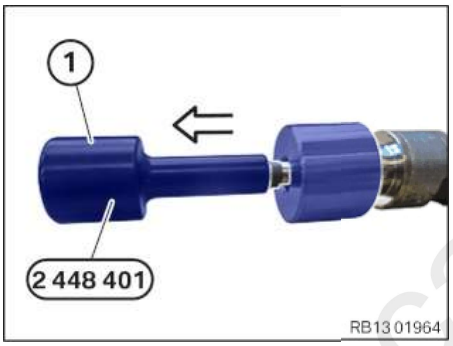
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



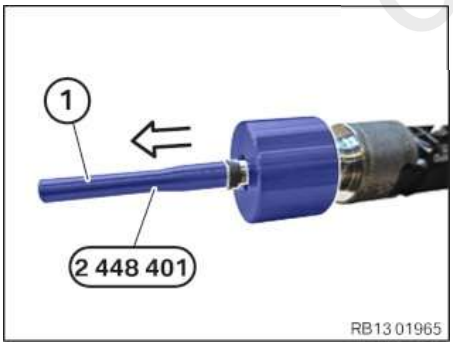
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



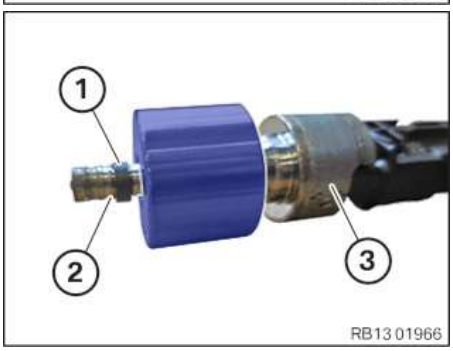
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

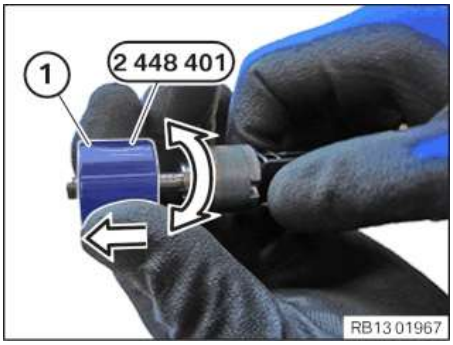


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



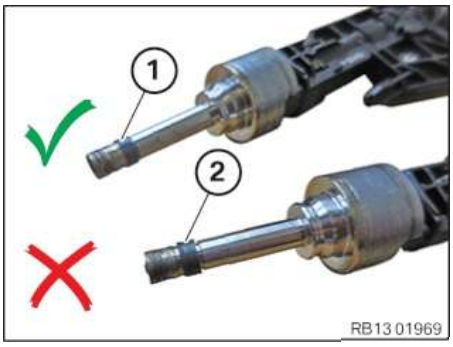
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

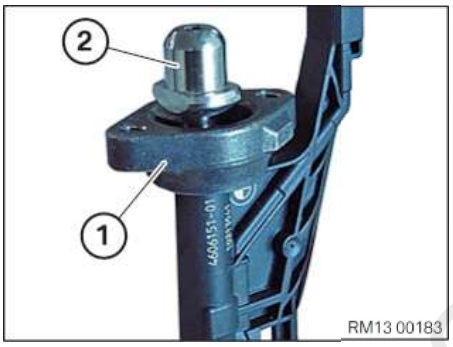


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

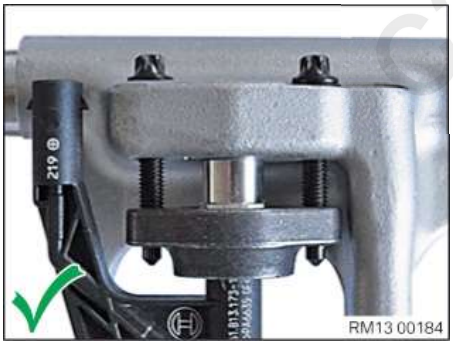
51 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

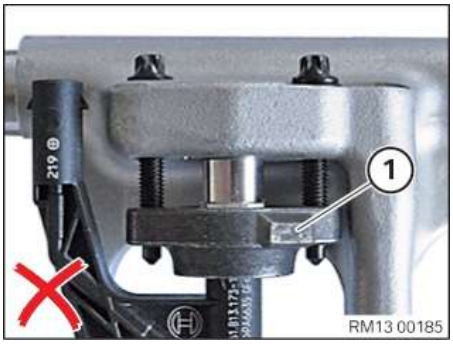


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

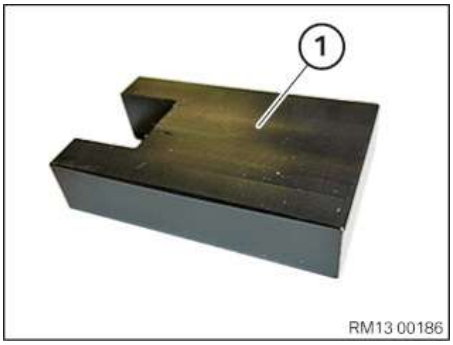
  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.

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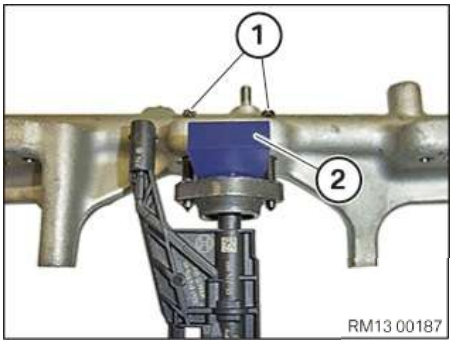
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)

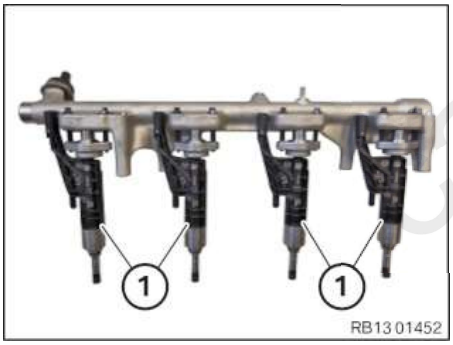
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.

- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



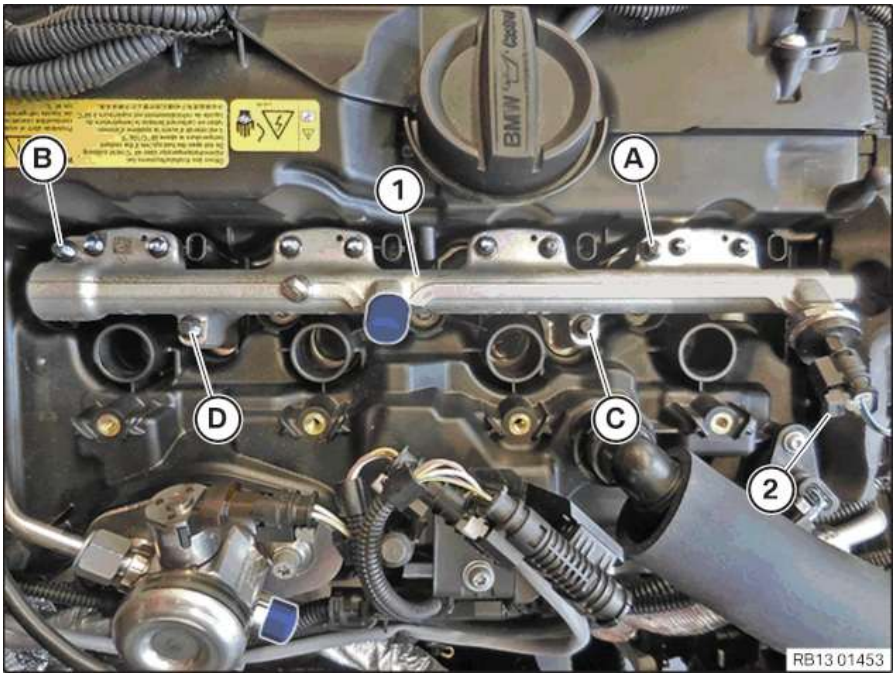
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

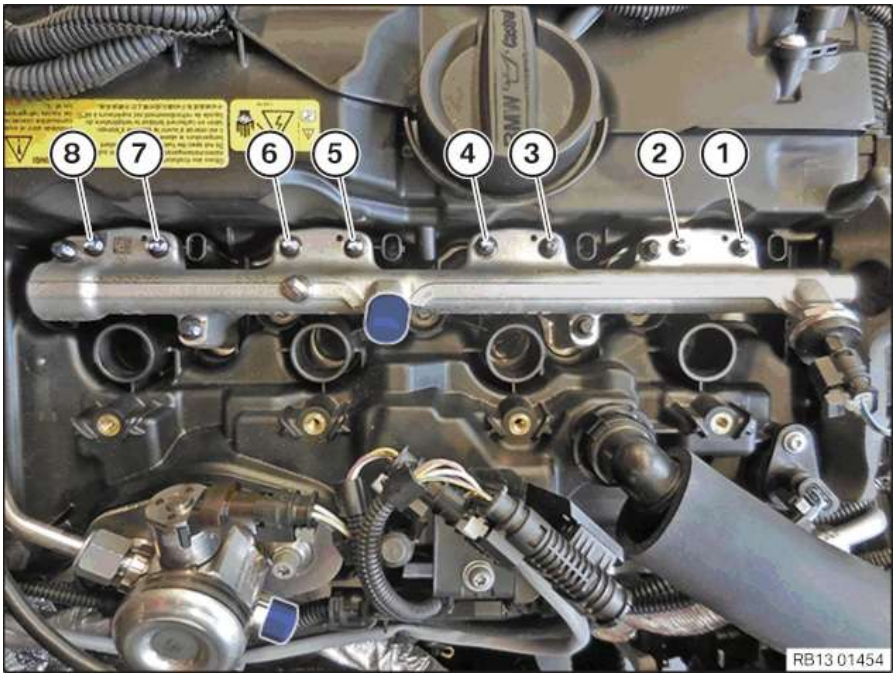
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

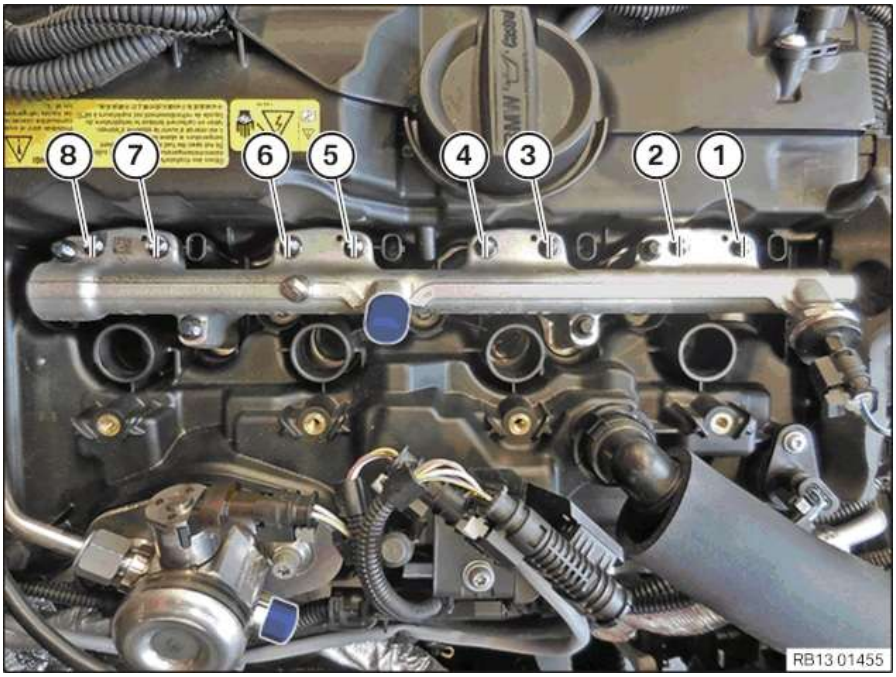
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

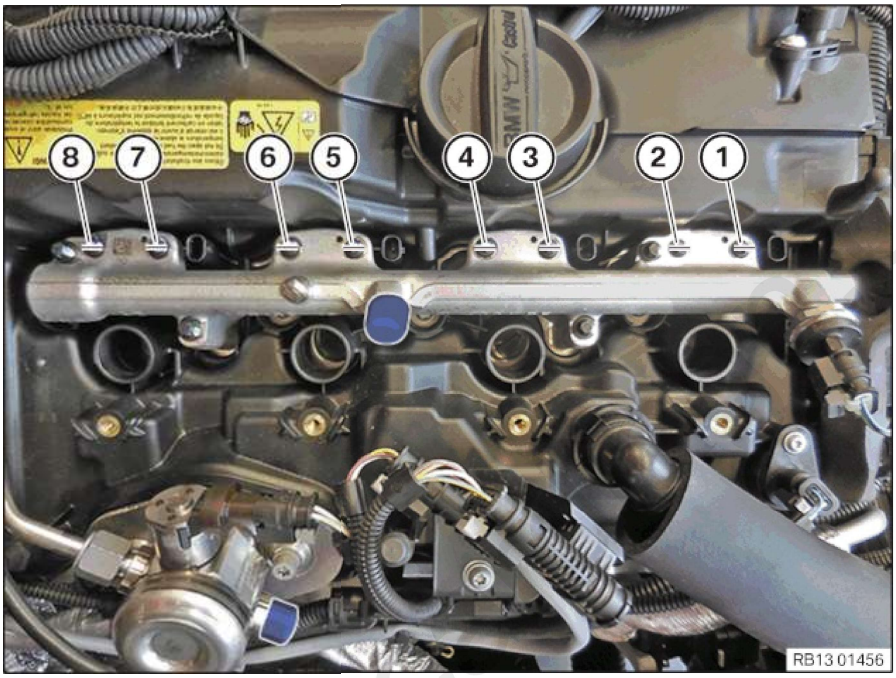
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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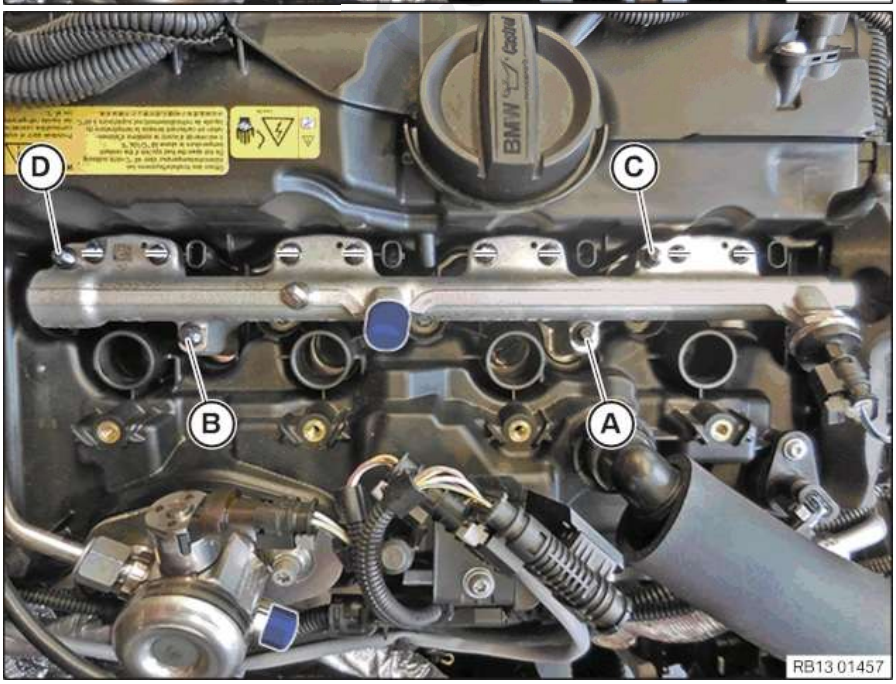


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

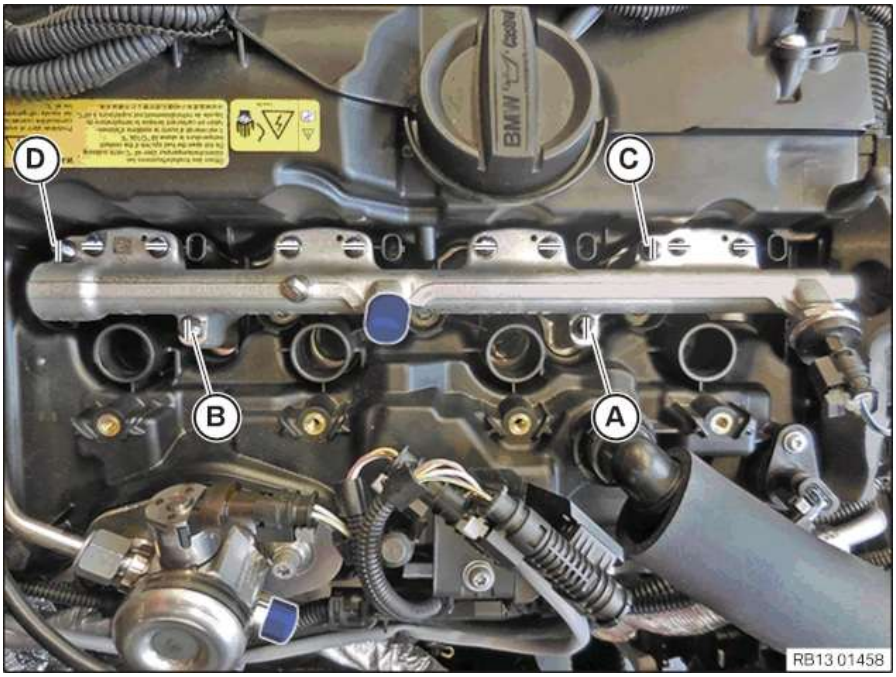
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

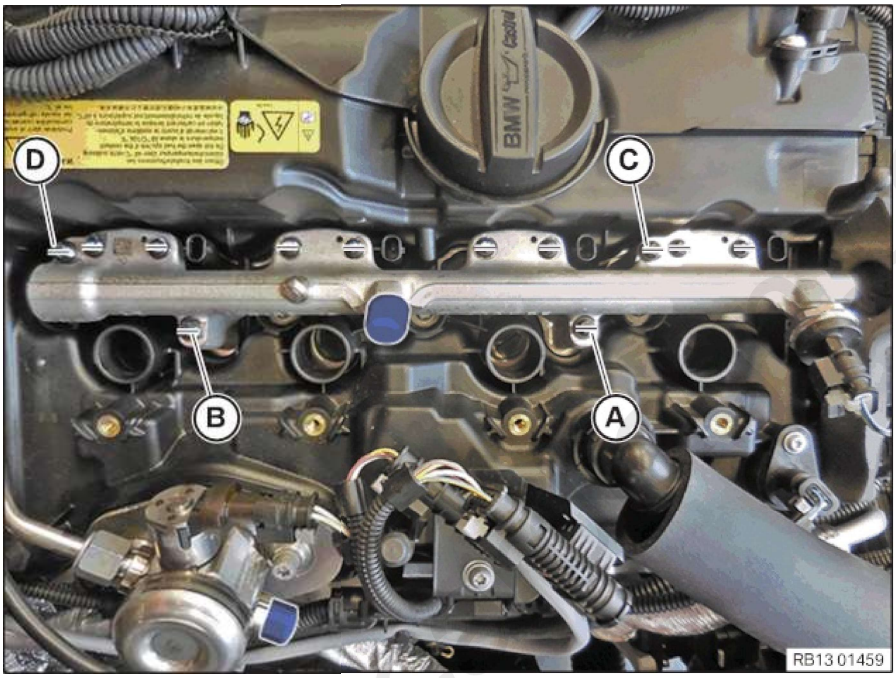
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

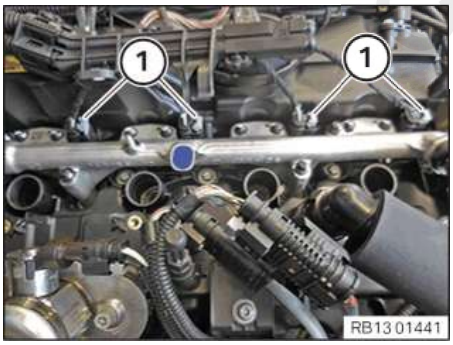


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



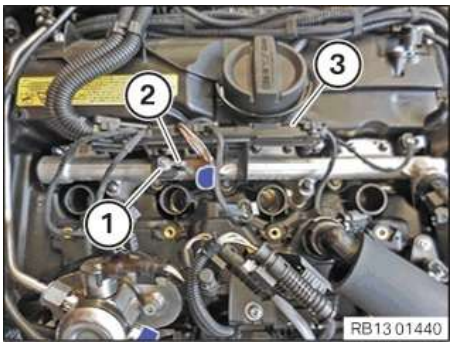
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

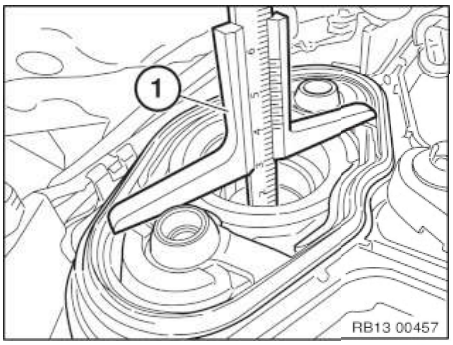
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

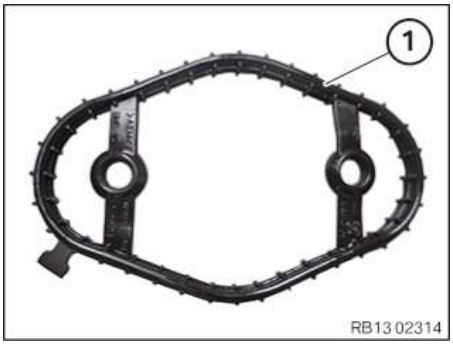
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

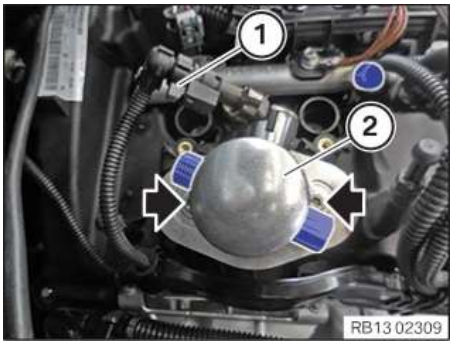
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

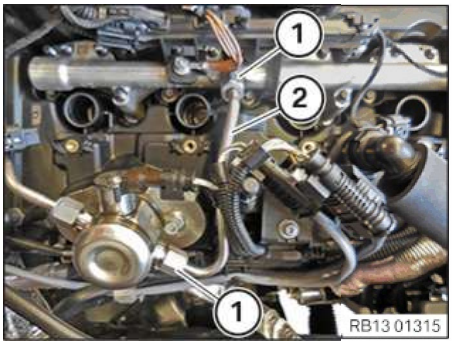
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

53 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

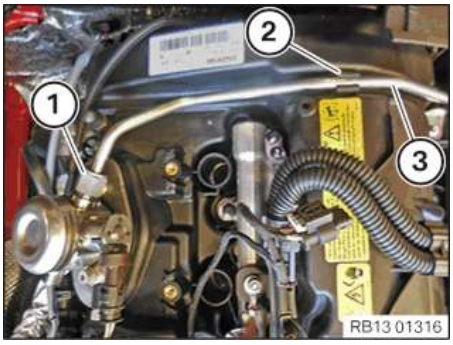
54 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

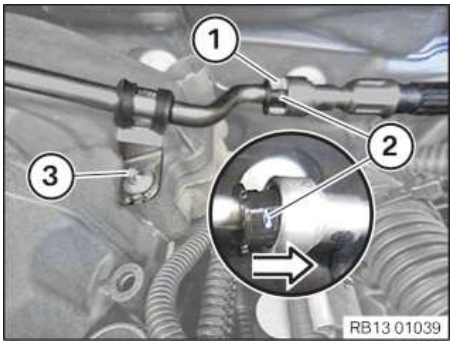


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

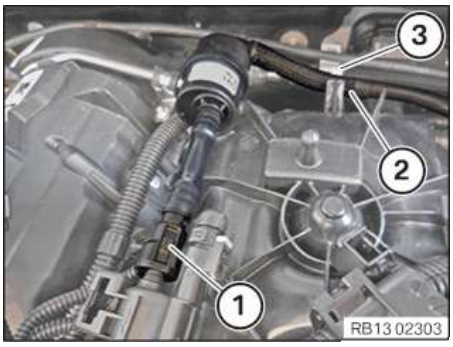
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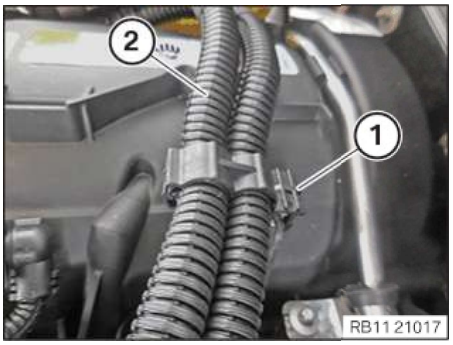
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

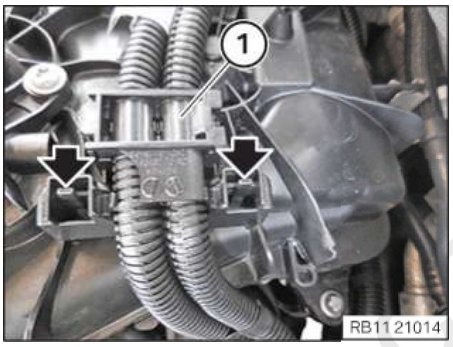
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

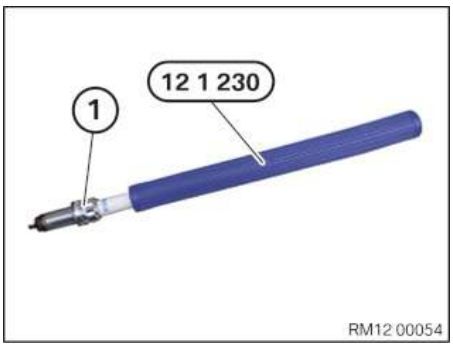


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

55 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

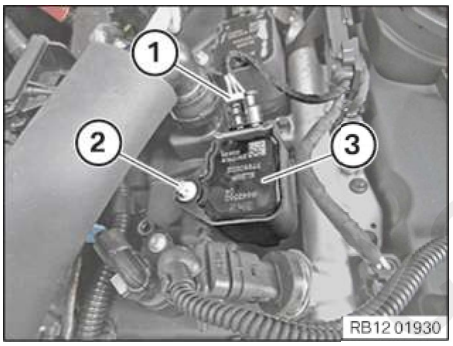
M12x1.25		Tightening torque	23 Nm

56 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



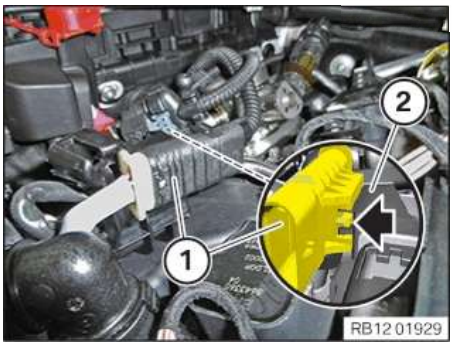
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

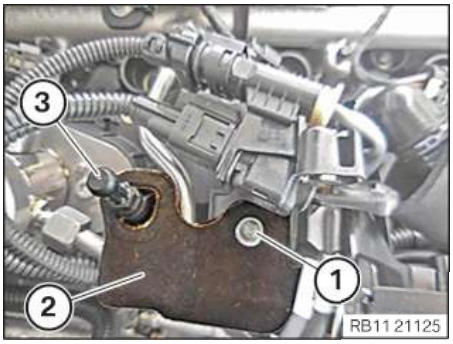
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

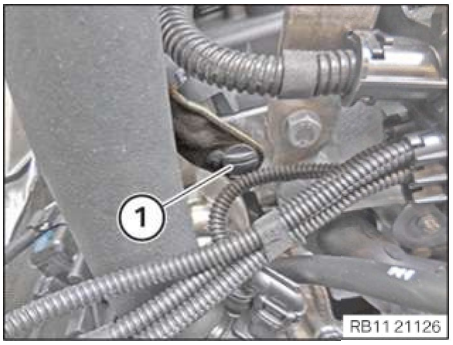
57 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

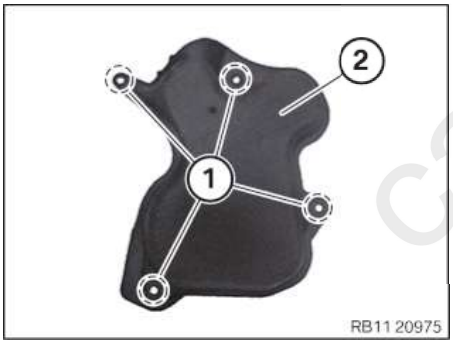
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



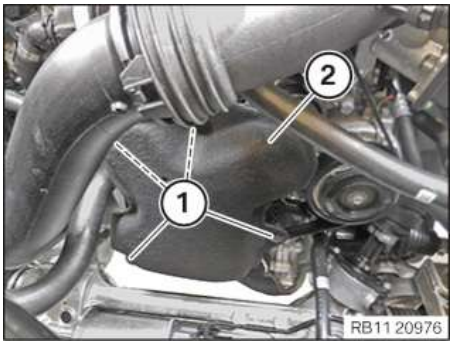
- Secure the clip (1).

58 – Install the acoustic cover for the engine at the front



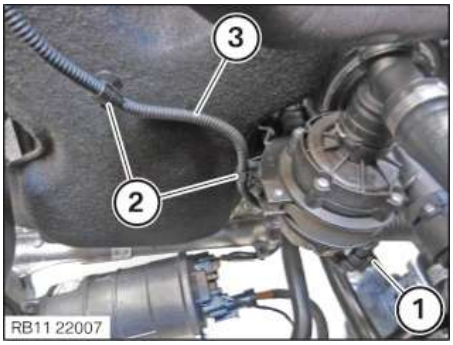
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



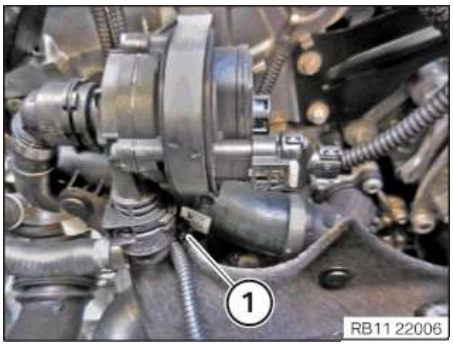
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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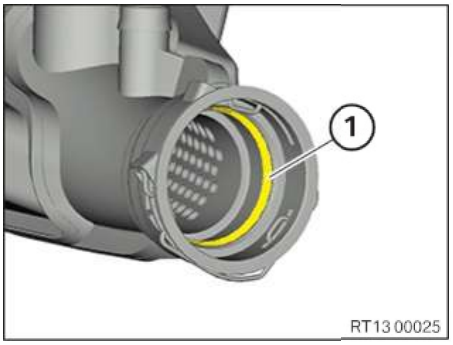
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

59 – Installing the clean air pipe with resonator

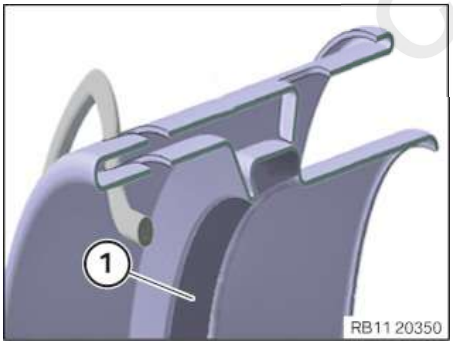


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

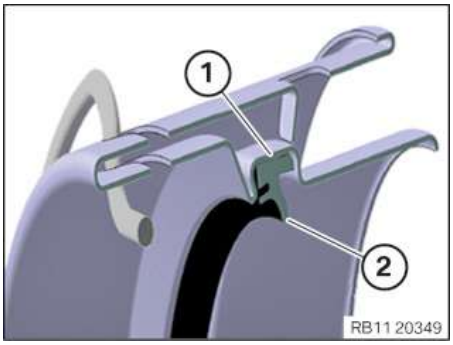
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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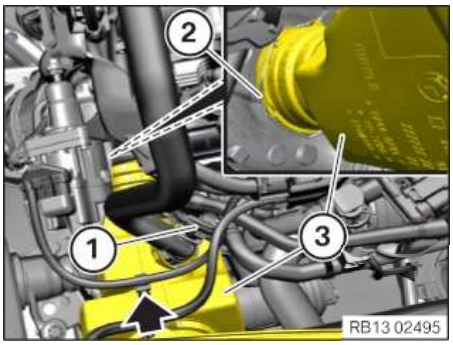
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

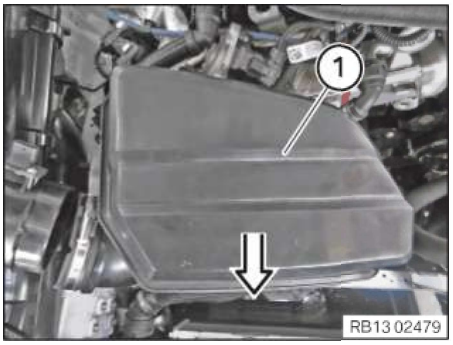
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



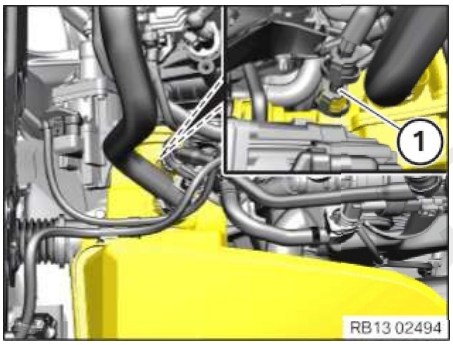
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

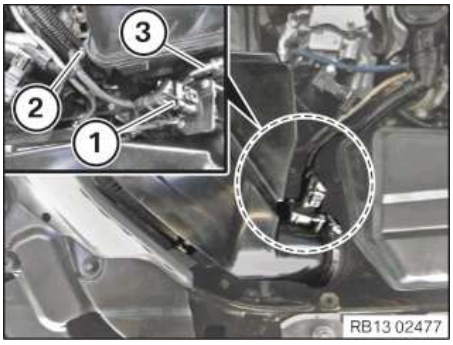
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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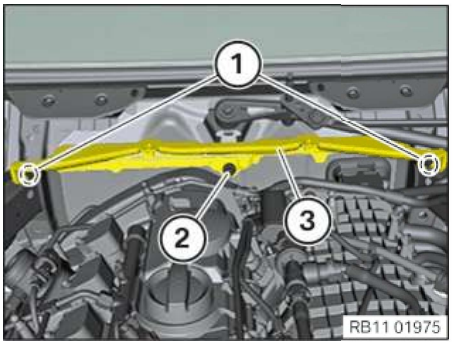
- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

60 – Disconnecting all battery earth leads



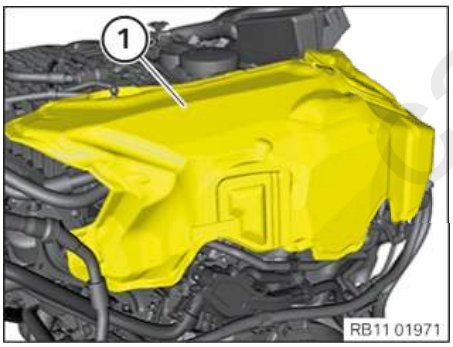
- See additional information.

61 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

62 – Installing acoustic cover at rear



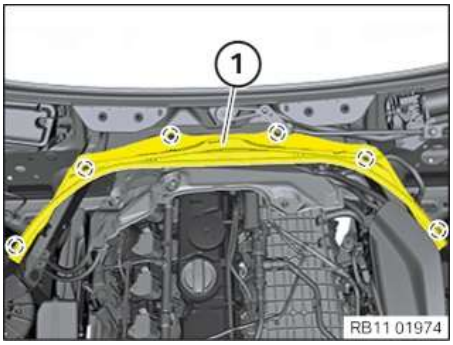
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

63 – Installing the centre bulkhead upper part

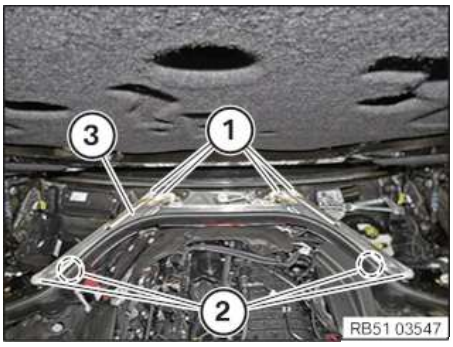
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- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

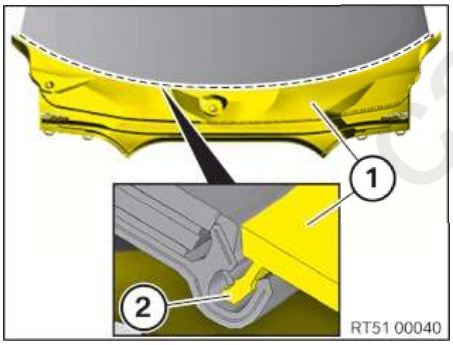
64 – Installing cowl panel cover

RISK OF DAMAGE

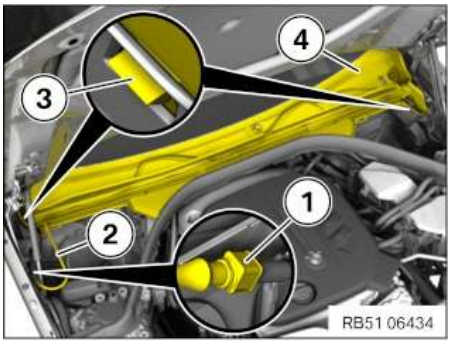
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

65 – Installing both wiper arms

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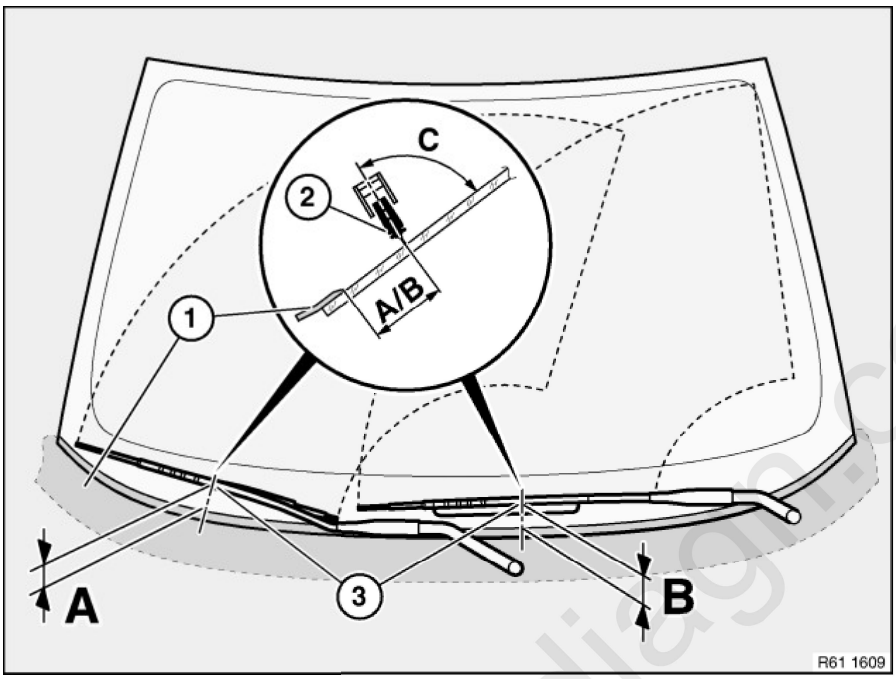
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

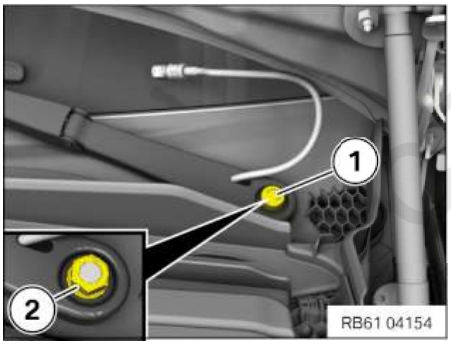
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

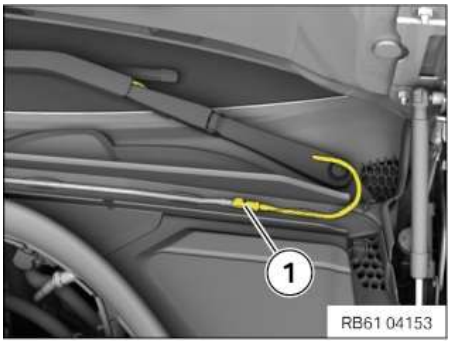


- Tighten nut (2).

Windscreen wiper arm

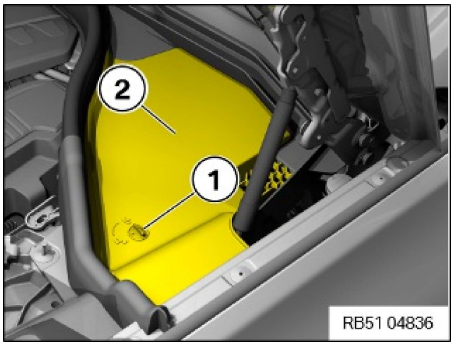
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



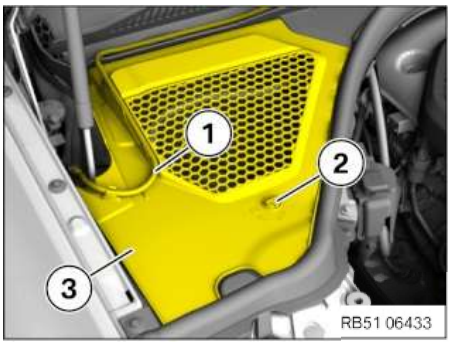
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

66 – Install the cover of the engine compartment on the rear left



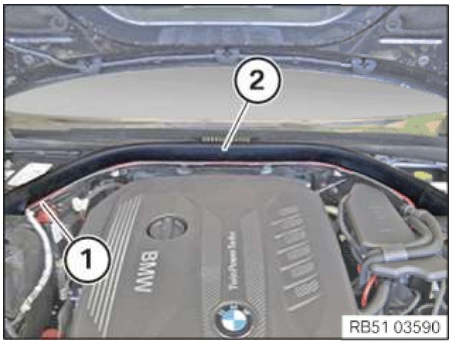
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

67 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

68 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

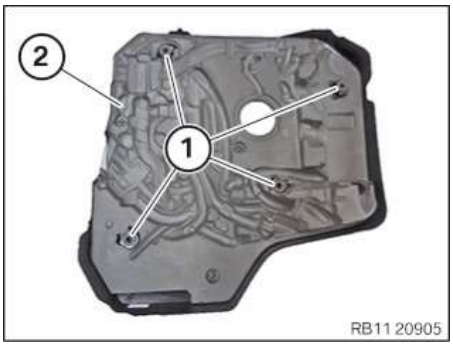
69 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

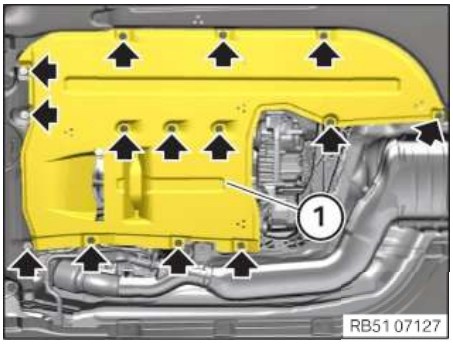
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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

70 – Installing underbody protection at rear



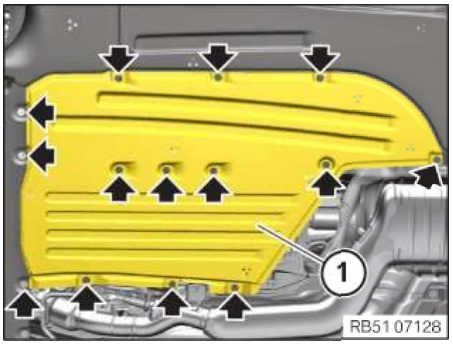
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

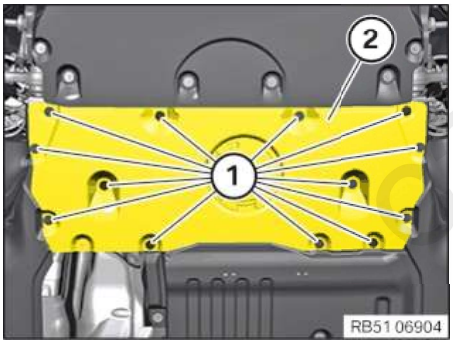
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

71 – Installing the centre underbody protection



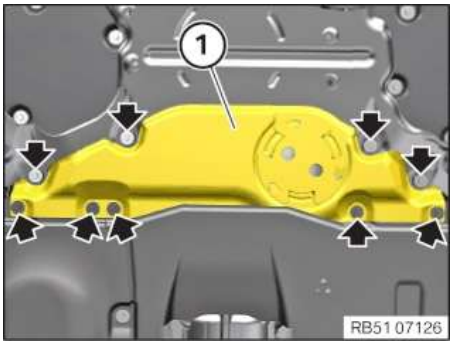
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

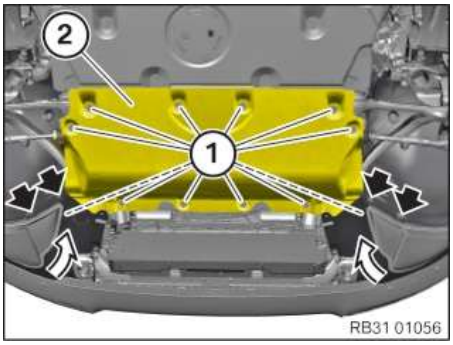
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

72 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

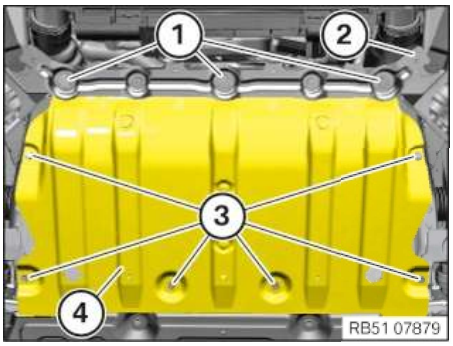
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

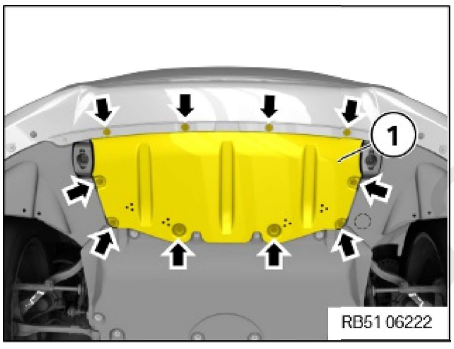
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

73 – Installing the front underbody protection



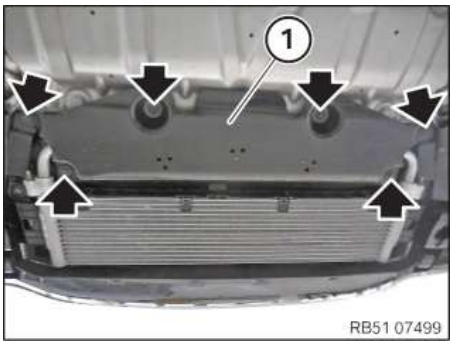
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



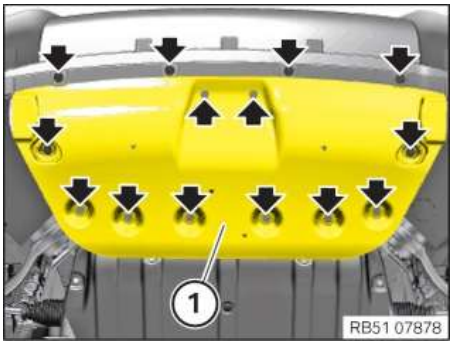
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

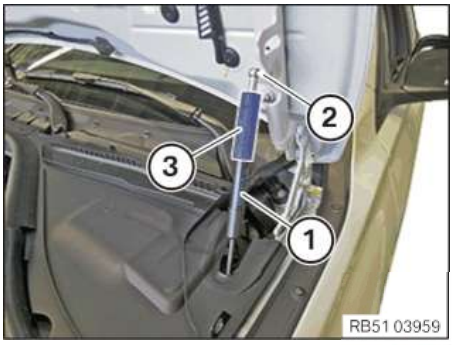
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

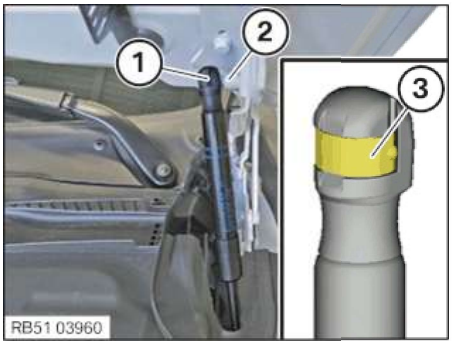
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

74 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head — Used in step 293945

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 293945

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4142

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 44

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Cylinder head cover to cylinder head — Used in step 46

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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Wiring harness section of engine to cylinder head cover — Used in step 46

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 4649

6X18		Tightening torque	6 Nm

Heat shield to cylinder head — Used in step 48

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 48

M6 x 12		Tightening torque	8 Nm

Ground cable to rail — Used in step 51

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 52

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 53

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 54

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 54

M6 screw		Tightening torque	6,5 Nm

Spark plugs — Used in step 55

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 56

Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover — Used in step 57

TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 59

Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead — Used in step 63

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 63

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 63

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 65

Combination hexagon nut		Tightening torque	35 Nm

Underbody protection — Used in step 7071

Hexagon screw		Tightening torque	3 Nm

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Underbody protection of the steering gear Used in step 72

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) Used in step 72

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support Used in step 72

M10		Tightening torque	56 Nm

Underbody protection front Used in step 73

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

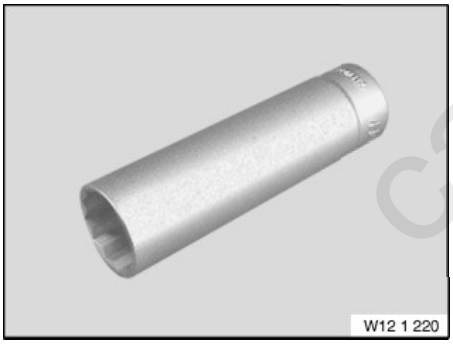
2 360 895 Pin wrench



Common Used in step 1247

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

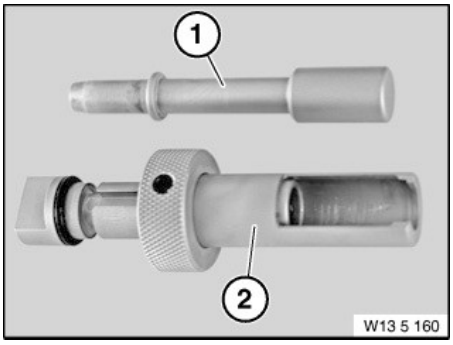
0 495 560 (12 1 220) Socket



Common Used in step 1655

Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 496 567 (13 5 161) Fastener

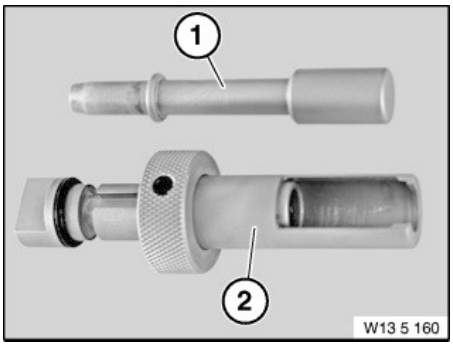


Common Used in step 19

Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

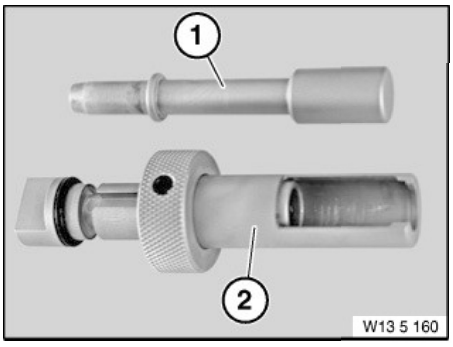
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0 496 568 (13 5 162) Fastener



Common	Used in step 19
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener

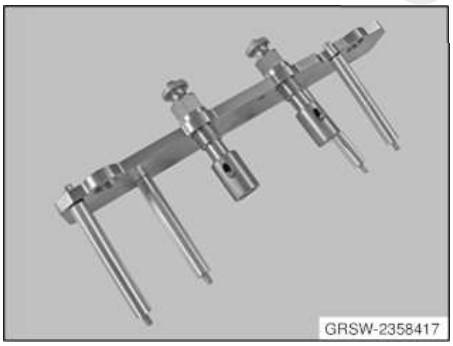


Common	Used in step 19
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

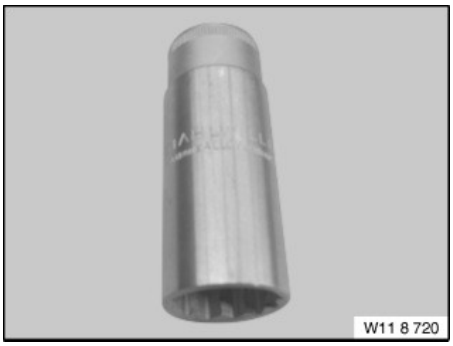
2 358 417 Device



Common	Used in step 20
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

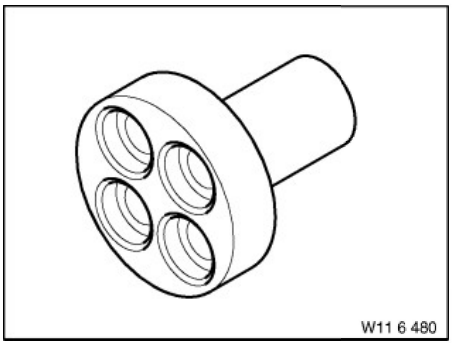
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0 496 106 (11 8 720) Socket WAF 46



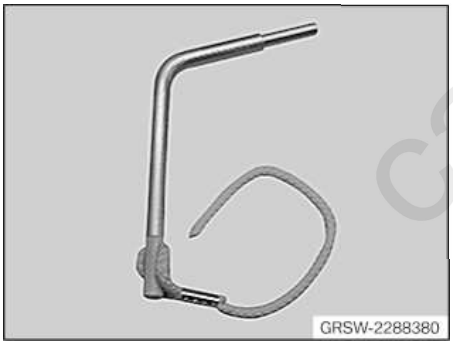
Common	Used in step 20
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 493 380 (11 6 480) Connector



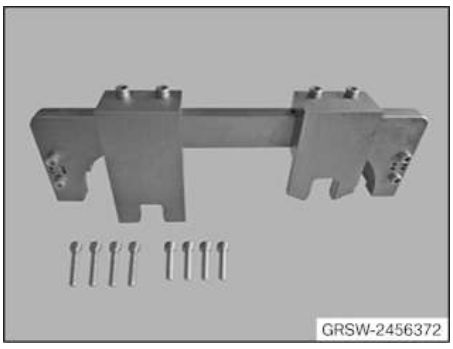
Common	Used in step 29434552
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 294345
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 2938394345
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 358 122 Gauge



Common Used in step 293845

Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



Common Used in step 31364142

Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common Used in step 31364142

Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

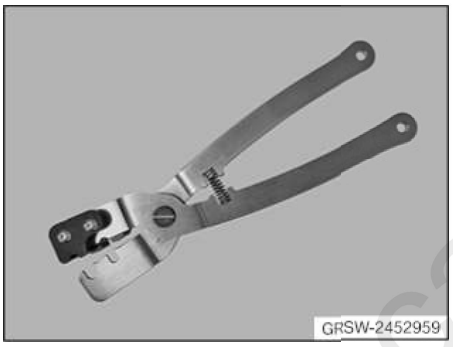
cardiagn.com

2 455 654 Tensioning tool



Common	Used in step 4043
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 50
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 448 401 Fitting aid



Common	Used in step 50
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

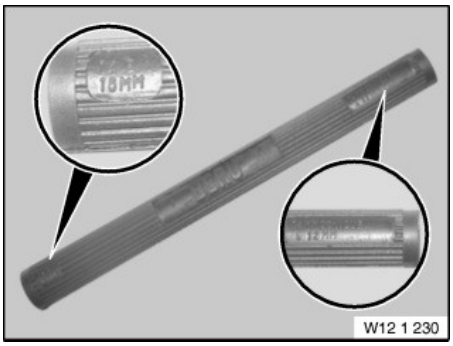
2 358 022 Gauge



Common	Used in step 51
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 065 (12 1 230) Fitting aid



Common	Used in step 55
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 65
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	160
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	160
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
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61 20 900 Disconnecting and connecting battery earth lead	160

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61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 20 900 Disconnecting and connecting battery earth lead	160
61 35 ... Notes on ESD protection (Electro Static Discharge)	12
61 35 ... Notes on ESD protection (Electro Static Discharge)	121520
13 53 ... Clean the cylinder head around the injectors due to grit / dust	20
61 13 ... Unlocking and disconnecting different plug connections	202446

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11 36 125 Removing and installing/replacing intake VANOS central valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

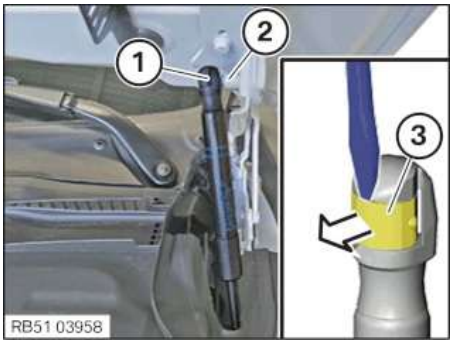
Engine compartment lid is open.

CAUTION

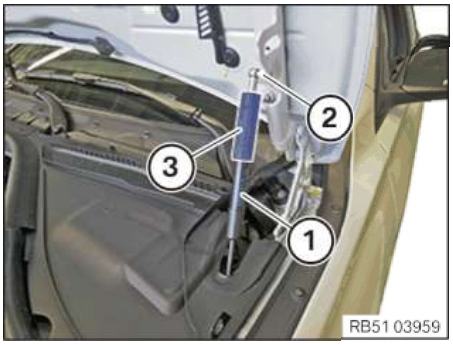
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

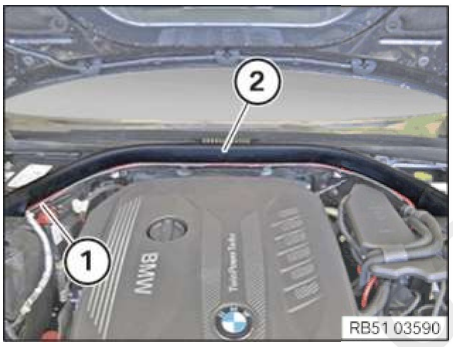


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

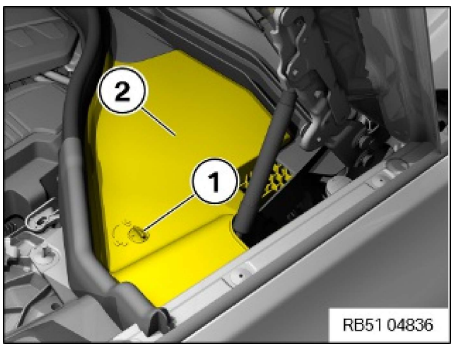
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

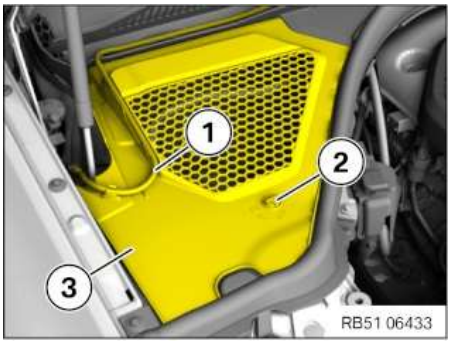
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

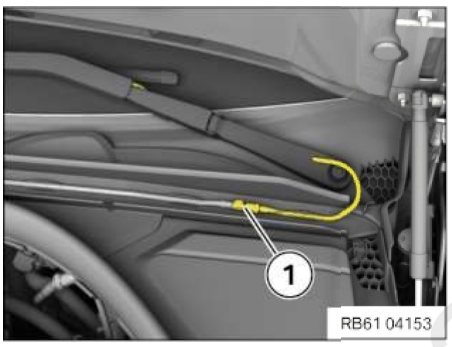
▶ **Remove the wiper arm**

RISK OF DAMAGE

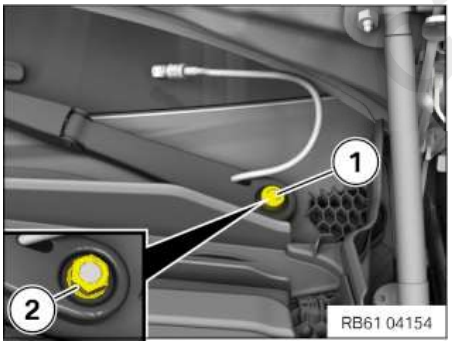
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

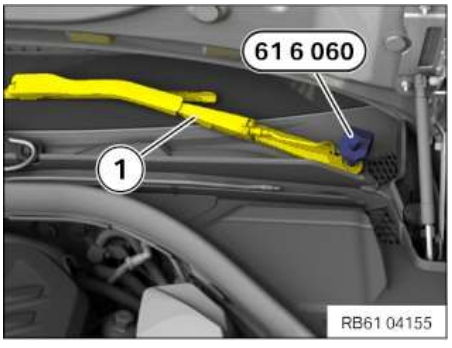
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



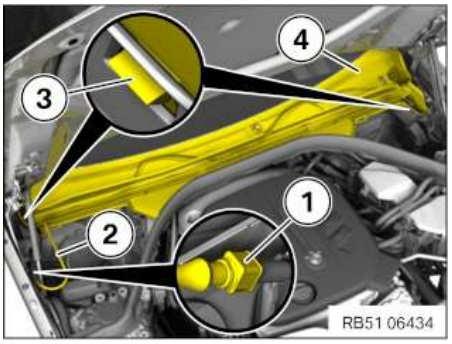
- Remove the protective cap (1).
- Loosen nut (2).



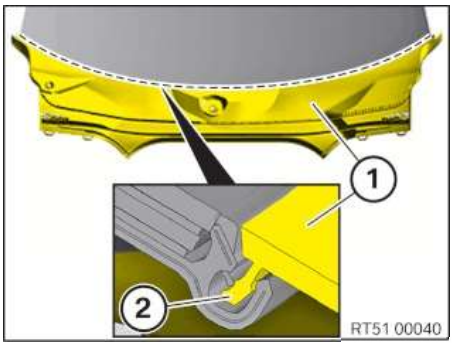
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

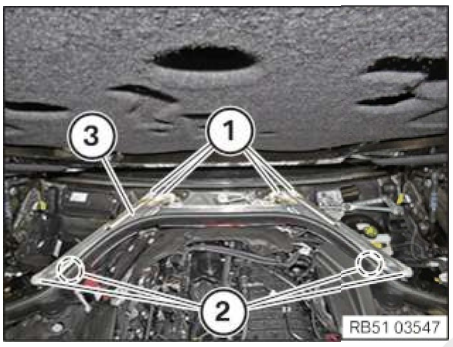


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

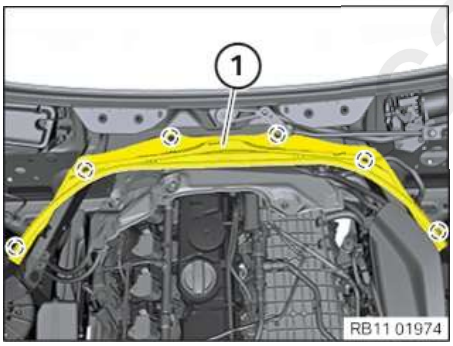
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

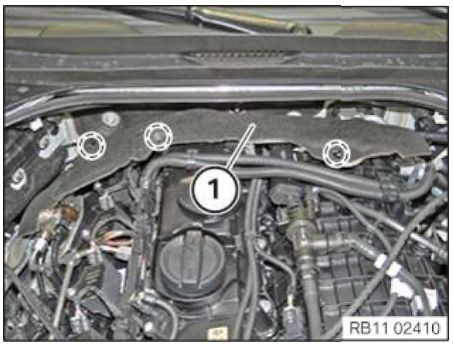
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



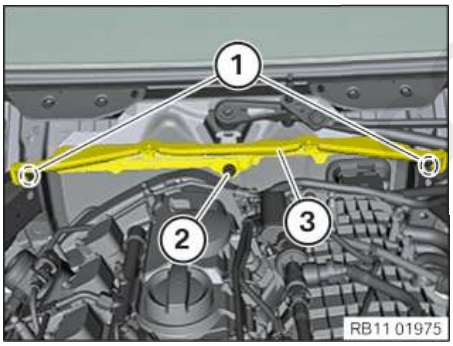
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

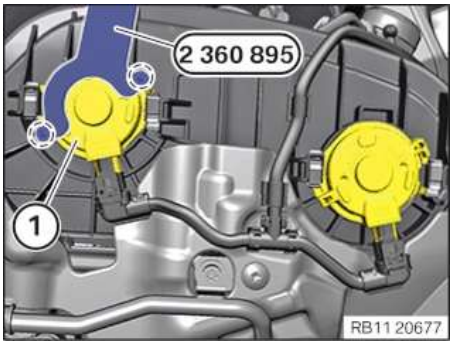
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

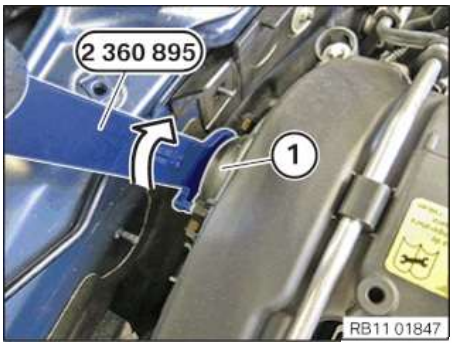
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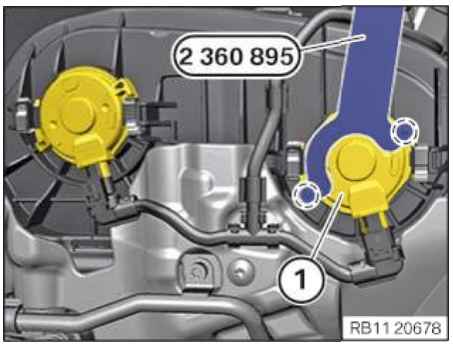
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



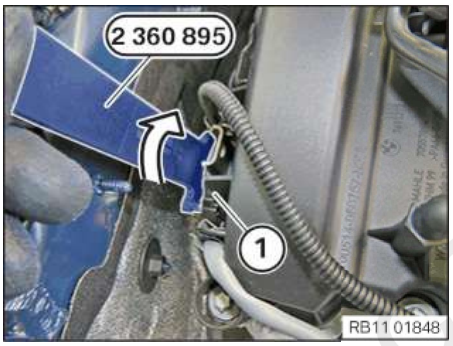
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



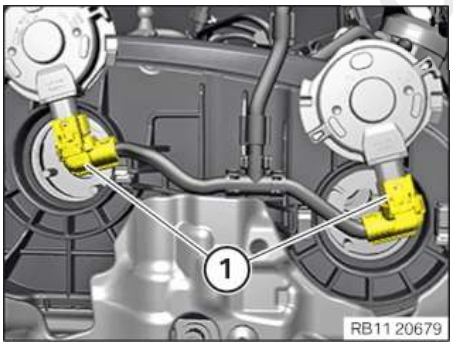
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

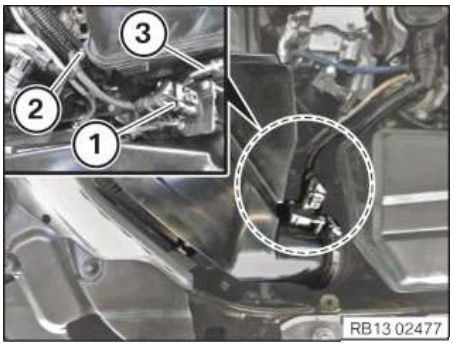
Risk of burning!

- Perform all work only on components that have cooled down.

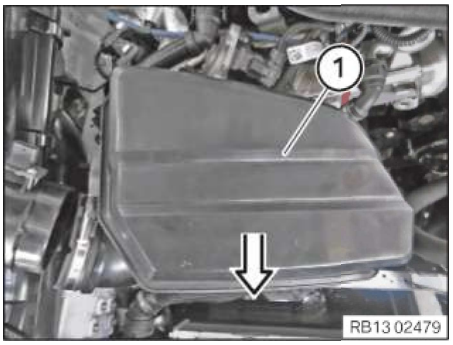
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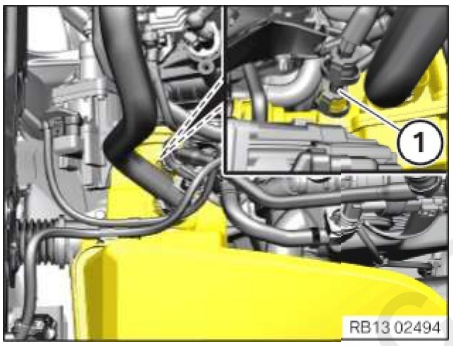
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



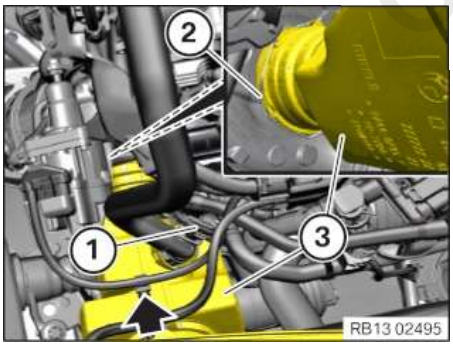
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



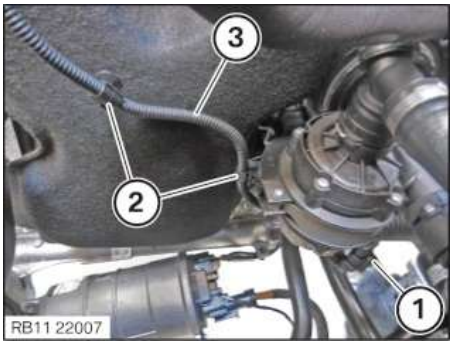
- Unlock and disconnect the tank ventilation line (1).



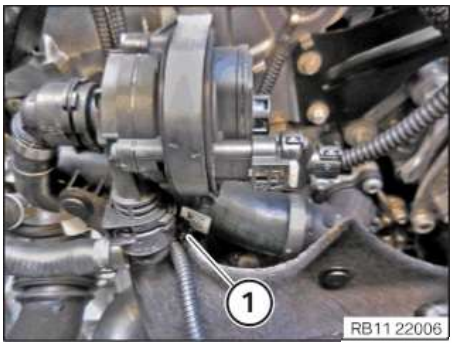
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

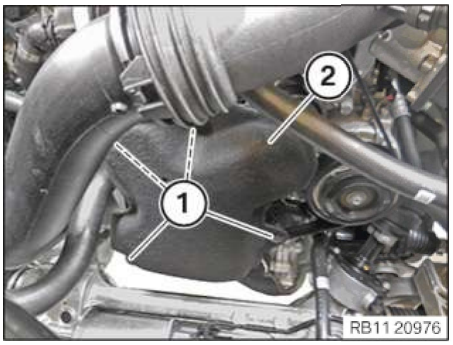
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

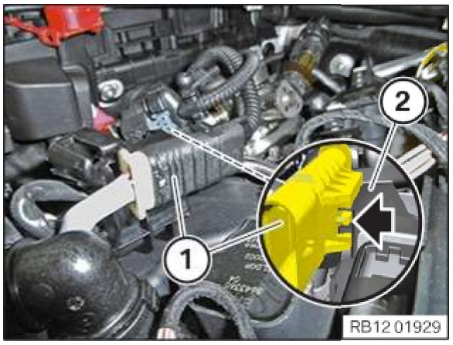
Electrostatic discharge.

Damage to or destruction of electrical components.

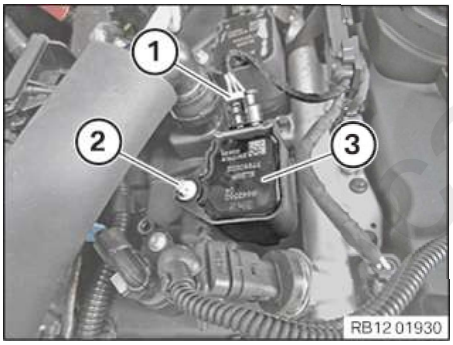
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

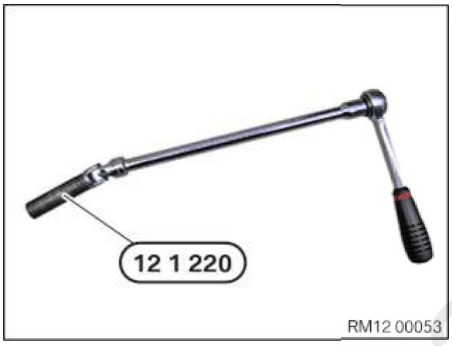
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

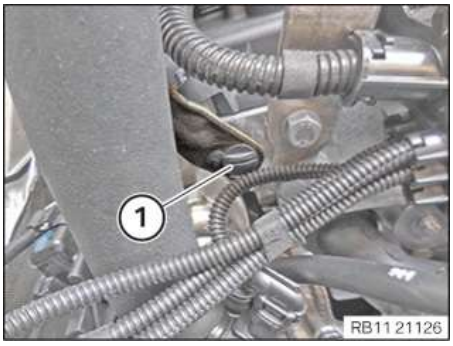
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

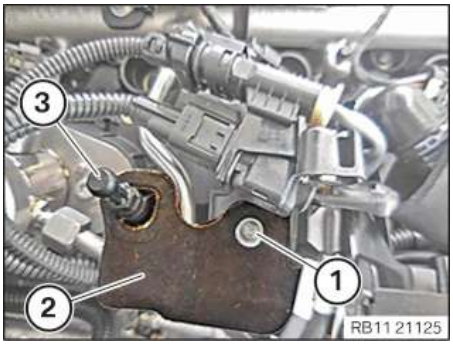


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

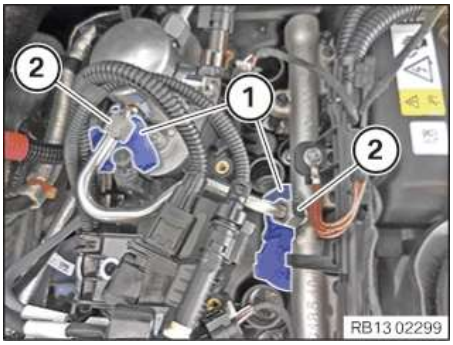
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

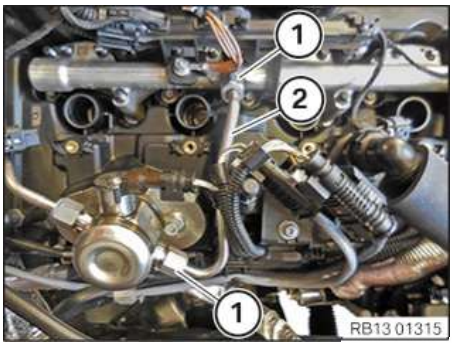


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

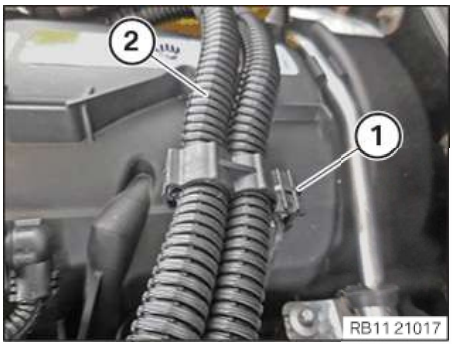
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

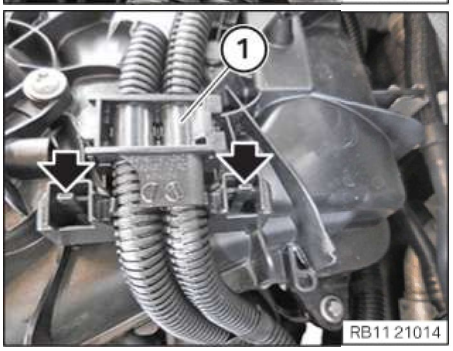
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

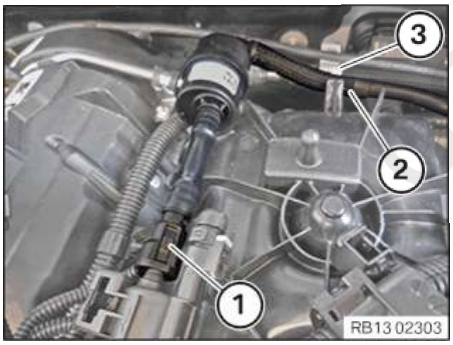
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



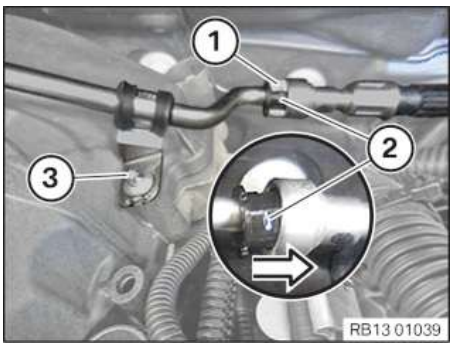
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

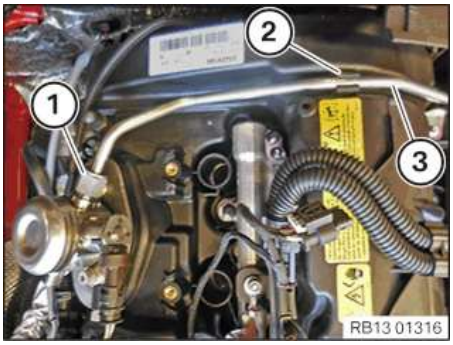


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

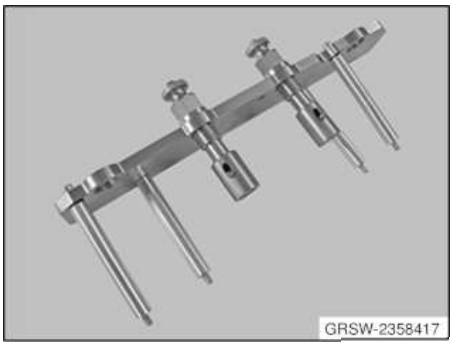
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



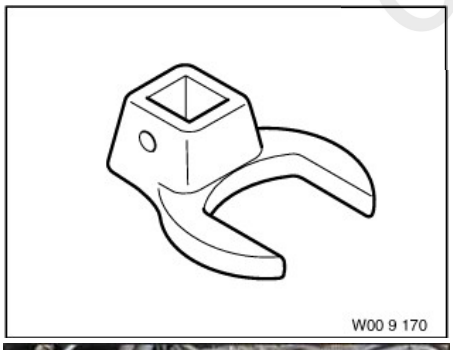
- Prepare special tool 2 358 417.



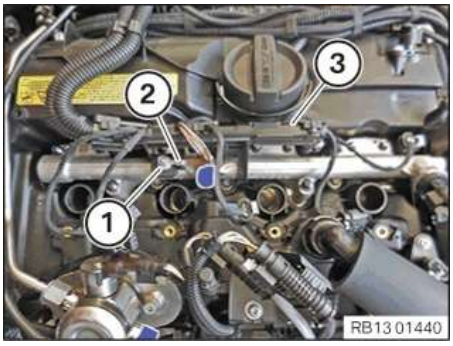
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

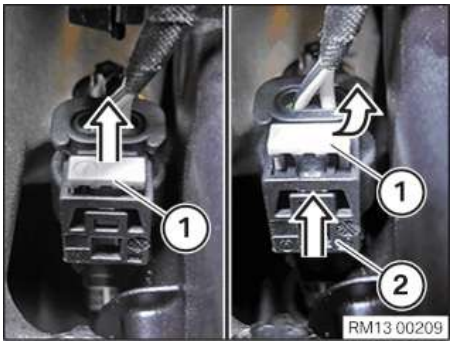


- Prepare special tool .

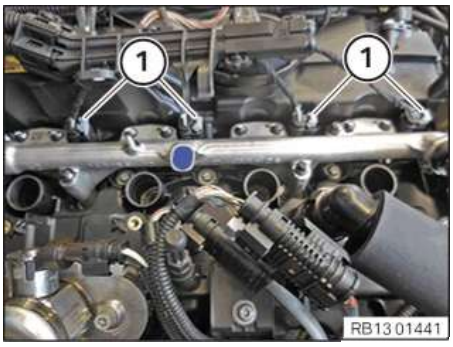


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



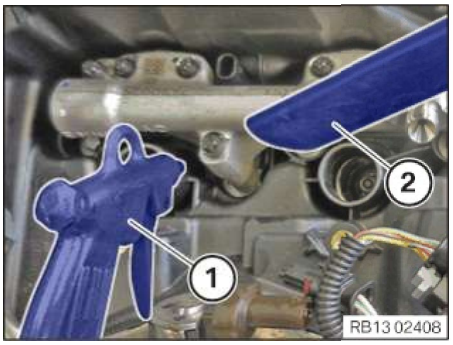
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

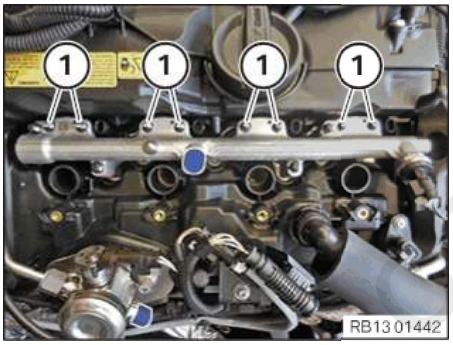


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

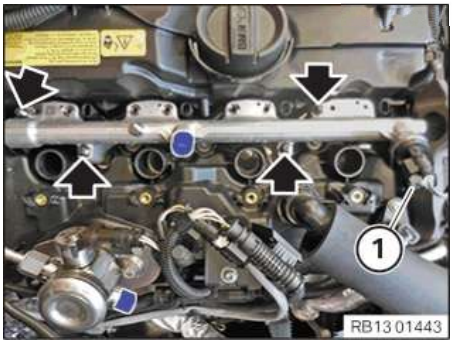
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



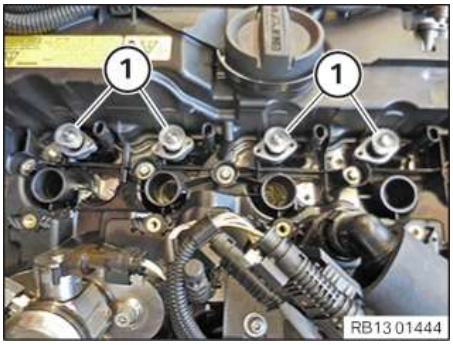
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

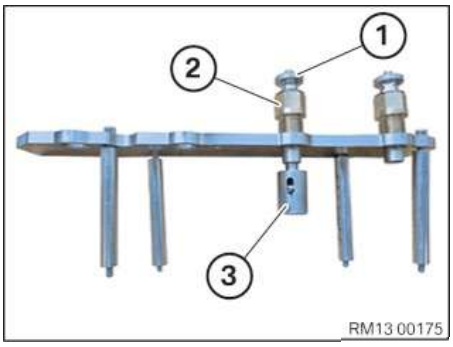
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

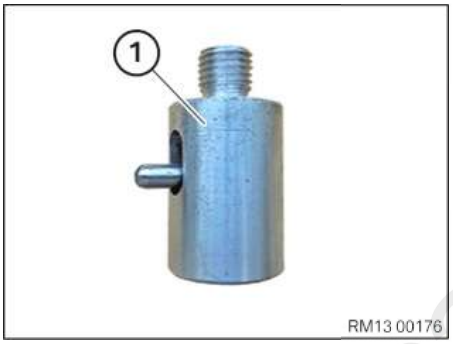
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

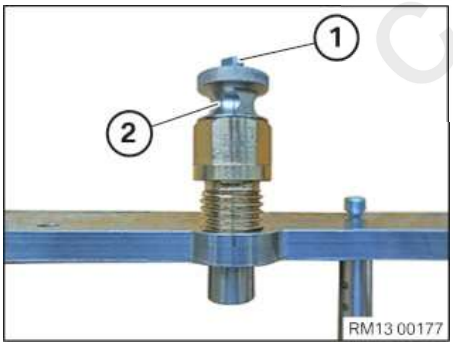
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

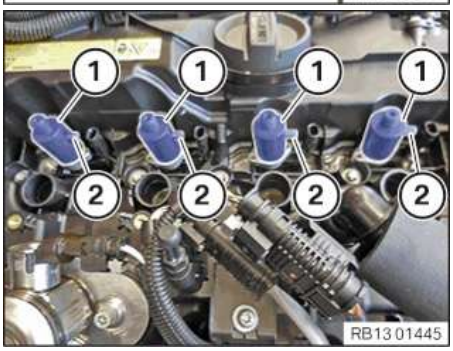
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



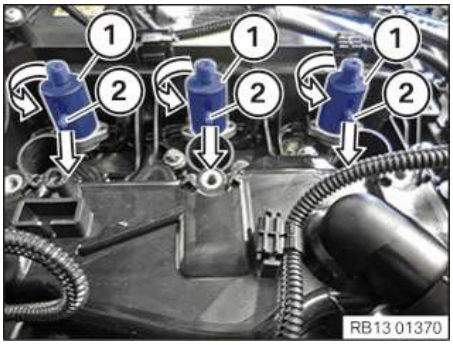
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



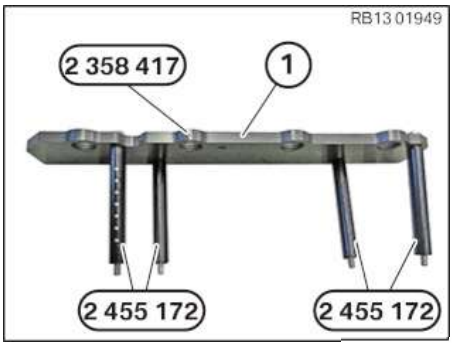
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

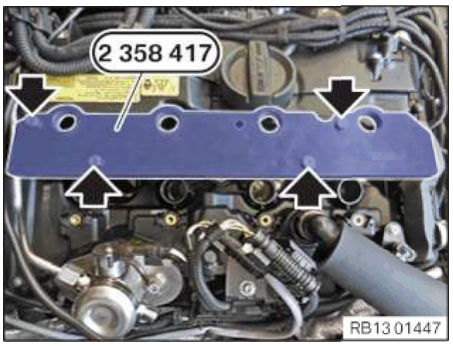
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



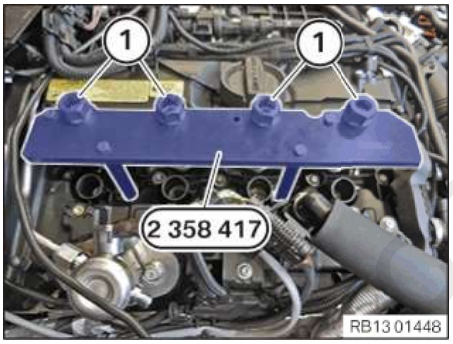
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

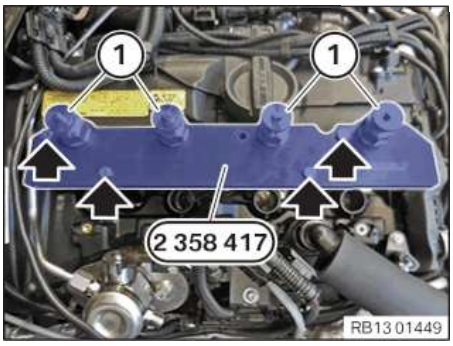
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

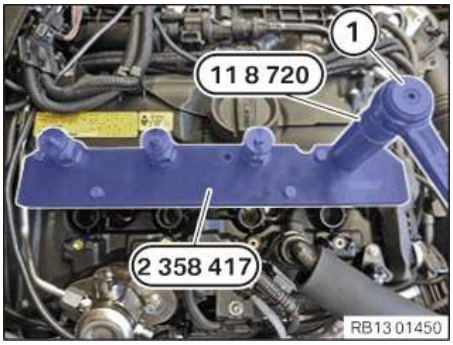
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

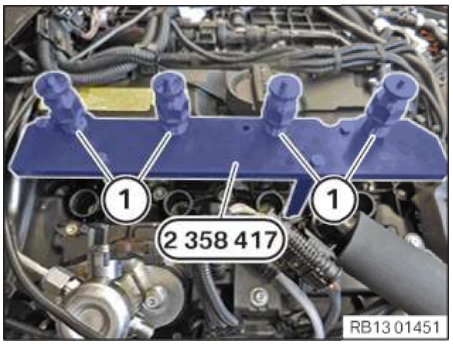


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

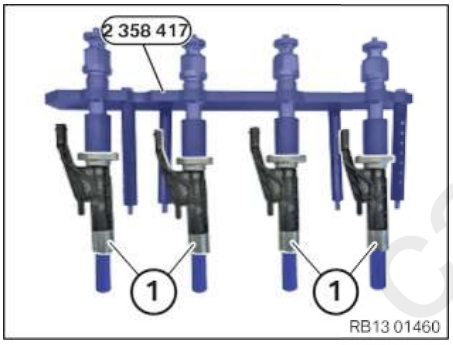
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

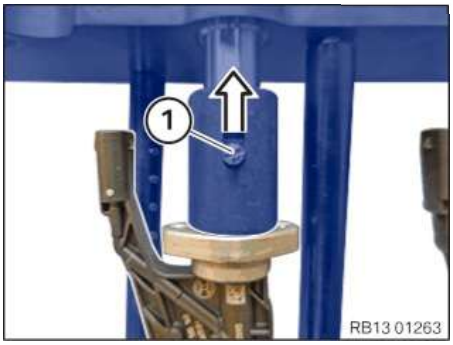


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

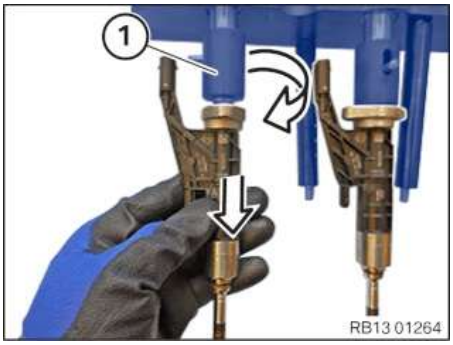


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

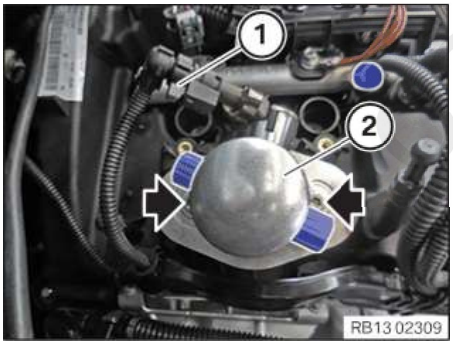
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

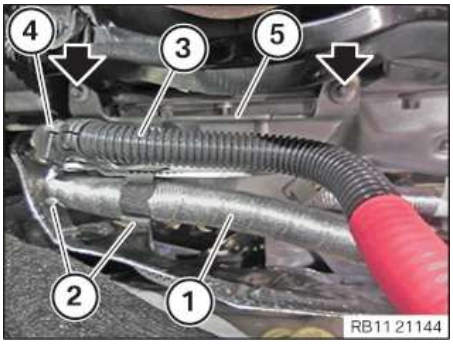
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

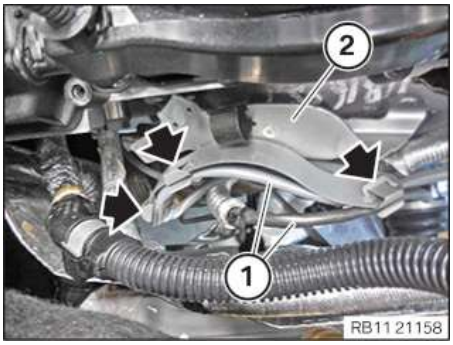


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

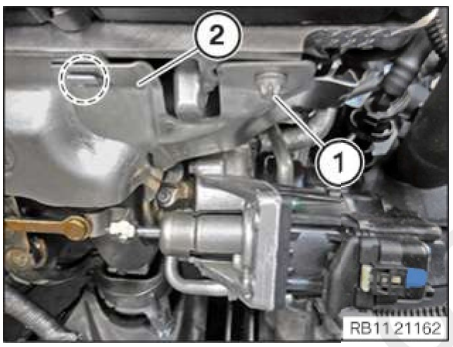
Hot surfaces.

Risk of burning!

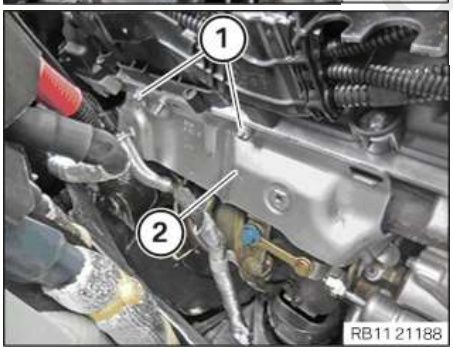
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

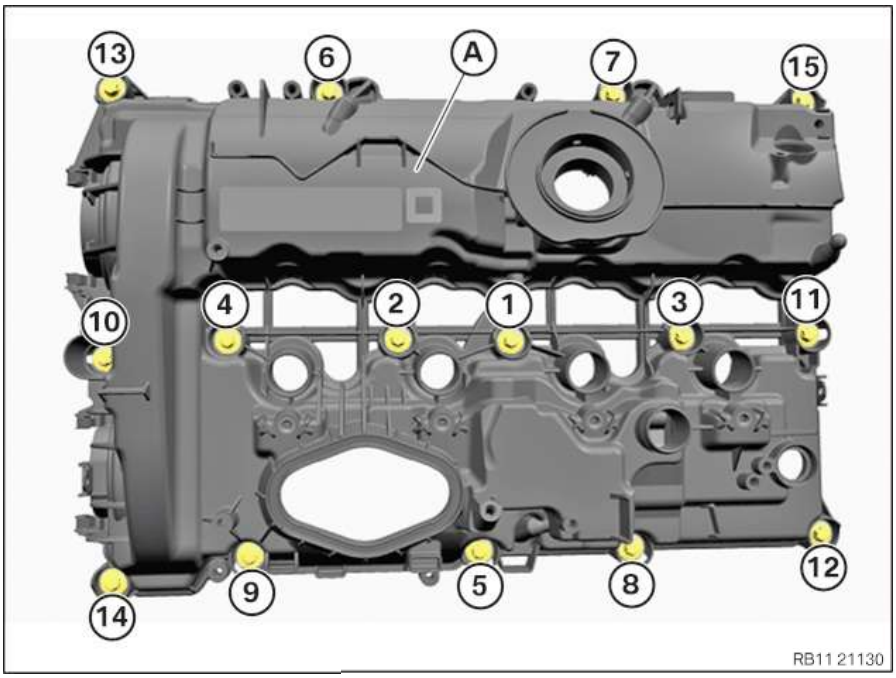


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

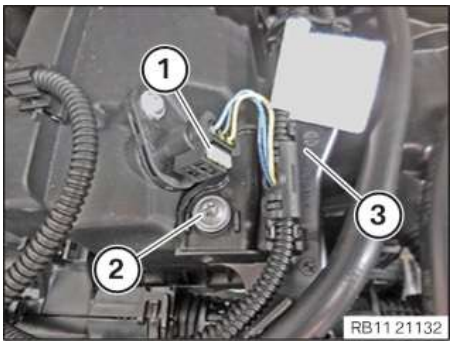
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

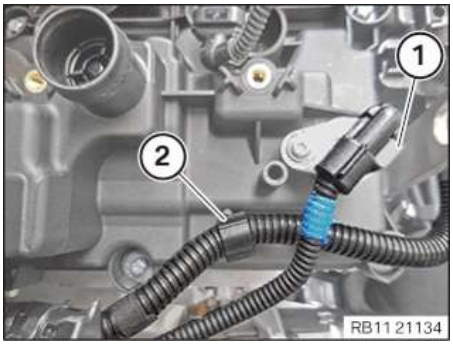
- Do not pull on the wires when disconnecting connectors and plug connections.



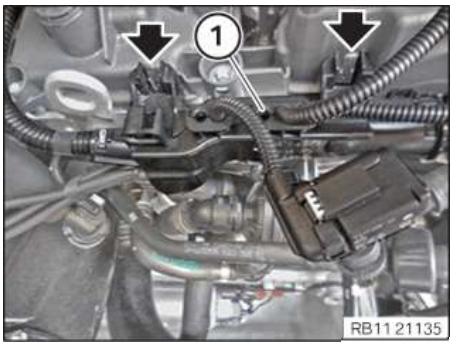
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



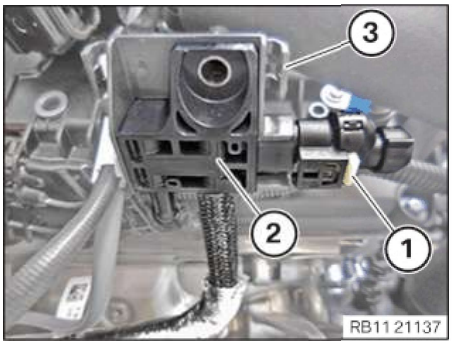
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



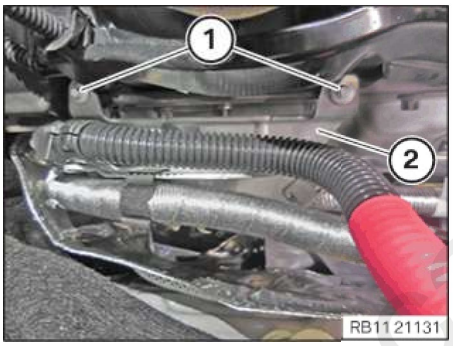
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



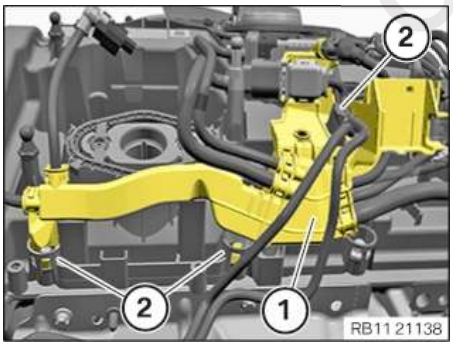
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



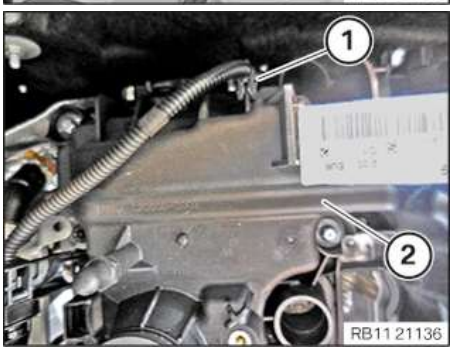
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

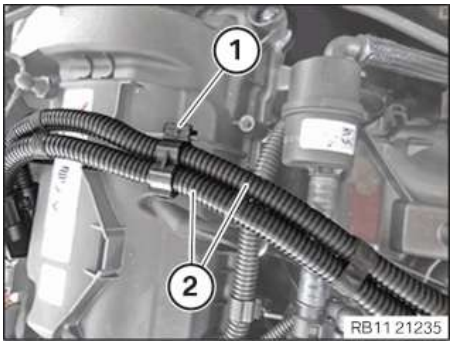


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

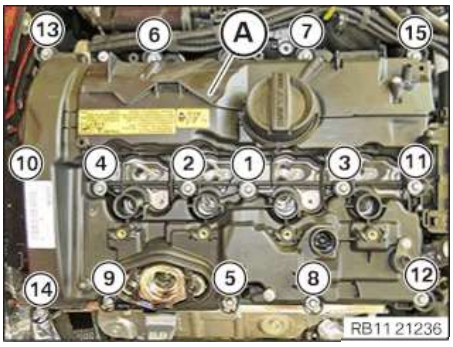


- Loosen clamp (1).

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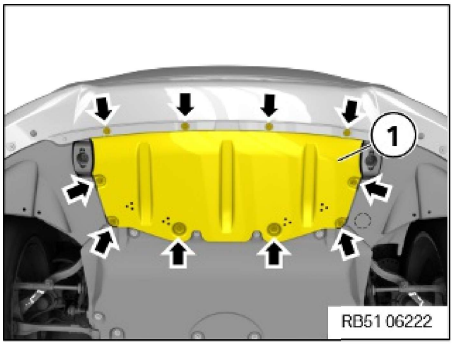


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

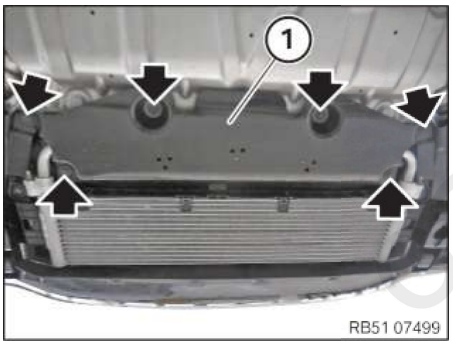
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

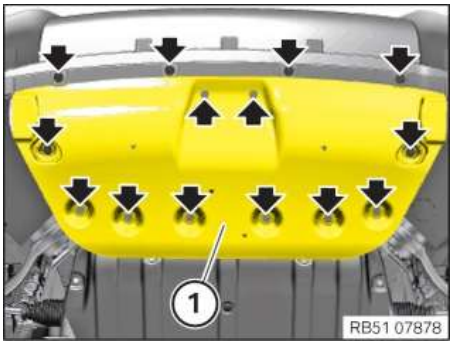
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

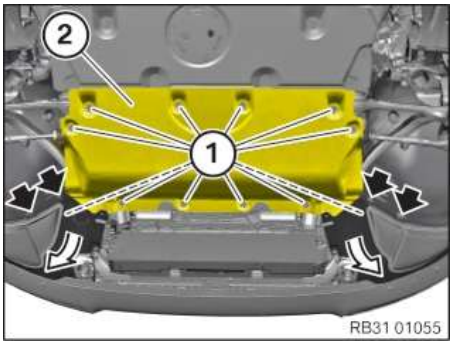


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



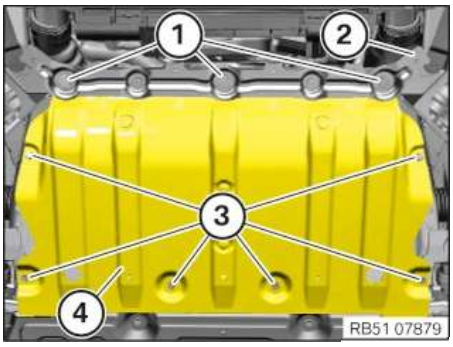
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

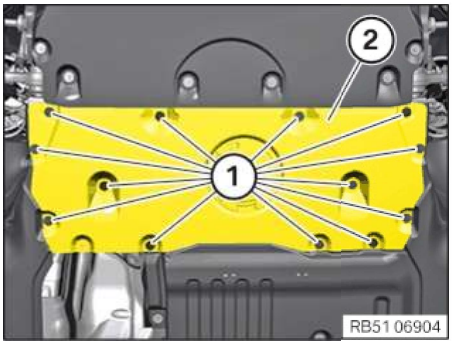
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

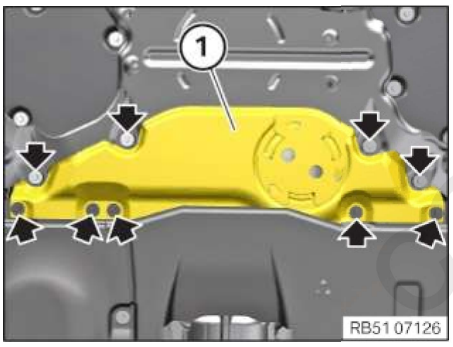
27 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

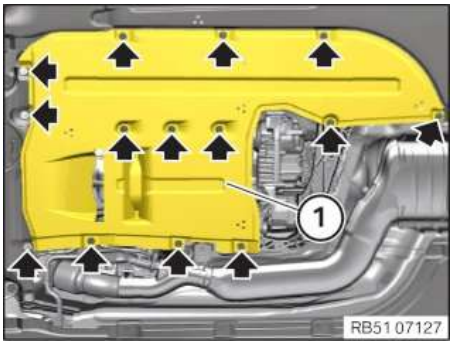


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

28 – Remove rear underbody protection

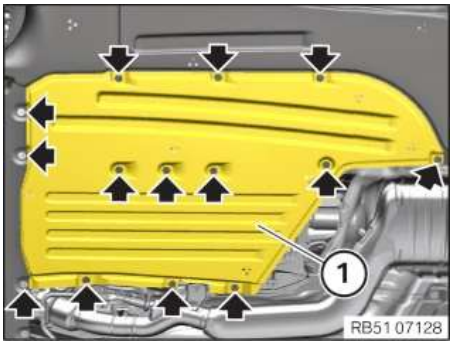


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

29 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



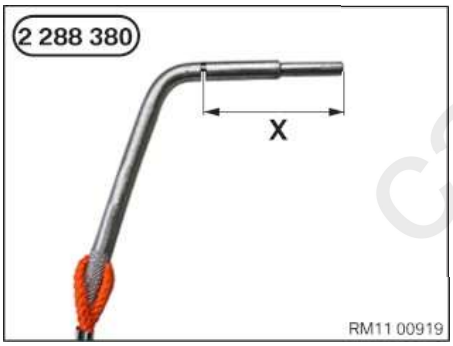
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

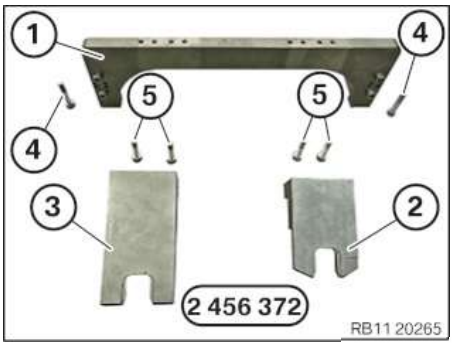
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- **Vehicles with automatic transmission:**

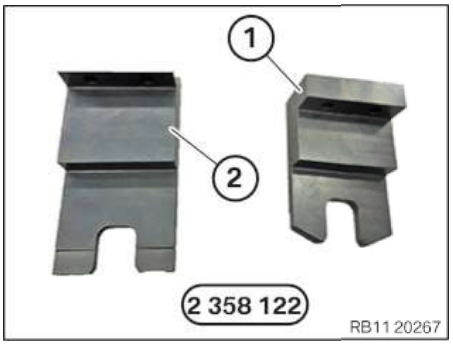
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



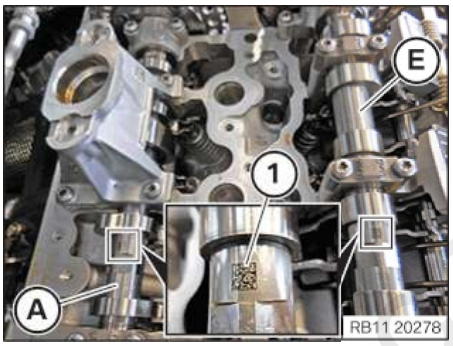
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

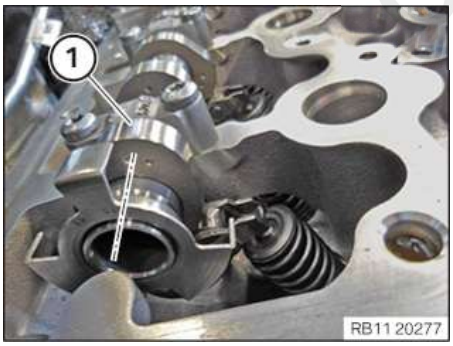


- Overview of the test gauges from the set of special tools 2 358 122:

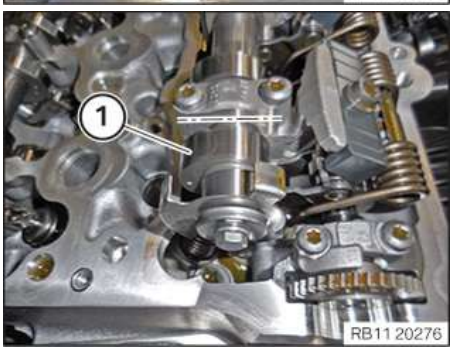
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

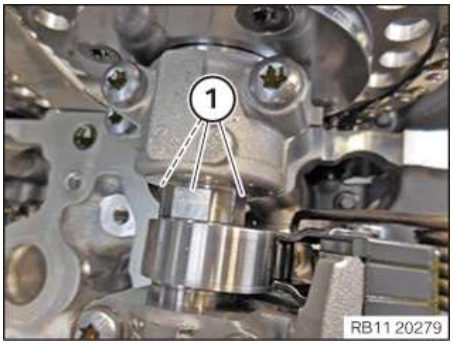


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

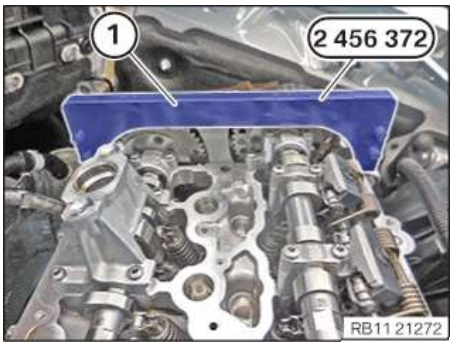


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

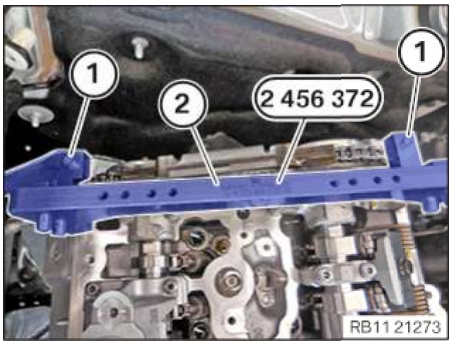
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- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



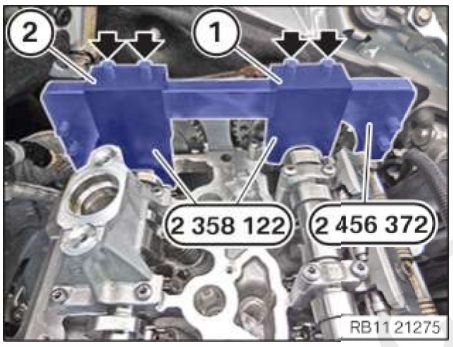
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

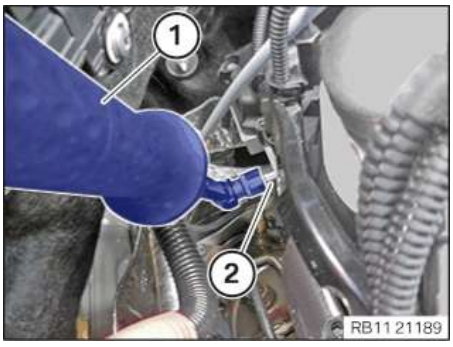
Test gauge to basic carrier

M6		Tightening torque	8 Nm

30 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

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- Feed out and remove the chain tensioner (1).

MAIN WORK

31 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

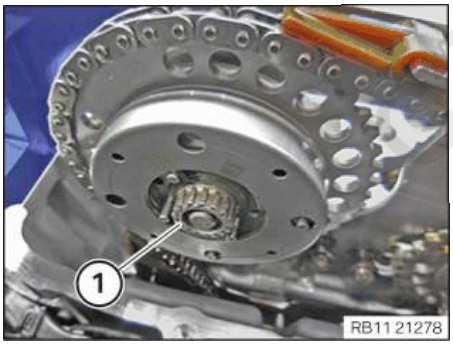


NOTICE

The figure shows the rear side of the engine.

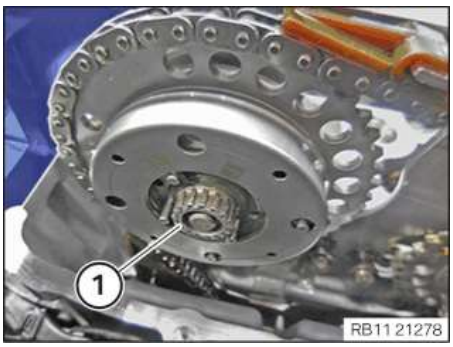
- Release the VANOS central valve (1) of the intake adjuster.

32 – Removing the VANOS central valve of the intake adjuster

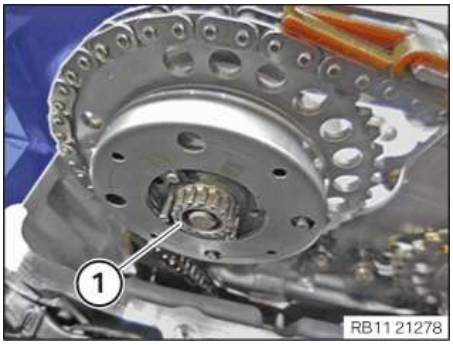


- Guide out and remove the VANOS central valve (1) of the intake adjuster.

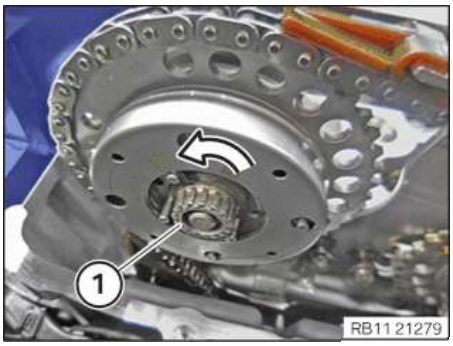
33 – Install the VANOS central valve of the intake adjuster



- Guide in the VANOS central valve (1) of the intake adjuster and install.



- Hand-tighten the VANOS central valve (1) of the intake adjuster.

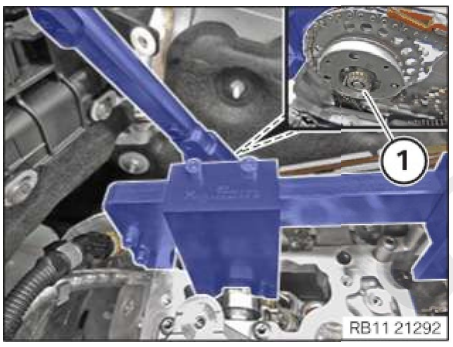


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

34 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

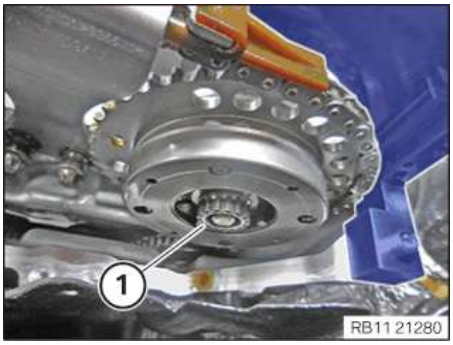


NOTICE

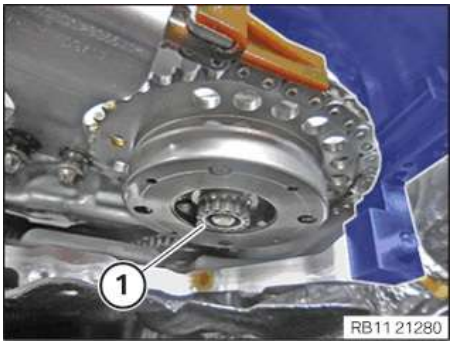
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

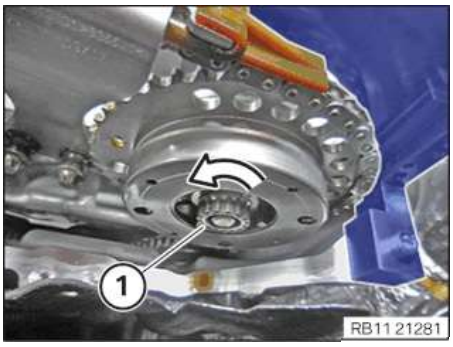
35 – Installing the VANOS central valve of the exhaust camshaft adjuster



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.

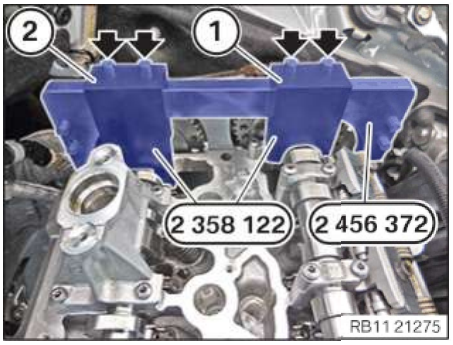


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



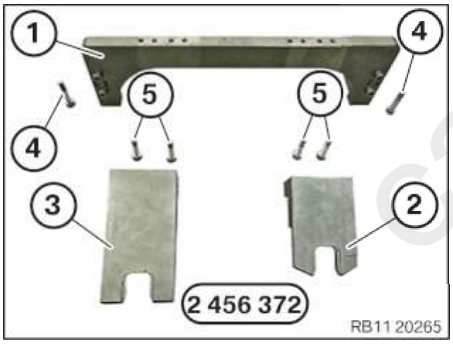
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

36 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

37 – Adjust the camshafts with the special tool



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

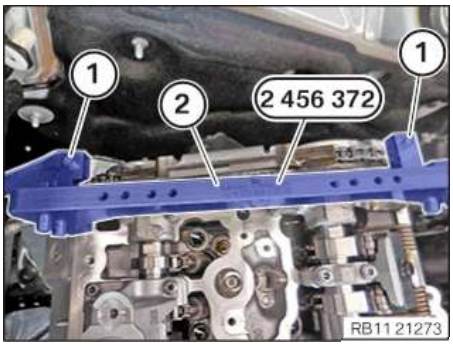


- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.

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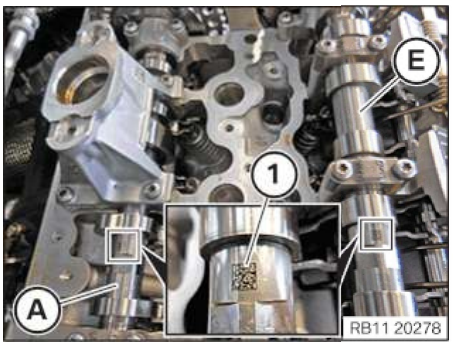
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



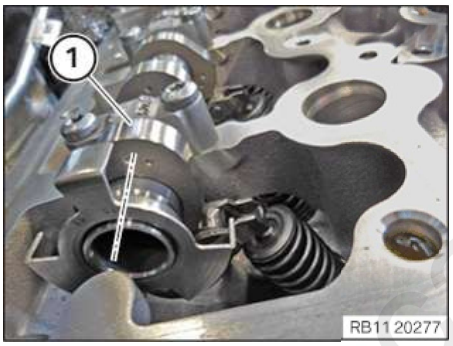
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

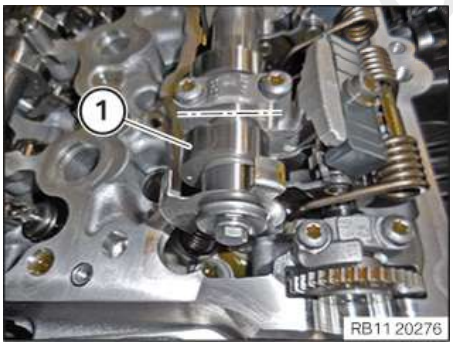
M6		Tightening torque	8 Nm



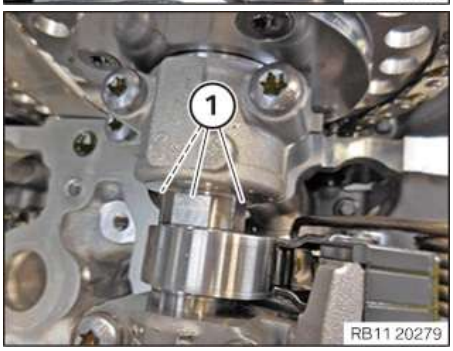
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

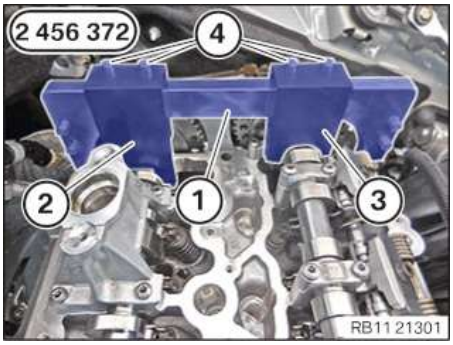


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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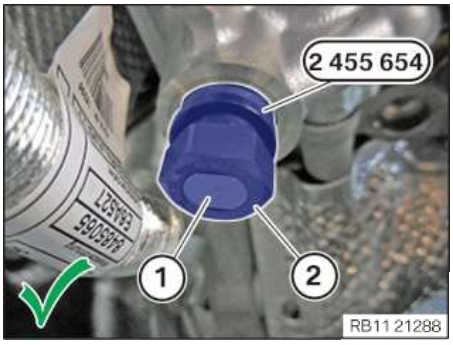


- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

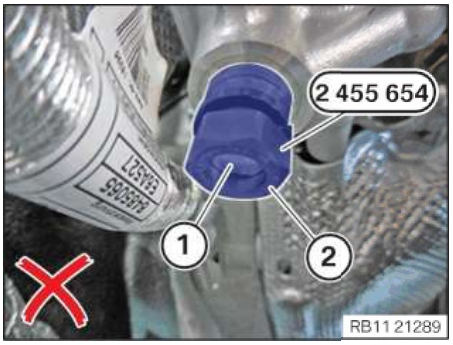
M6		Tightening torque	8 Nm

38 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

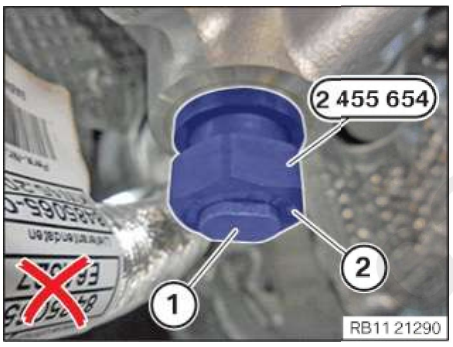
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

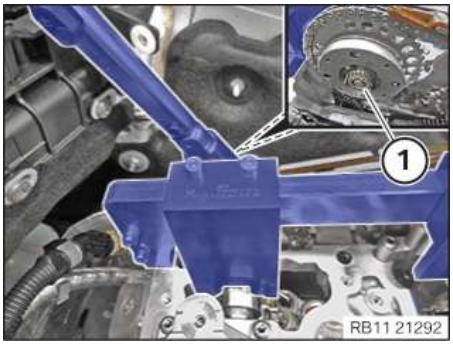
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

39 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

40 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



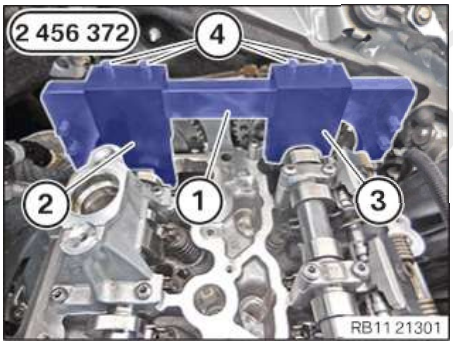
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

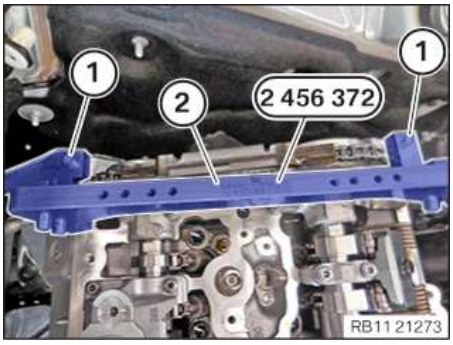
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

41 – Disassembling all special tools

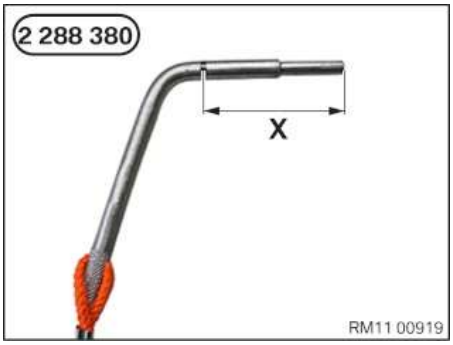


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.

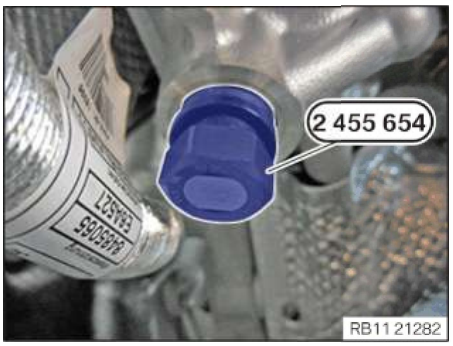
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- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

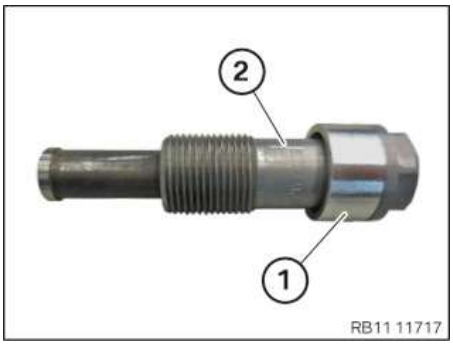
42 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



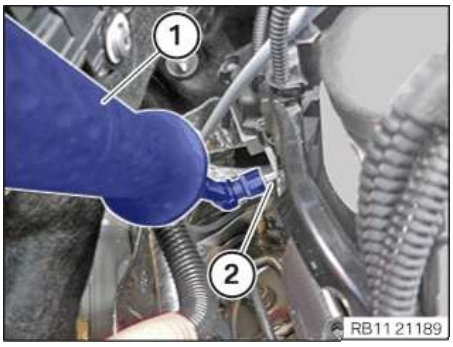
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.

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- Insert and install the chain tensioner (1).

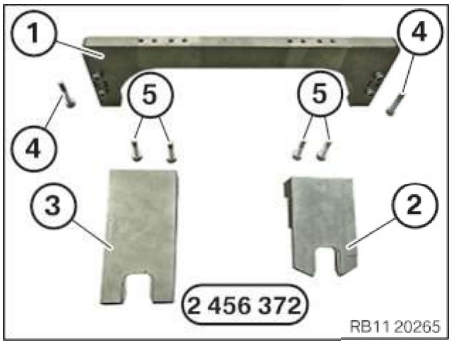


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

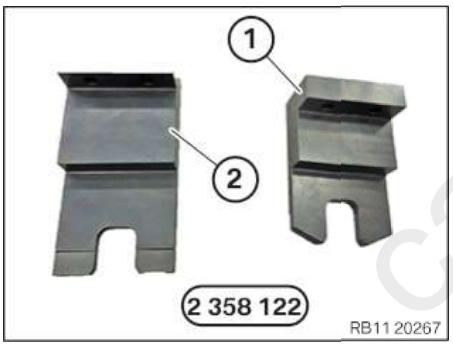
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

43 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



RISK OF DAMAGE

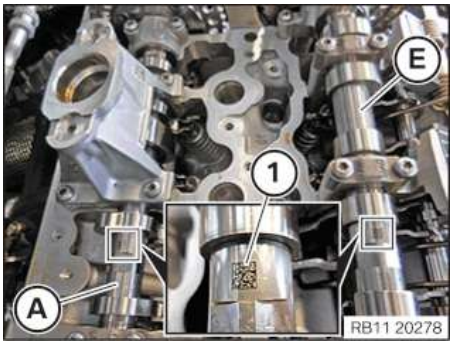
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

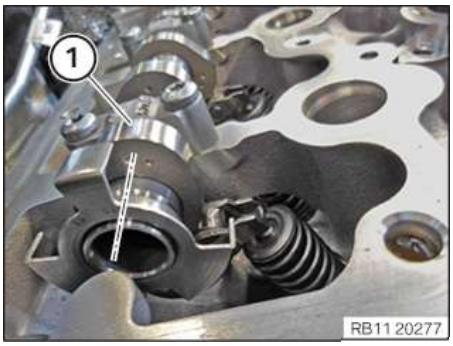
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

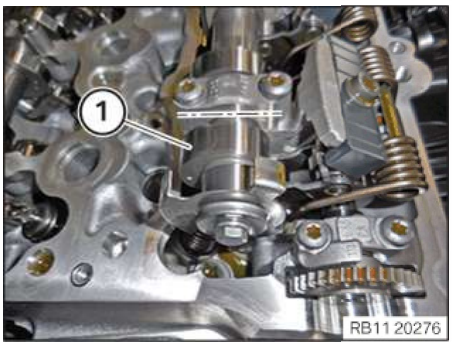
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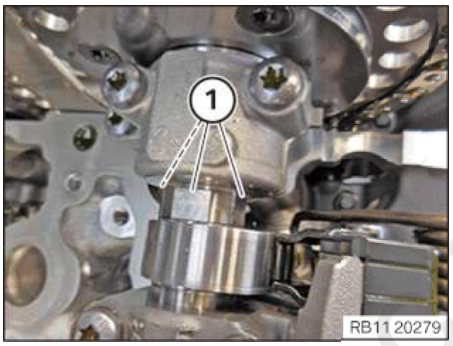
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



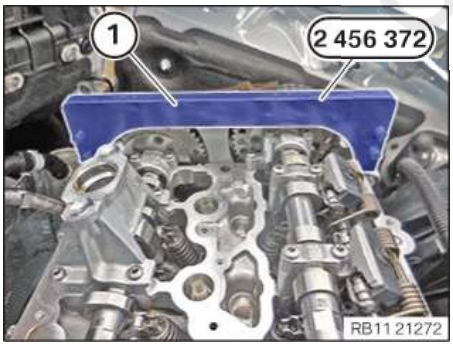
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



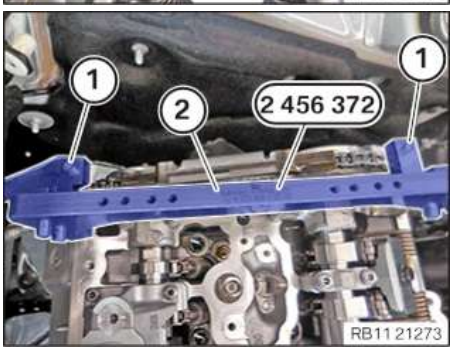
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

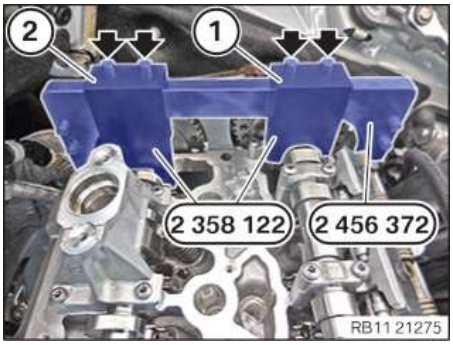


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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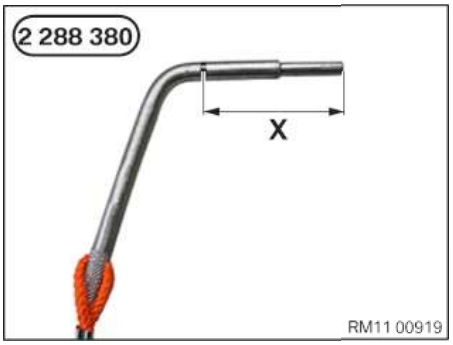
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

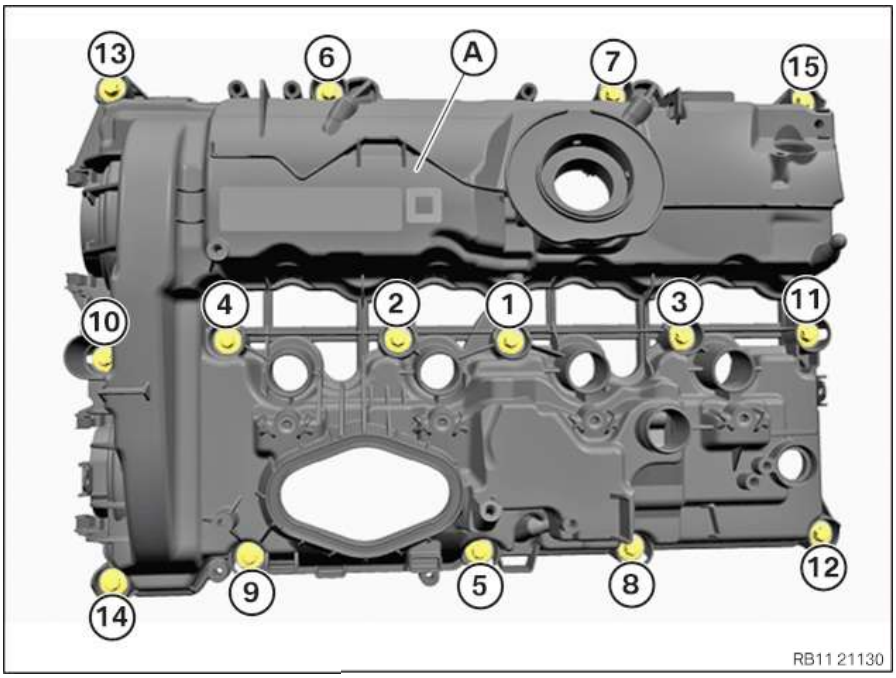
  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

44 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

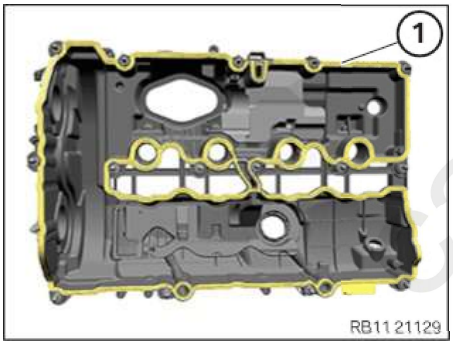
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

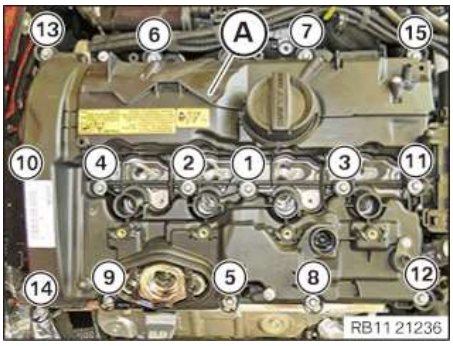
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

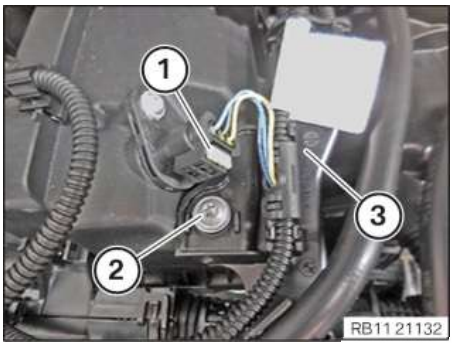
Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

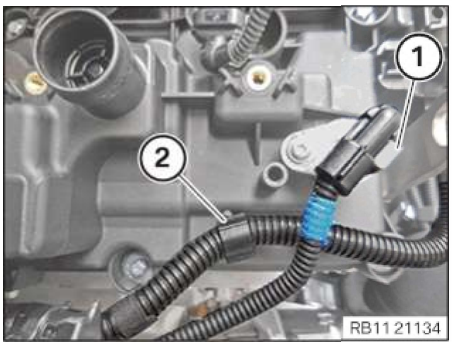


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

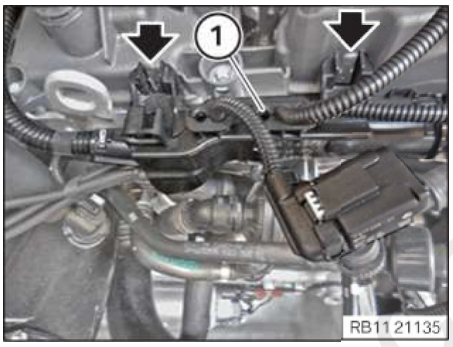
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

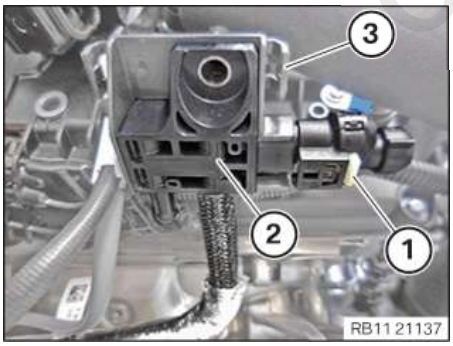
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

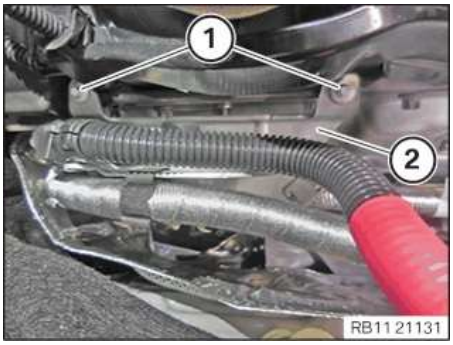


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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CAUTION

Improper routing of the positive battery cable.

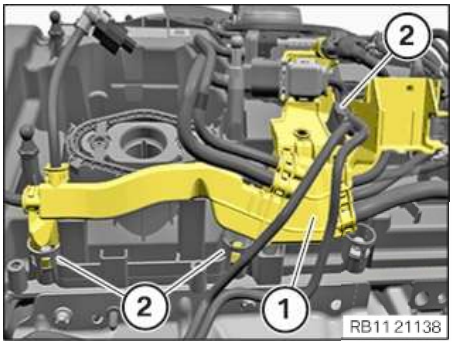
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

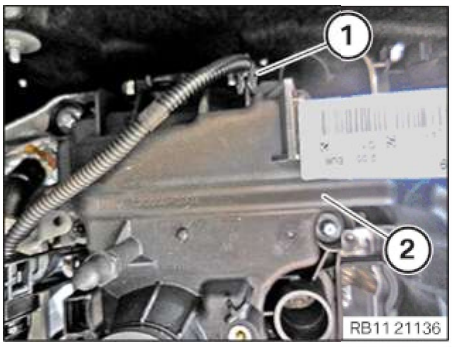
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

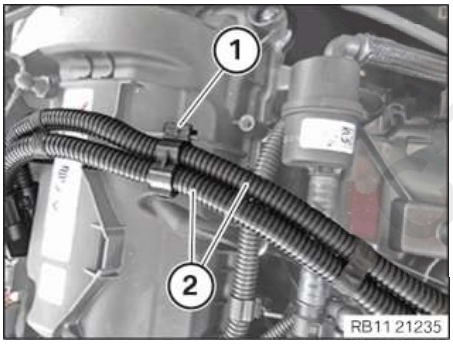
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

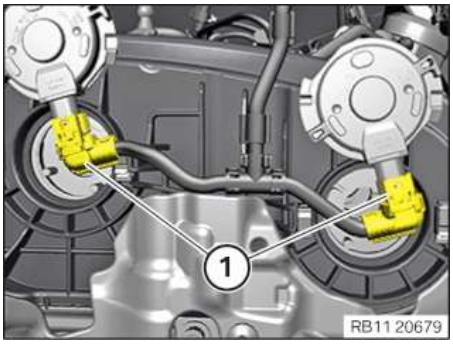


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

45 – Installing both actuators

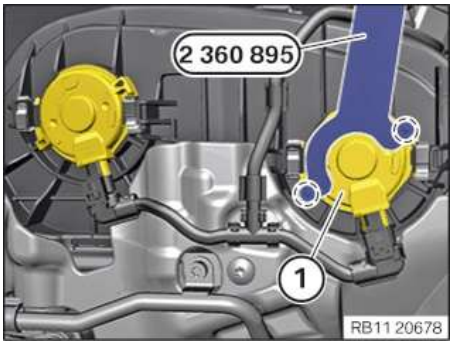


NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

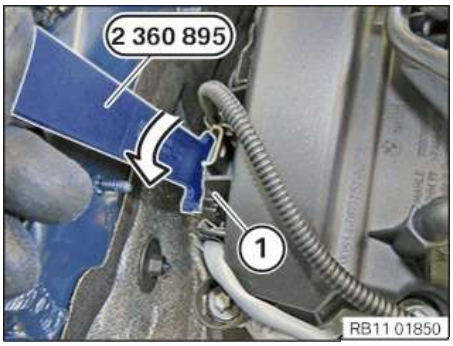
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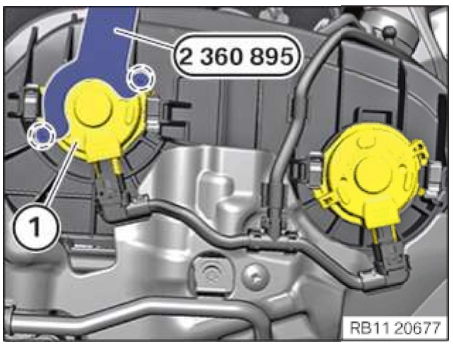
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



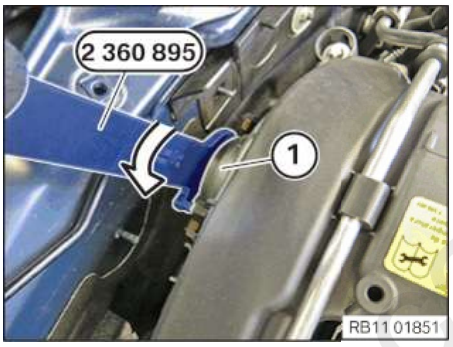
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

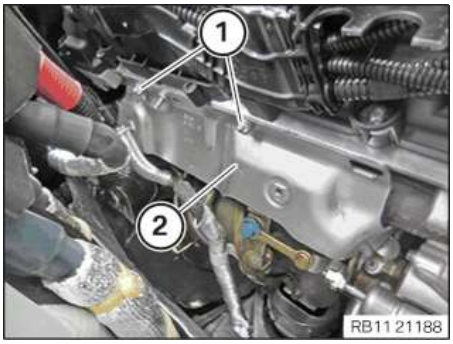
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

46 – Installing the heat shield on the cylinder head

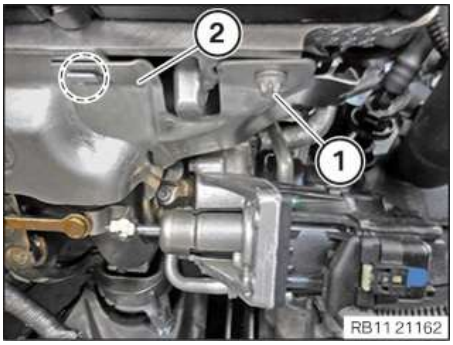


- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

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- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

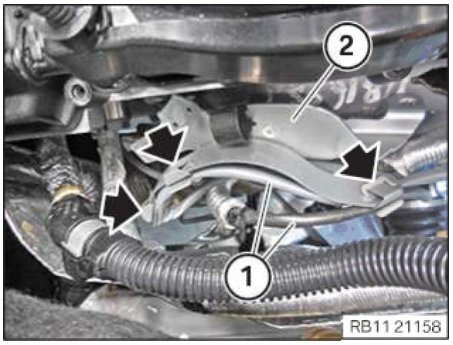


- Tighten down screw (1).

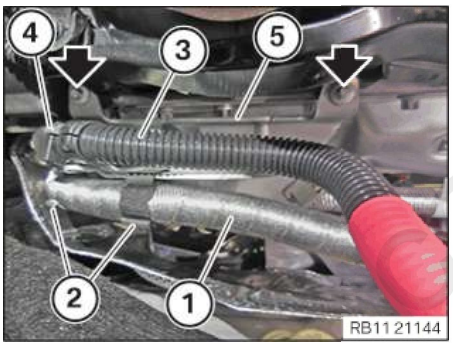
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

47 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

48 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

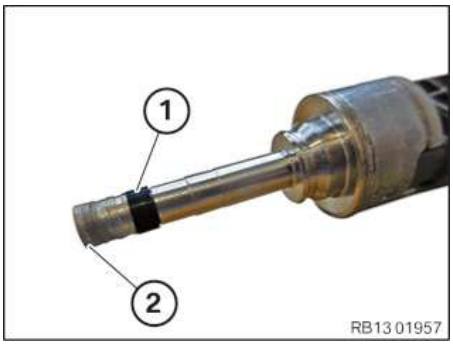
- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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TECHNICAL INFORMATION

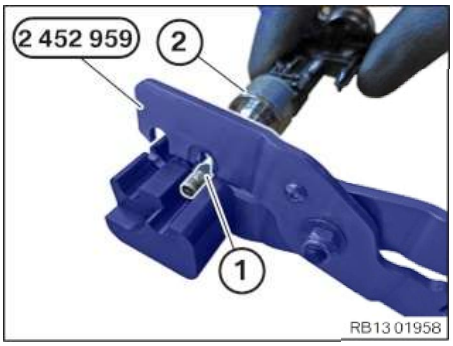
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

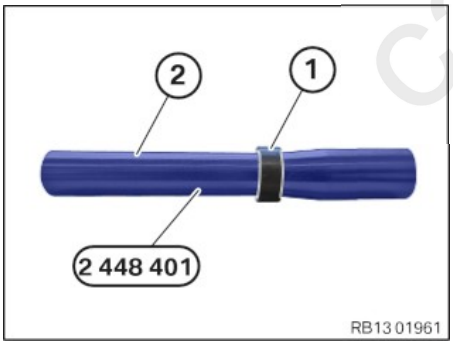


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

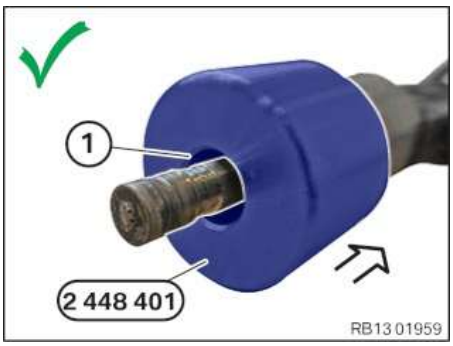
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

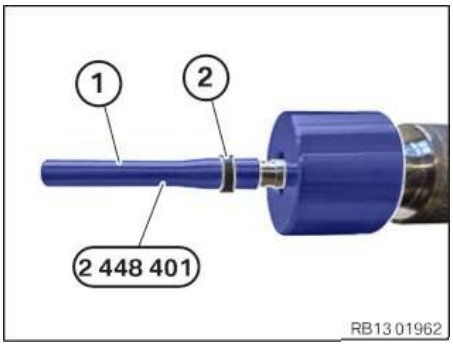
  The larger diameter of the assembly sleeve (1) must point to the injector tip.

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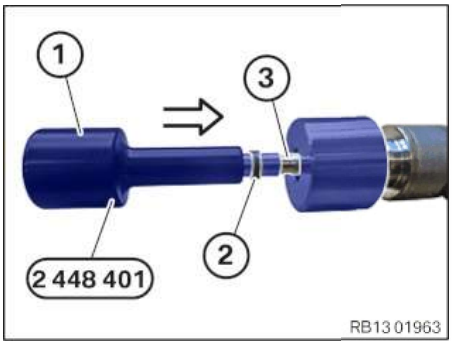


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

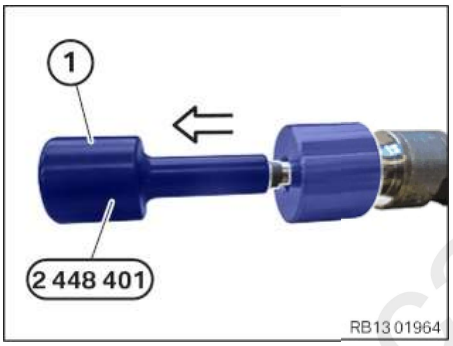
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



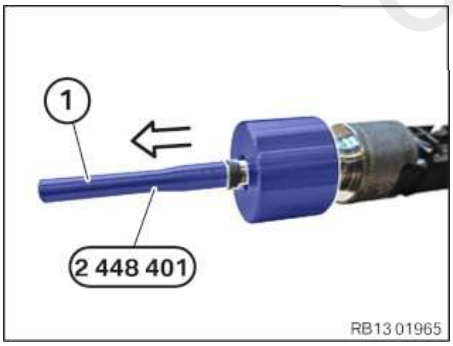
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



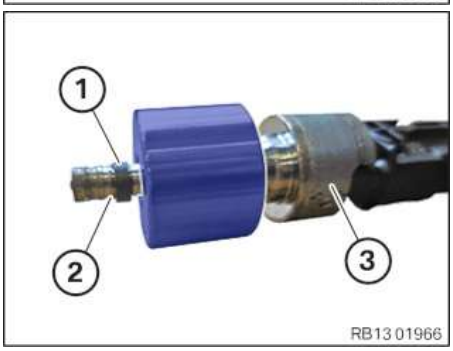
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

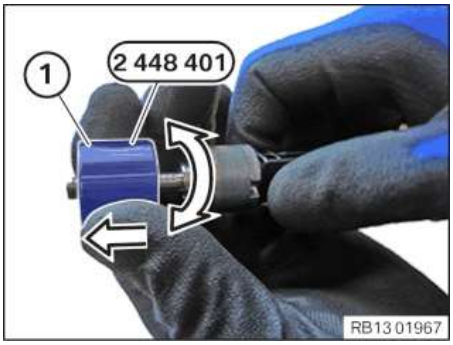


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



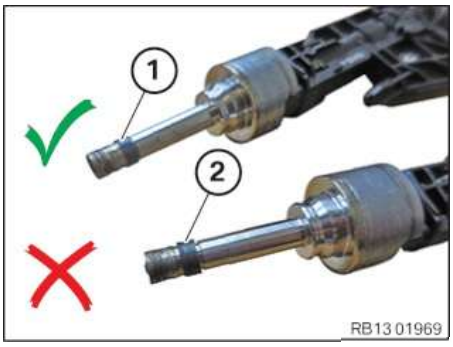
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

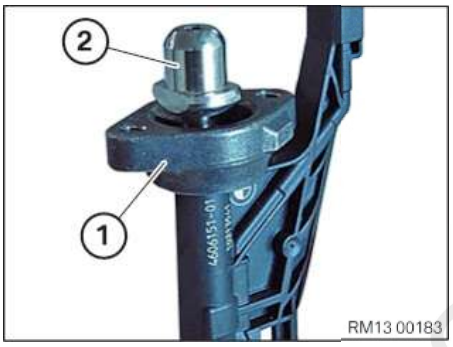


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

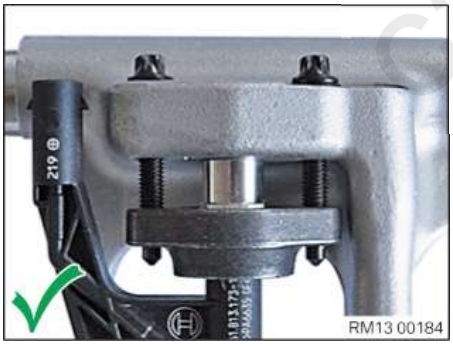
49 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

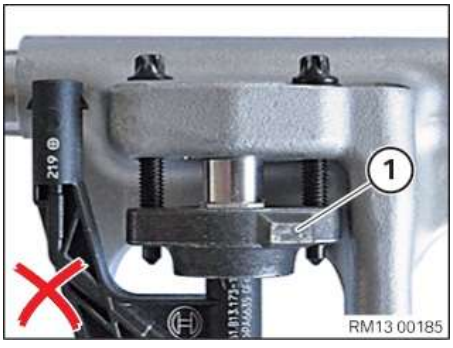


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

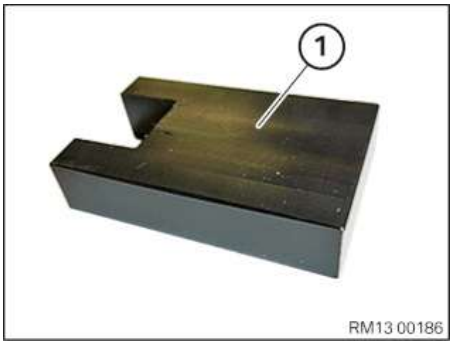
  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.

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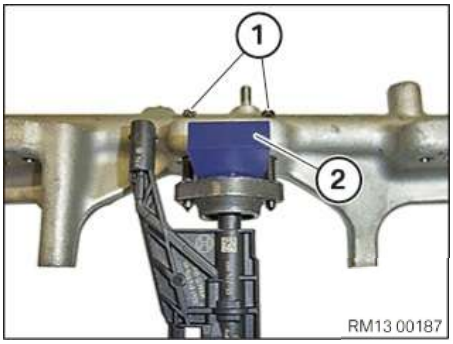
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)

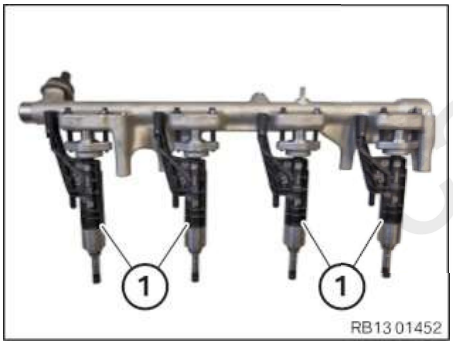
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.

- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



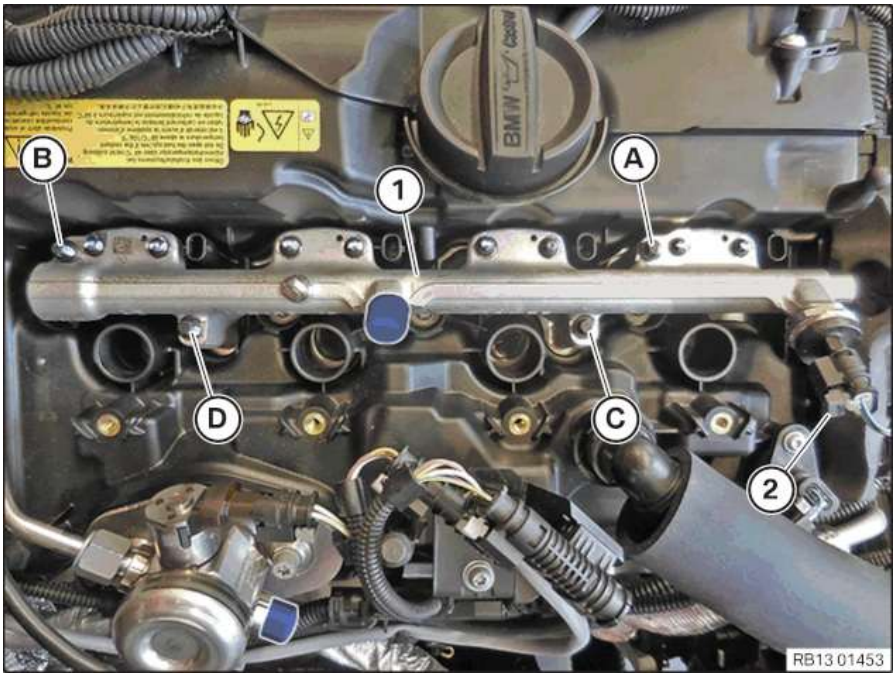
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

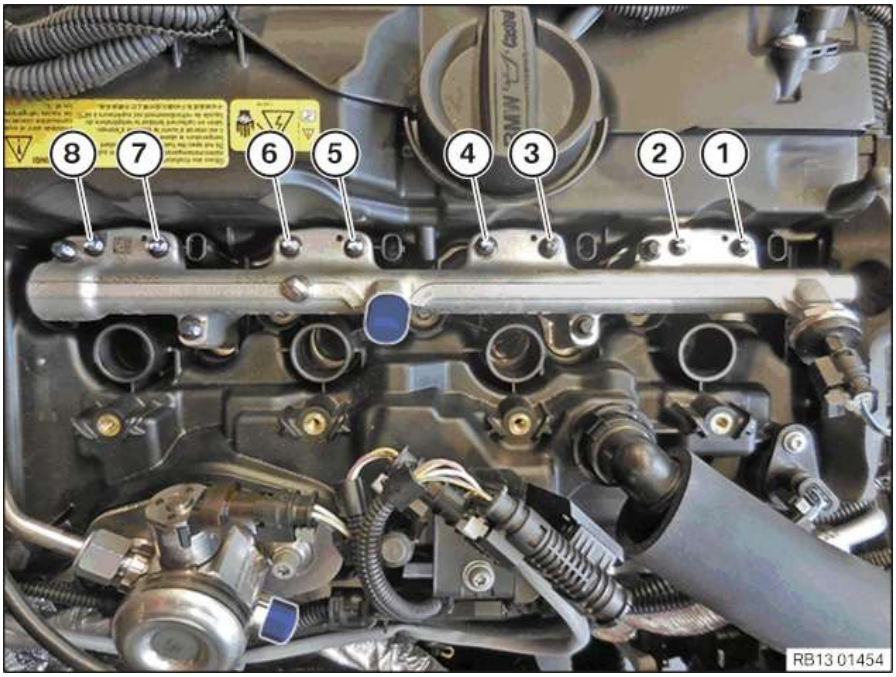
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

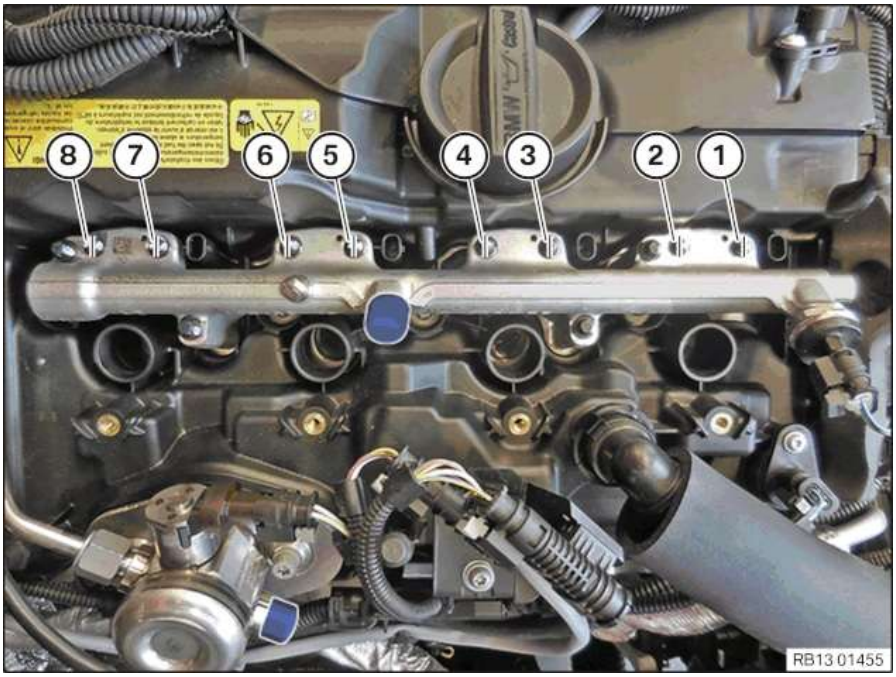
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

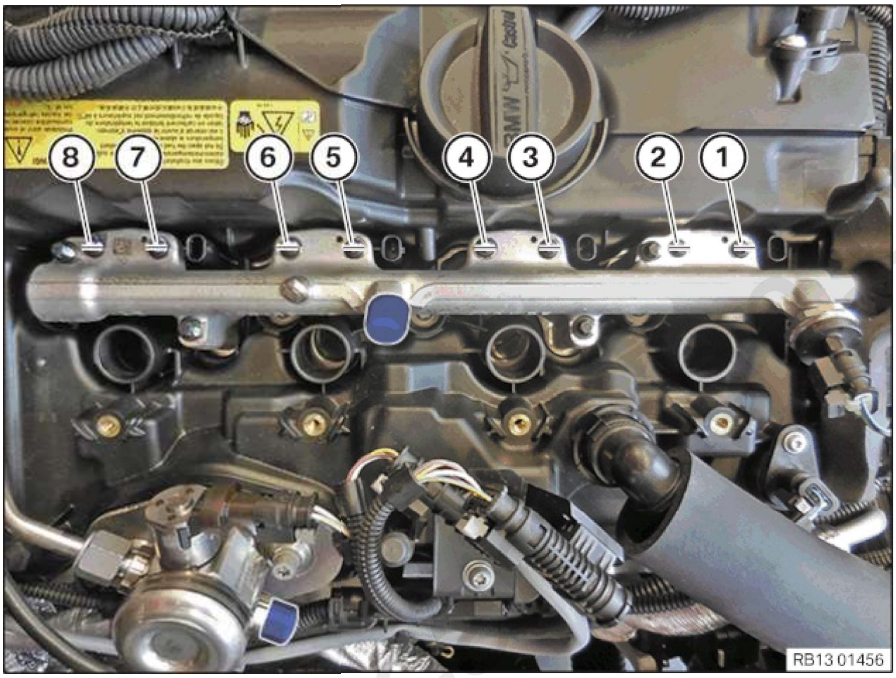
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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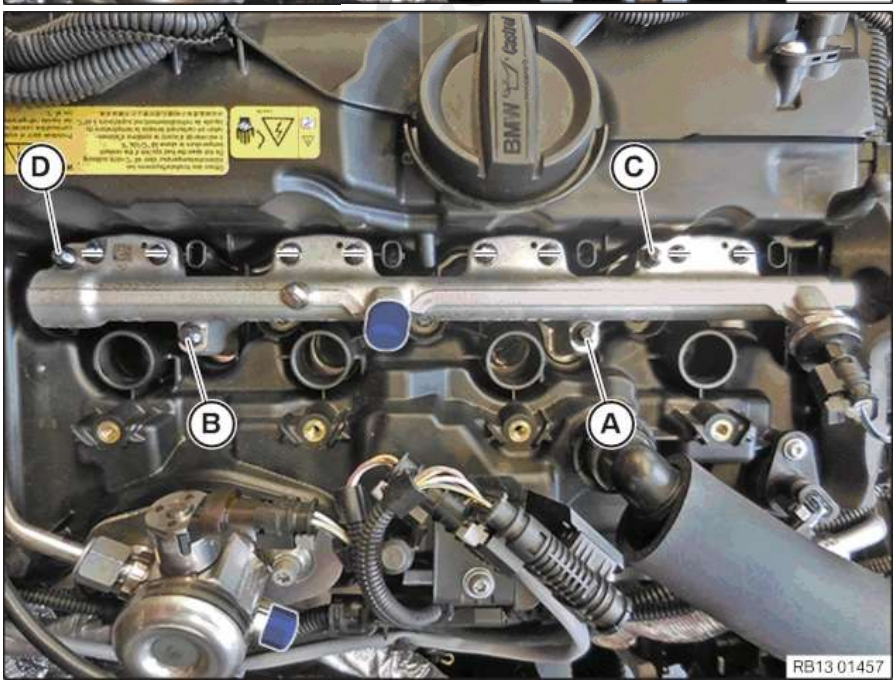


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

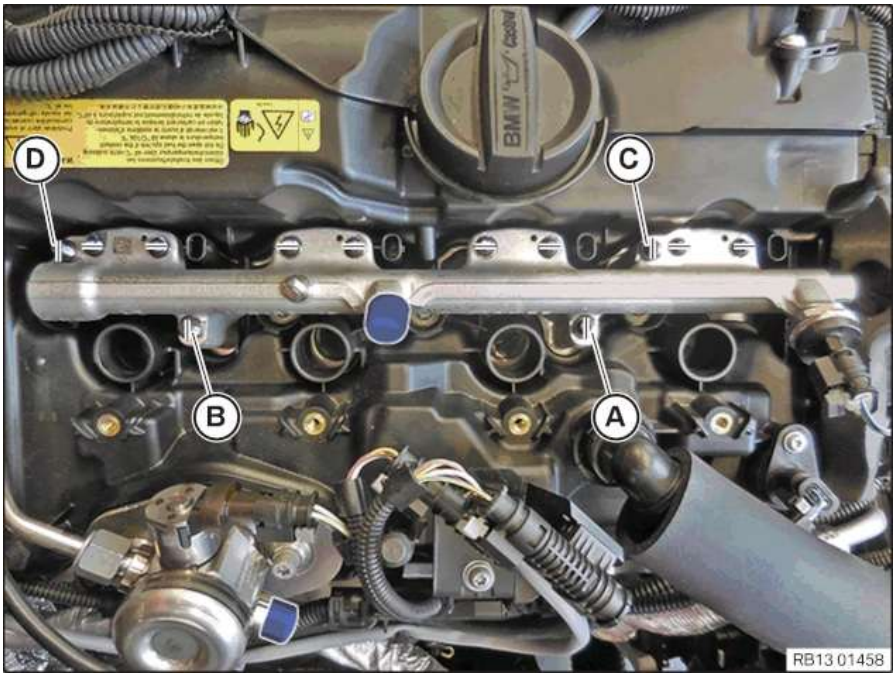
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

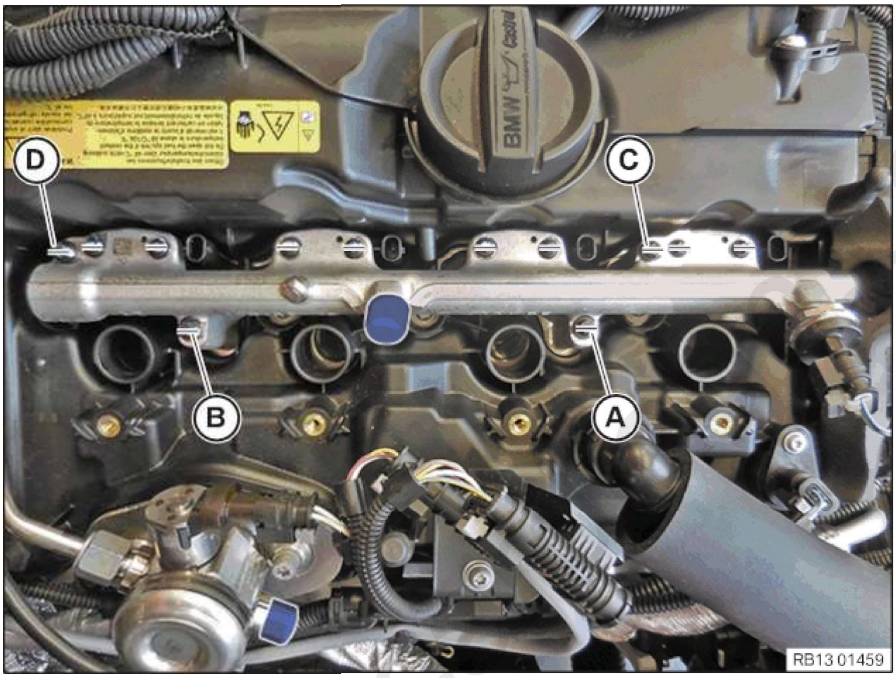
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

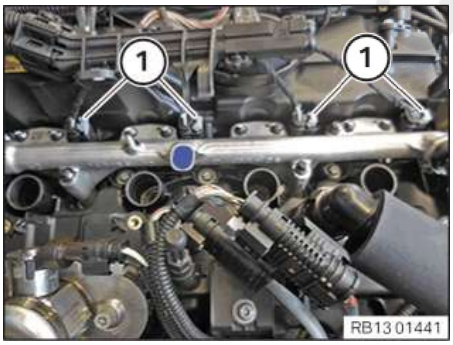


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



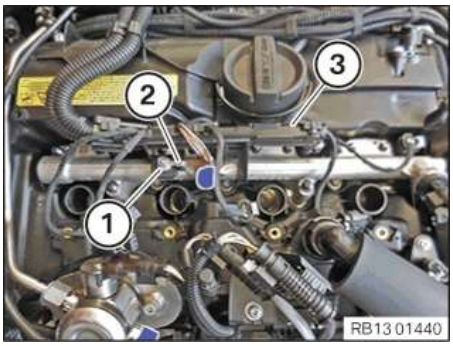
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

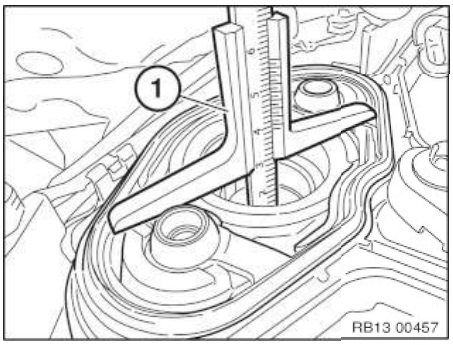
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

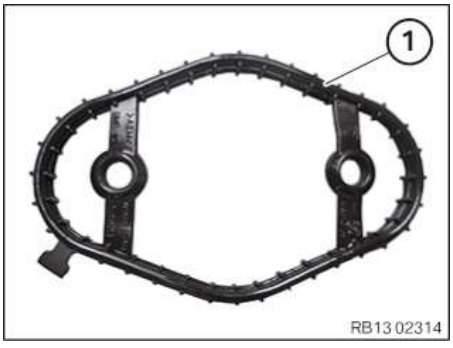
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

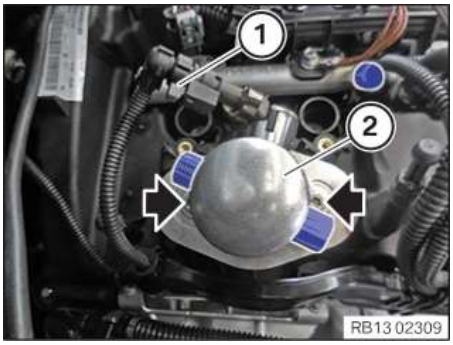
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

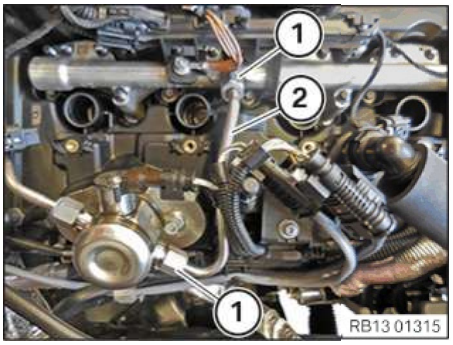
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

51 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

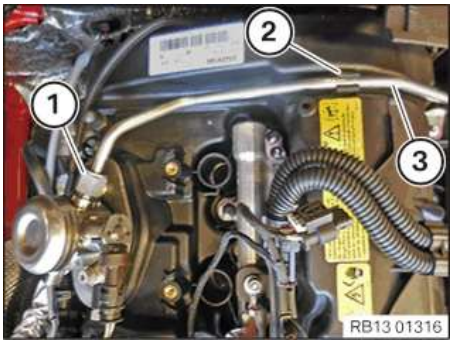
52 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

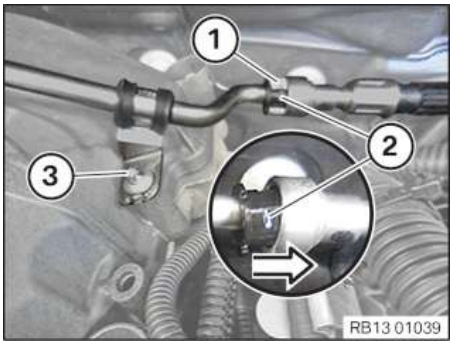


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

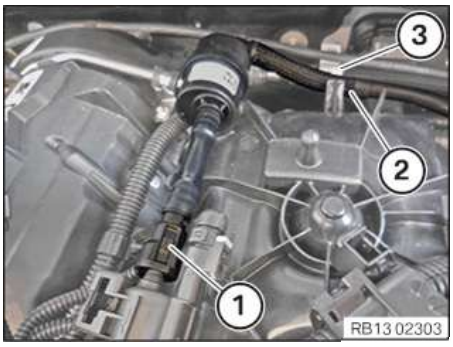
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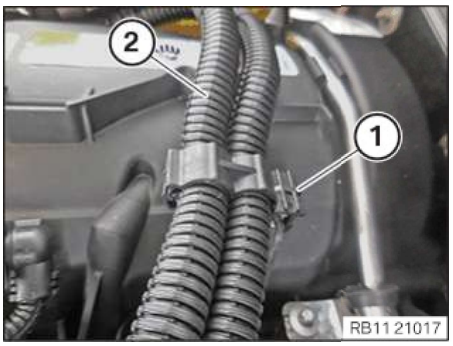
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

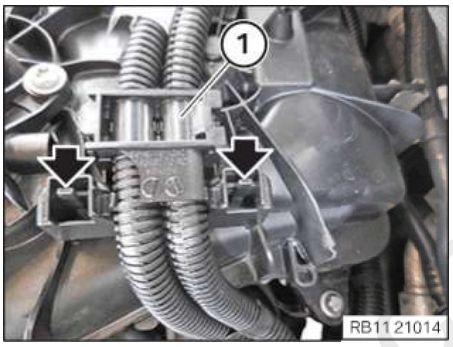
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

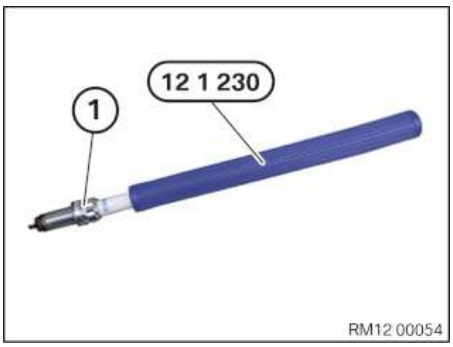


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

53 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

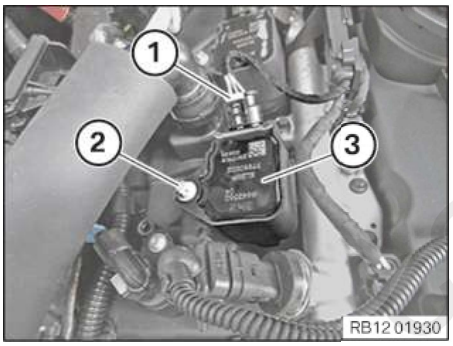
M12x1.25		Tightening torque	23 Nm

54 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



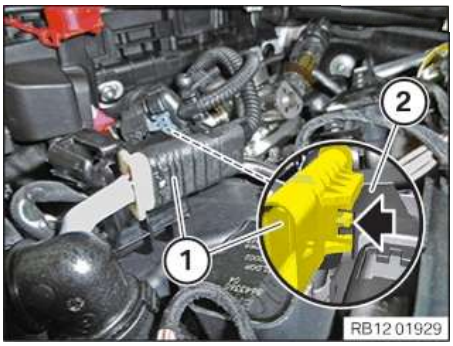
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

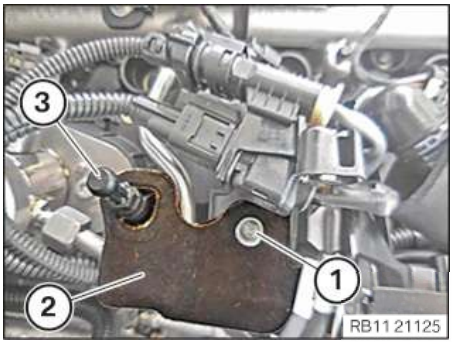
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

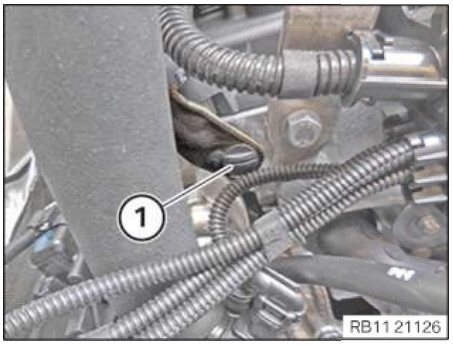
55 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

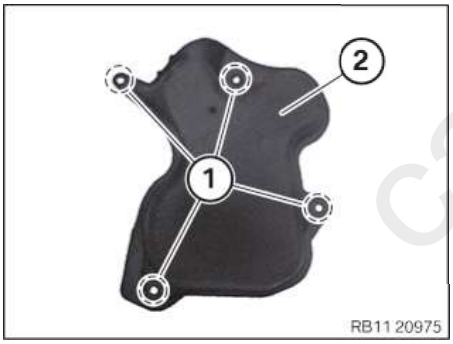
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



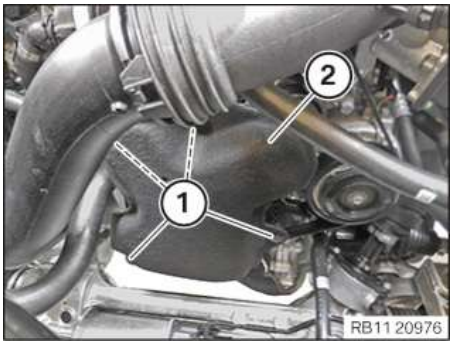
- Secure the clip (1).

56 – Install the acoustic cover for the engine at the front



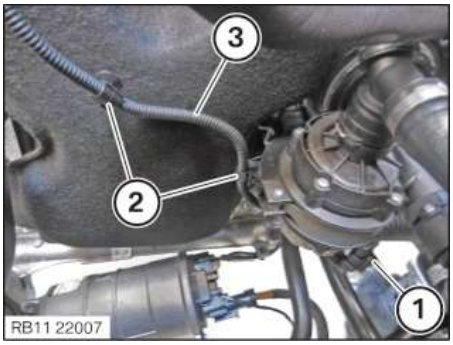
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



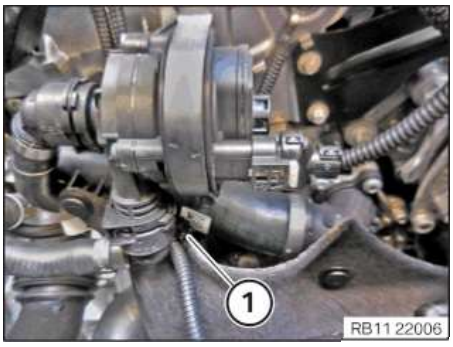
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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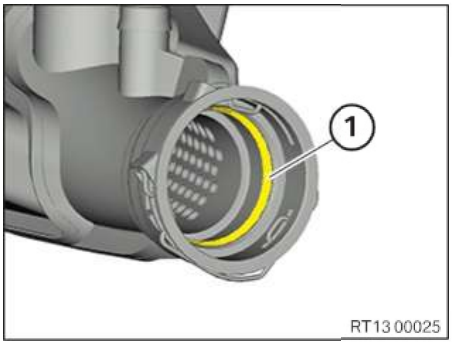
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

57 – Installing the clean air pipe with resonator

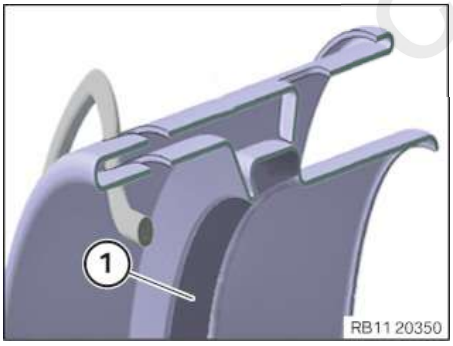


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

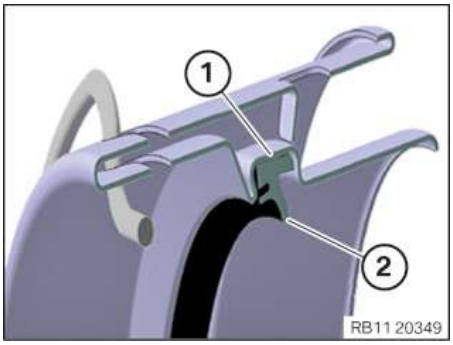
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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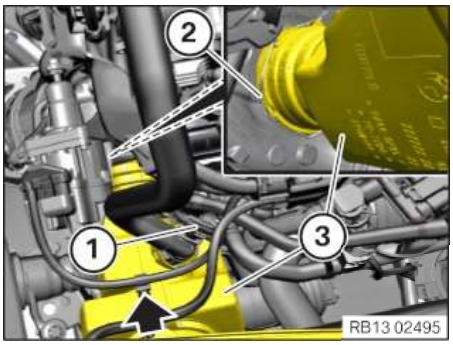
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

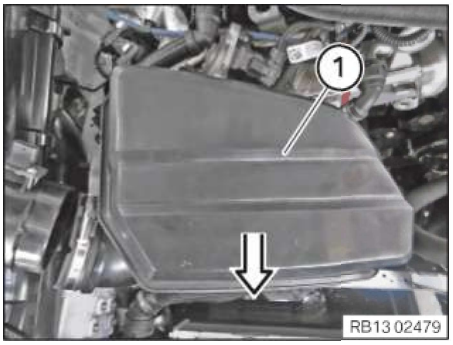
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



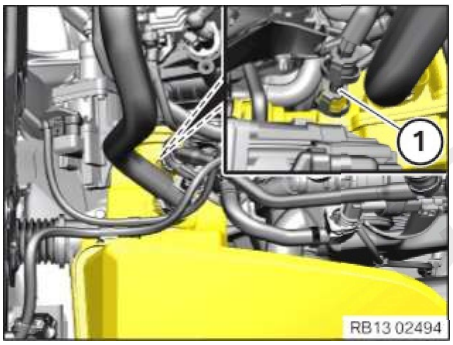
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

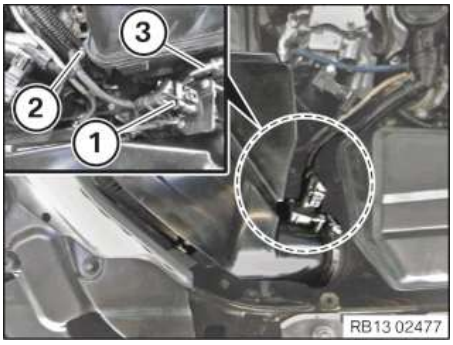
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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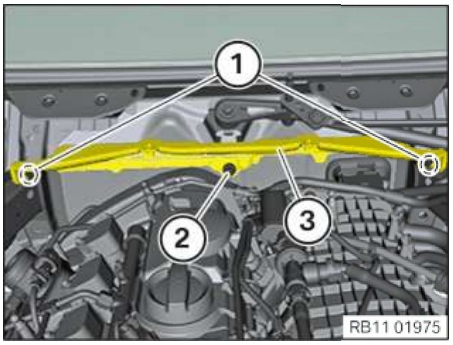
- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

58 – Disconnecting all battery earth leads



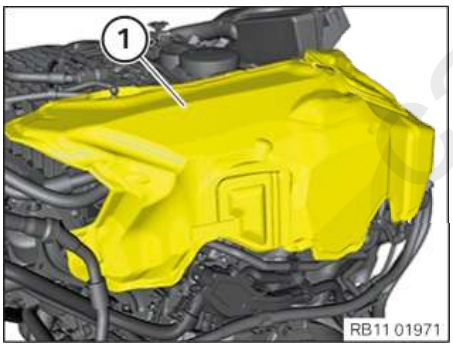
- See additional information.

59 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

60 – Installing acoustic cover at rear



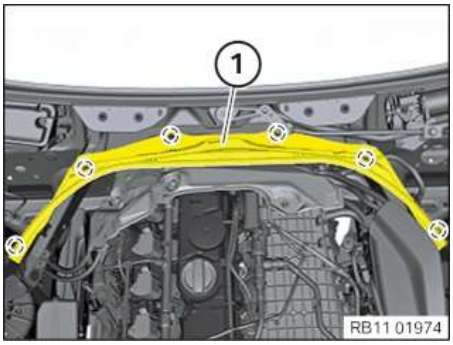
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

61 – Installing the centre bulkhead upper part

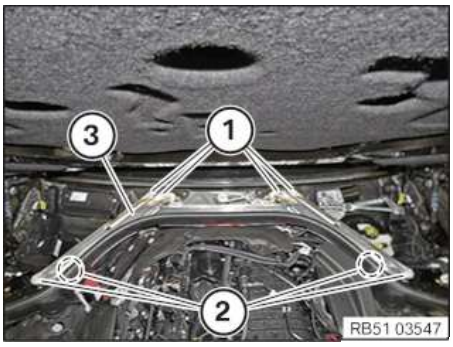
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- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

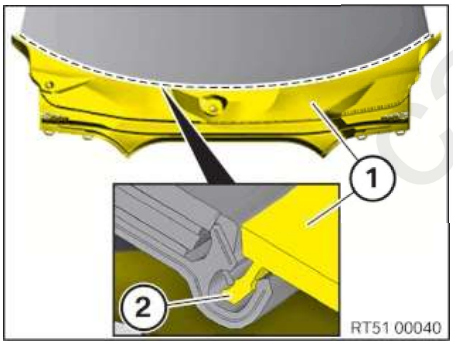
62 – Installing cowl panel cover

RISK OF DAMAGE

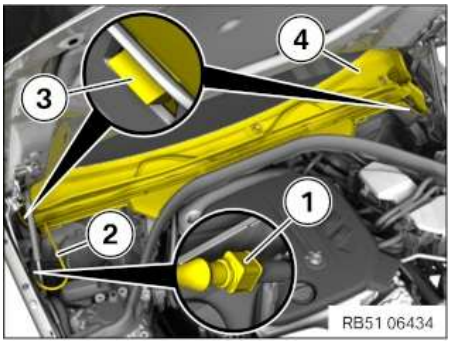
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

63 – Installing both wiper arms

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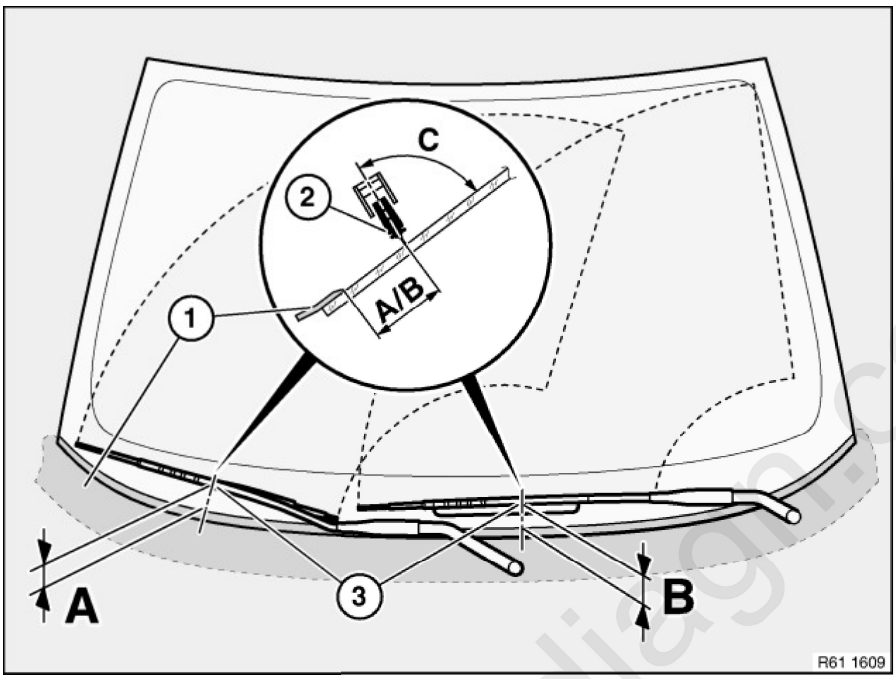
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

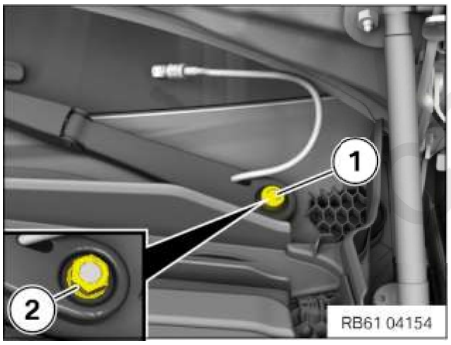
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

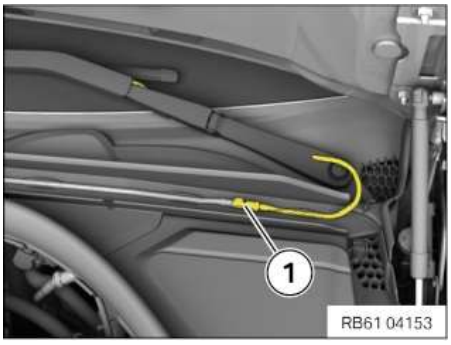


- Tighten nut (2).

Windscreen wiper arm

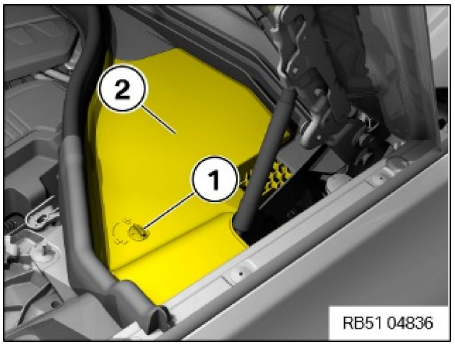
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



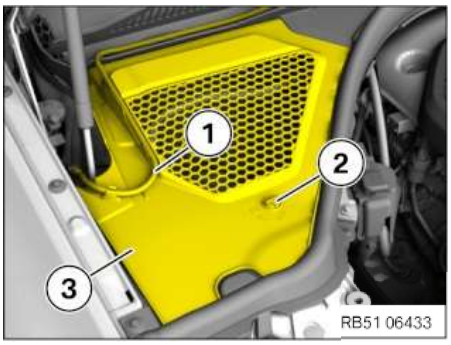
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

64 – Install the cover of the engine compartment on the rear left



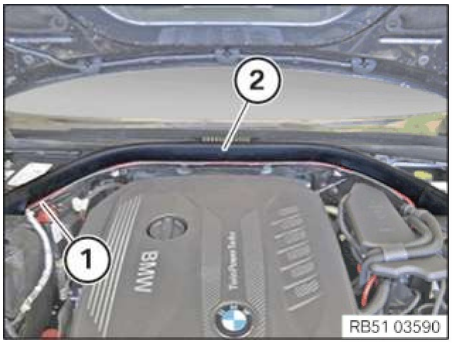
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

65 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

66 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

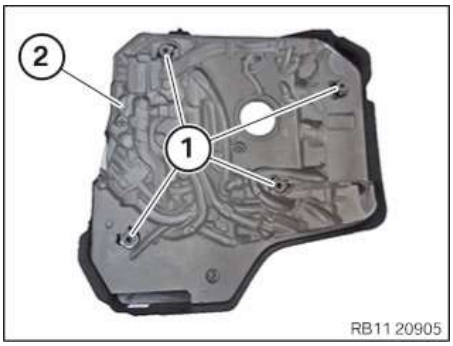
67 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

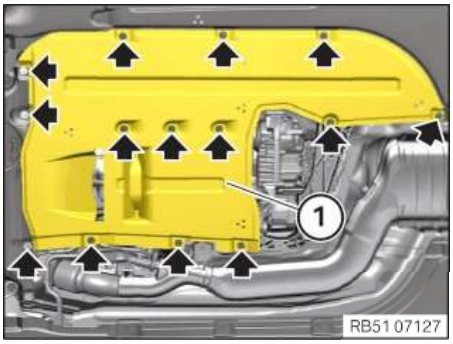
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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

68 – Installing underbody protection at rear



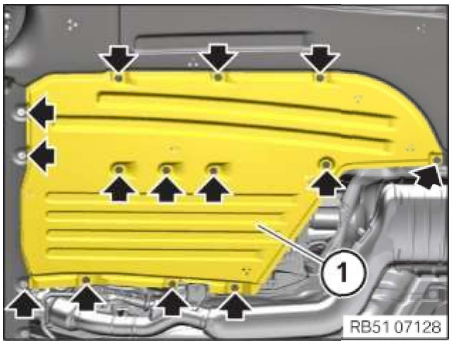
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

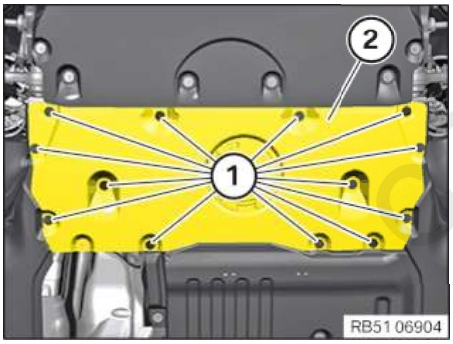
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

69 – Installing the centre underbody protection



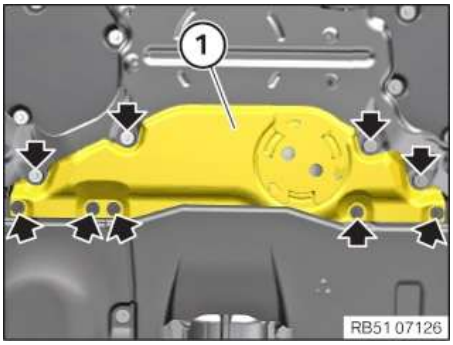
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

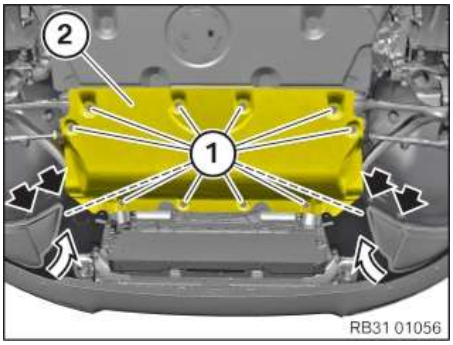
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

70 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

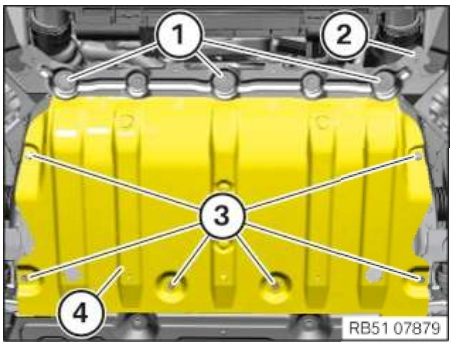
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

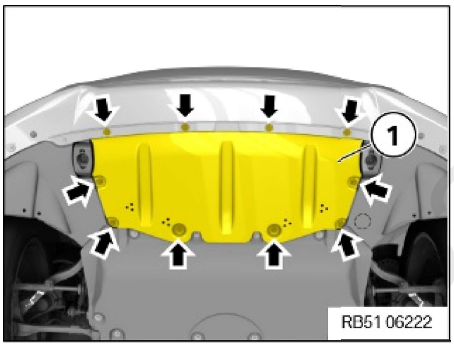
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

71 – Installing the front underbody protection



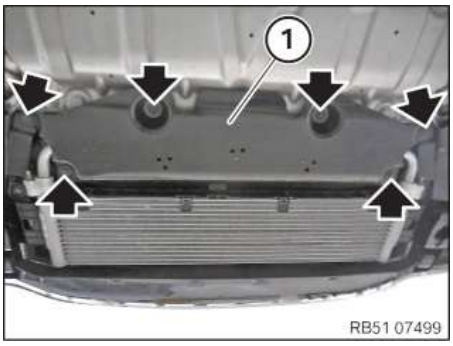
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 2:**

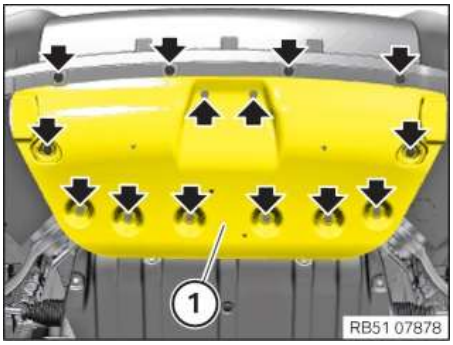
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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- **Version 3:**

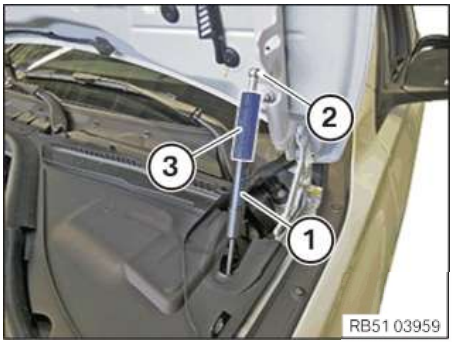
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

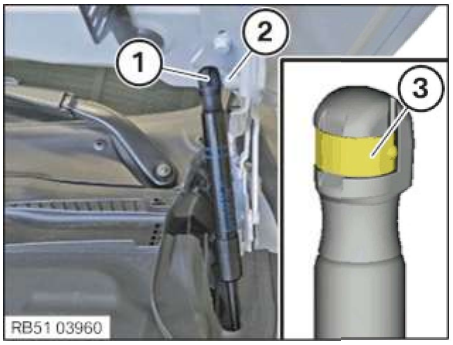
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

72 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head — Used in step 293743

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 293743

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 3940

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 42

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Cylinder head cover to cylinder head — Used in step 44

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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Wiring harness section of engine to cylinder head cover			Used in step 44
M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover			Used in step 4447
6X18		Tightening torque	6 Nm

Heat shield to cylinder head			Used in step 46
M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip			Used in step 46
M6 x 12		Tightening torque	8 Nm

Ground cable to rail			Used in step 49
M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange			Used in step 50
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail			Used in step 51
M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump			Used in step 52
M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover			Used in step 52
M6 screw		Tightening torque	6,5 Nm

Spark plugs			Used in step 53
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 54
Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover			Used in step 55
TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 57
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 61
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 61
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 61
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 63
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection			Used in step 6869
Hexagon screw		Tightening torque	3 Nm

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Underbody protection of the steering gear — Used in step 70

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 70

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 70

M10		Tightening torque	56 Nm

Underbody protection front — Used in step 71

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

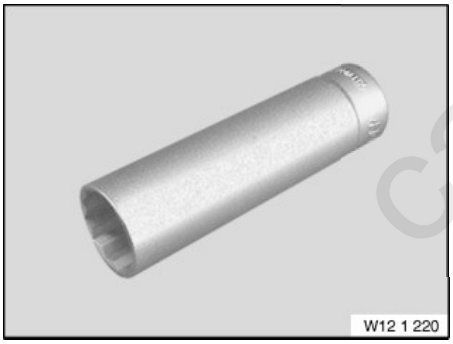
2 360 895 Pin wrench



Common — Used in step 1245

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

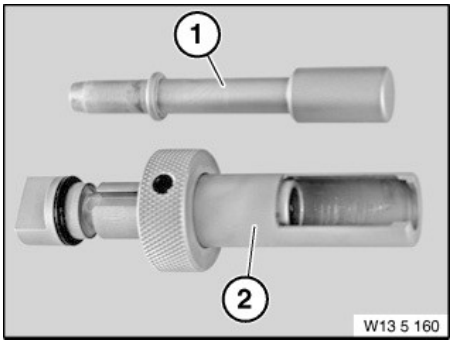
0 495 560 (12 1 220) Socket



Common — Used in step 1653

Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 496 567 (13 5 161) Fastener

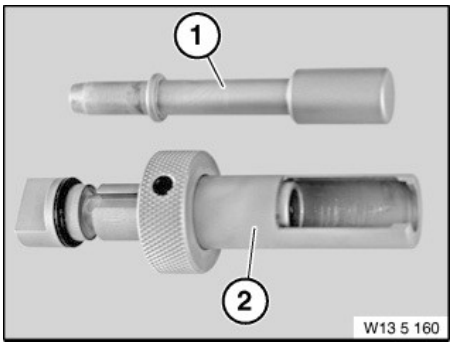


Common — Used in step 19

Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

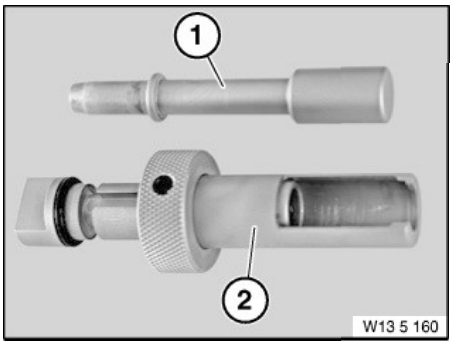
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0 496 568 (13 5 162) Fastener



Common	Used in step 19
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener

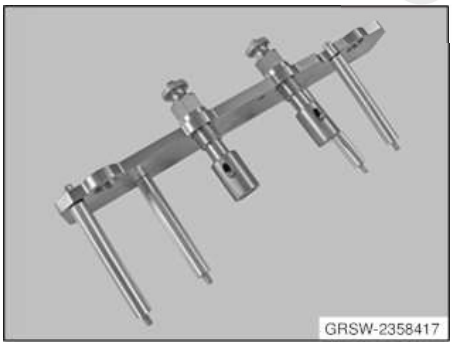


Common	Used in step 19
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

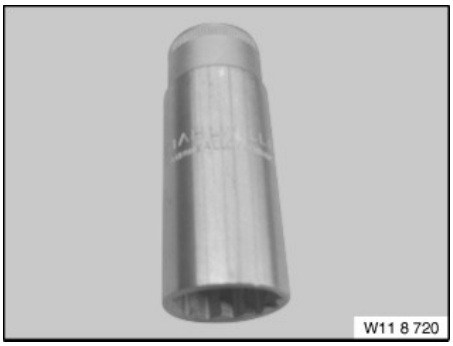
2 358 417 Device



Common	Used in step 20
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

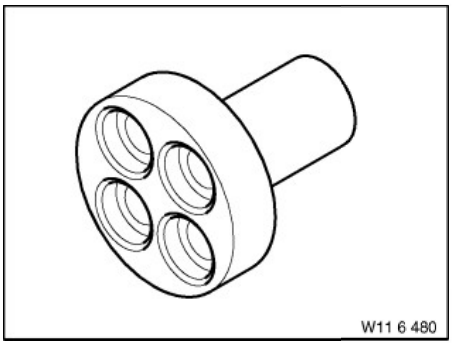
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0 496 106 (11 8 720) Socket WAF 46



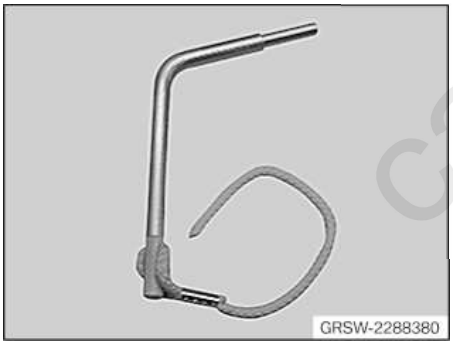
Common	Used in step 20
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 493 380 (11 6 480) Connector



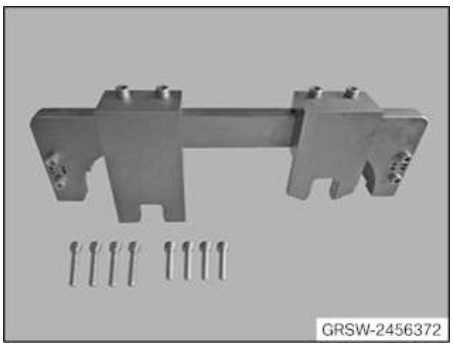
Common	Used in step 29414350
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 288 380 Locating stud



Common	Used in step 294143
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 2936374143
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 358 122 Gauge



Common Used in step 293643

Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



Common Used in step 31343940

Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



Common Used in step 31343940

Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

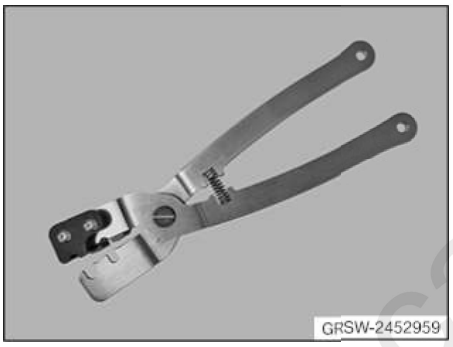
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2 455 654 Tensioning tool



Common	Used in step 3841
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 48
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 448 401 Fitting aid



Common	Used in step 48
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

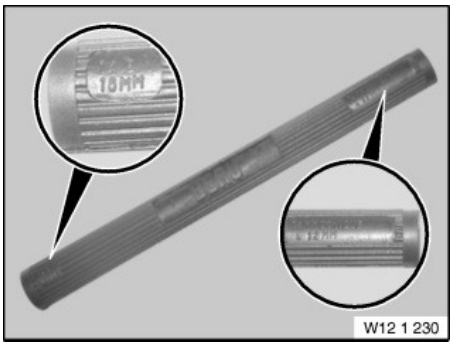
2 358 022 Gauge



Common	Used in step 49
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 065 (12 1 230) Fitting aid



Common	Used in step 53
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 63
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	158
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	158
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	158
61 20 900 Disconnecting and connecting battery earth lead	158
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61 20 900 Disconnecting and connecting battery earth lead	158
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61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
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61 35 ... Notes on ESD protection (Electro Static Discharge)	12
61 35 ... Notes on ESD protection (Electro Static Discharge)	121520
13 53 ... Clean the cylinder head around the injectors due to grit / dust	20
61 13 ... Unlocking and disconnecting different plug connections	202444

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11 36 046 Removing and installing/replacing the intake and exhaust camshaft adjusters

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

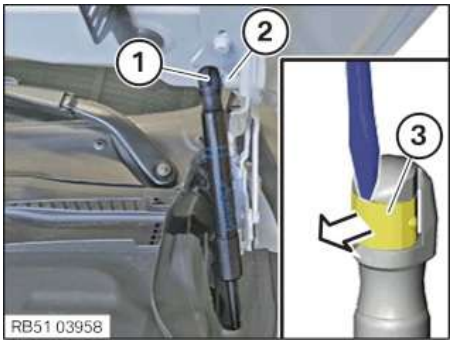
Engine compartment lid is open.

CAUTION

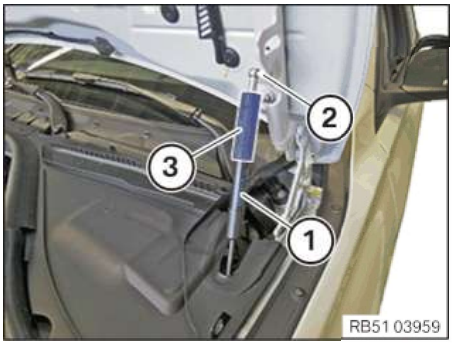
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

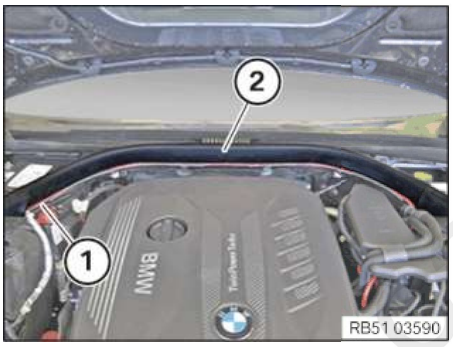


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

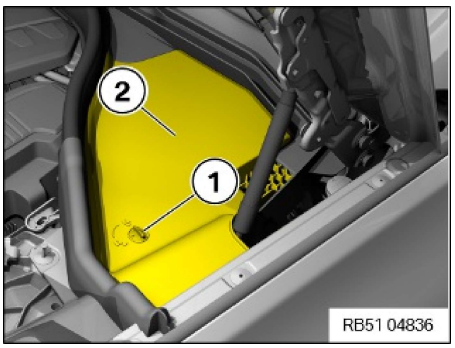
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

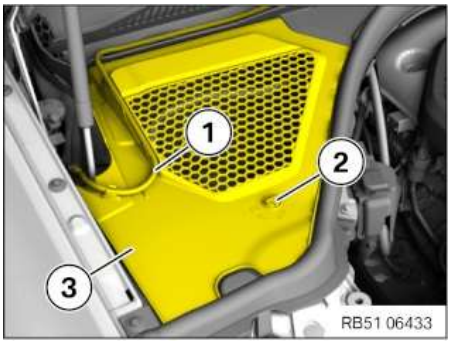
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

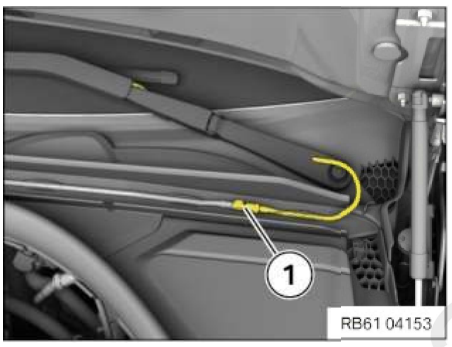
▶ **Remove the wiper arm**

RISK OF DAMAGE

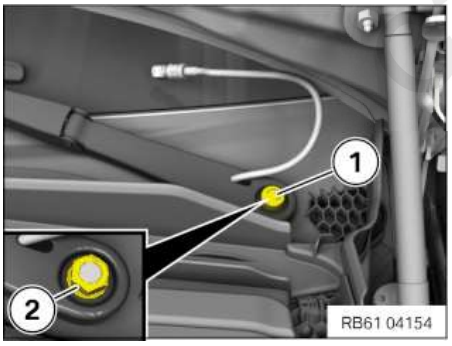
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

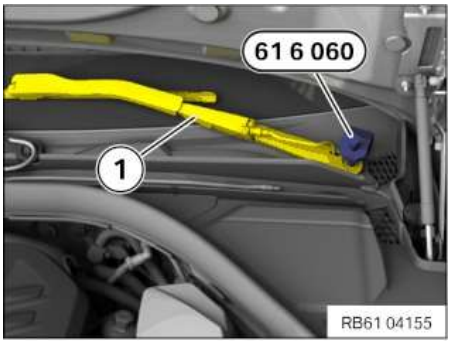
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



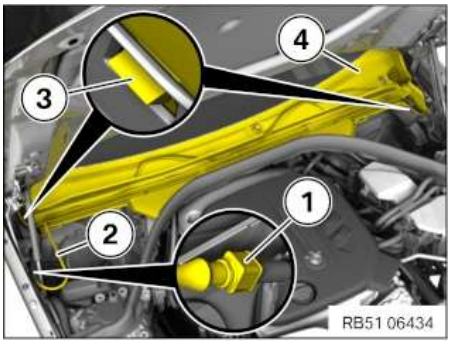
- Remove the protective cap (1).
- Loosen nut (2).



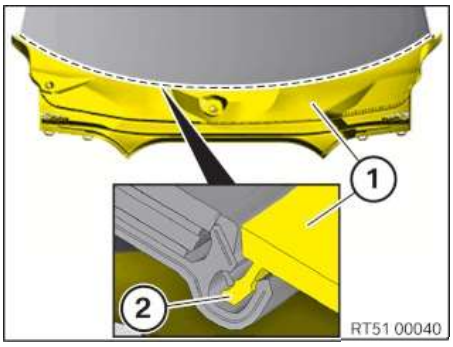
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

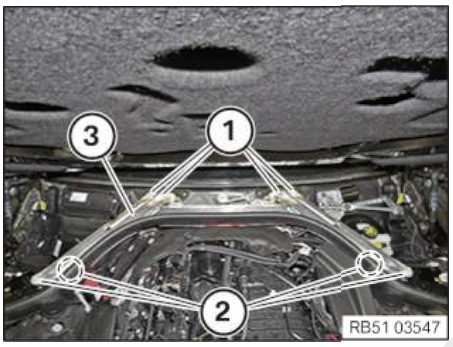


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

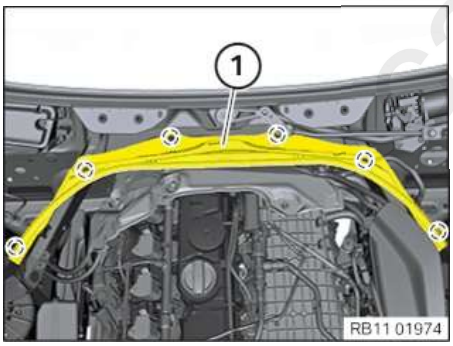
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

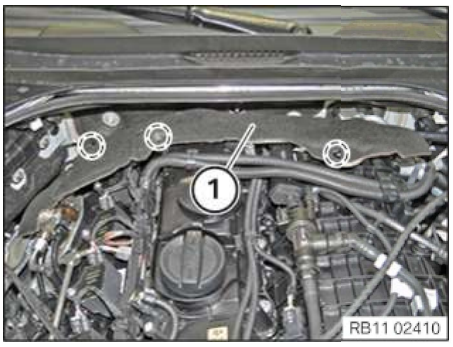
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



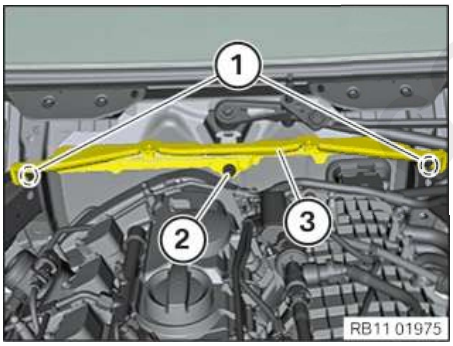
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

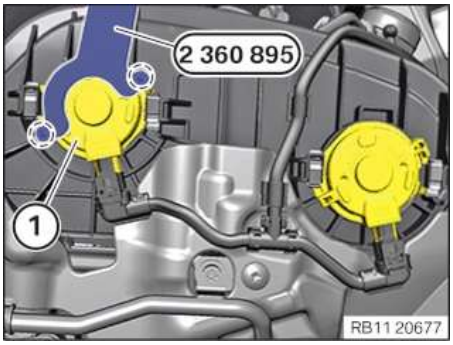
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

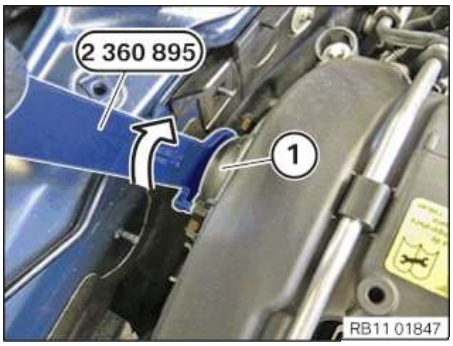
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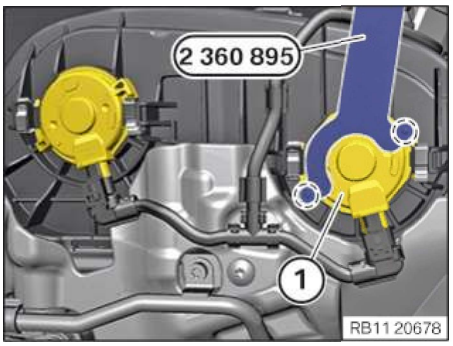
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



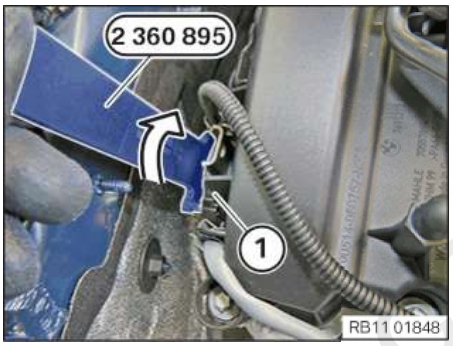
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



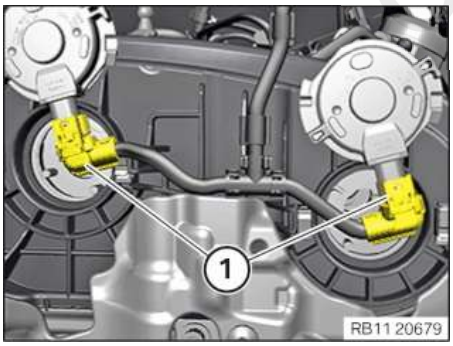
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

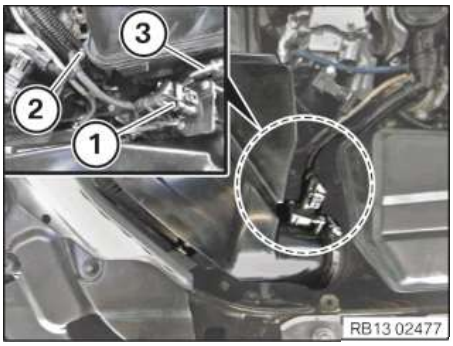
Risk of burning!

- Perform all work only on components that have cooled down.

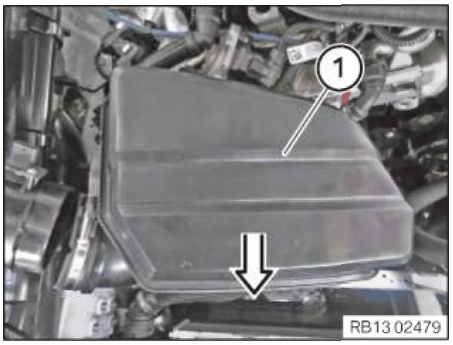
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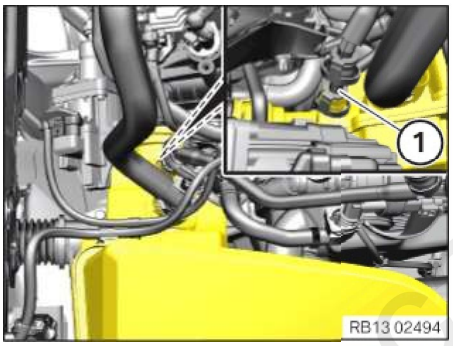
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



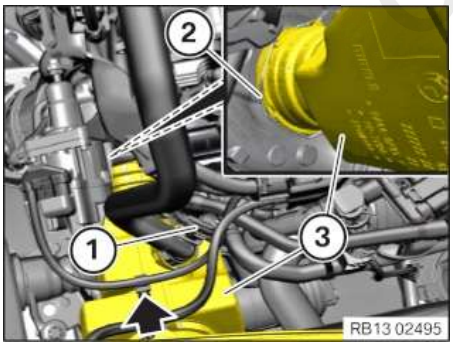
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



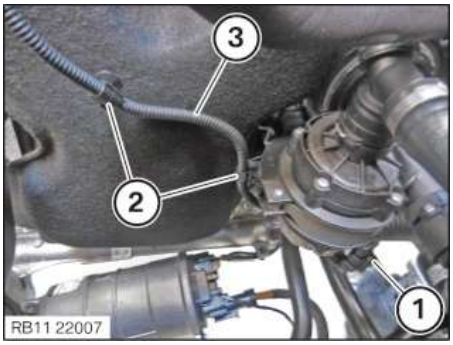
- Unlock and disconnect the tank ventilation line (1).



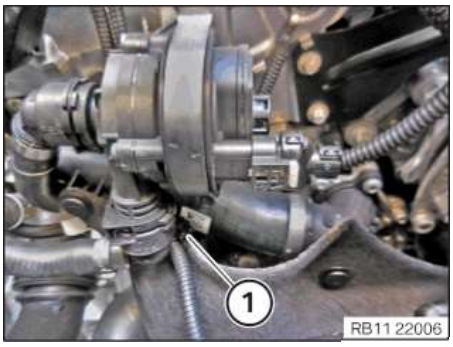
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

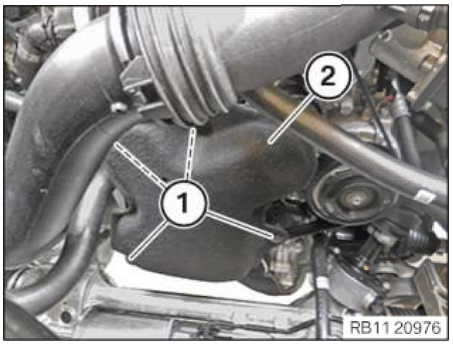
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

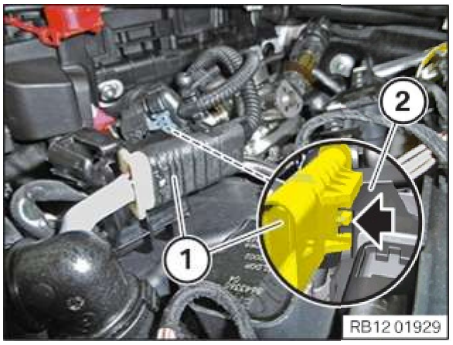
Electrostatic discharge.

Damage to or destruction of electrical components.

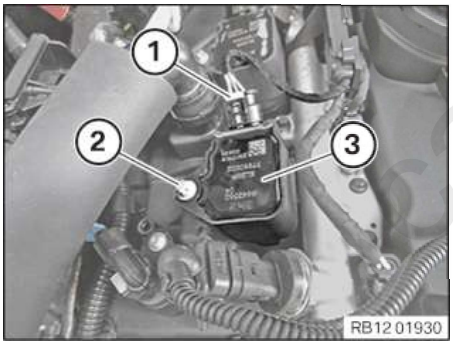
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

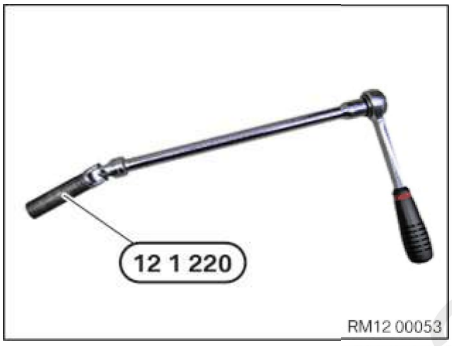
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

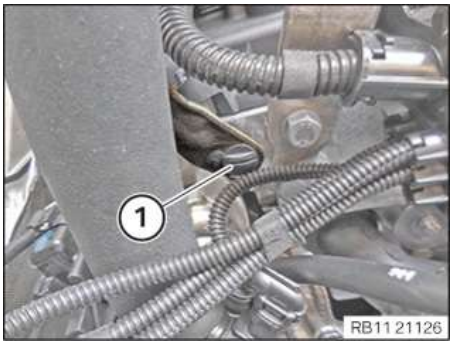
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

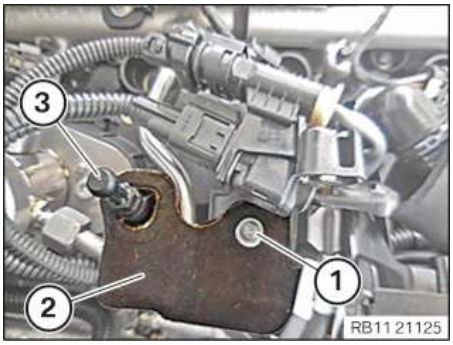


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

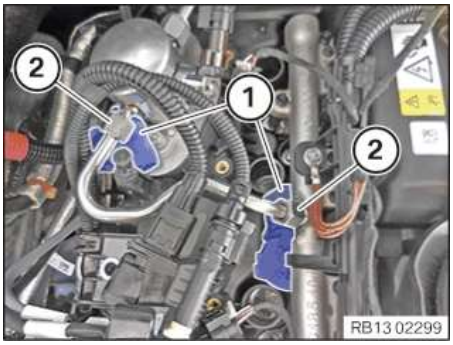
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

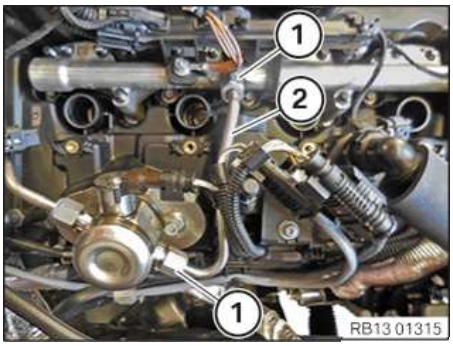


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

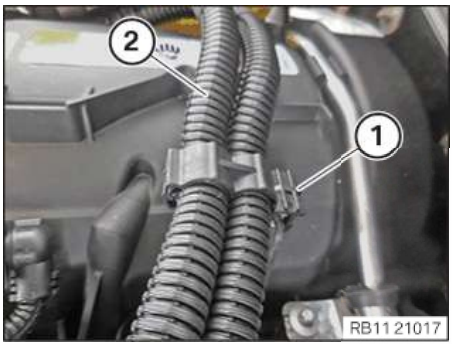
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

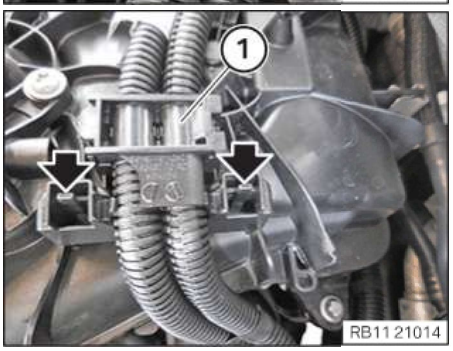
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

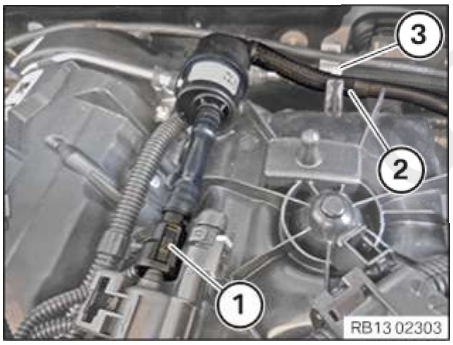
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



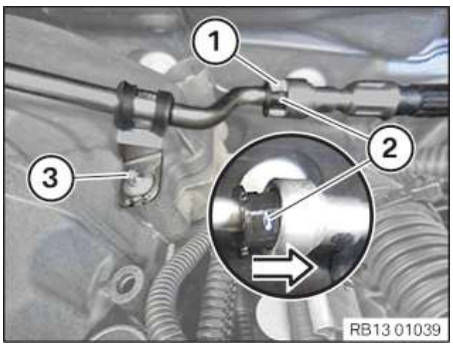
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

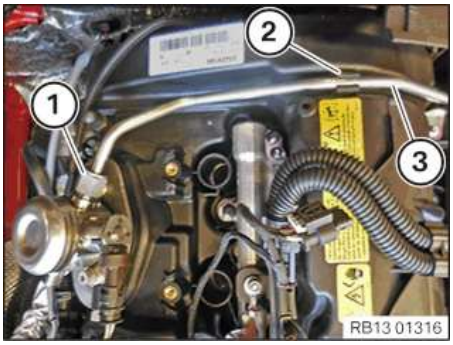


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

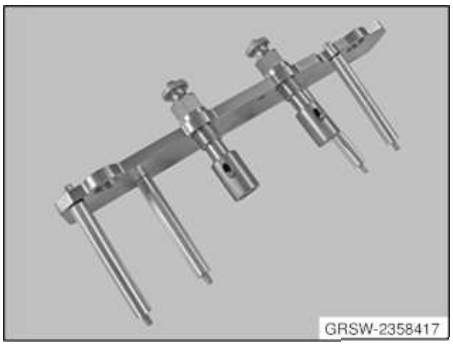
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



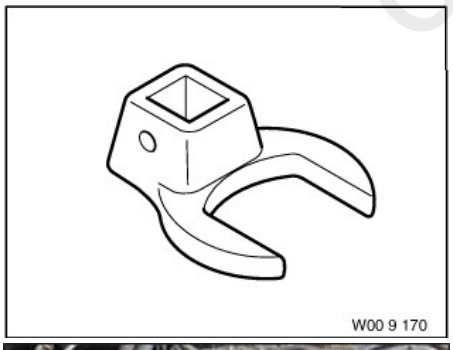
- Prepare special tool 2 358 417.



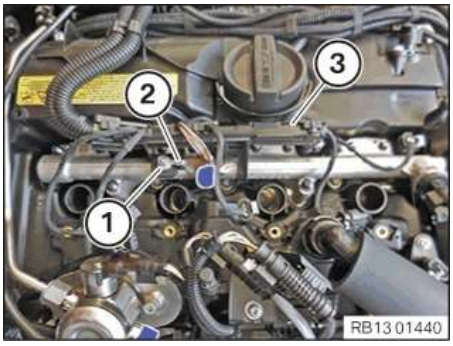
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

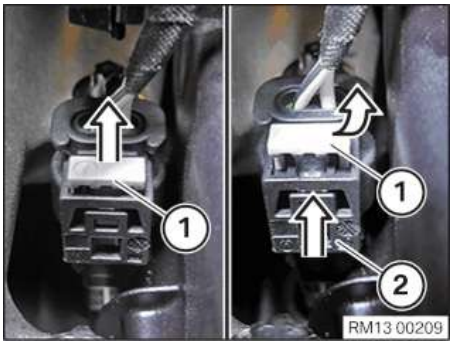


- Prepare special tool .

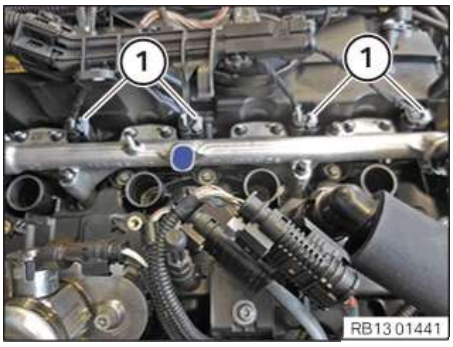


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



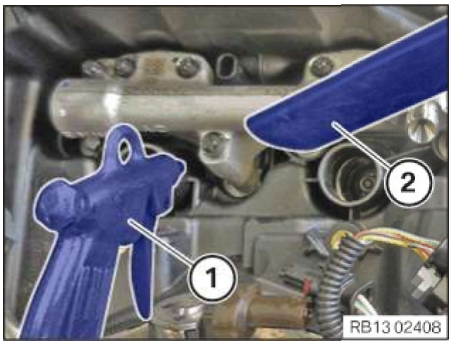
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

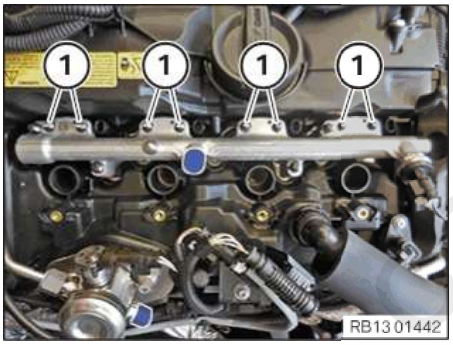


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

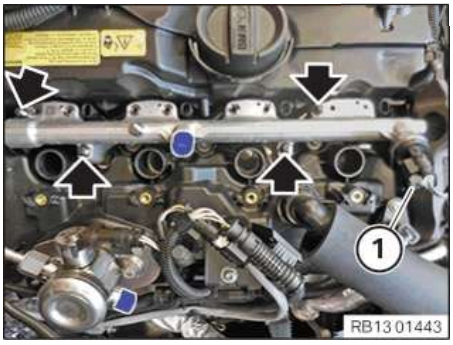
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



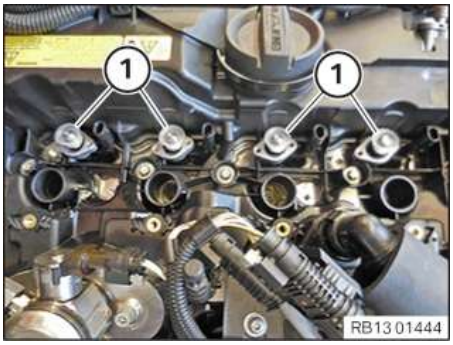
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

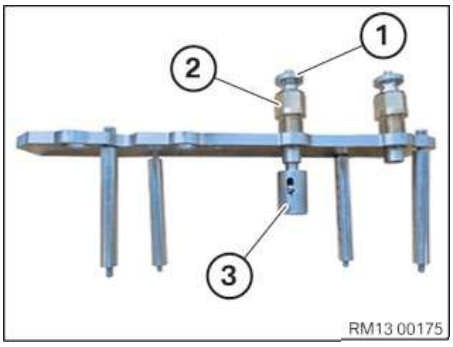
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

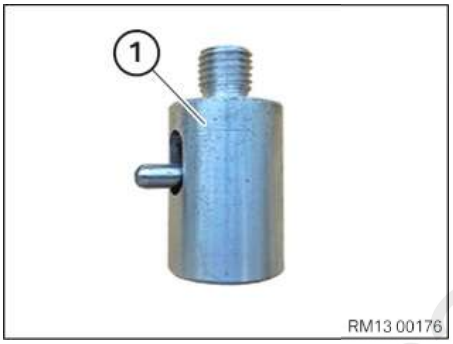
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

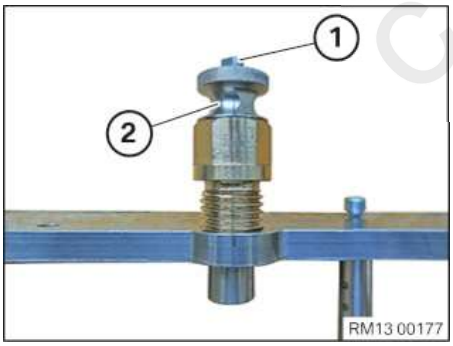
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

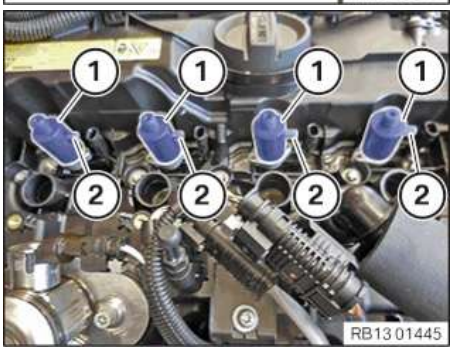
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



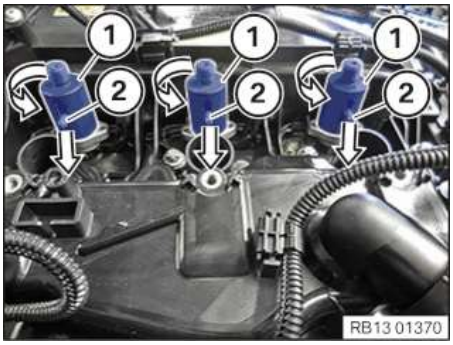
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



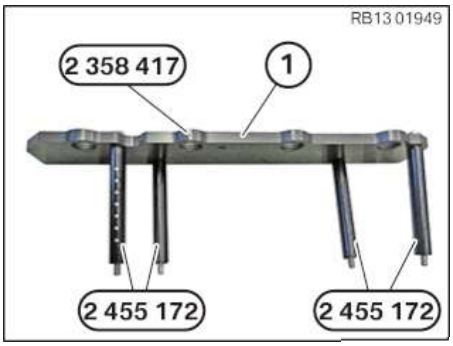
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

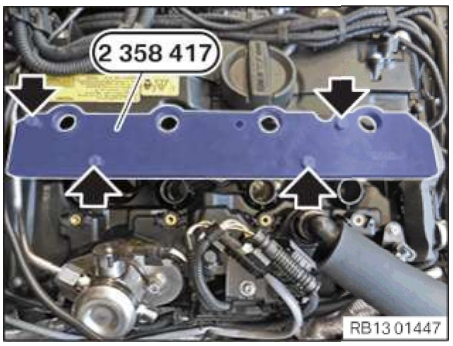
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



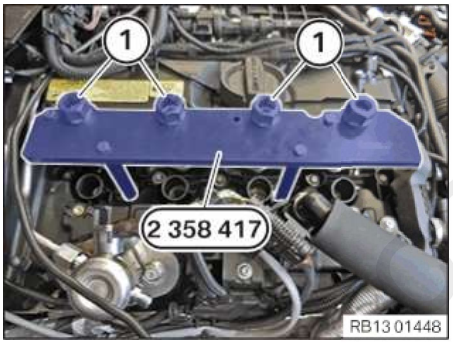
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

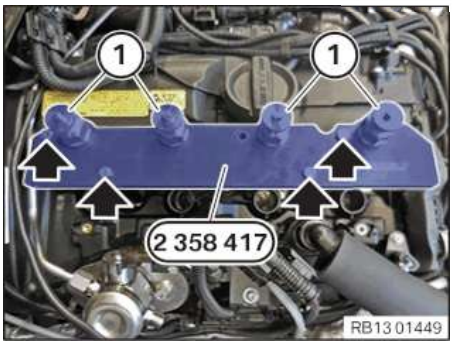
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

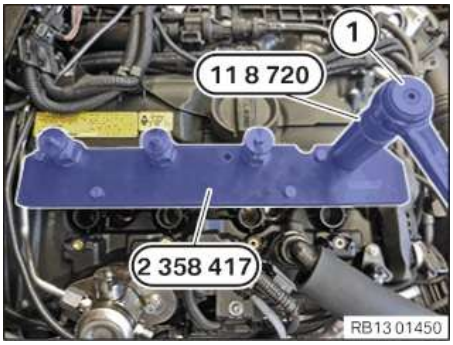
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

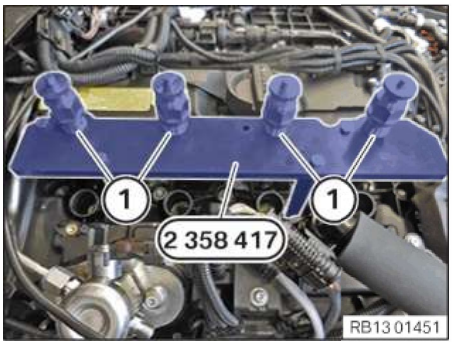


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

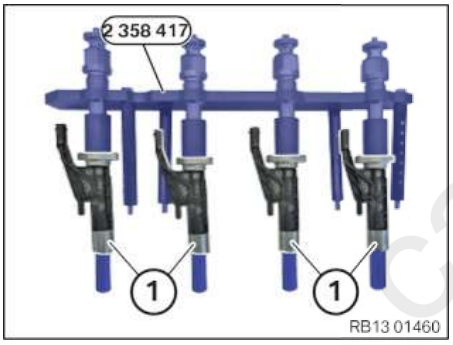
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

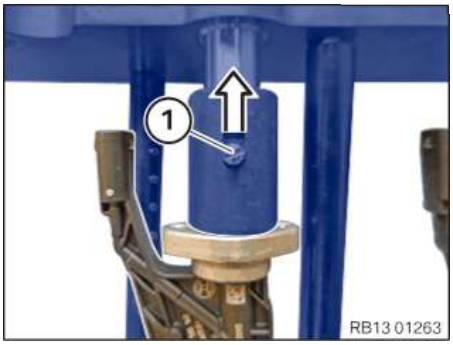


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

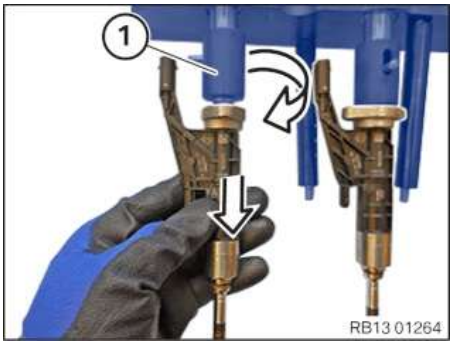


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

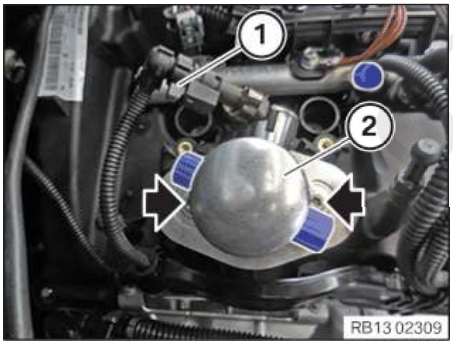
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

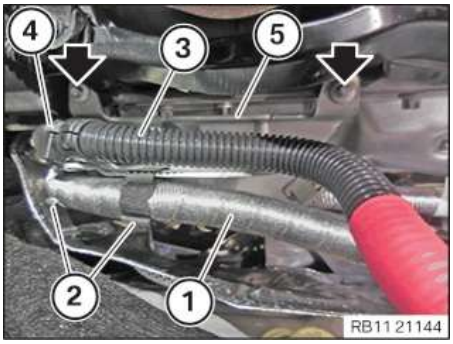
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

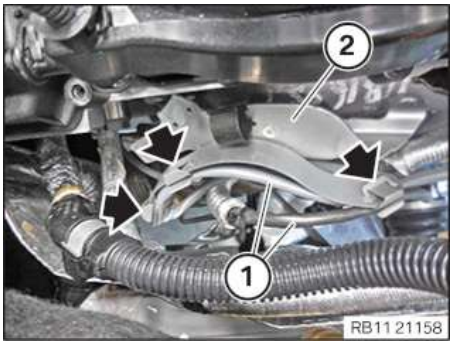


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

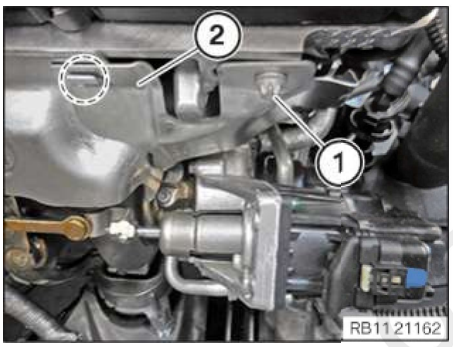
Hot surfaces.

Risk of burning!

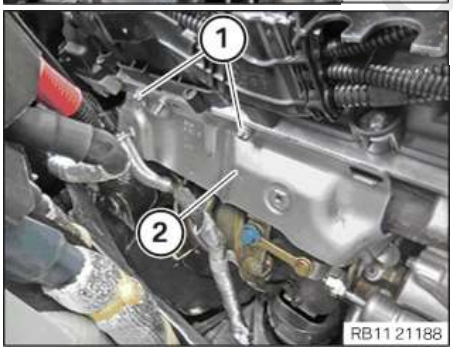
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

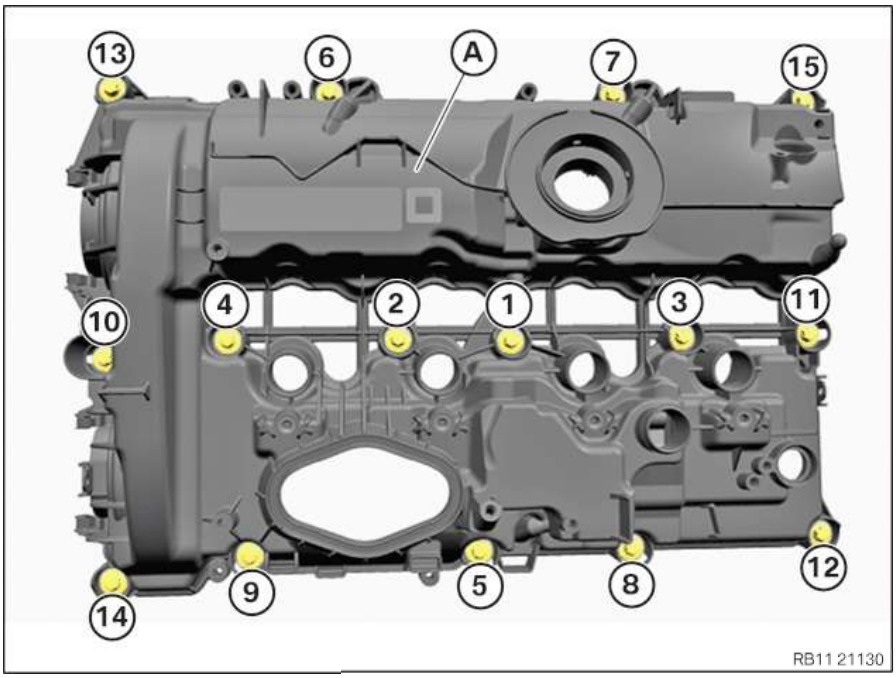


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

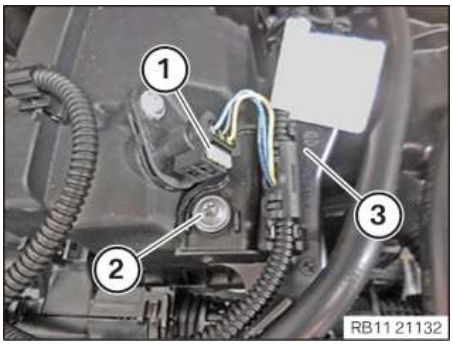
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

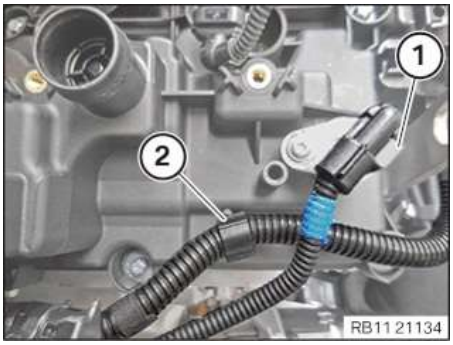
- Do not pull on the wires when disconnecting connectors and plug connections.



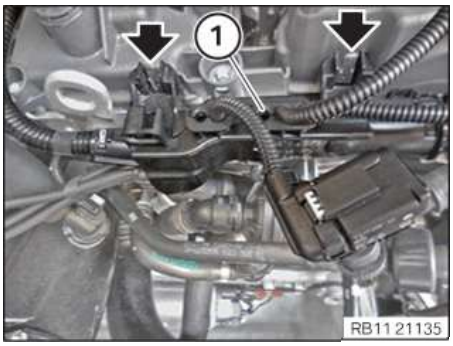
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



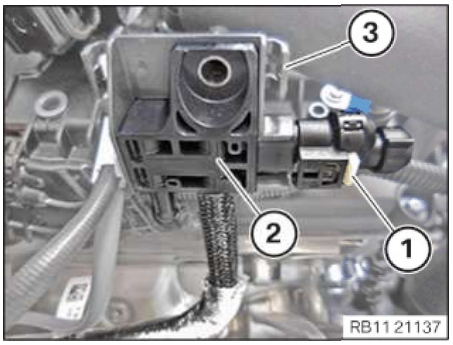
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



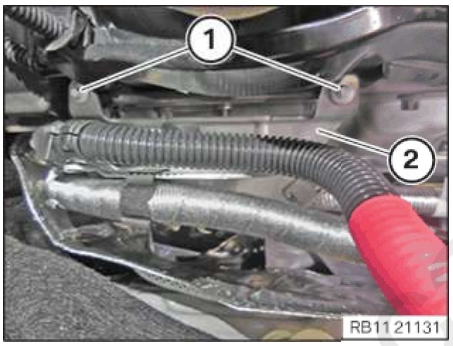
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



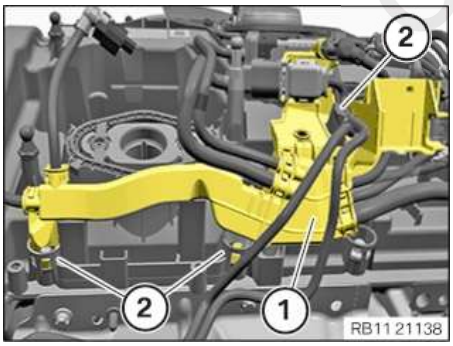
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



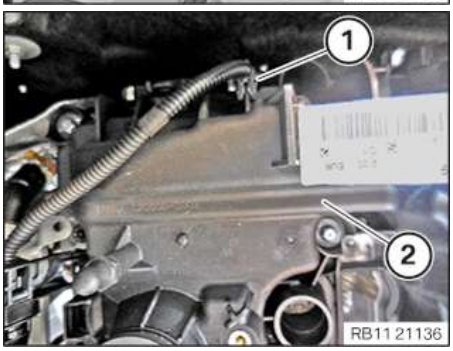
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

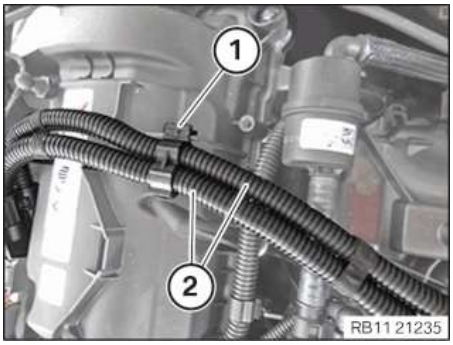


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

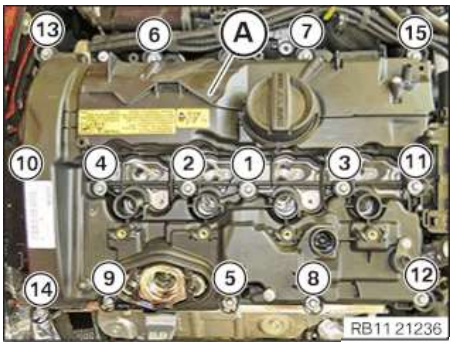


- Loosen clamp (1).

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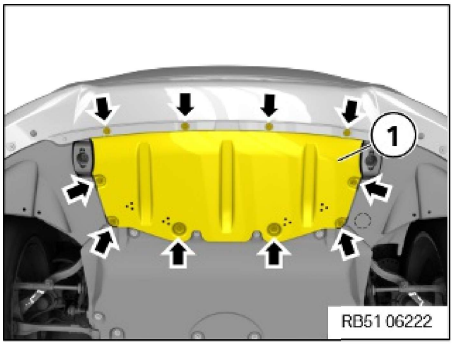


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

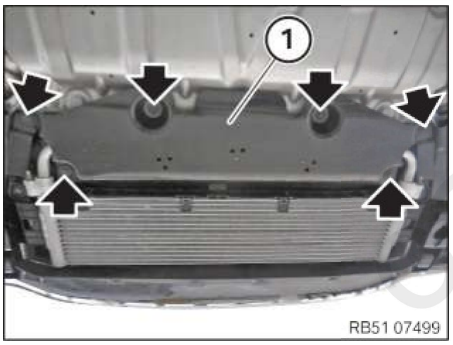
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

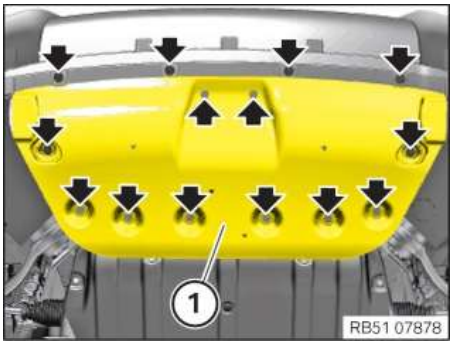
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

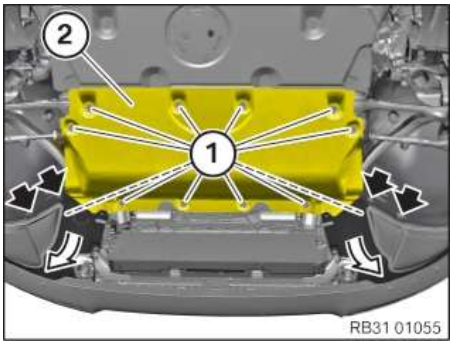


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



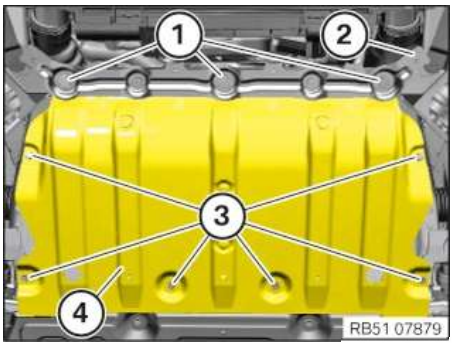
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

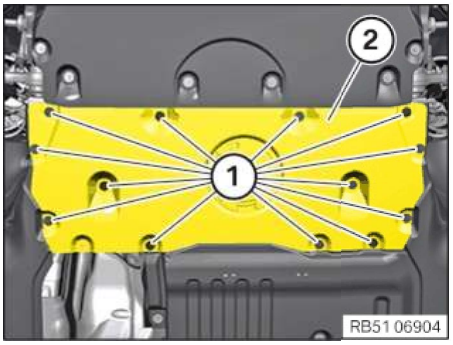
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

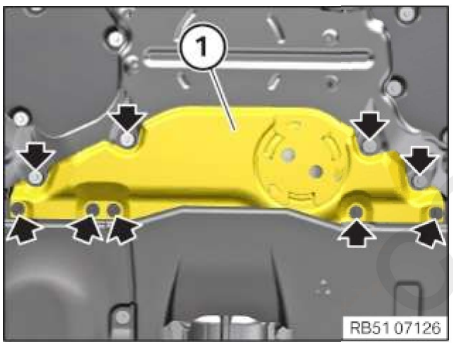
27 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

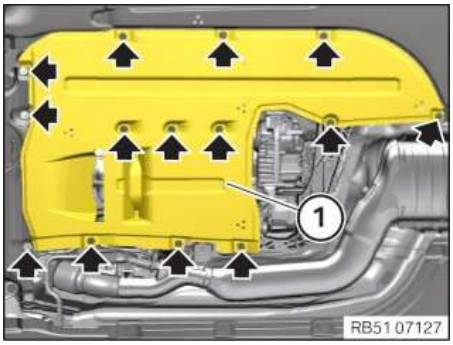


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

28 – Remove rear underbody protection

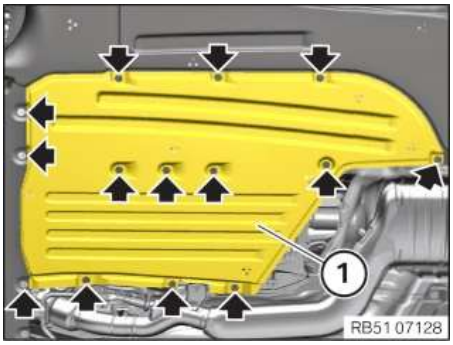


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

29 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



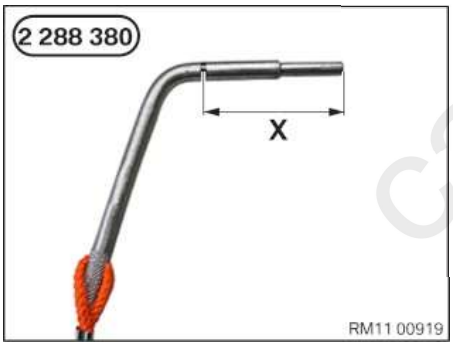
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

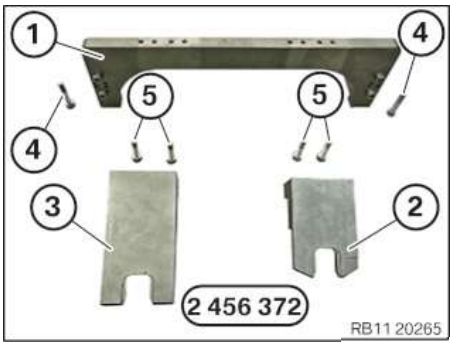
cardiagn.com



- **Vehicles with automatic transmission:**

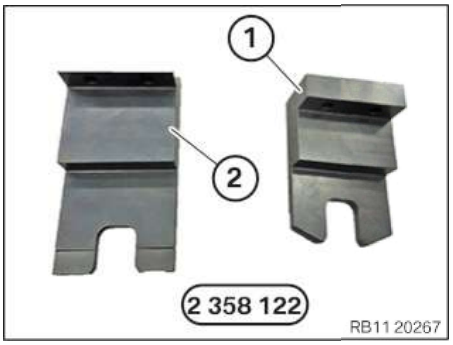
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



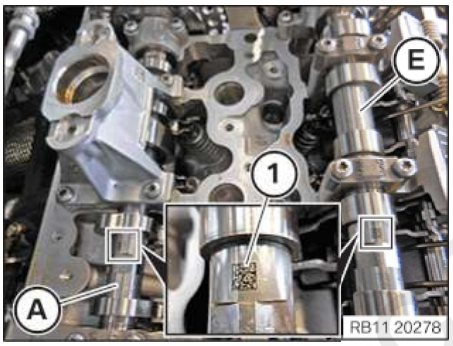
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

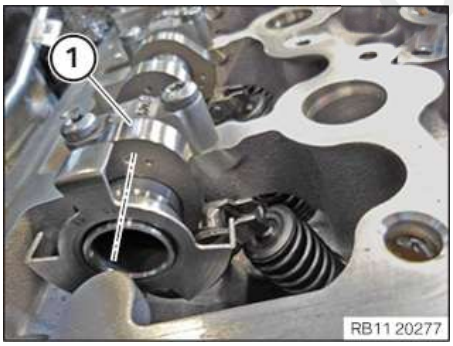


- Overview of the test gauges from the set of special tools 2 358 122:

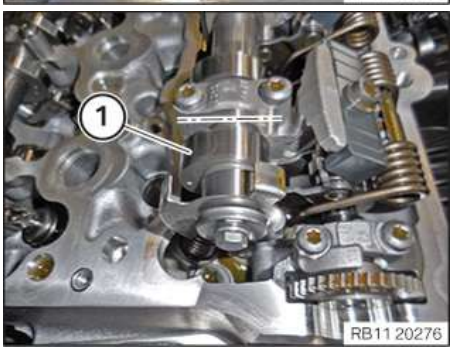
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

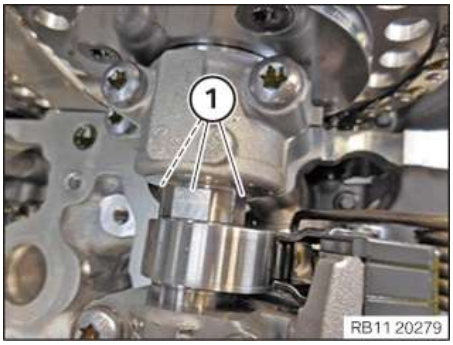


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

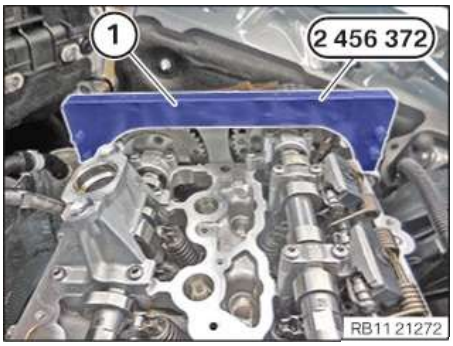


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

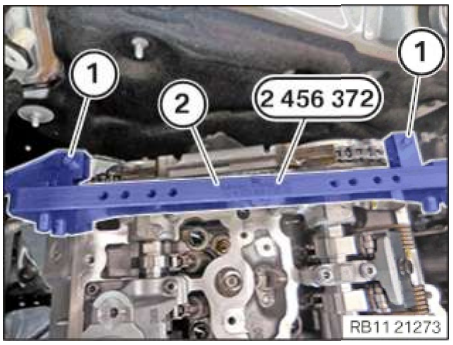
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- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



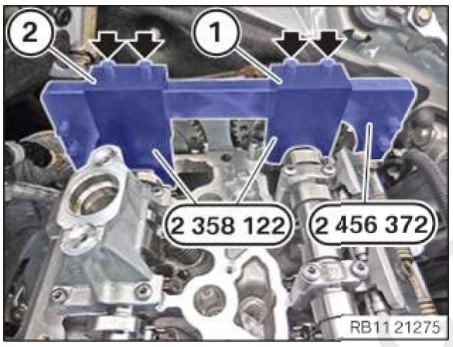
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

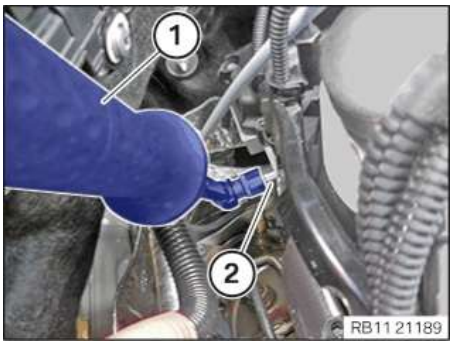
Test gauge to basic carrier

M6		Tightening torque	8 Nm

30 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

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- Feed out and remove the chain tensioner (1).

MAIN WORK

31 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



NOTICE

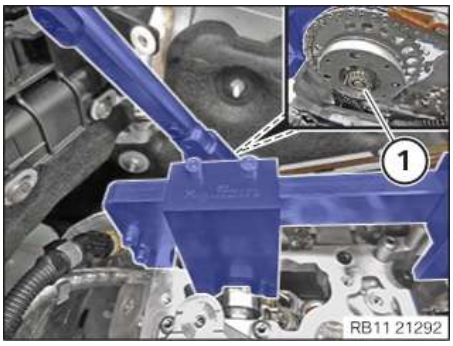
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

32 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.



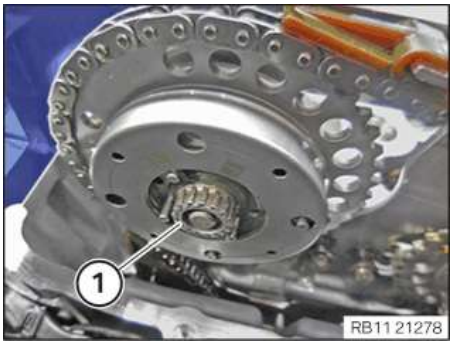
NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

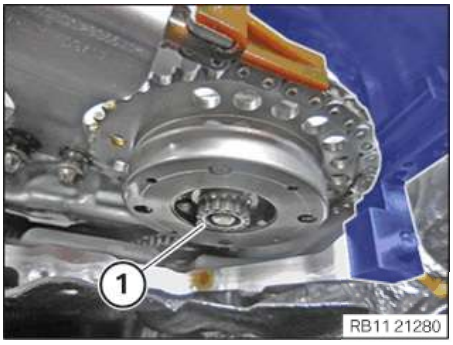
33 – Removing the VANOS central valve of the intake adjuster

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- Guide out and remove the VANOS central valve (1) of the intake adjuster.

34 – Remove the VANOS central valve of the exhaust camshaft adjuster

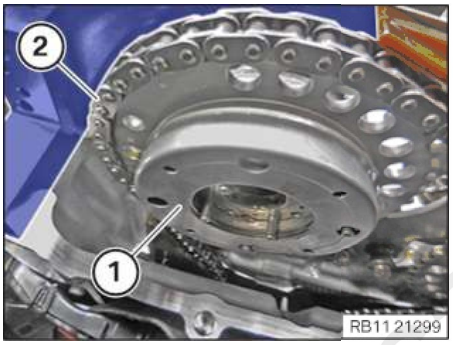


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

35 – Removing intake adjuster

NOTICE

The figure shows the rear side of the engine.

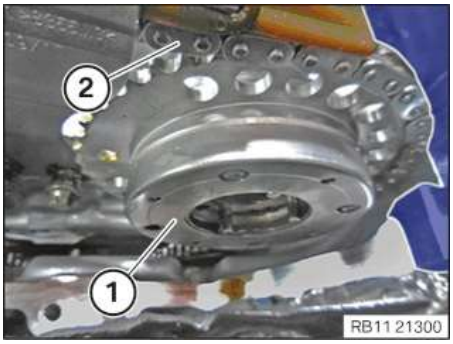


- Guide out the intake adjuster (1) from the timing chain (2) and remove.

36 – Remove exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



- Guide out the exhaust camshaft adjuster (1) from the timing chain (2) and remove.

37 – Installing the intake adjuster

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NOTICE

The figure shows the rear side of the engine.



- Keep intake adjuster (1) marked IN ready.



- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

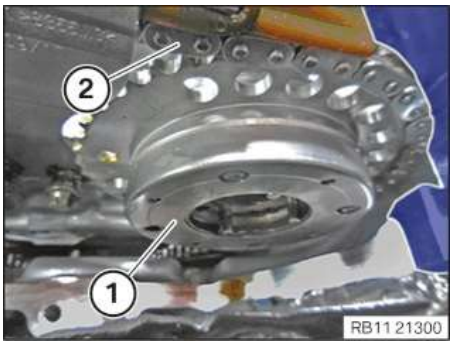
38 – Install exhaust camshaft adjuster

NOTICE

The figure shows the rear side of the engine.



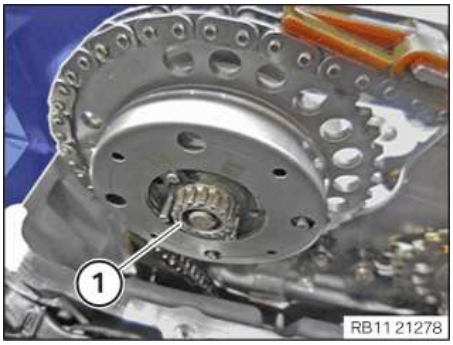
- Keep exhaust camshaft adjuster (1) marked EX ready.



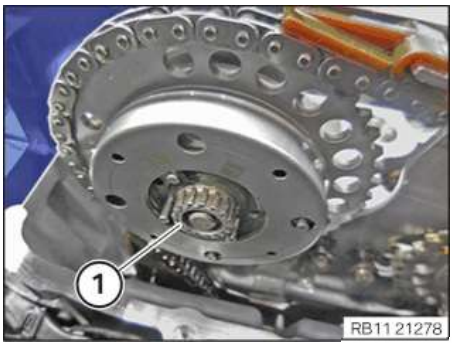
- Feed in exhaust camshaft adjuster (1) in the timing chain (2) and position on the exhaust camshaft .

39 – Install the VANOS central valve of the intake adjuster

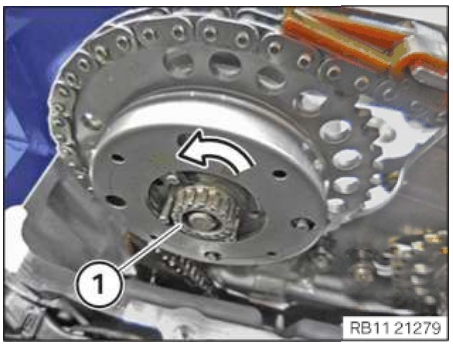
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- Guide in the VANOS central valve (1) of the intake adjuster and install.

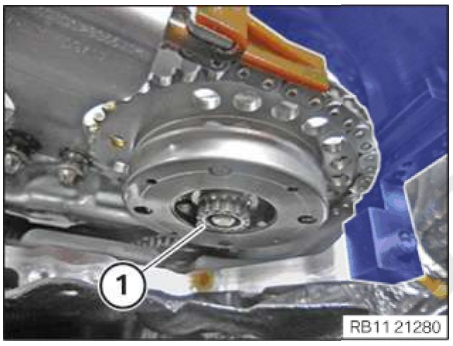


- Hand-tighten the VANOS central valve (1) of the intake adjuster.

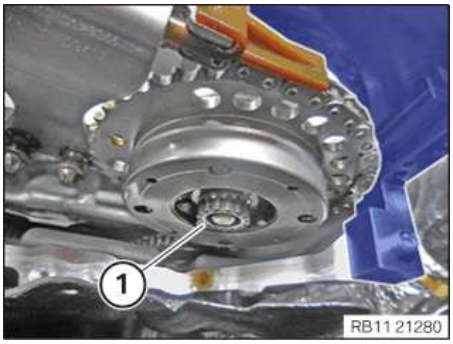


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

40 – Installing the VANOS central valve of the exhaust camshaft adjuster

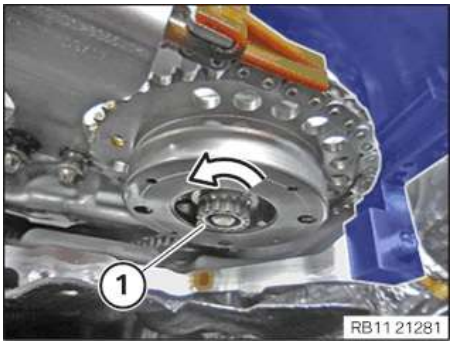


- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



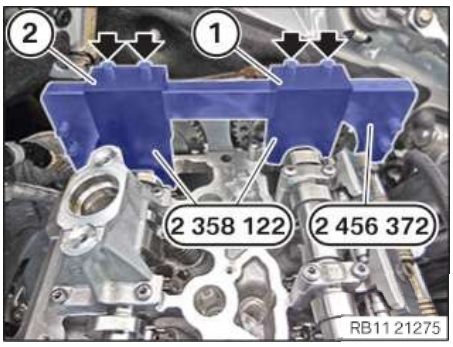
- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

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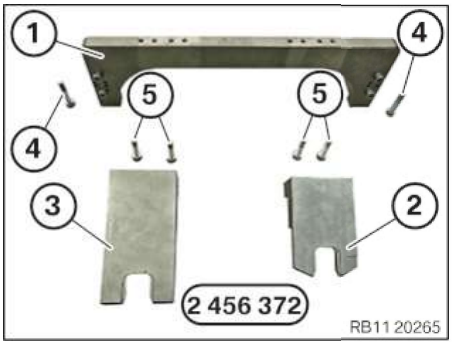
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

41 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

42 – Adjust the camshafts with the special tool

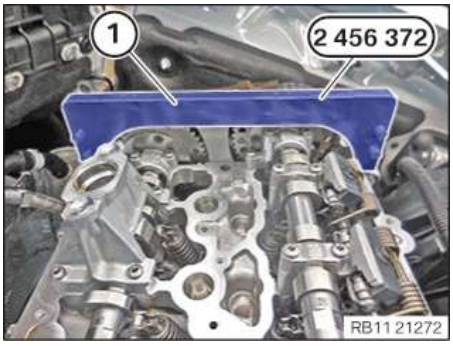


- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

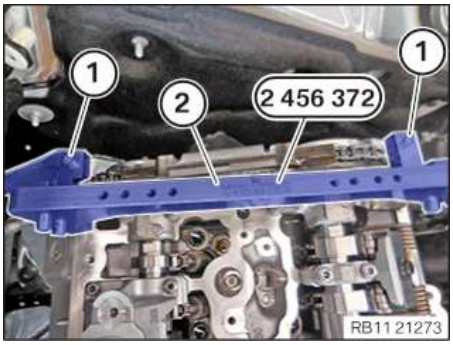


- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

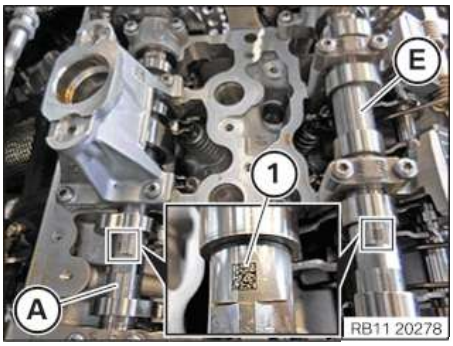
carliagh.com



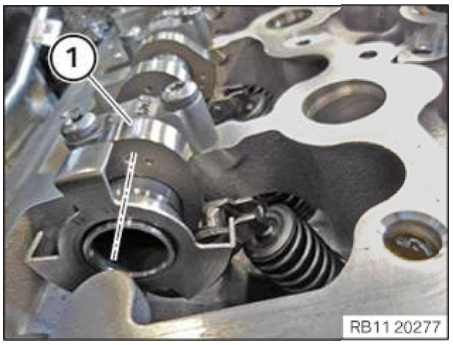
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

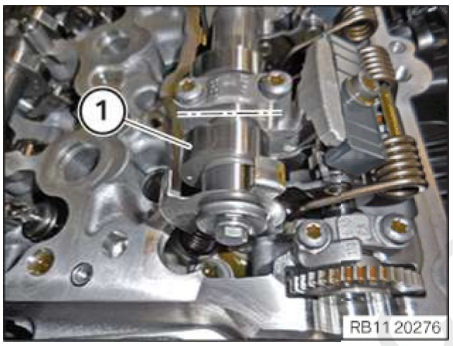
M6		Tightening torque	8 Nm



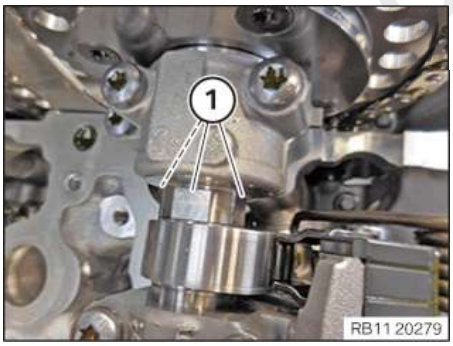
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



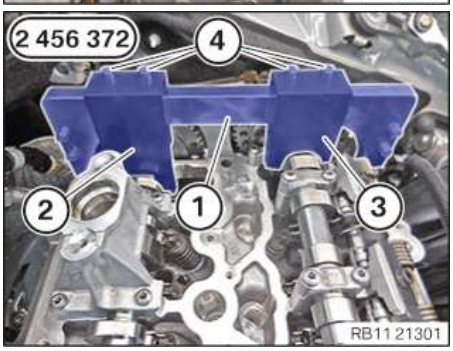
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



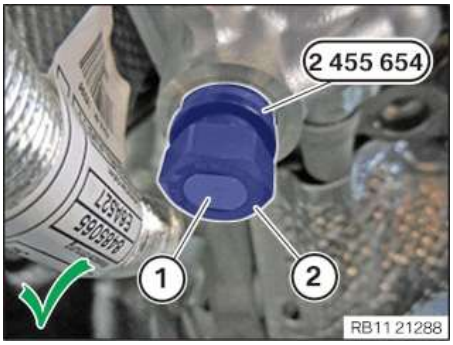
- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

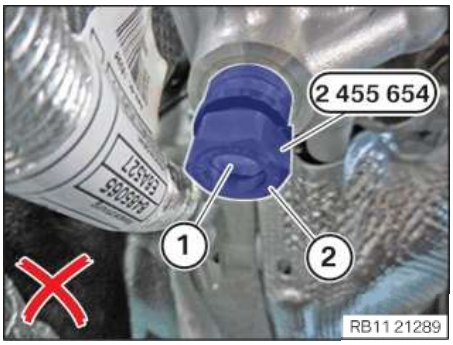
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43 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

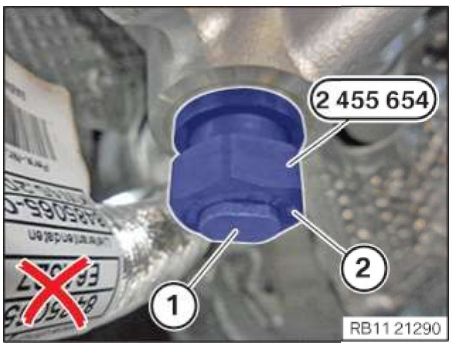
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

44 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

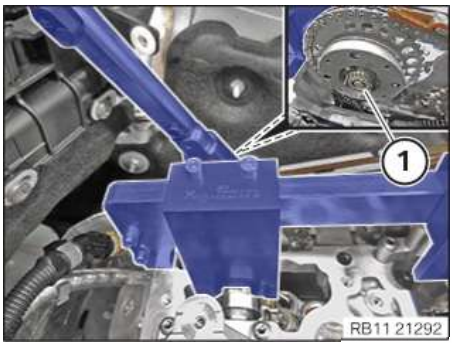
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

45 – Tightening the VANOS central valve of the exhaust camshaft adjuster

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- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



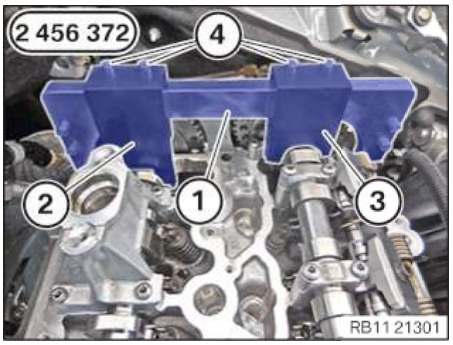
- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

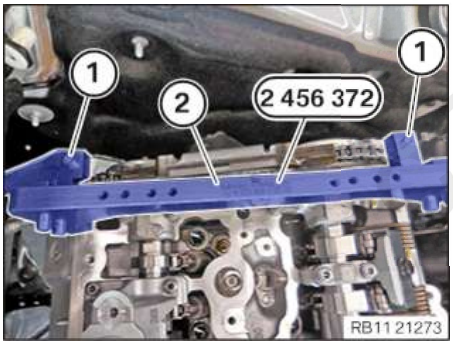
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

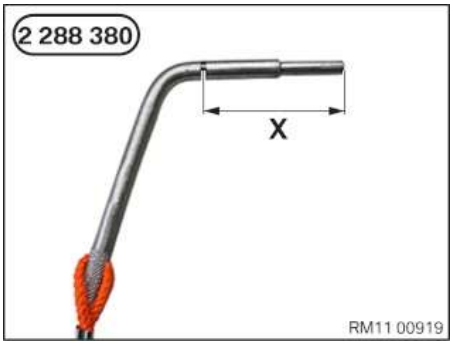
46 – Disassembling all special tools



- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.

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- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

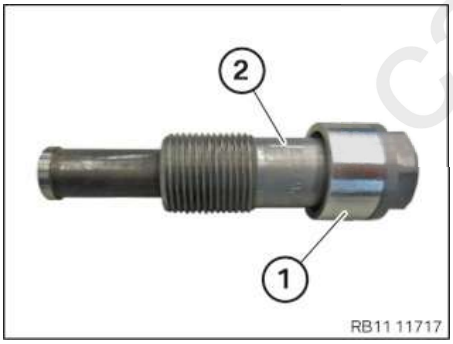
47 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



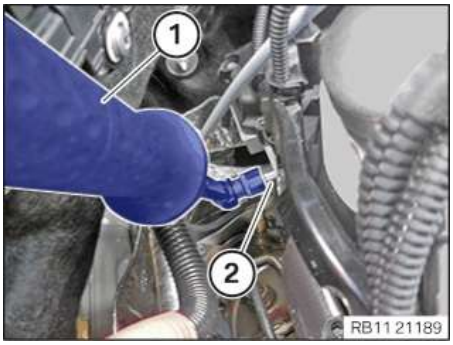
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

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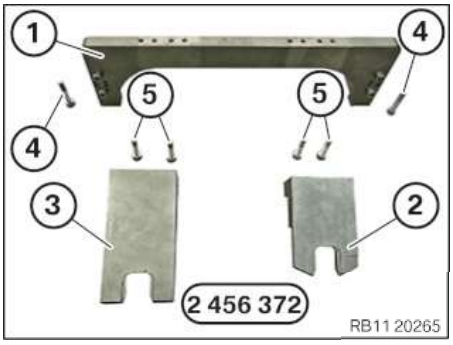


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

48 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



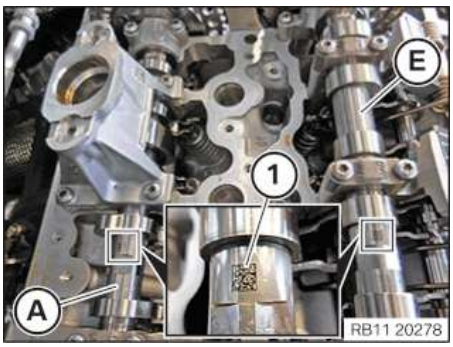
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

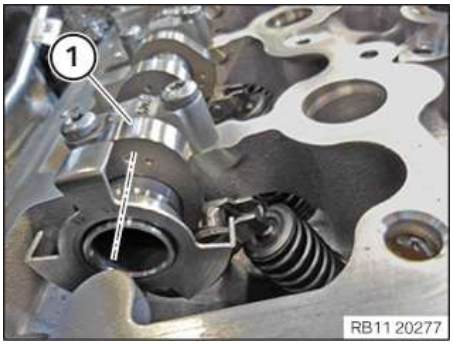
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

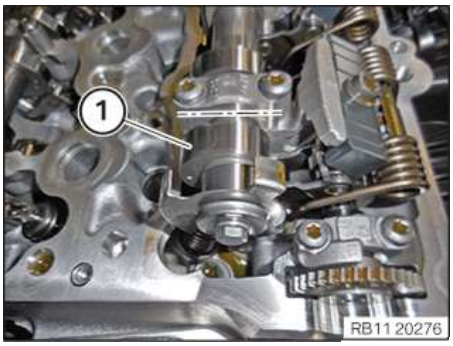


- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.

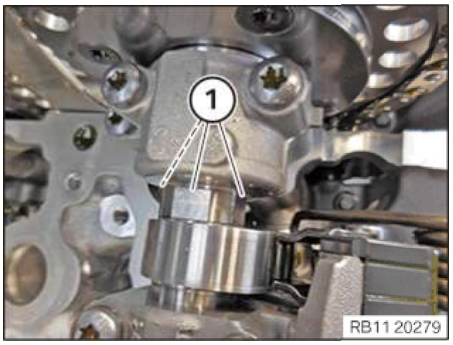
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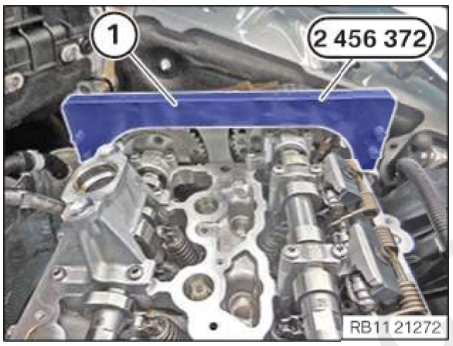
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



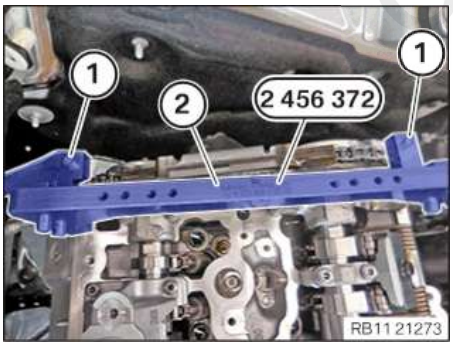
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



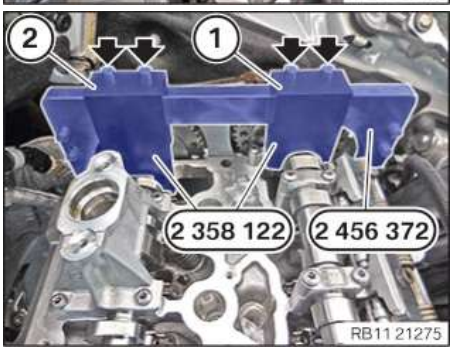
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

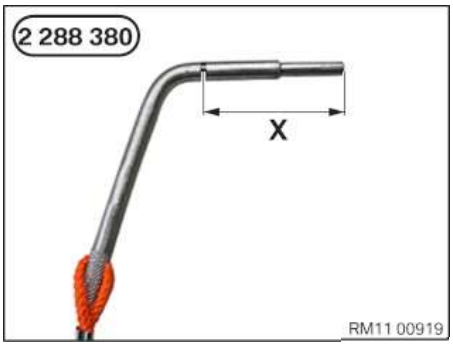
Test gauge to basic carrier

M6		Tightening torque	8 Nm

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- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

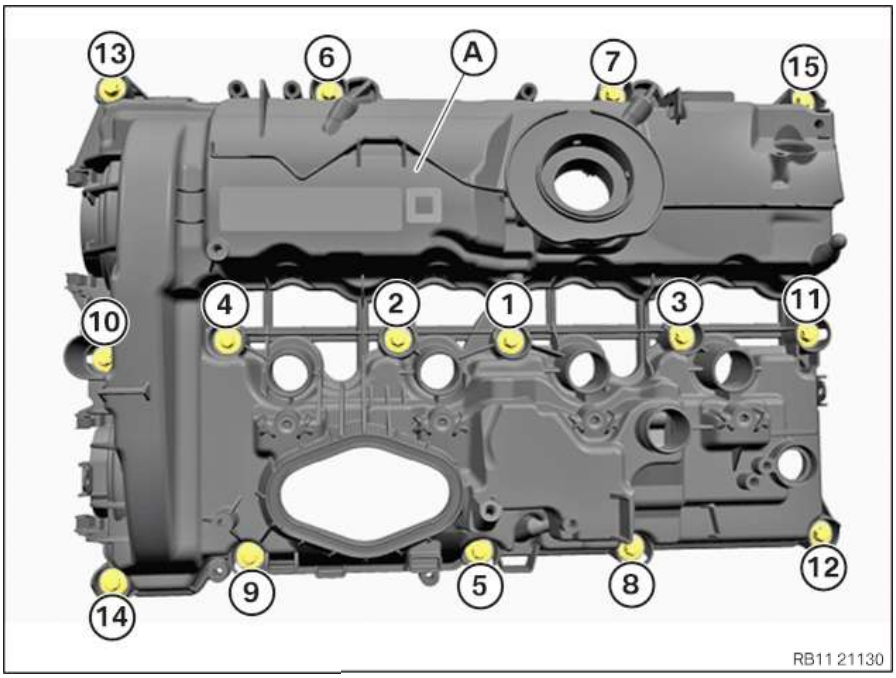
  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

49 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

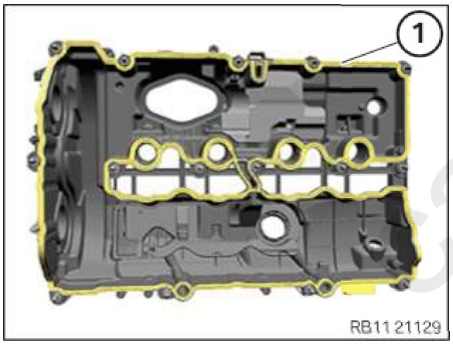
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

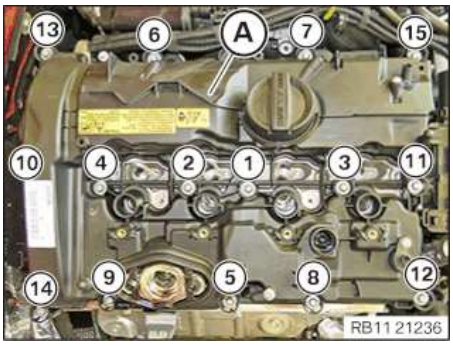
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

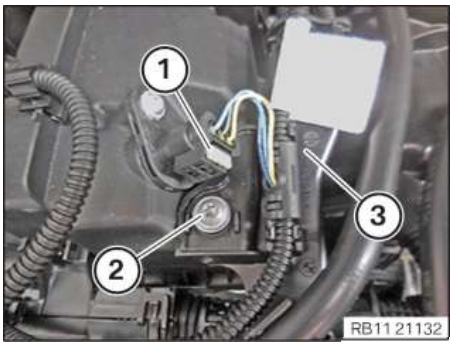
Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

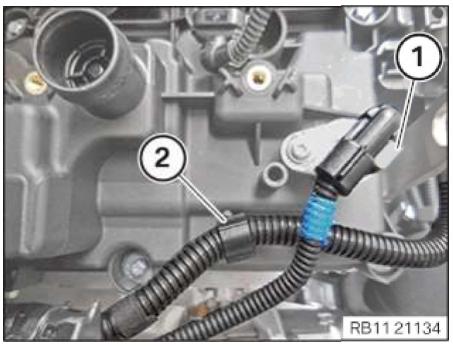


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

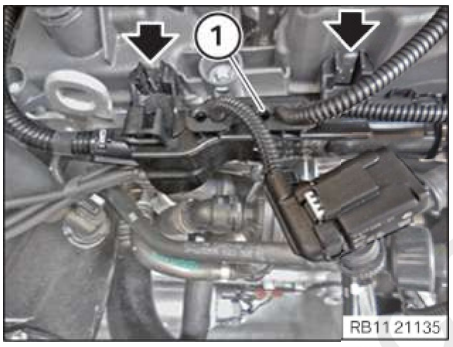
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

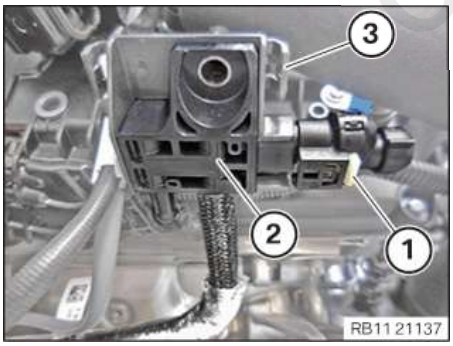
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

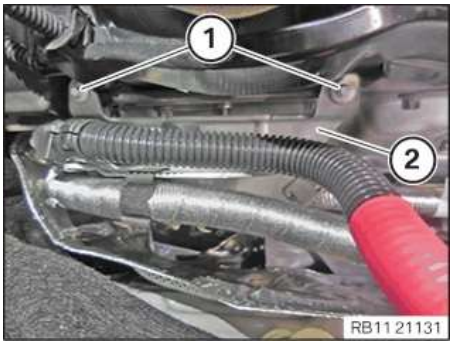


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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CAUTION

Improper routing of the positive battery cable.

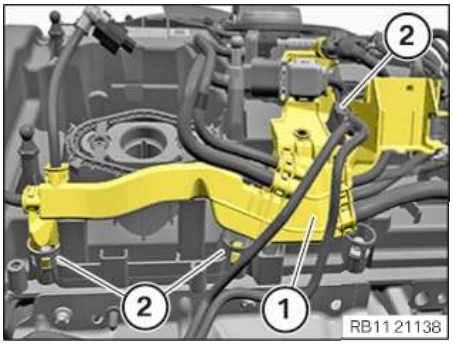
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

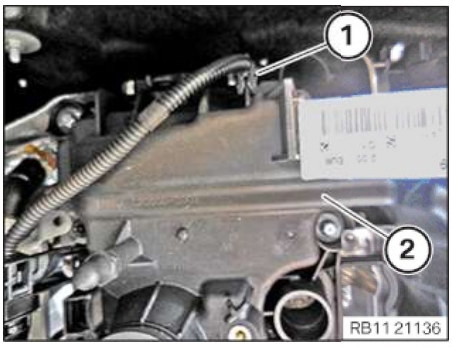
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

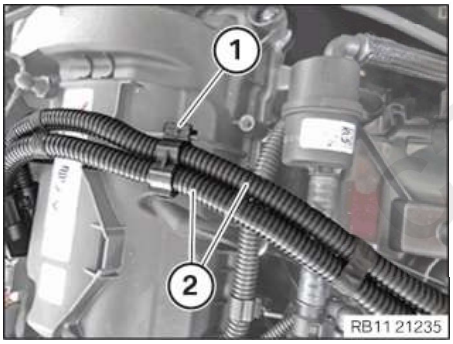
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

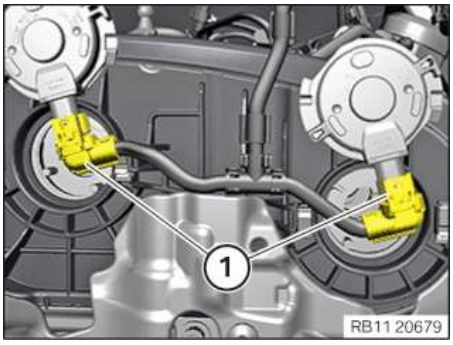


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

50 – Installing both actuators

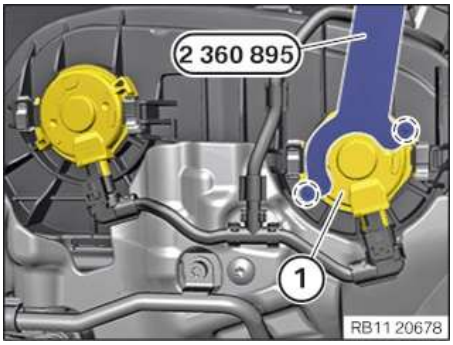


NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

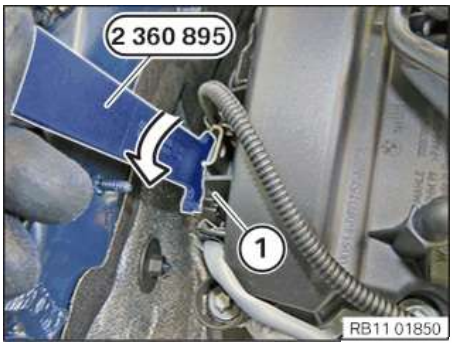
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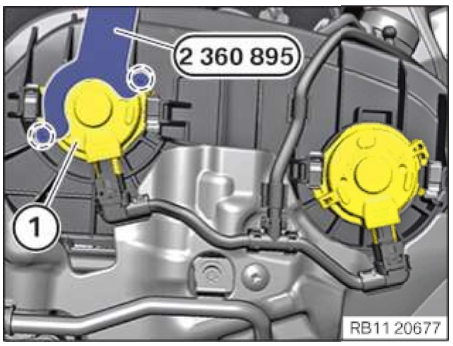
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



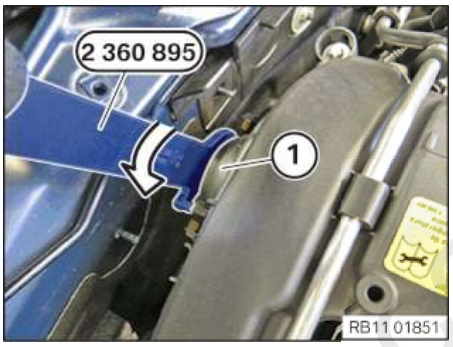
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

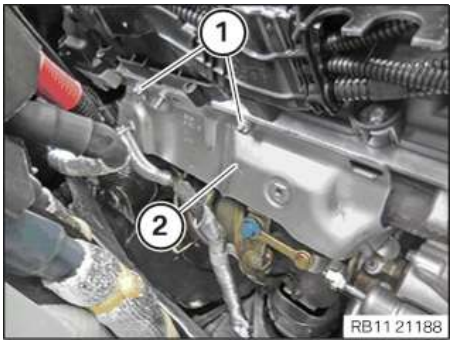
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

51 – Installing the heat shield on the cylinder head

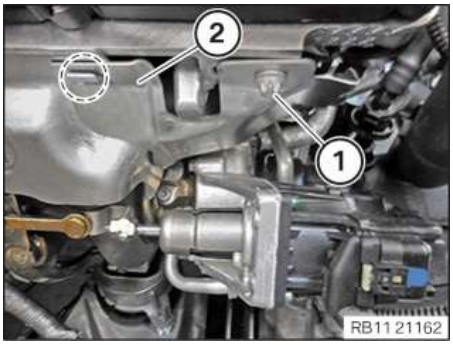


- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

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- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

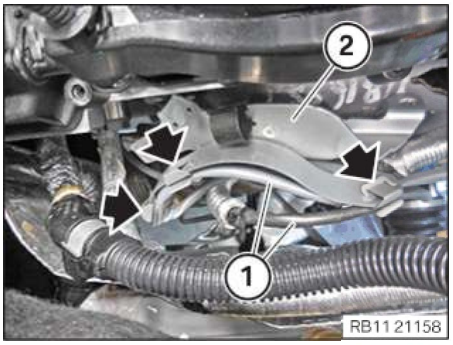


- Tighten down screw (1).

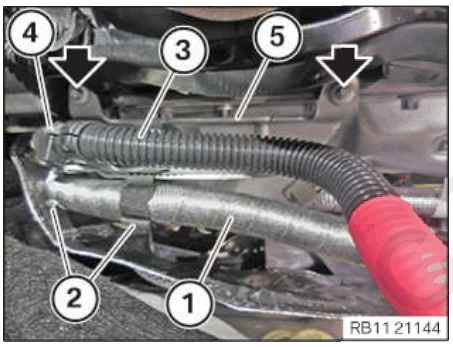
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

52 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

53 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

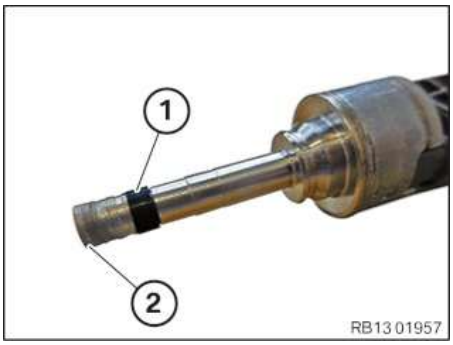
- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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TECHNICAL INFORMATION

Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

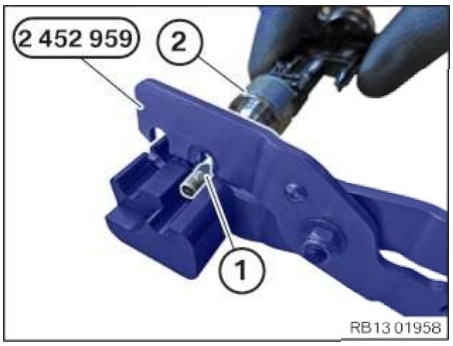
After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings

- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

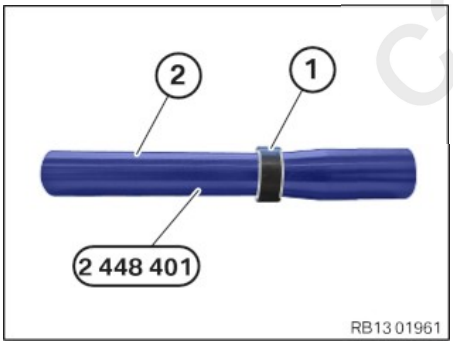


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

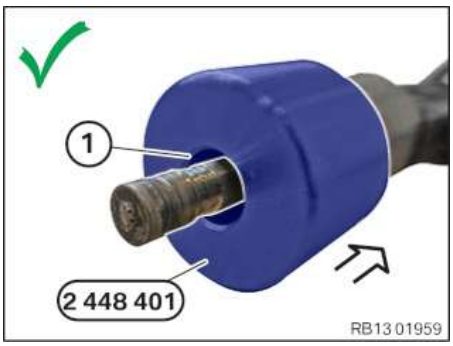
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

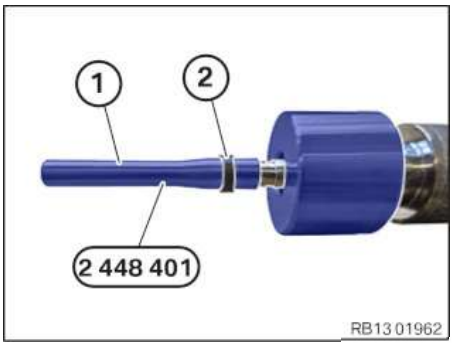
  The larger diameter of the assembly sleeve (1) must point to the injector tip.

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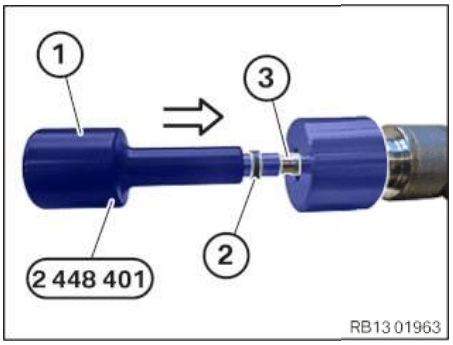


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

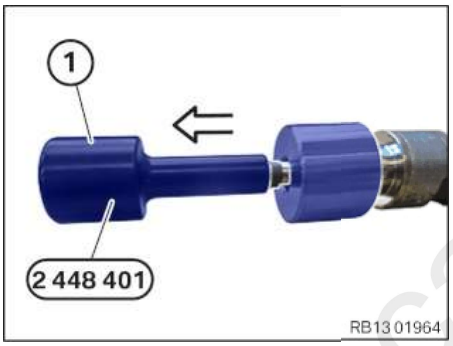
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



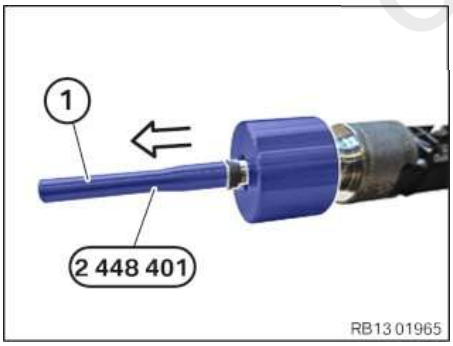
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



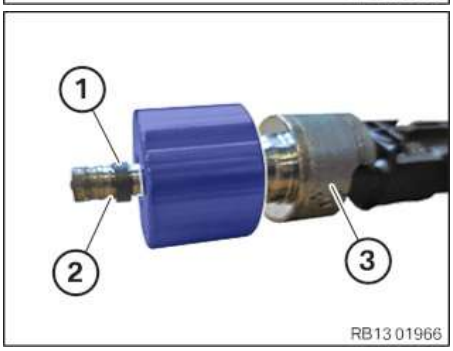
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

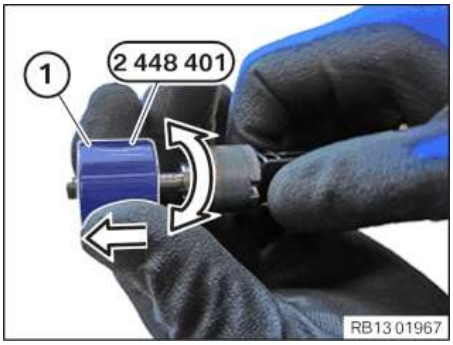


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



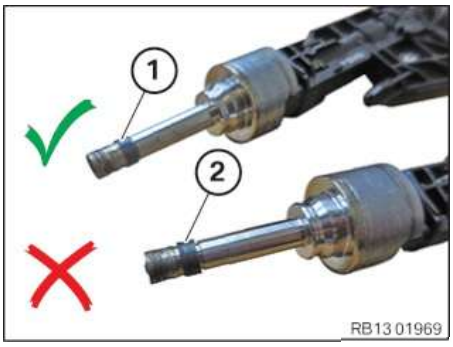
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

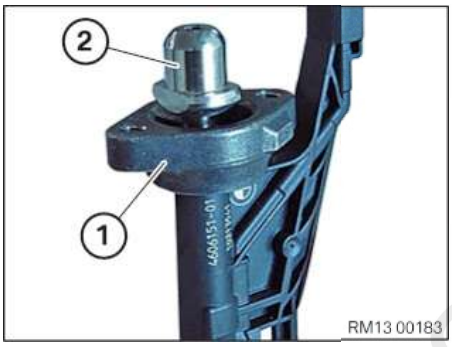


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

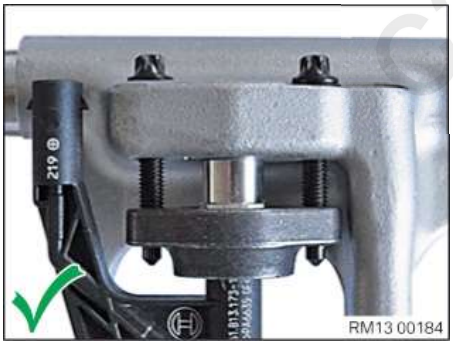
54 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

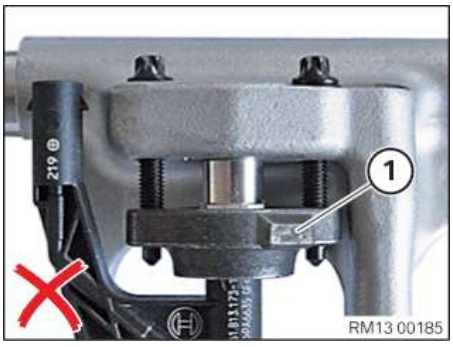


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

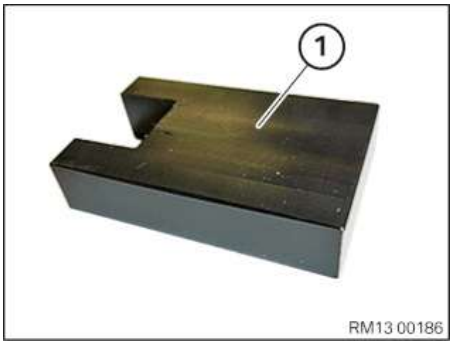
  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.

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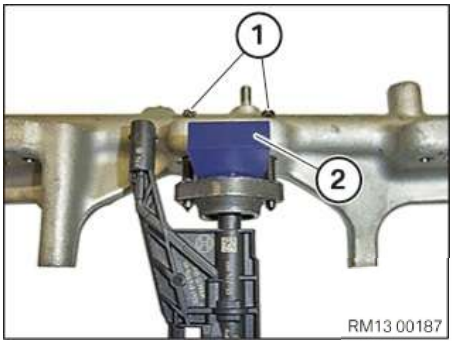
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)

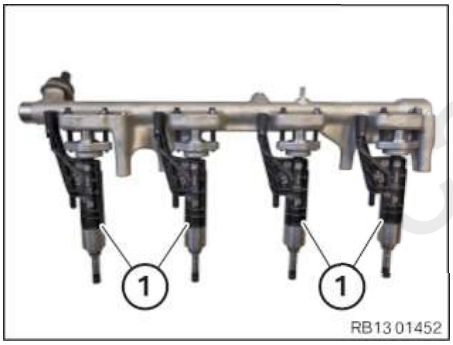
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.

- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



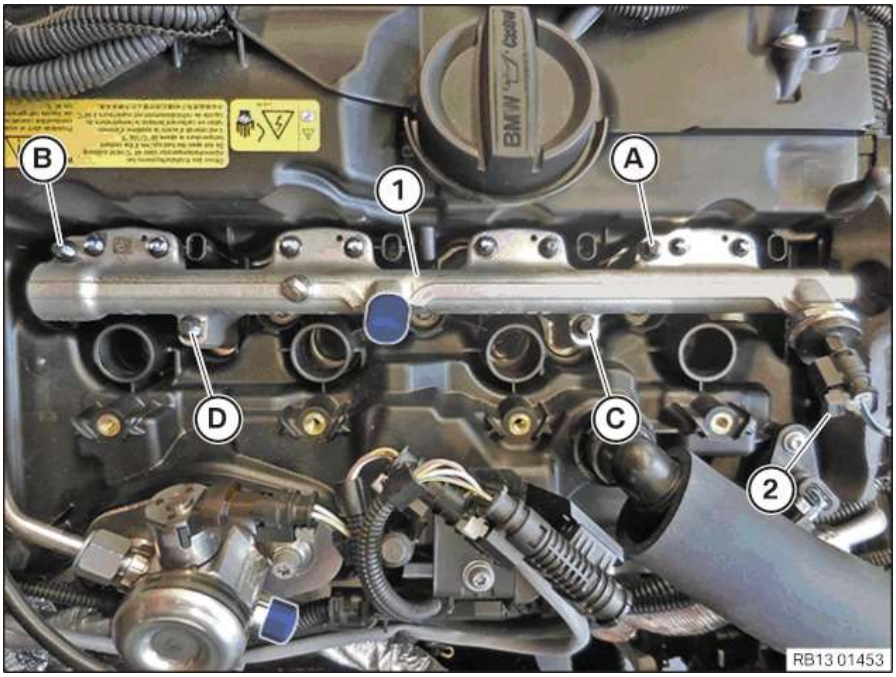
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

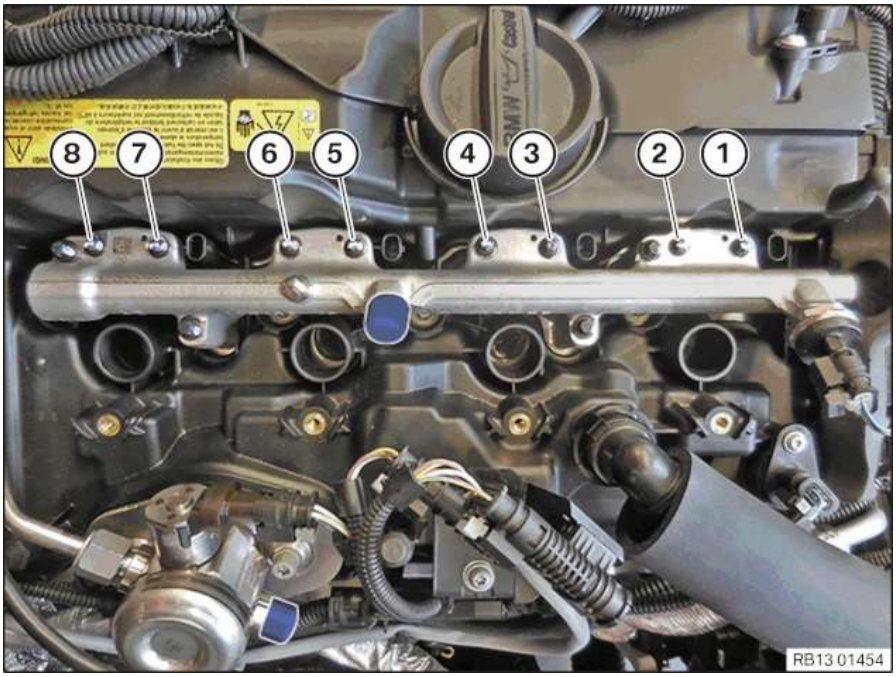
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

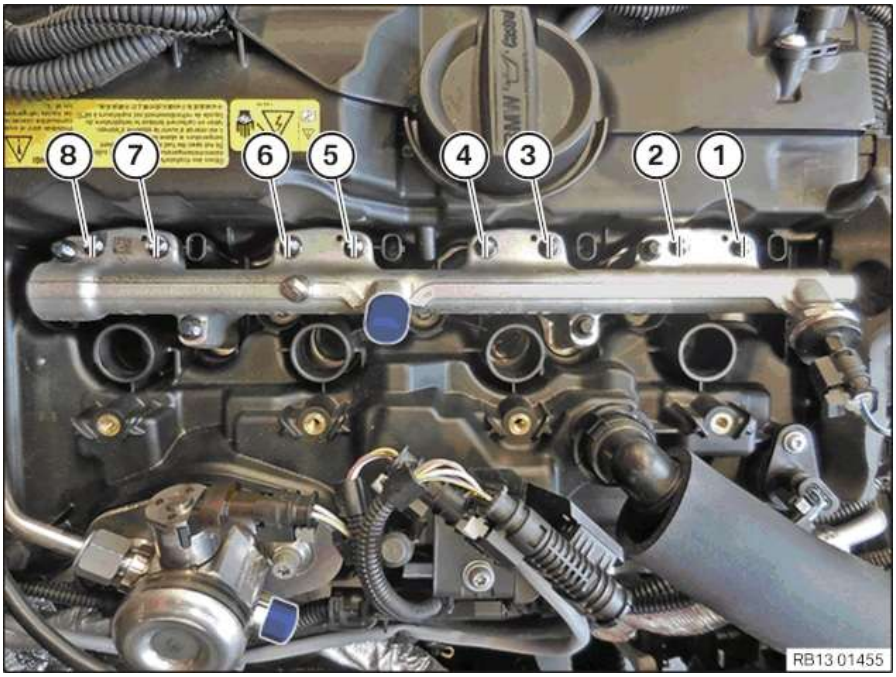
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

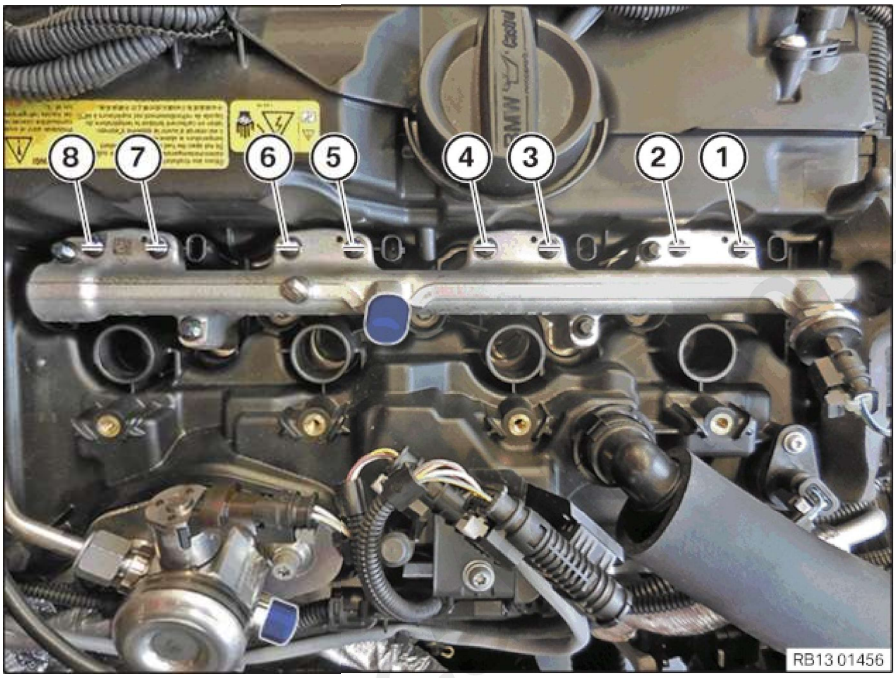
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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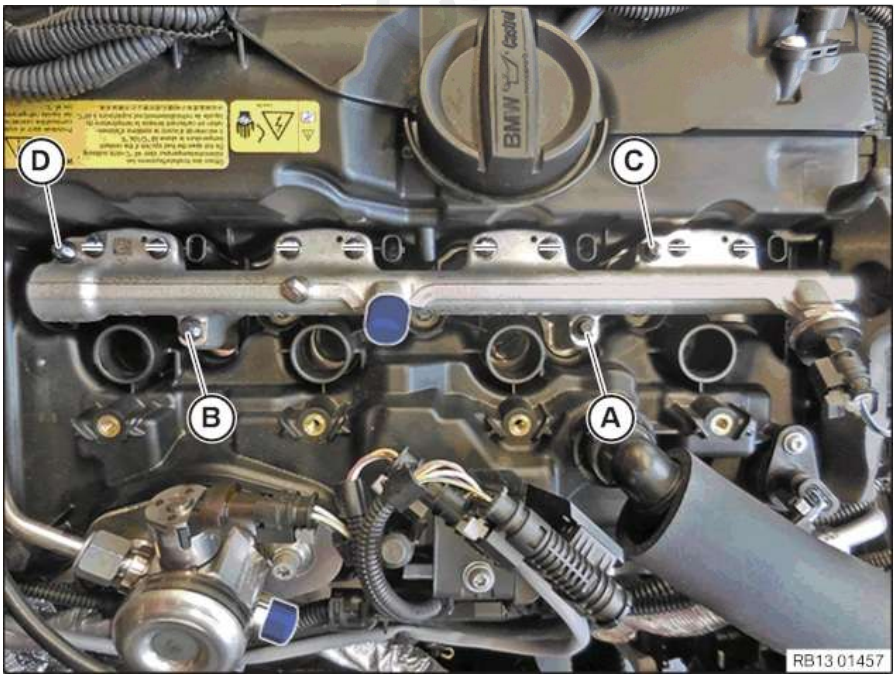


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

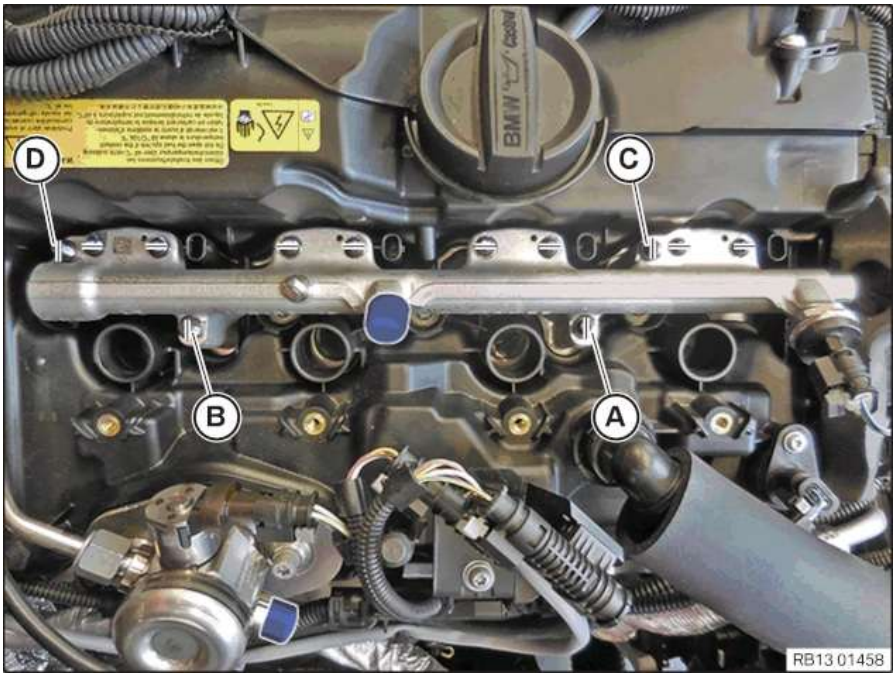
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

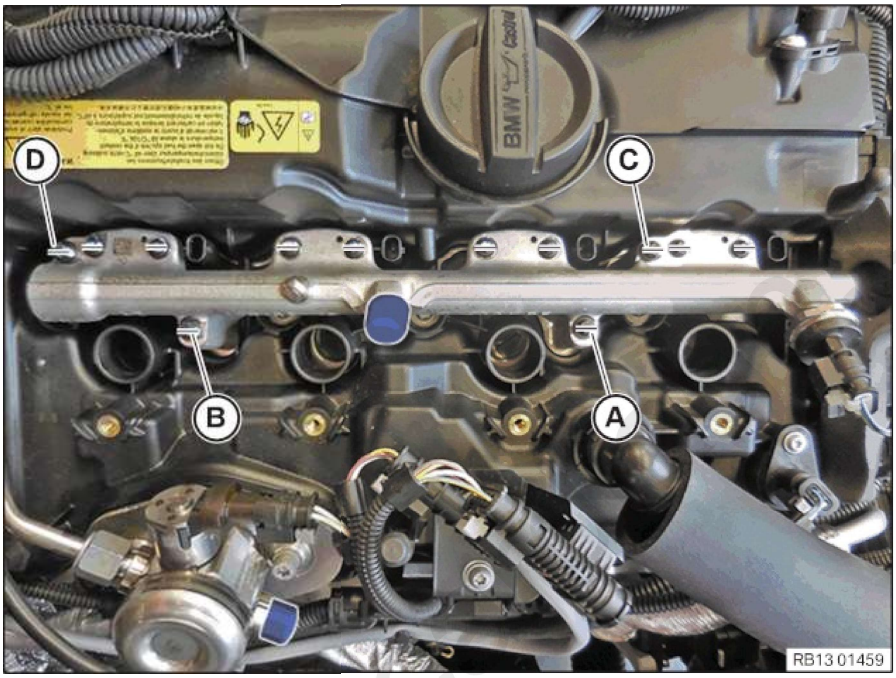
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

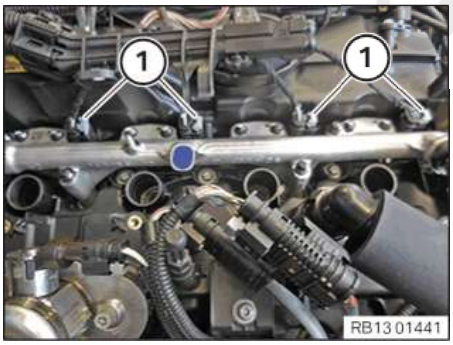


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



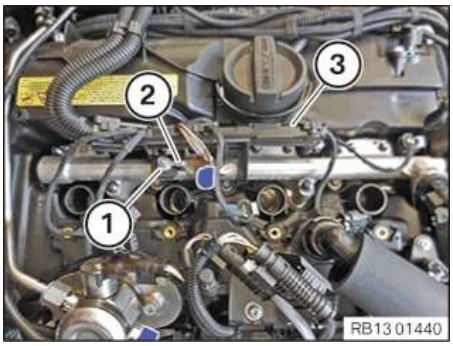
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

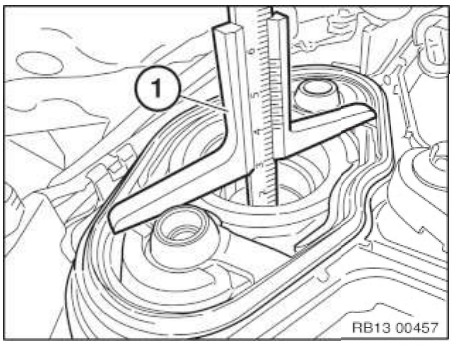
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

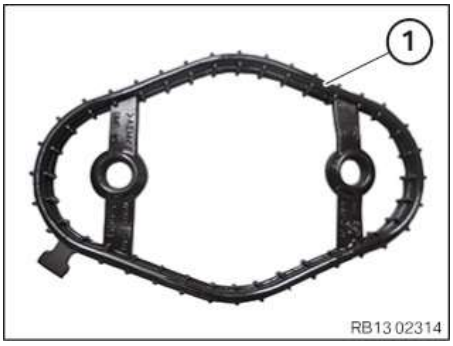
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

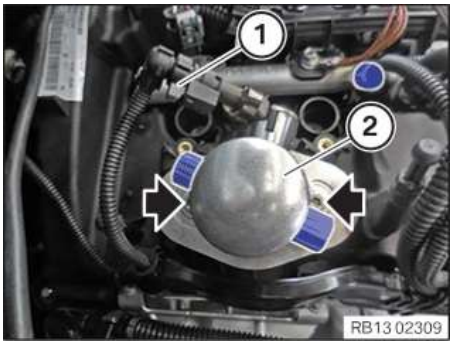
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

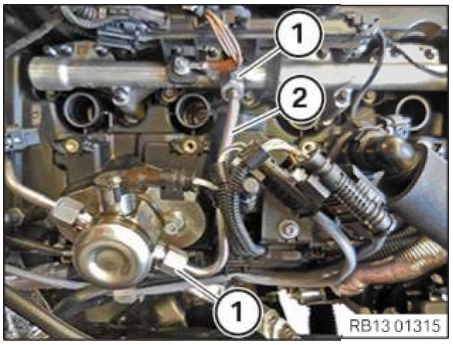
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

56 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

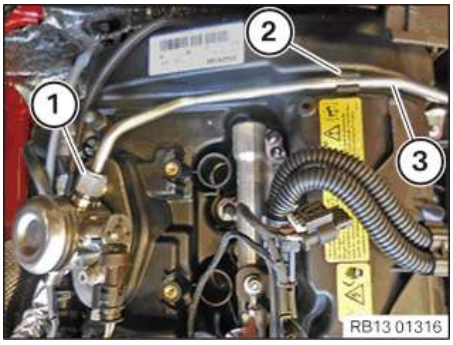
57 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

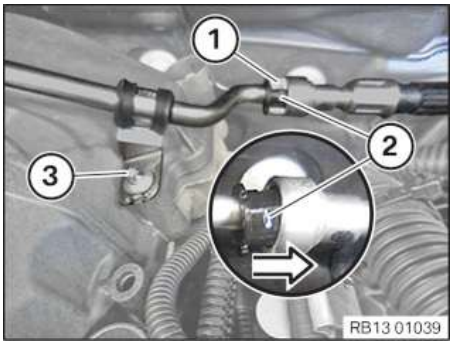


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

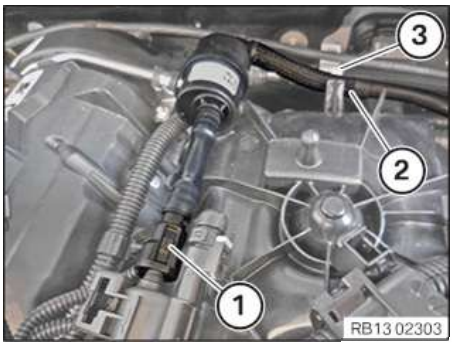
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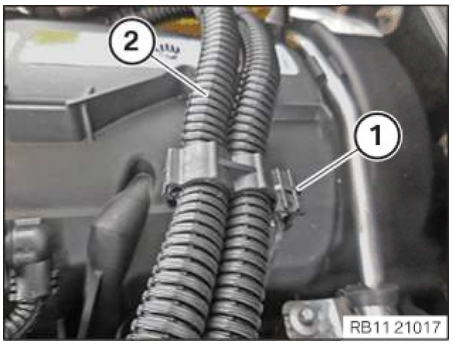
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

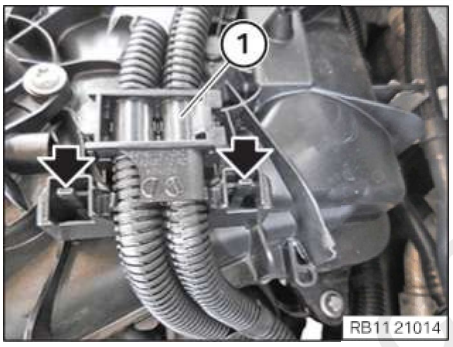
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

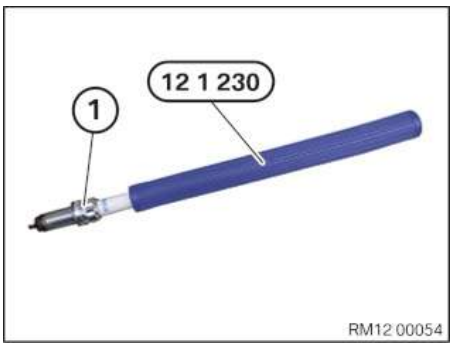


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

58 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

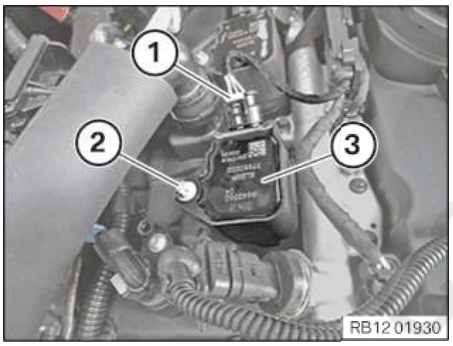
M12x1.25		Tightening torque	23 Nm

59 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



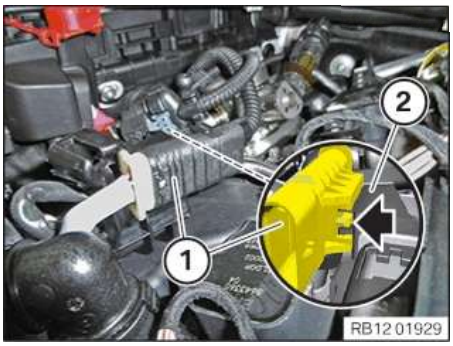
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

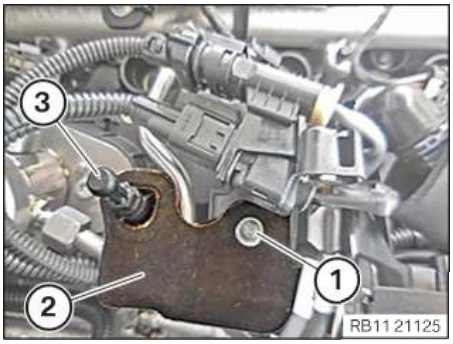
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

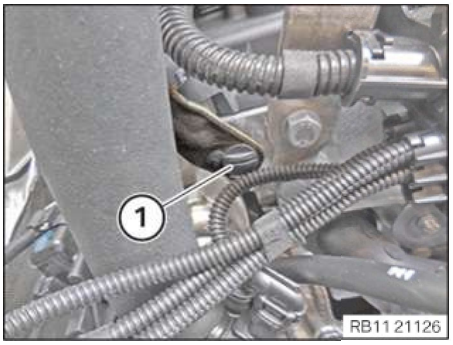
60 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

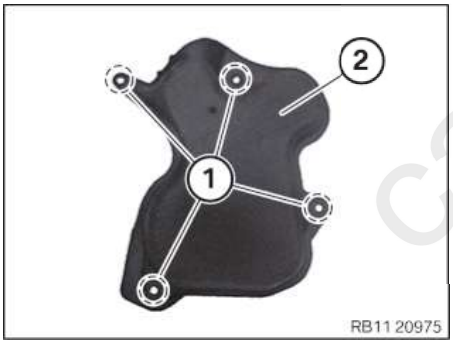
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



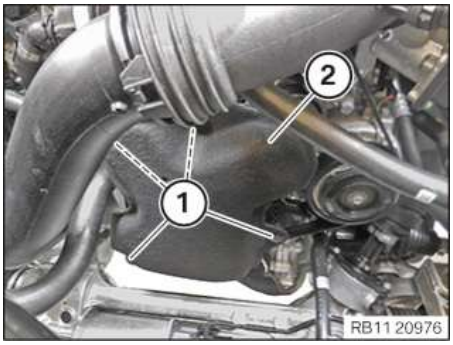
- Secure the clip (1).

61 – Install the acoustic cover for the engine at the front



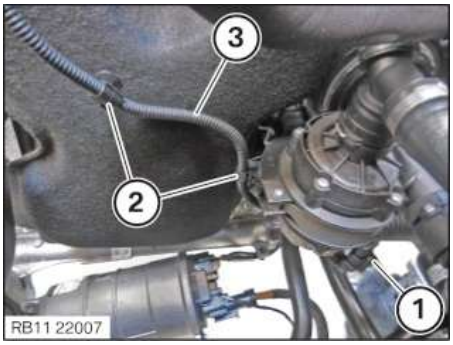
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



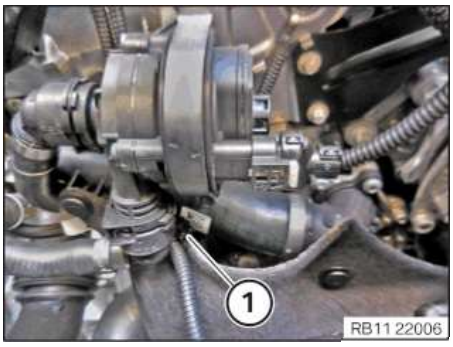
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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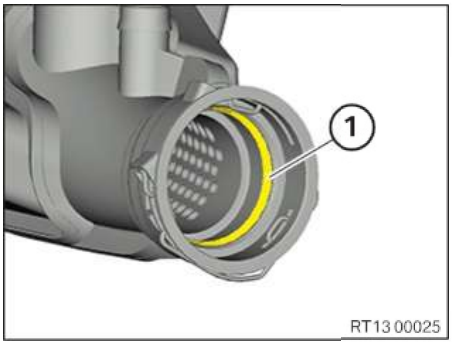
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

62 – Installing the clean air pipe with resonator

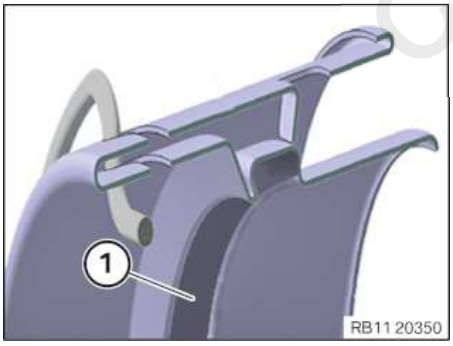


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

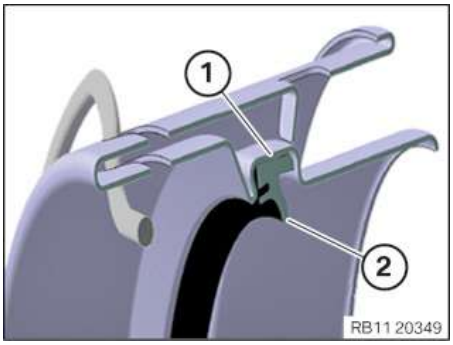
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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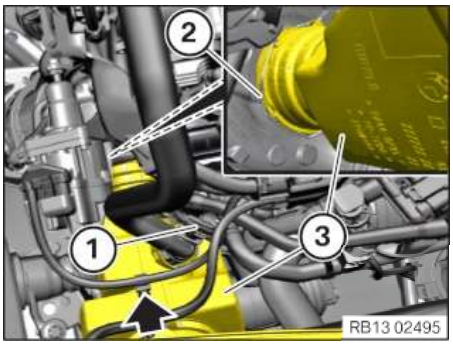
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

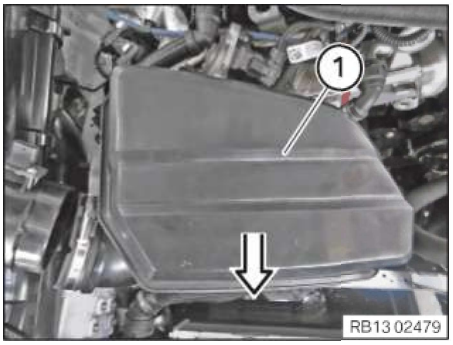
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



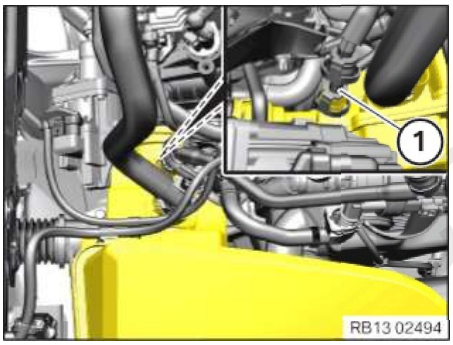
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

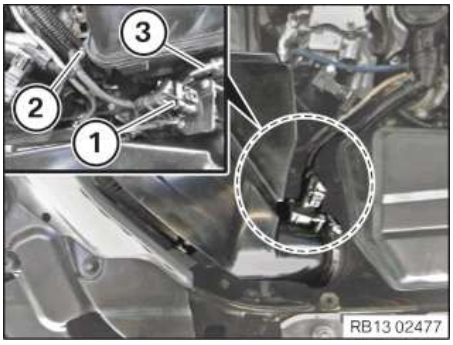
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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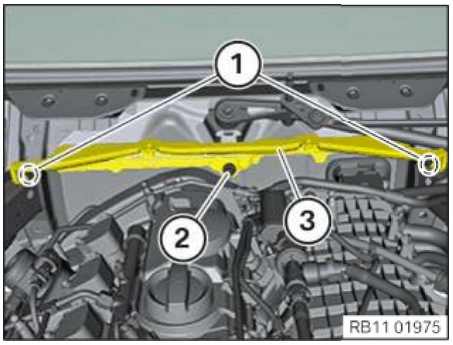
- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

63 – Disconnecting all battery earth leads



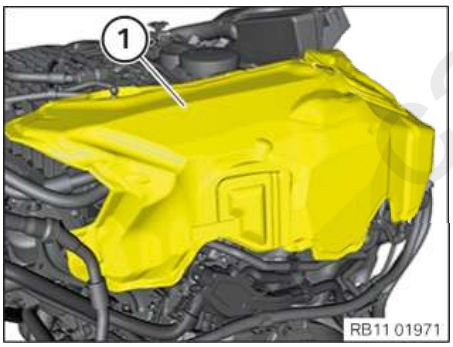
- See additional information.

64 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

65 – Installing acoustic cover at rear



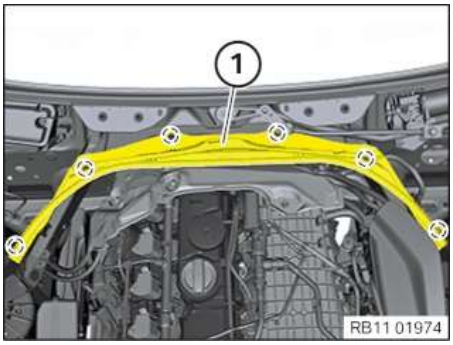
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

66 – Installing the centre bulkhead upper part

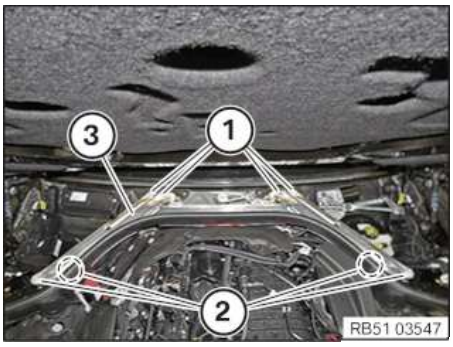
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- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

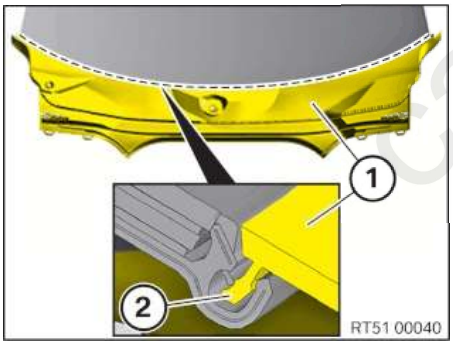
67 – Installing cowl panel cover

RISK OF DAMAGE

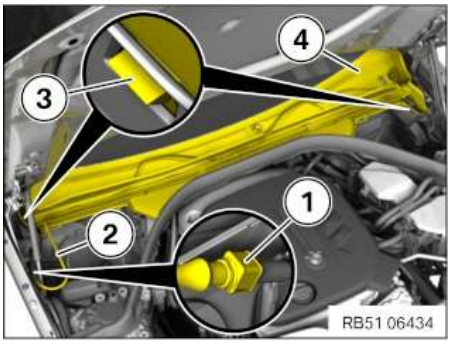
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

68 – Installing both wiper arms

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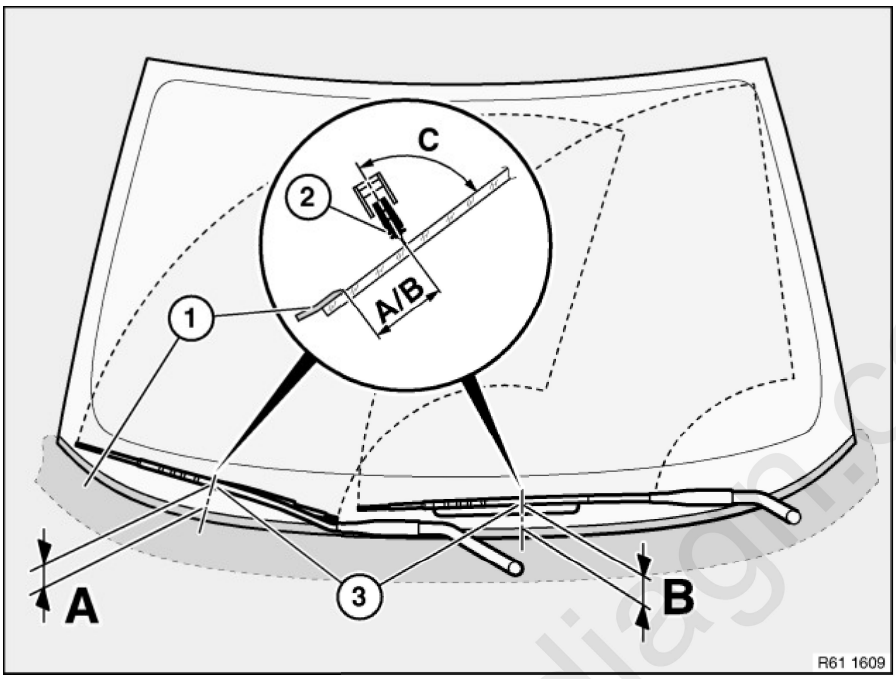
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

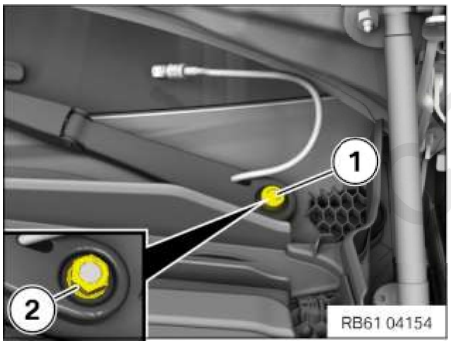
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

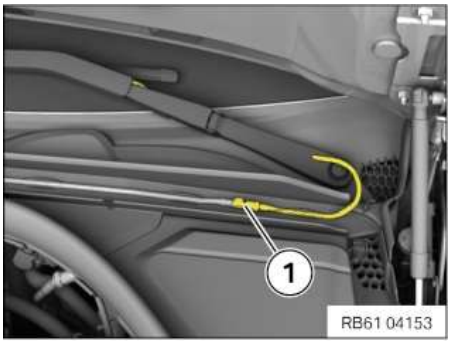


- Tighten nut (2).

Windscreen wiper arm

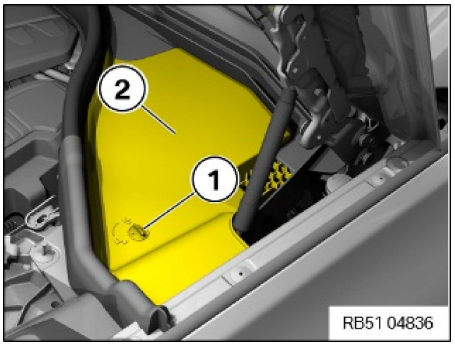
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



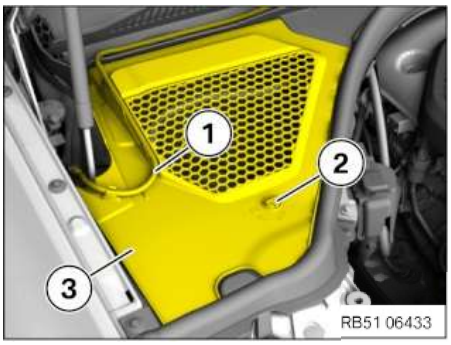
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

69 – Install the cover of the engine compartment on the rear left



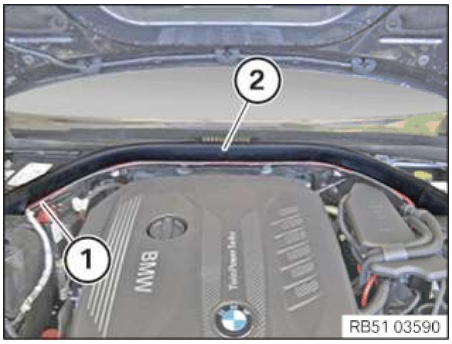
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

70 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

71 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

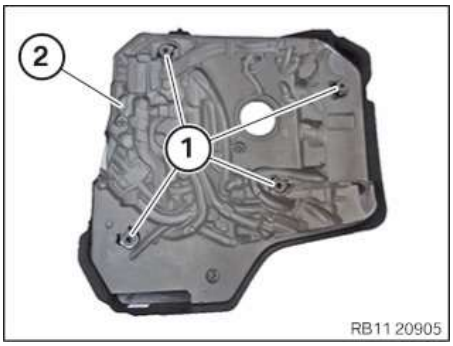
72 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

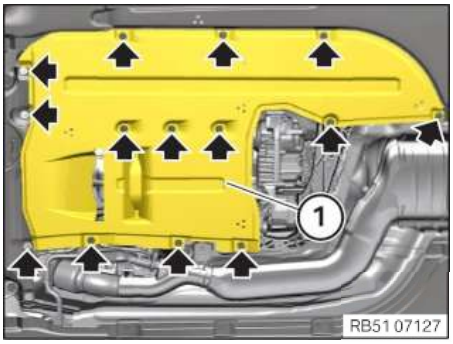
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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

73 – Installing underbody protection at rear



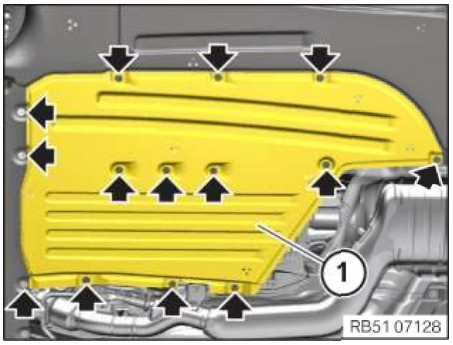
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

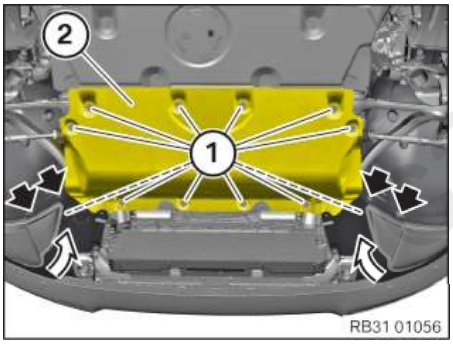
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

74 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

Underbody protection of the steering gear

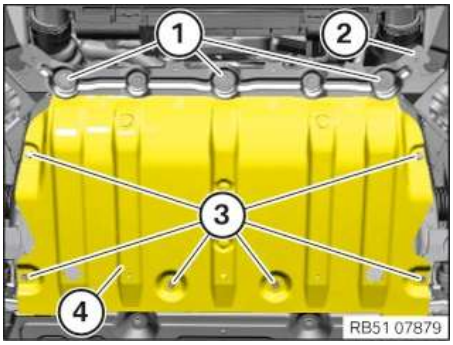
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm

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- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

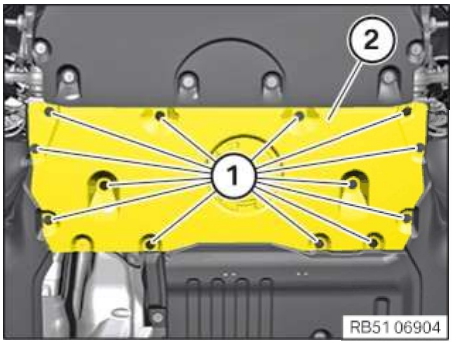
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

75 – Installing the centre underbody protection



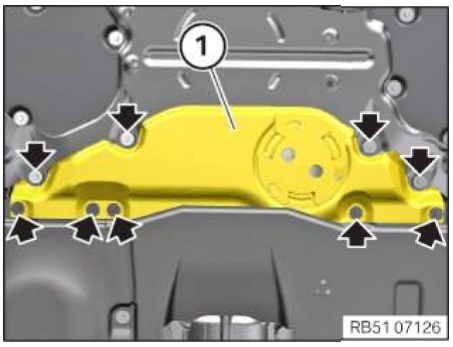
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

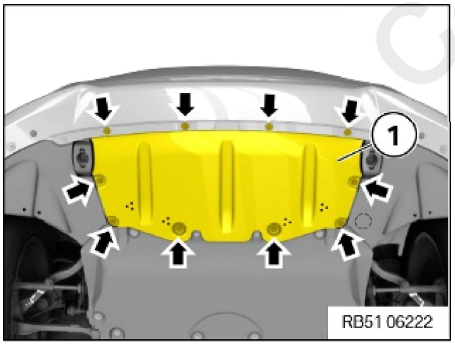
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

76 – Installing the front underbody protection



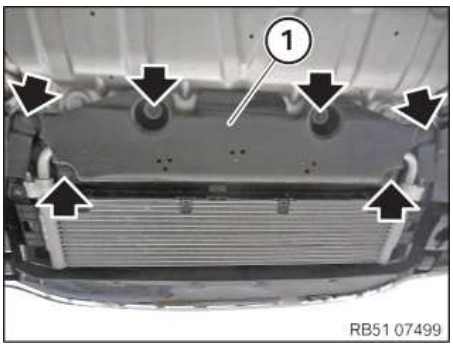
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 2:**

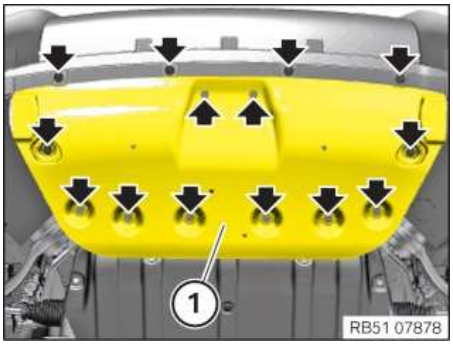
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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- **Version 3:**

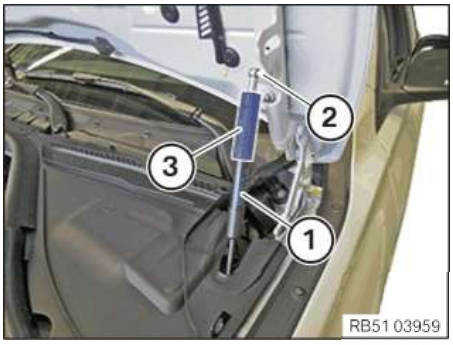
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

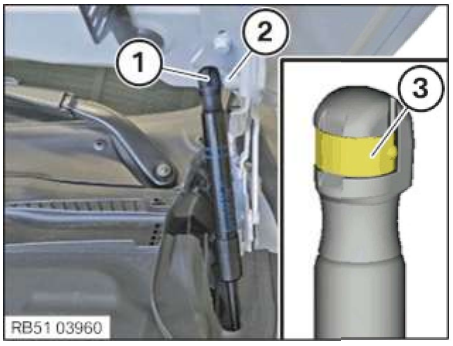
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

77 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head — Used in step 294248

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 294248

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 4445

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 47

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Cylinder head cover to cylinder head — Used in step 49

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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Wiring harness section of engine to cylinder head cover — Used in step 49

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 4952

6X18		Tightening torque	6 Nm

Heat shield to cylinder head — Used in step 51

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 51

M6 x 12		Tightening torque	8 Nm

Ground cable to rail — Used in step 54

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 55

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 56

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 57

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 57

M6 screw		Tightening torque	6,5 Nm

Spark plugs — Used in step 58

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 59

Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover — Used in step 60

TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 62

Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead — Used in step 66

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 66

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 66

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 68

Combination hexagon nut		Tightening torque	35 Nm

Underbody protection — Used in step 7375

Hexagon screw		Tightening torque	3 Nm

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Underbody protection of the steering gear Used in step 74

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) Used in step 74

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support Used in step 74

M10		Tightening torque	56 Nm

Underbody protection front Used in step 76

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

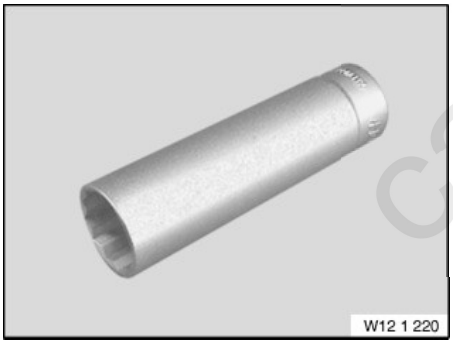
2 360 895 Pin wrench



Common Used in step 1250

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

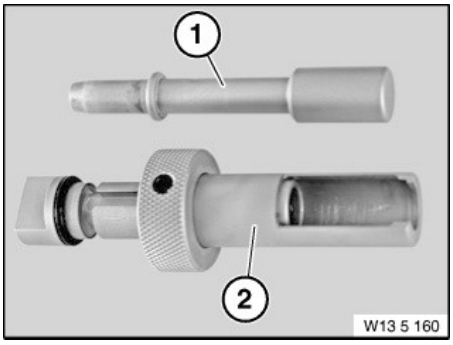
0 495 560 (12 1 220) Socket



Common Used in step 1658

Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 496 567 (13 5 161) Fastener

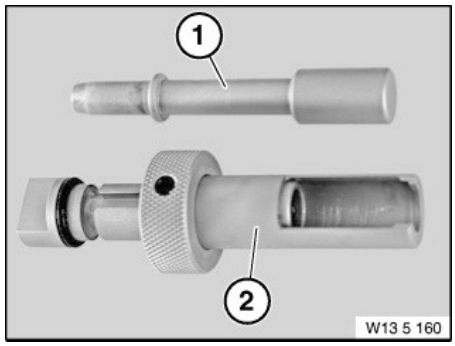


Common Used in step 19

Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 568 (13 5 162) Fastener

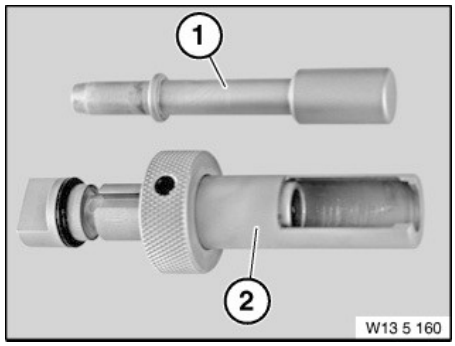


Common Used in step 19

Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 565 (13 5 160) Fastener



Common Used in step 19

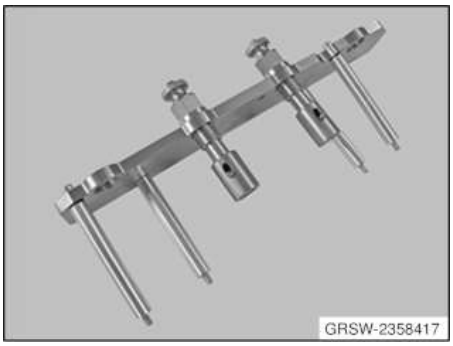
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

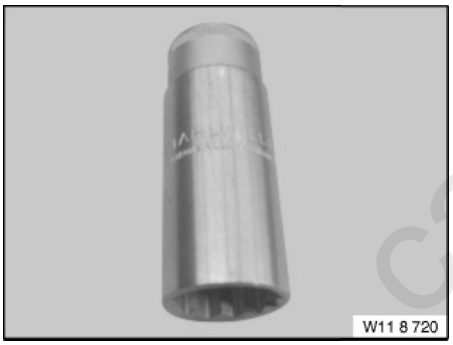
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2 358 417 Device



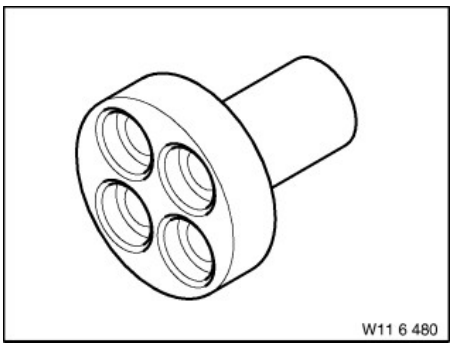
Common	Used in step 20
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 20
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 493 380 (11 6 480) Connector



Common	Used in step 29464855
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

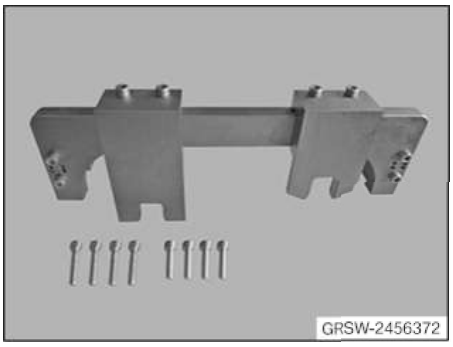
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2 288 380 Locating stud



Common	Used in step 294648
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 2941424648
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 294148
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



Common	Used in step 31324445
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

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2 450 487 Socket



Common	Used in step 31324445
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

2 455 654 Tensioning tool



Common	Used in step 4346
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 53
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 448 401 Fitting aid



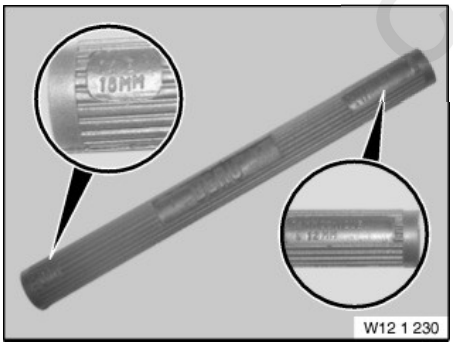
Common	Used in step 53
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 54
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



Common	Used in step 58
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 68
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step

61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	163
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	163
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
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61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 20 900 Disconnecting and connecting battery earth lead	163
61 35 ... Notes on ESD protection (Electro Static Discharge)	12
61 35 ... Notes on ESD protection (Electro Static Discharge)	121520
13 53 ... Clean the cylinder head around the injectors due to grit / dust	20
61 13 ... Unlocking and disconnecting different plug connections	202449

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11 36 126 Removing and installing/replacing the Vanos central valve on the exhaust side

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

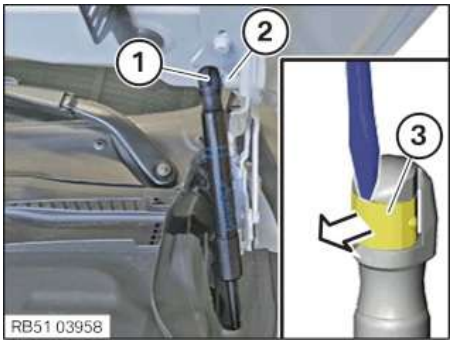
Engine compartment lid is open.

CAUTION

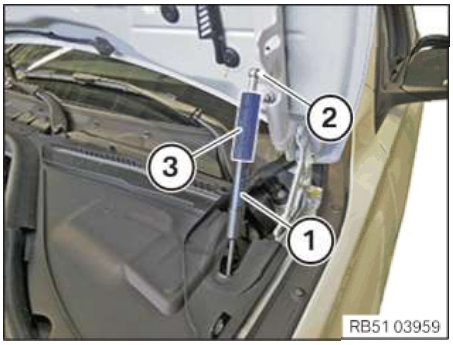
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

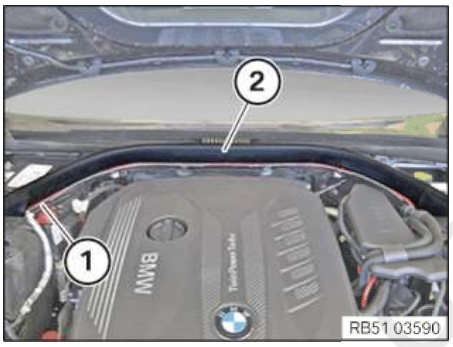


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

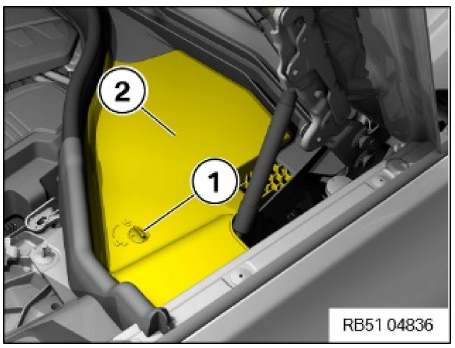
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

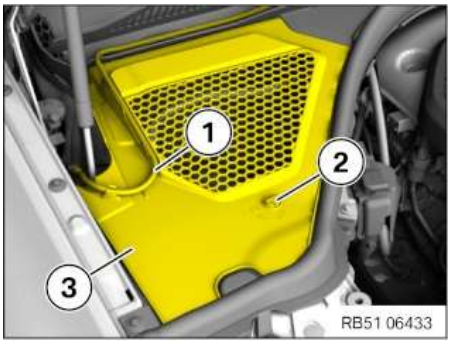
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

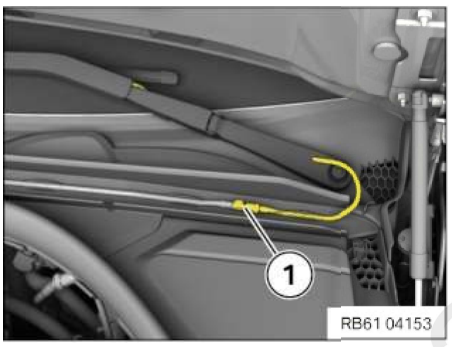
▶ **Remove the wiper arm**

RISK OF DAMAGE

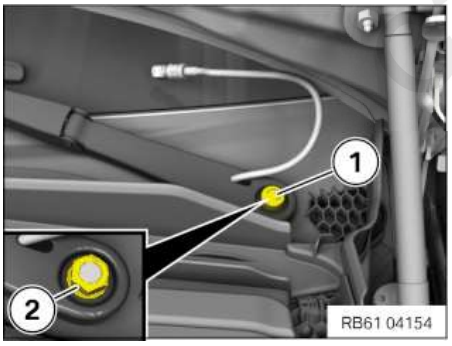
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

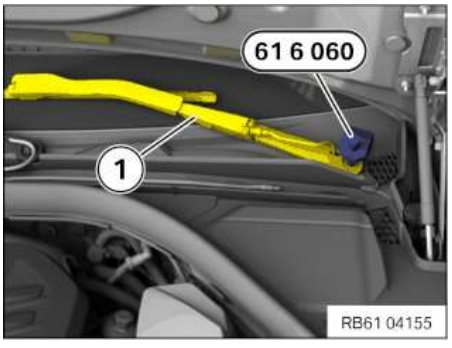
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



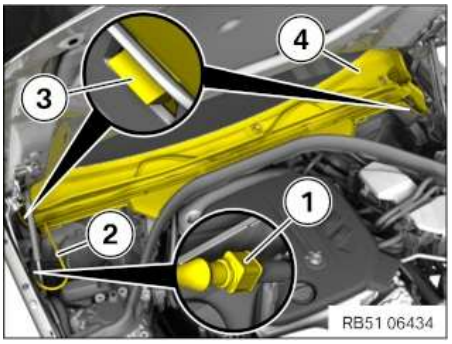
- Remove the protective cap (1).
- Loosen nut (2).



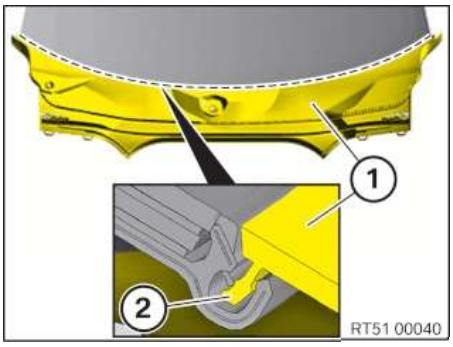
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

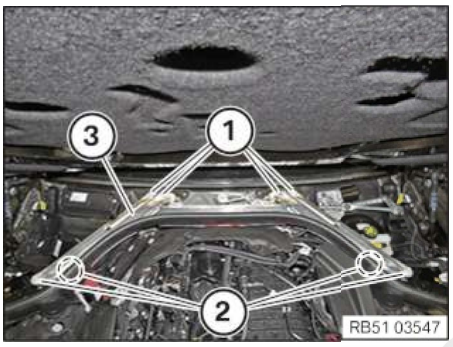


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

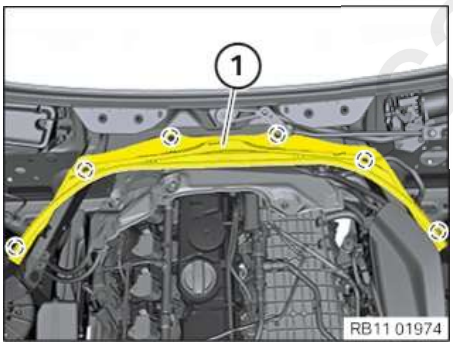
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

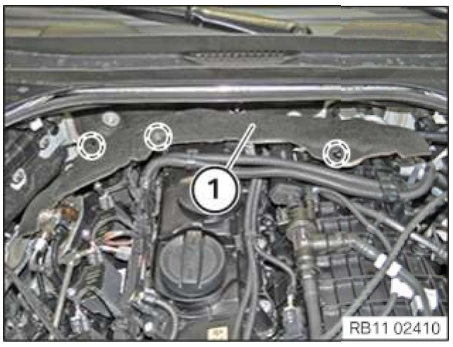
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



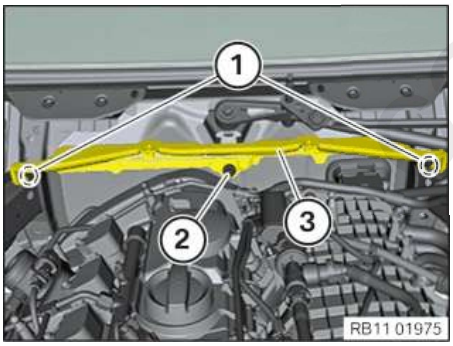
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

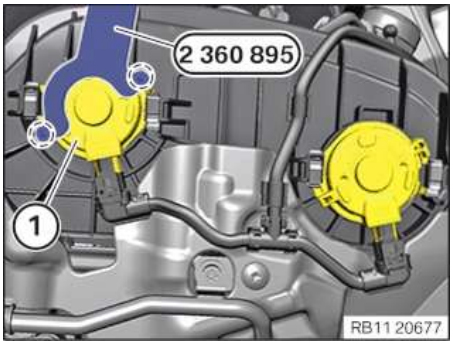
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

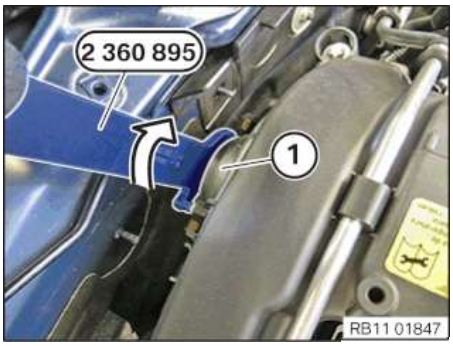
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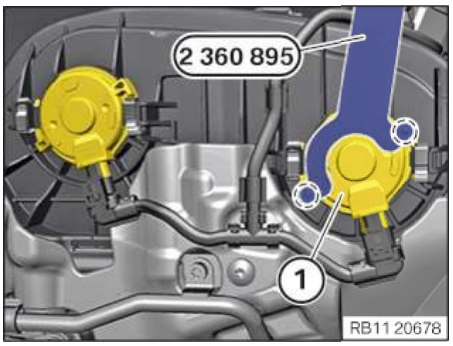
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



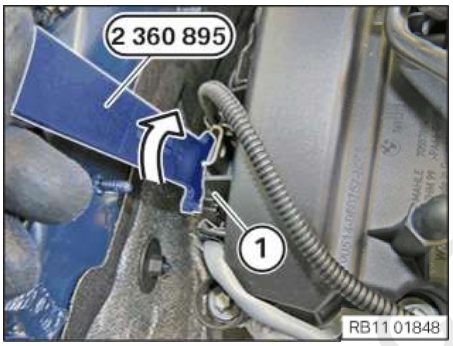
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



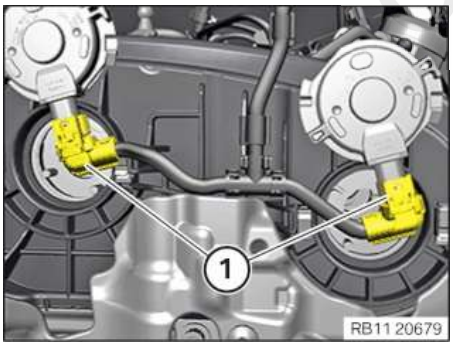
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

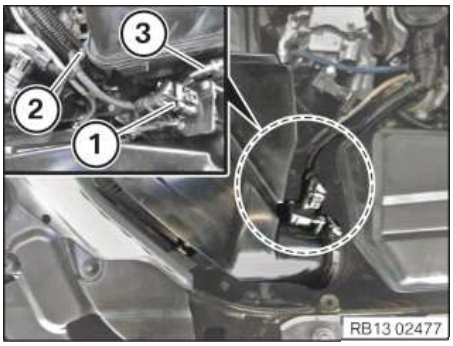
Risk of burning!

- Perform all work only on components that have cooled down.

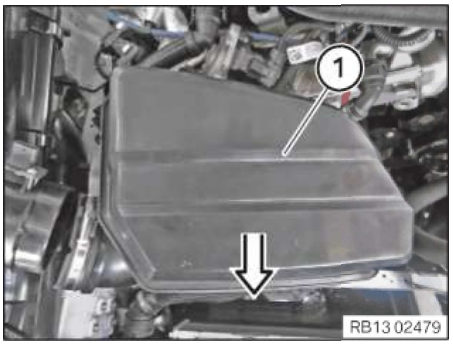
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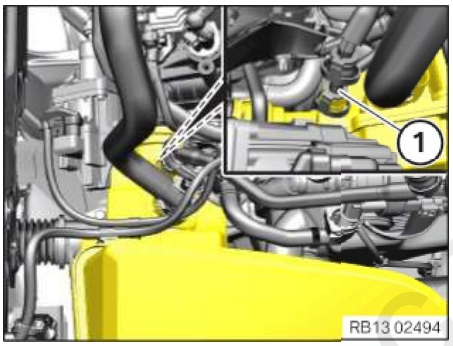
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



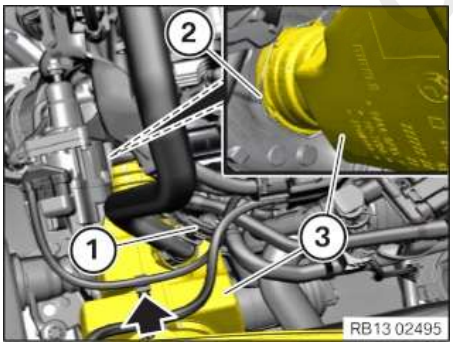
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



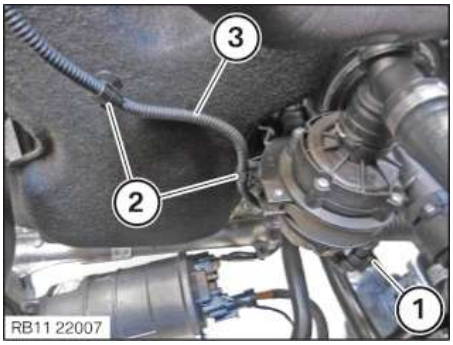
- Unlock and disconnect the tank ventilation line (1).



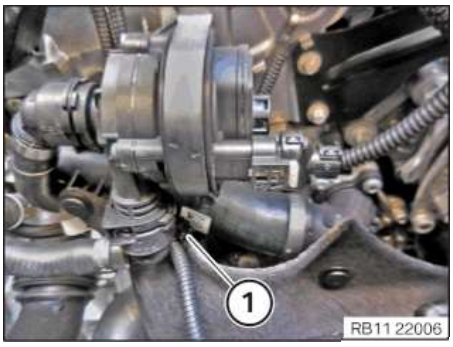
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

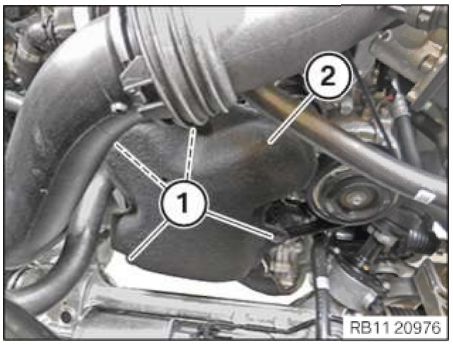
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

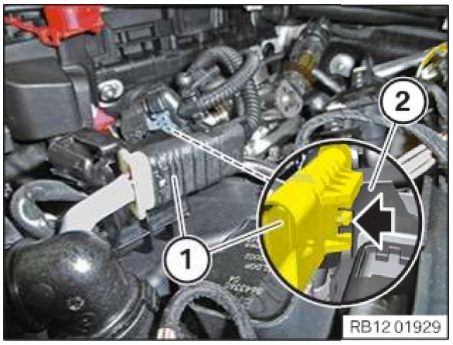
Electrostatic discharge.

Damage to or destruction of electrical components.

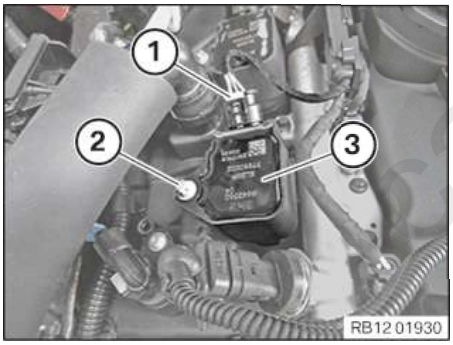
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

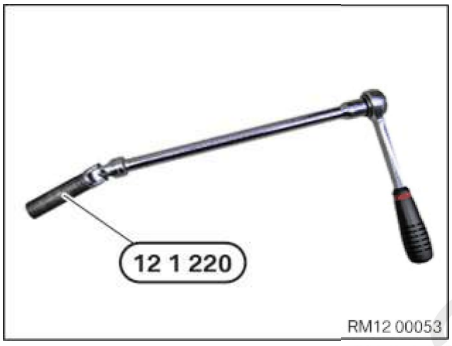
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

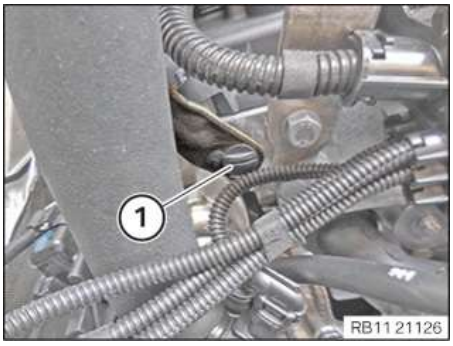
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

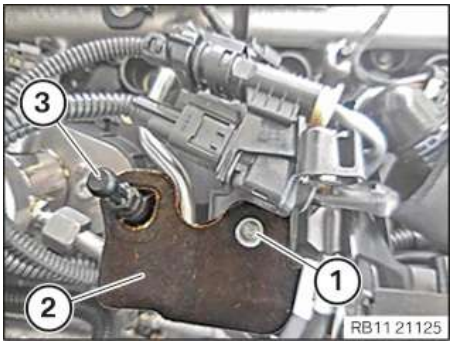


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

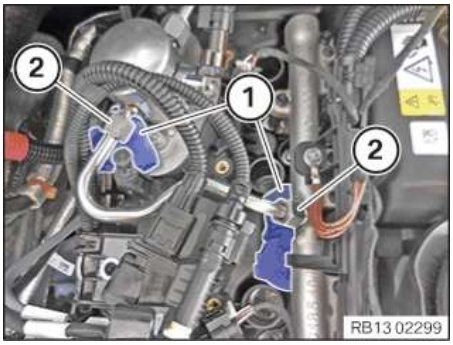
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

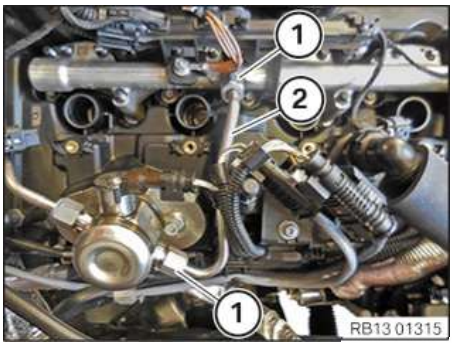


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

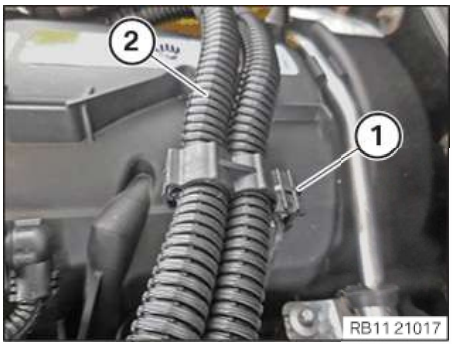
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

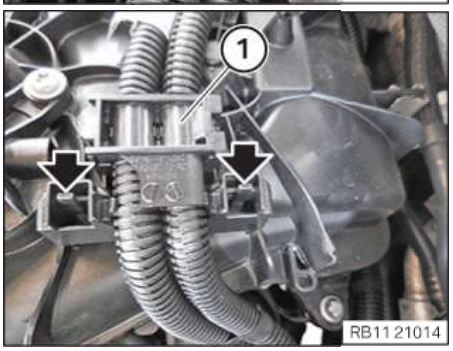
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

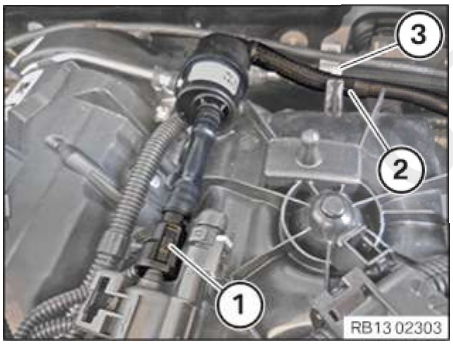
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



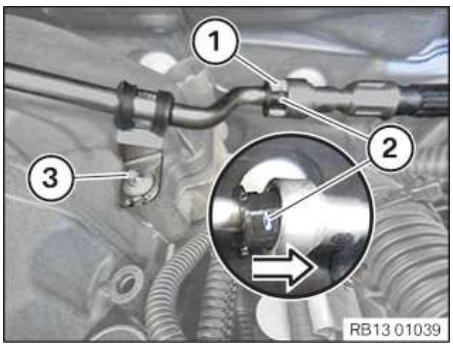
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

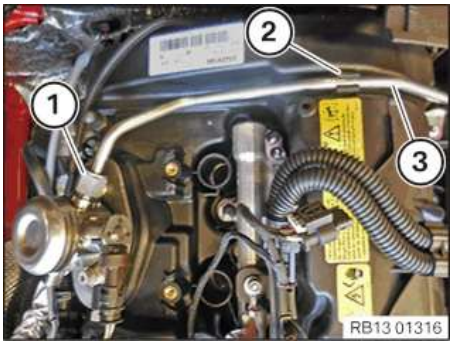


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

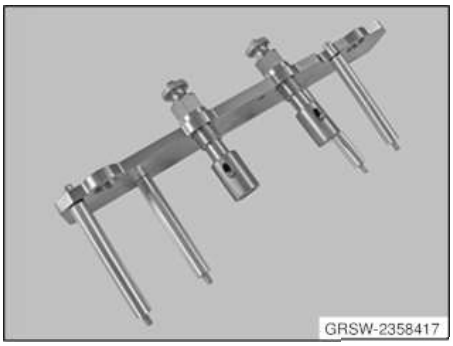
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



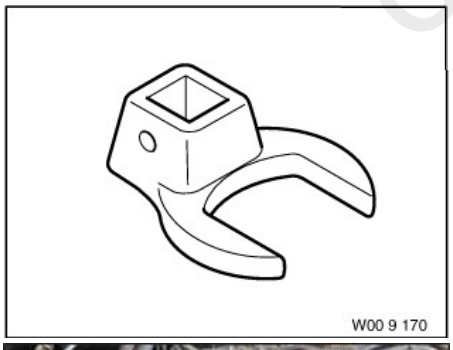
- Prepare special tool 2 358 417.



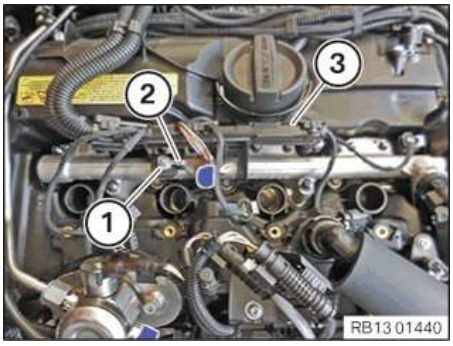
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

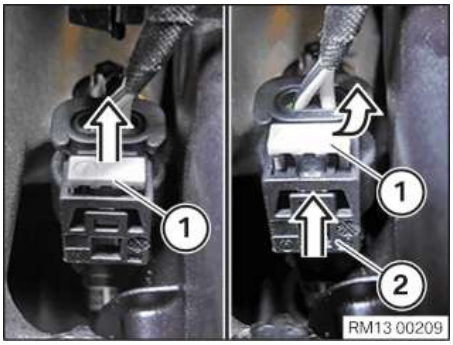


- Prepare special tool .

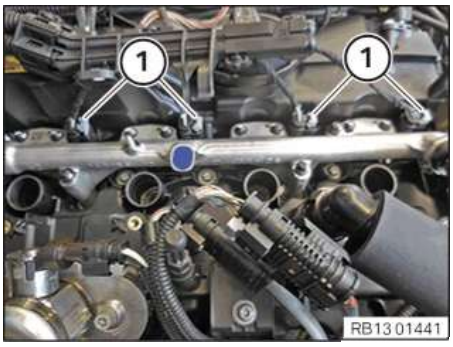


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



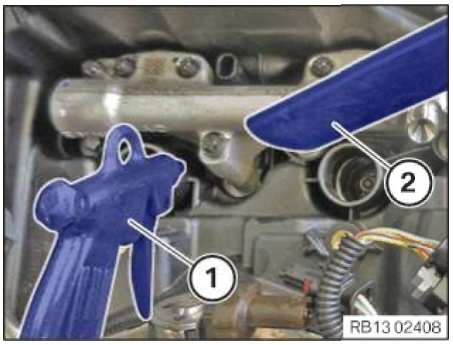
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

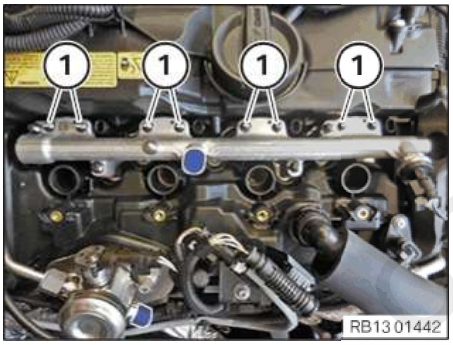


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

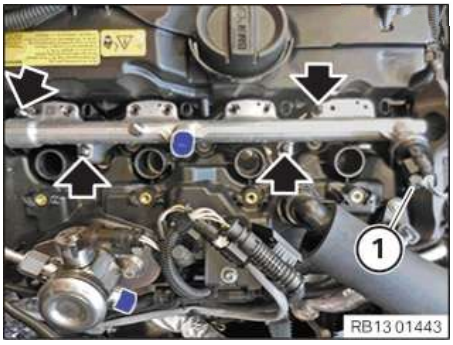
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



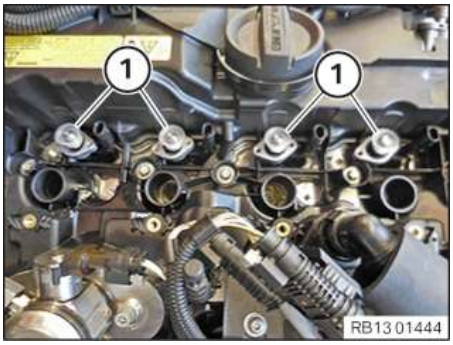
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

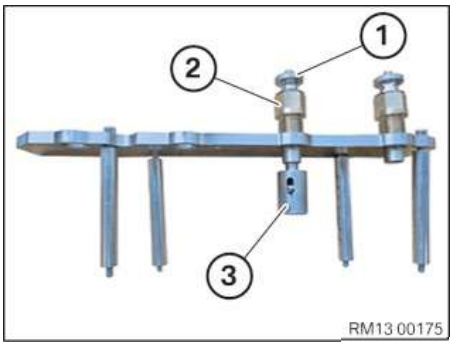
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

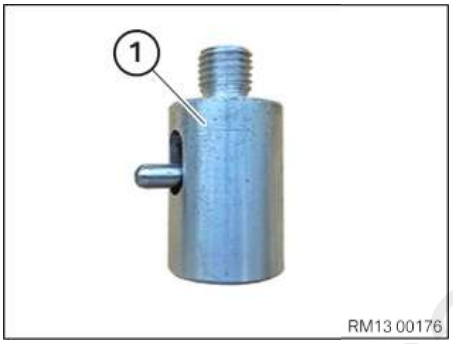
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

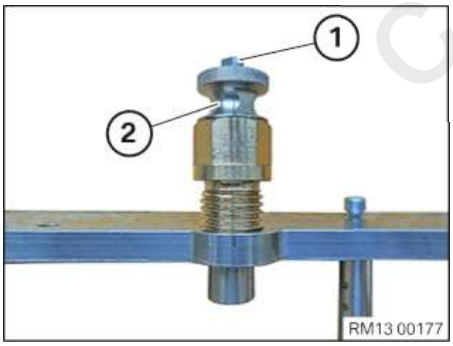
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

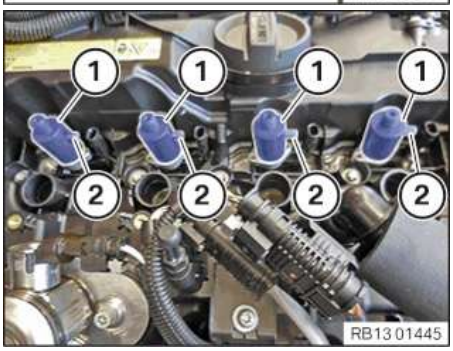
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



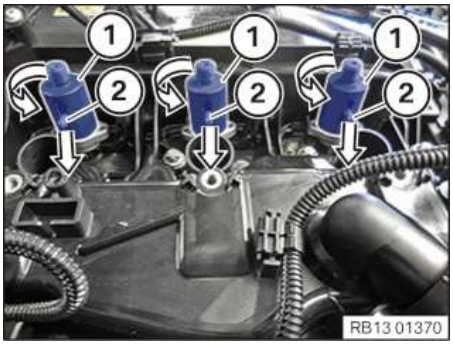
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



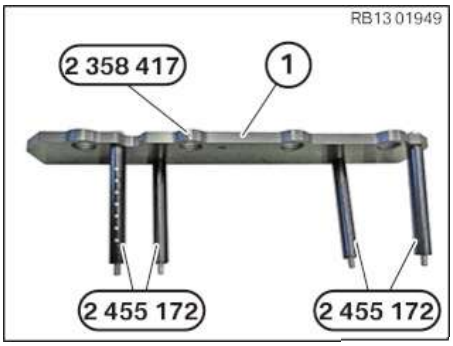
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

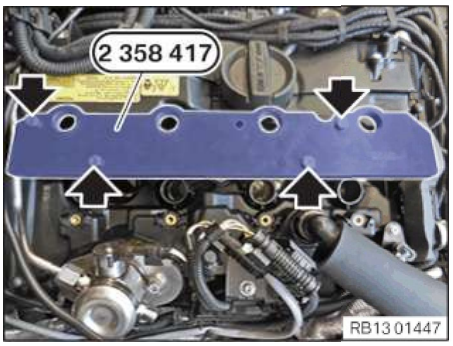
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



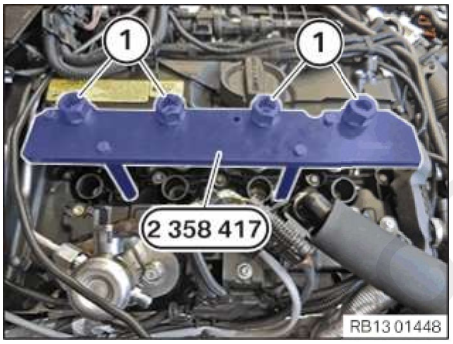
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

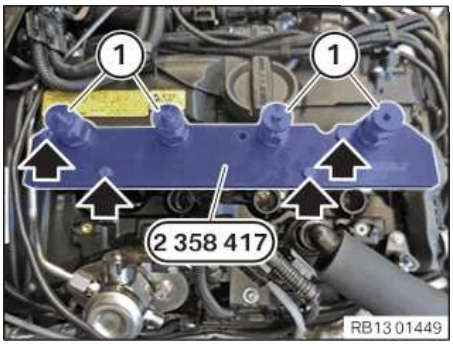
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

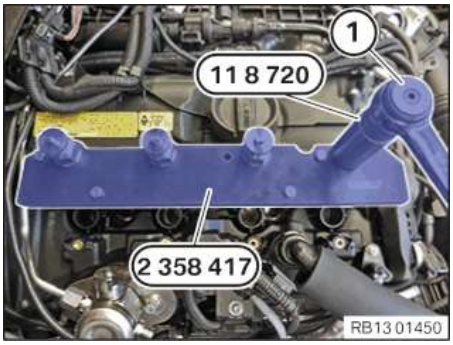
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

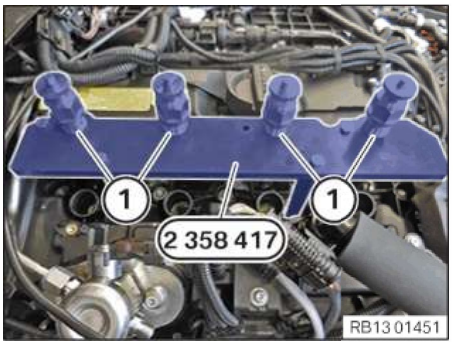


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

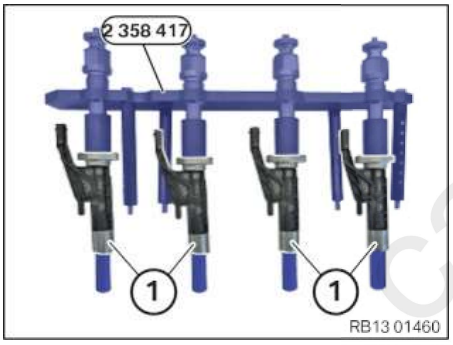
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

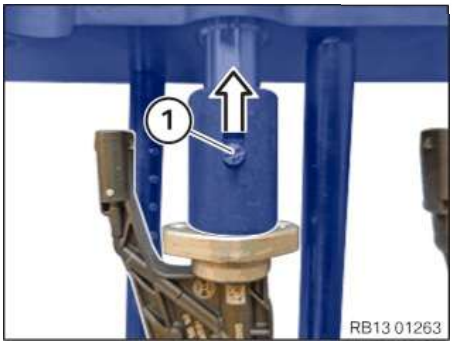


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

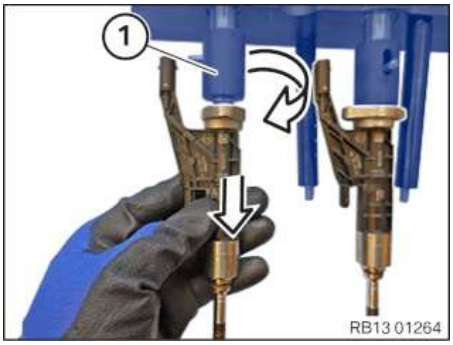


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

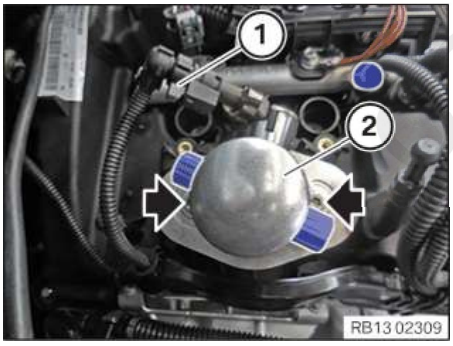
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

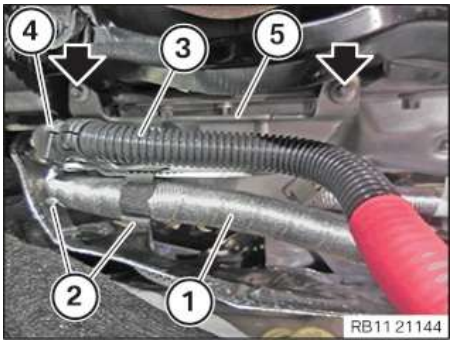
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

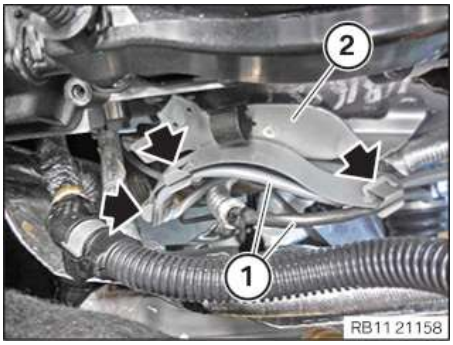


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

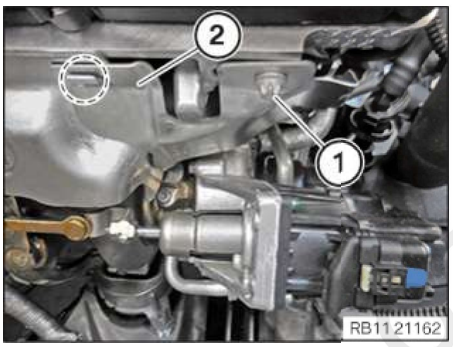
Hot surfaces.

Risk of burning!

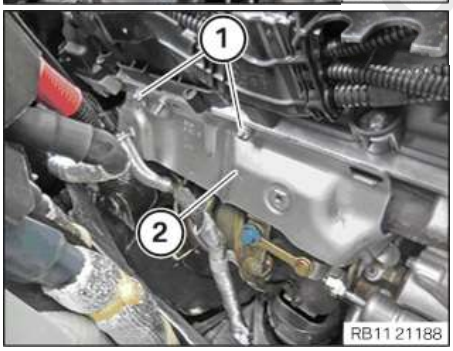
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

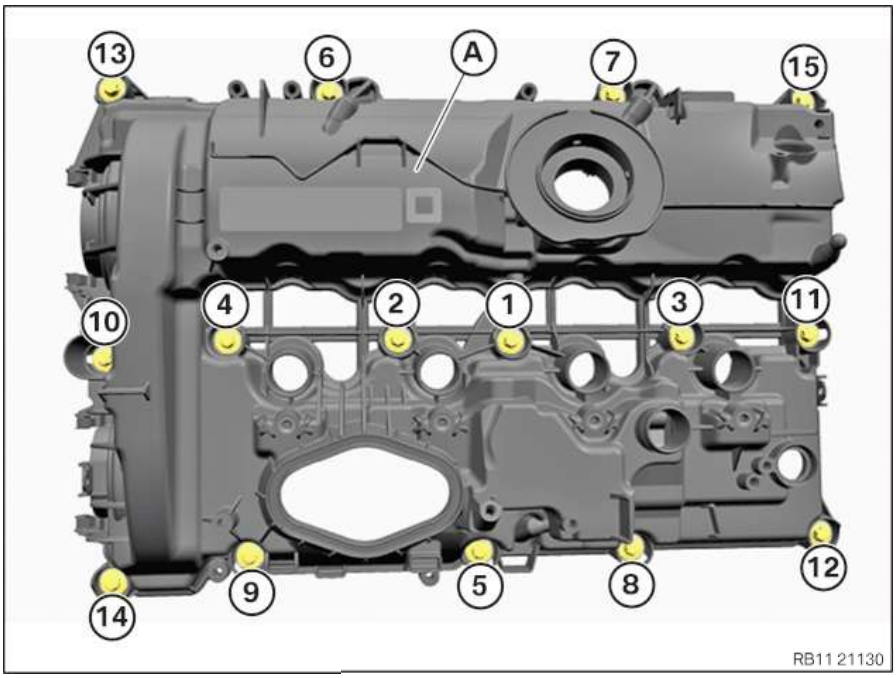


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

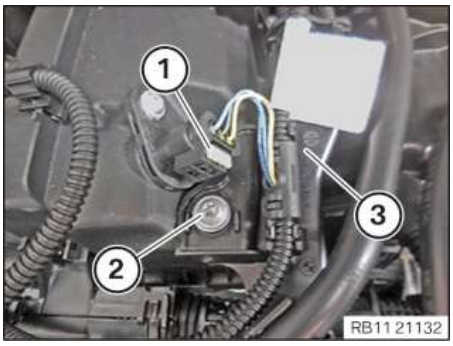
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

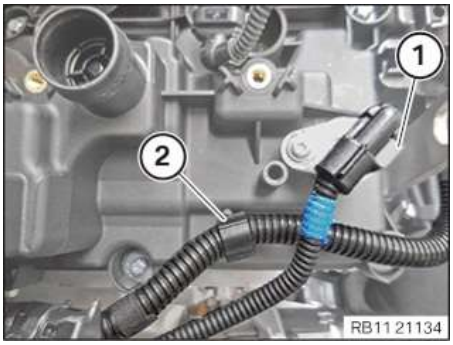
- Do not pull on the wires when disconnecting connectors and plug connections.



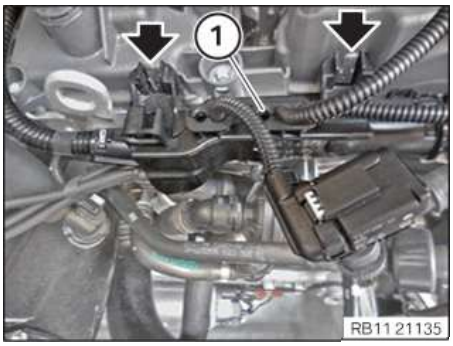
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



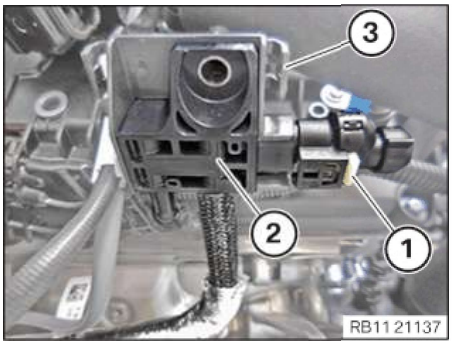
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



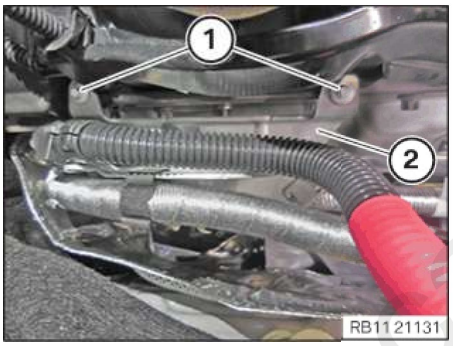
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



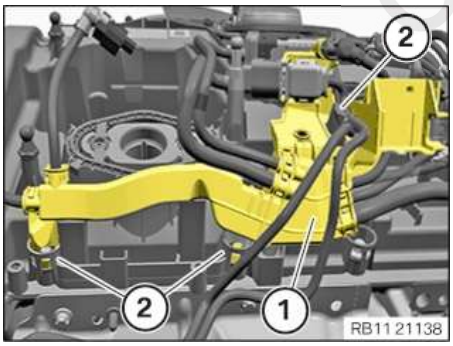
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



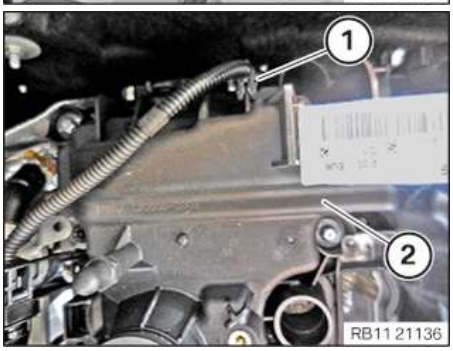
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

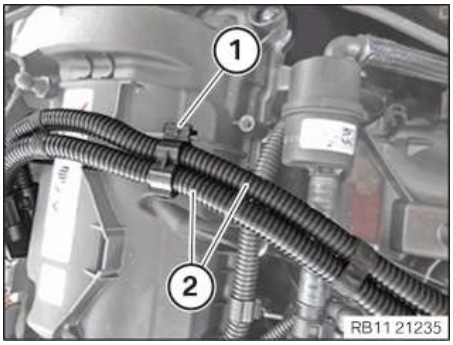


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

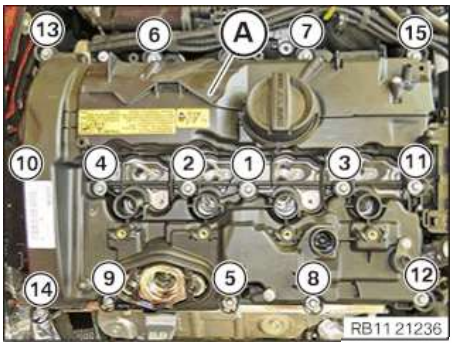


- Loosen clamp (1).

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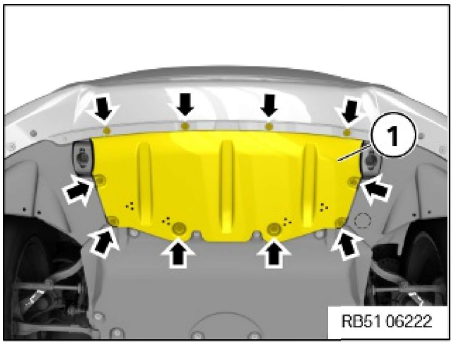


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

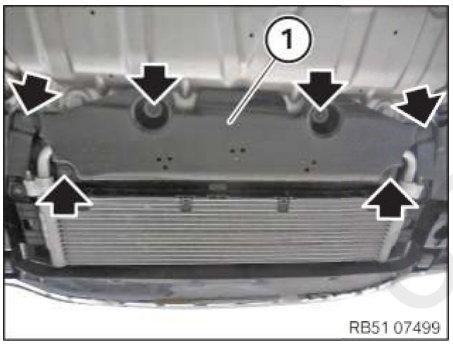
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

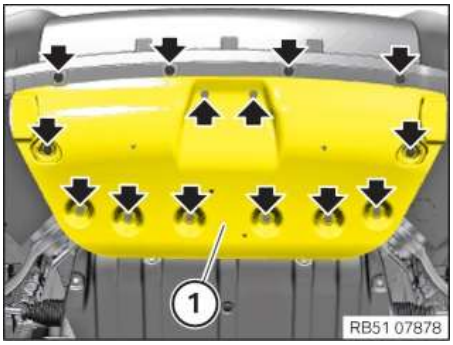
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

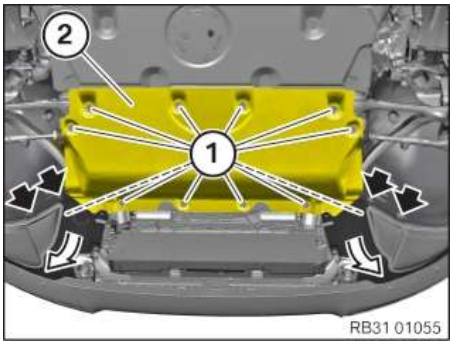


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



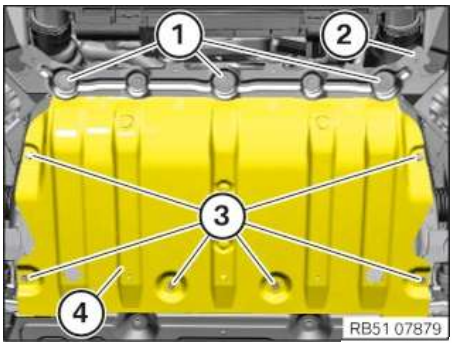
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

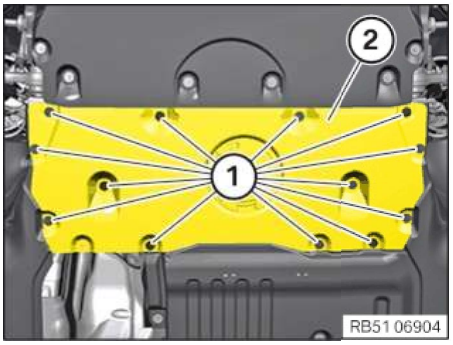
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

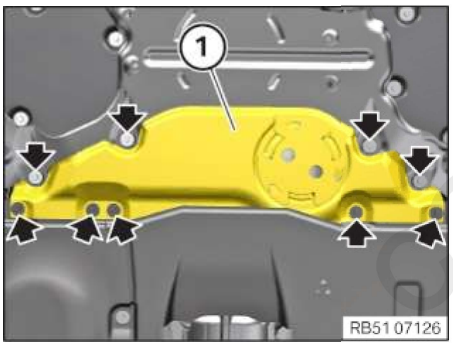
27 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

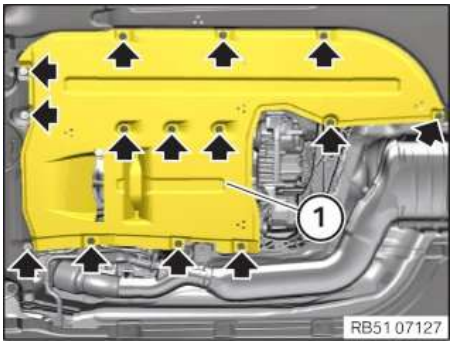


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

28 – Remove rear underbody protection

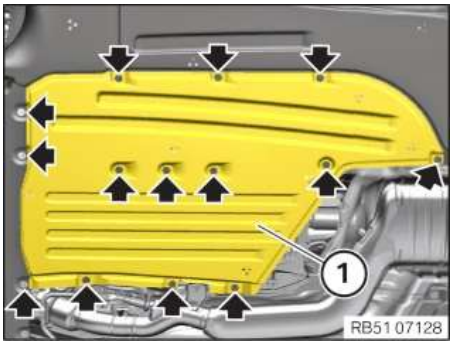


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

29 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



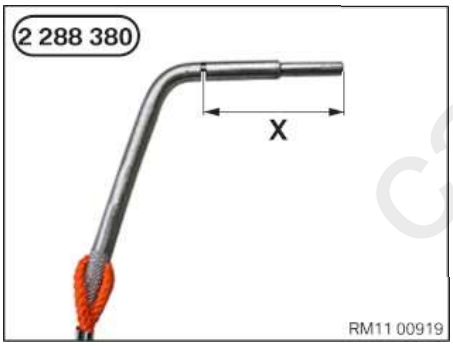
RISK OF DAMAGE

Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

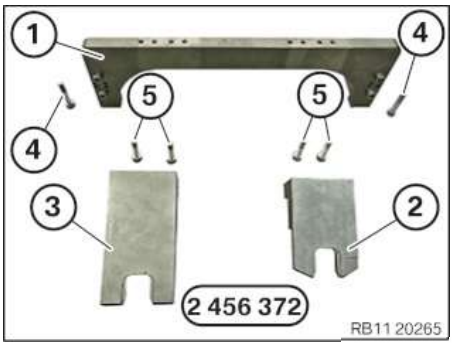
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- **Vehicles with automatic transmission:**

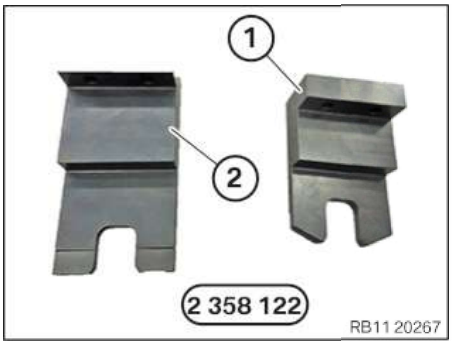
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



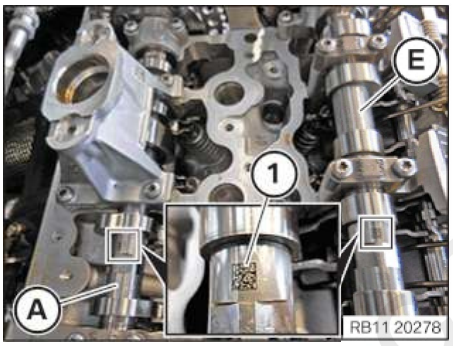
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

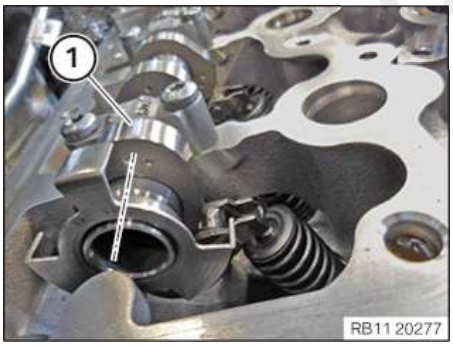


- Overview of the test gauges from the set of special tools 2 358 122:

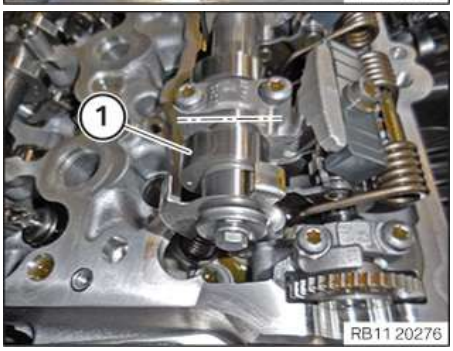
Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

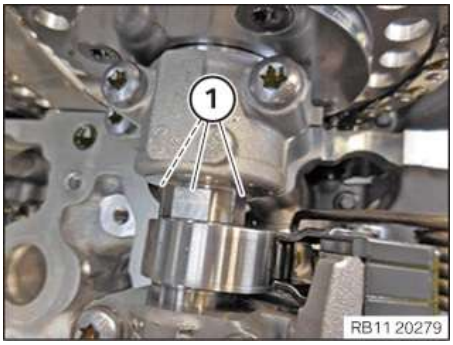


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

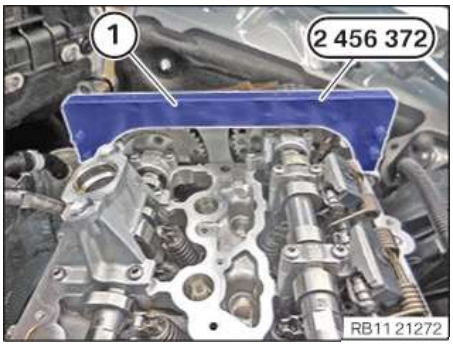


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

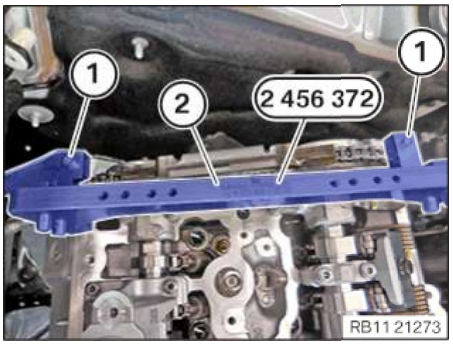
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- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



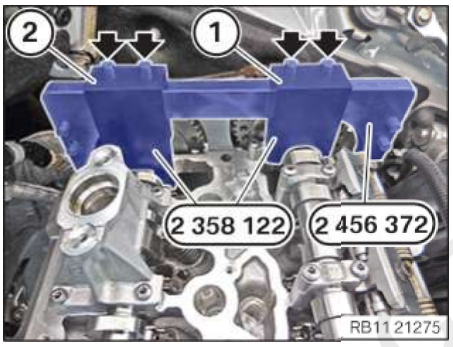
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

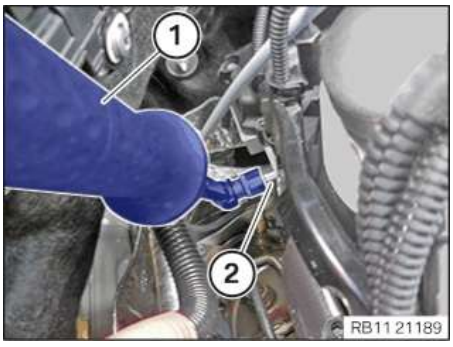
Test gauge to basic carrier

M6		Tightening torque	8 Nm

30 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).

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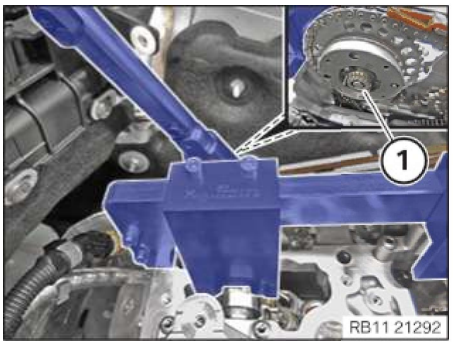
- Feed out and remove the chain tensioner (1).

MAIN WORK

31 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

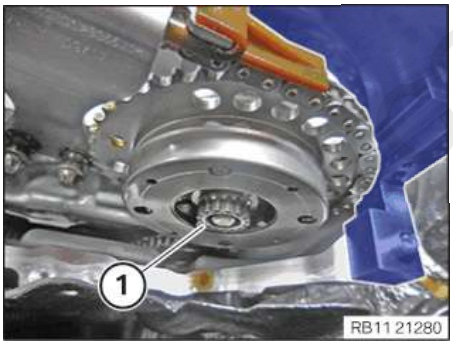


NOTICE

The figure shows the rear side of the engine.

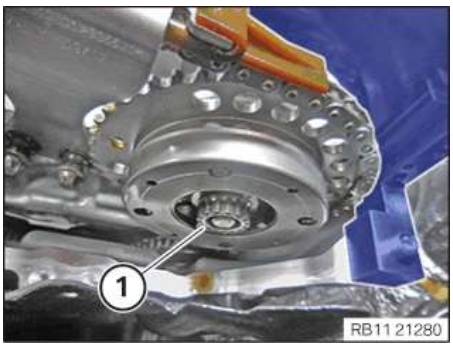
- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

32 – Remove the VANOS central valve of the exhaust camshaft adjuster

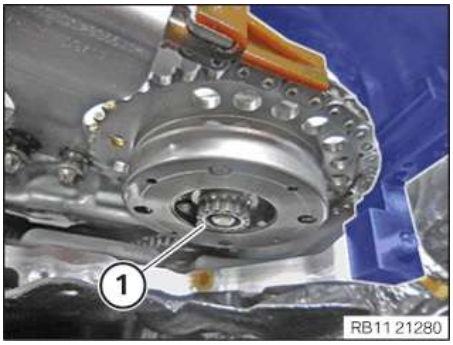


- Guide out and remove the VANOS central valve (1) of the exhaust camshaft adjuster.

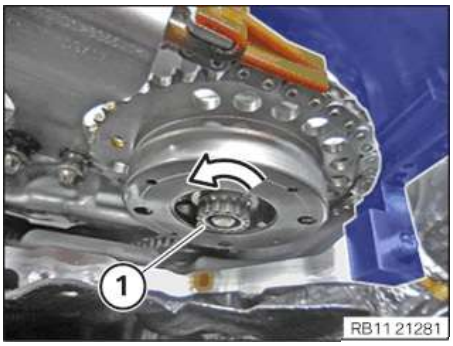
33 – Installing the VANOS central valve of the exhaust camshaft adjuster



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.



- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

34 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

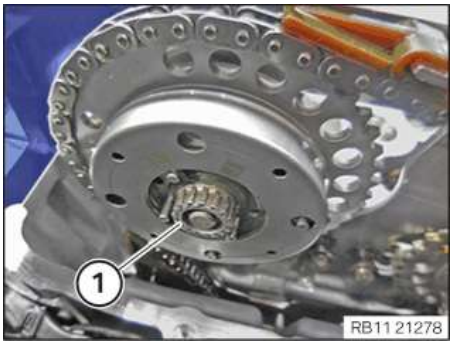


NOTICE

The figure shows the rear side of the engine.

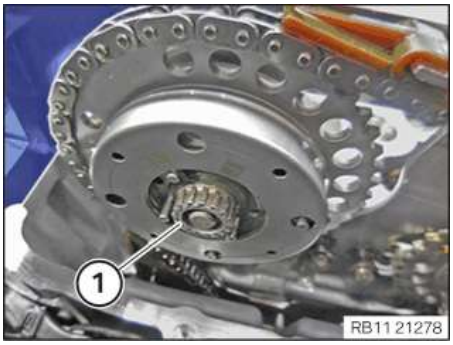
- Release the VANOS central valve (1) of the intake adjuster.

35 – Install the VANOS central valve of the intake adjuster

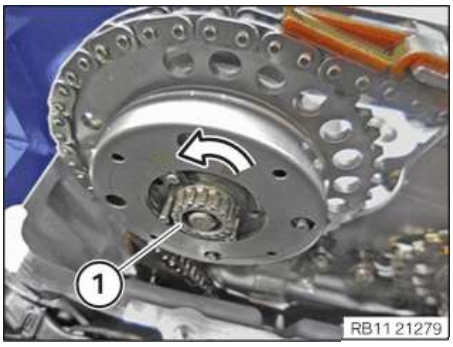


- Guide in the VANOS central valve (1) of the intake adjuster and install.

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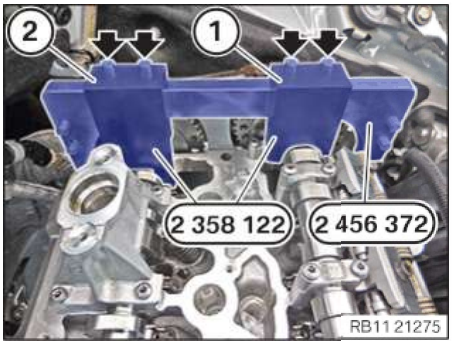


- Hand-tighten the VANOS central valve (1) of the intake adjuster.



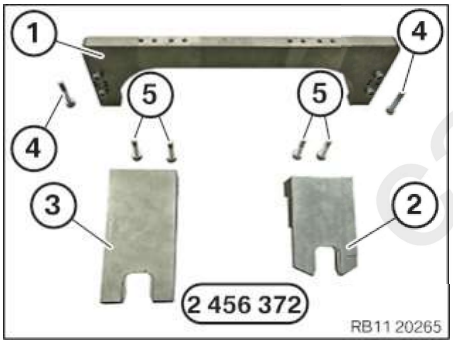
- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

36 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

37 – Adjust the camshafts with the special tool



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

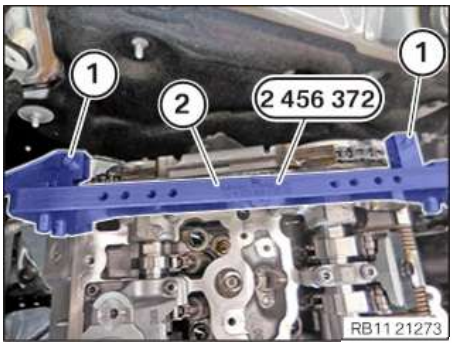


- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.

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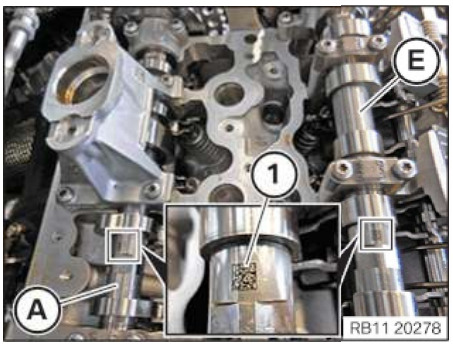
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



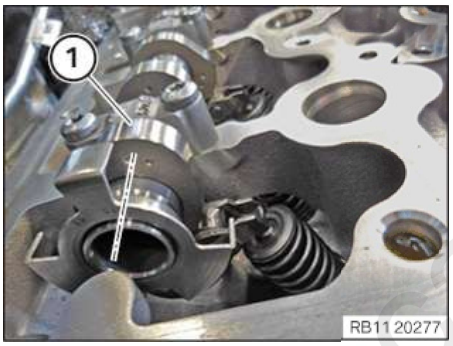
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

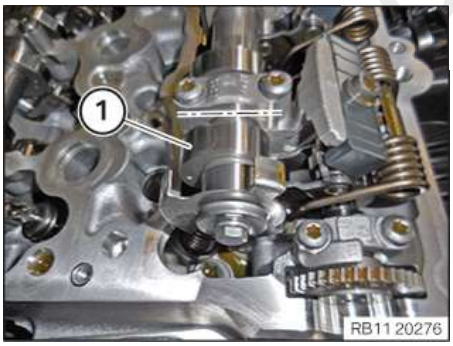
M6		Tightening torque	8 Nm



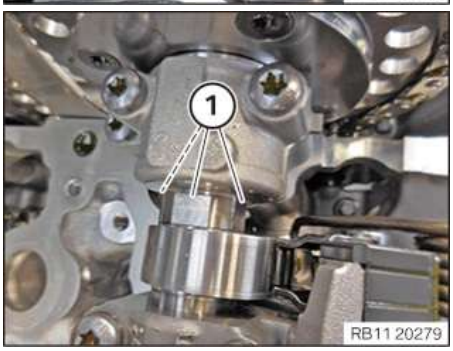
- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

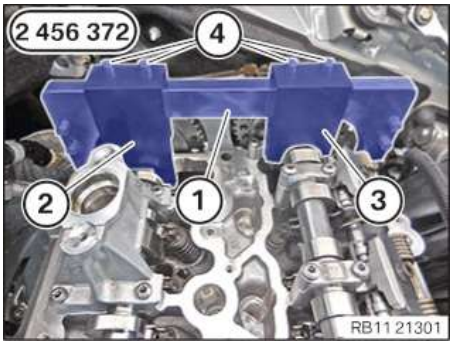


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.

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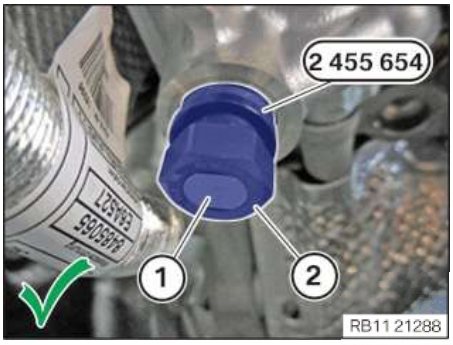


- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

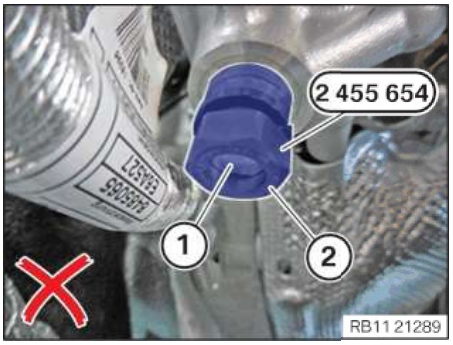
M6		Tightening torque	8 Nm

38 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

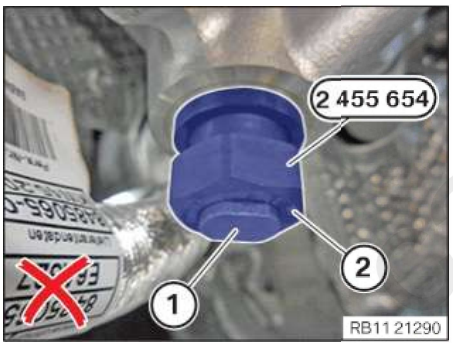
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

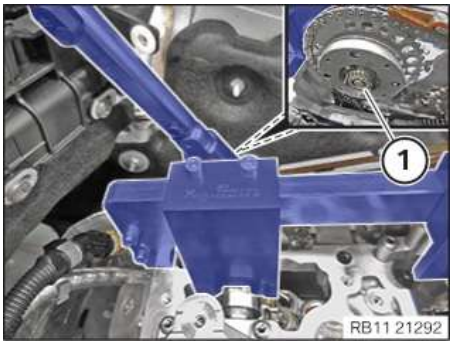
  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

39 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

40 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



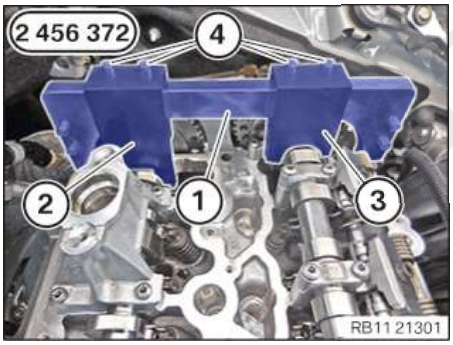
- Tighten the VANOS central valve (1) of the intake adjuster.

VANOS central valve to camshaft

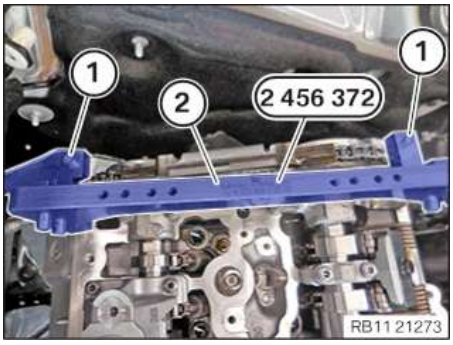
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

POSTPROCESSES

41 – Disassembling all special tools

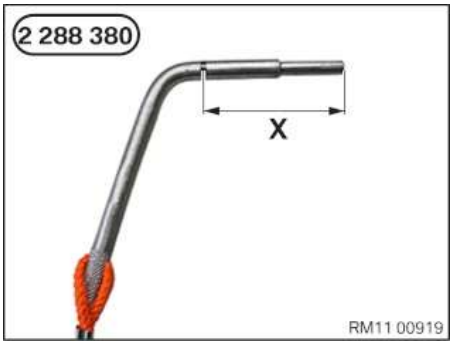


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.



- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.

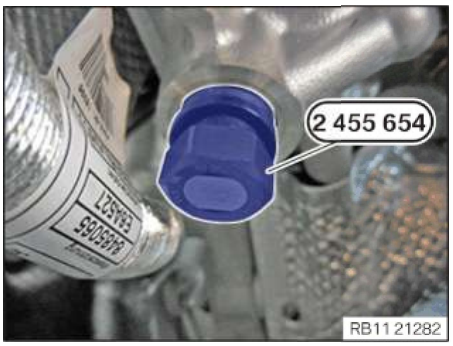
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- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

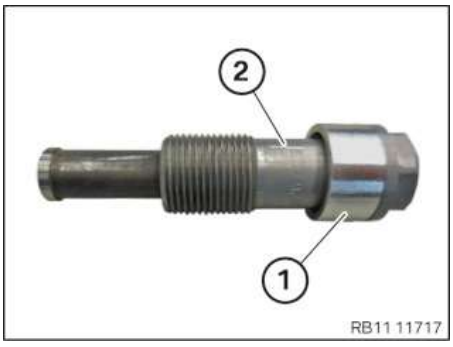
42 – Install chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.



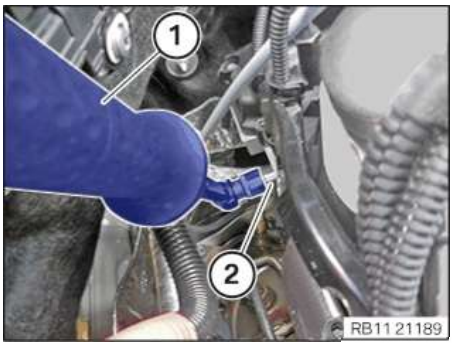
- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.

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- Insert and install the chain tensioner (1).

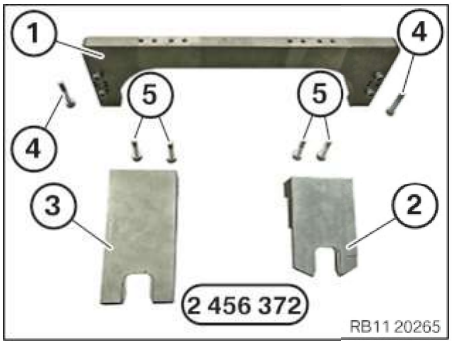


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

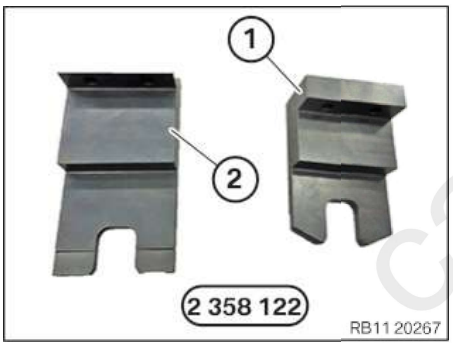
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

43 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft



RISK OF DAMAGE

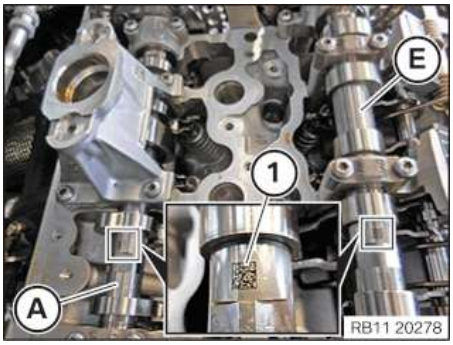
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

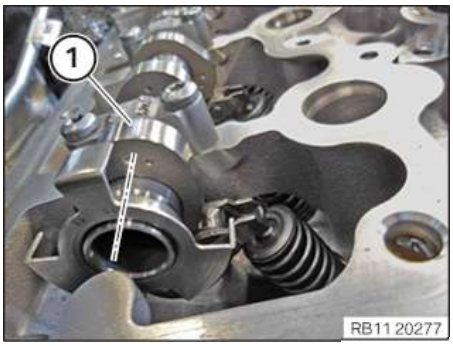
- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

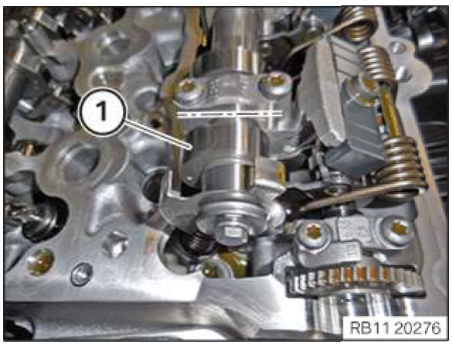
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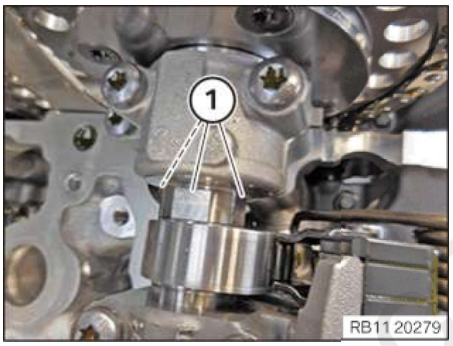
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



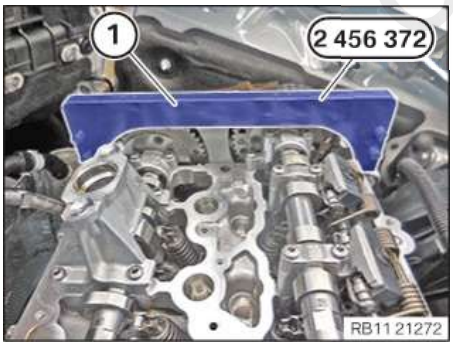
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



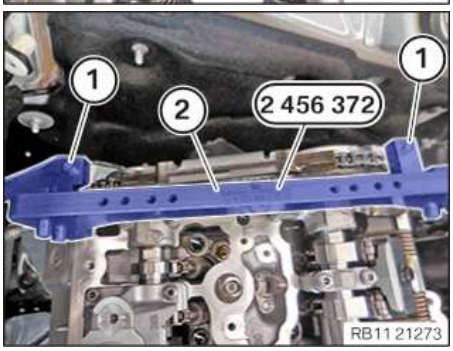
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.



- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.

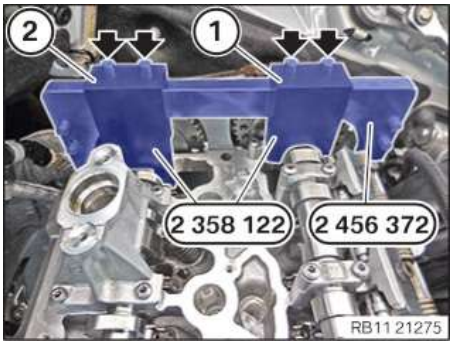


- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm

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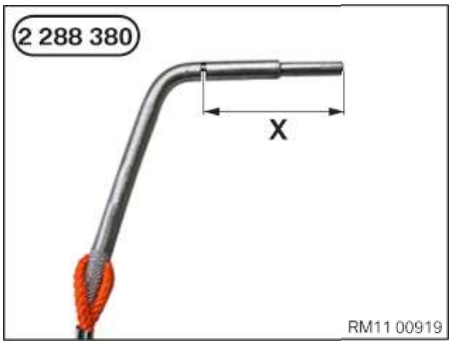
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

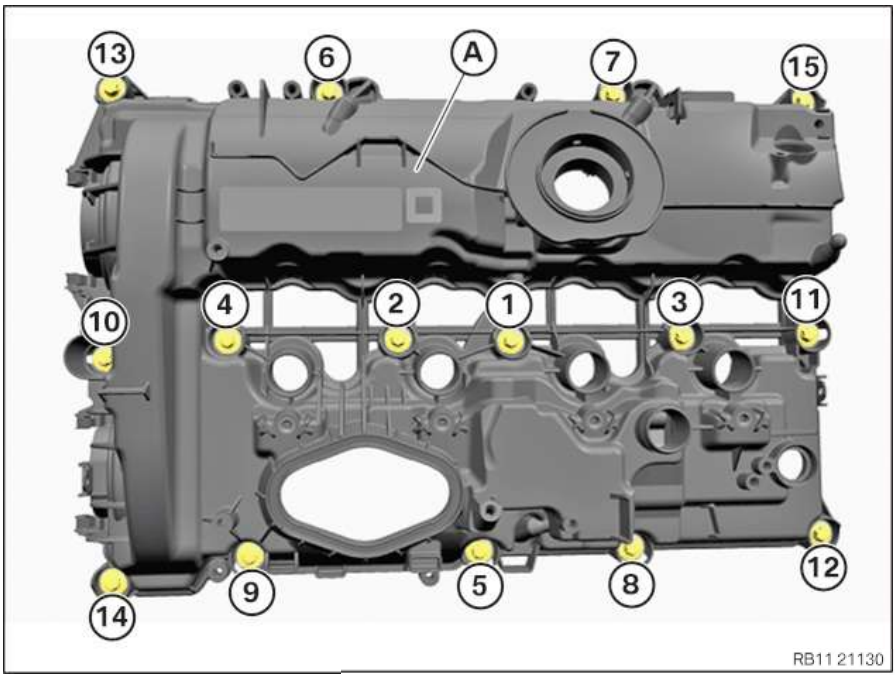
  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

44 – Installing cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

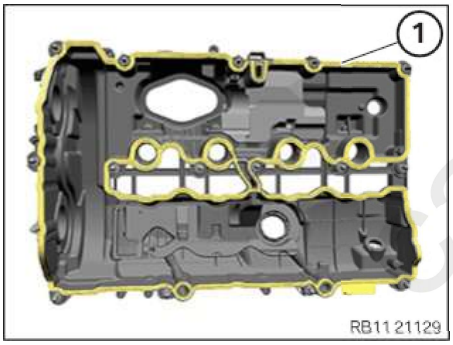
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

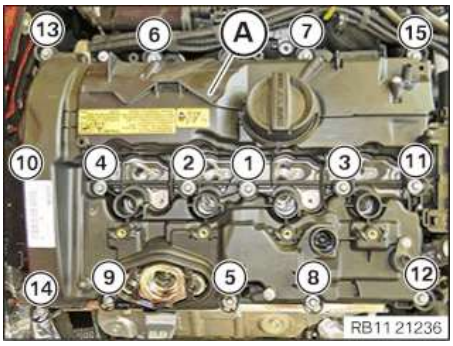
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

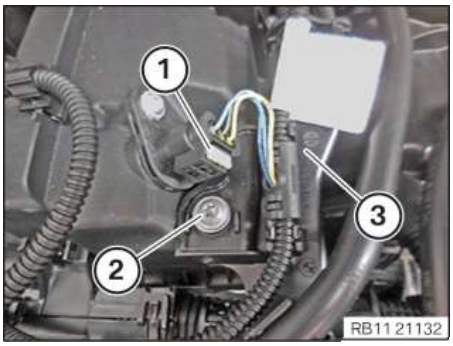
Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

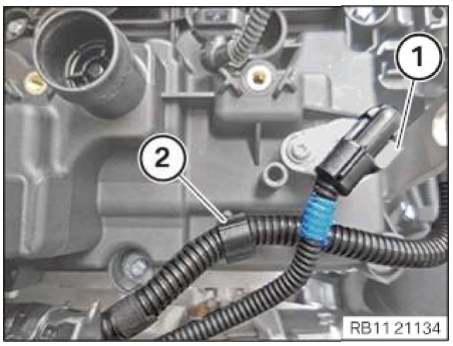


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

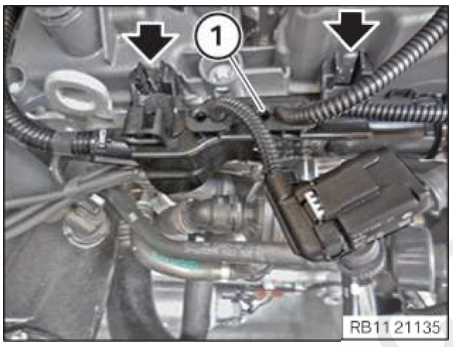
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

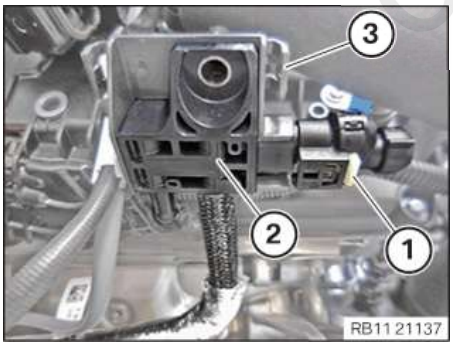
- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.



- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

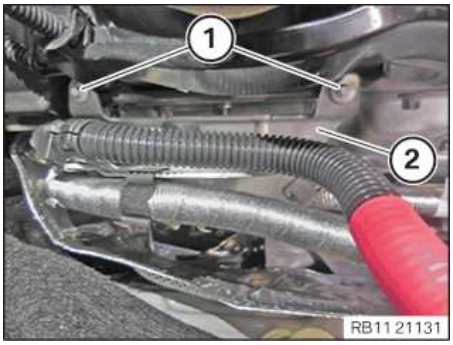


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

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CAUTION

Improper routing of the positive battery cable.

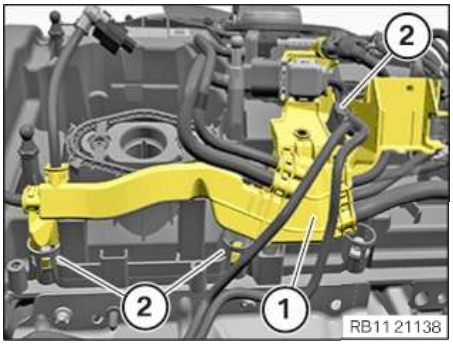
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

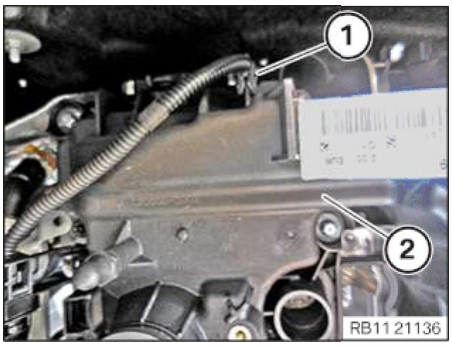
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

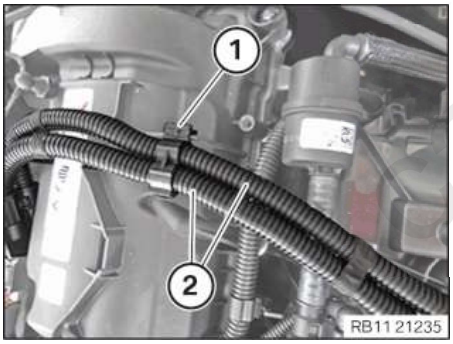
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.

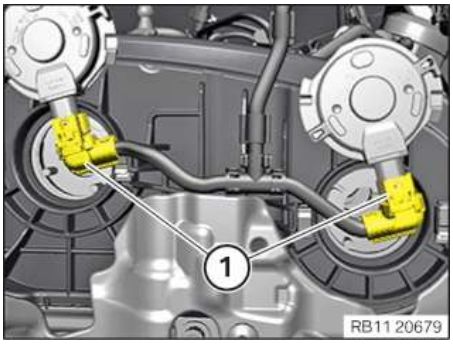


- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

45 – Installing both actuators

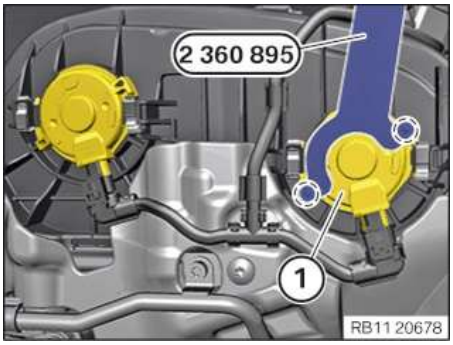


NOTICE

The figure shows the rear side of the engine.

- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.

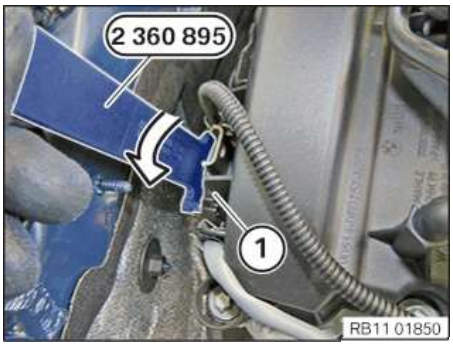
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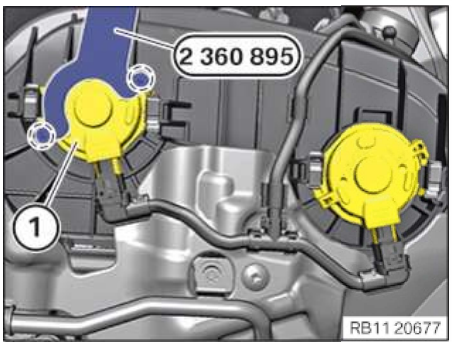
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



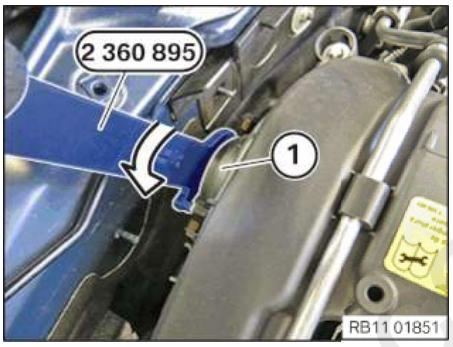
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

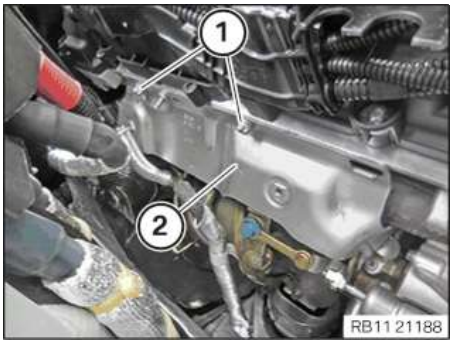
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

46 – Installing the heat shield on the cylinder head

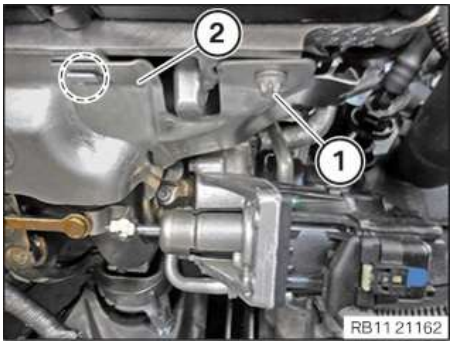


- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

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- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

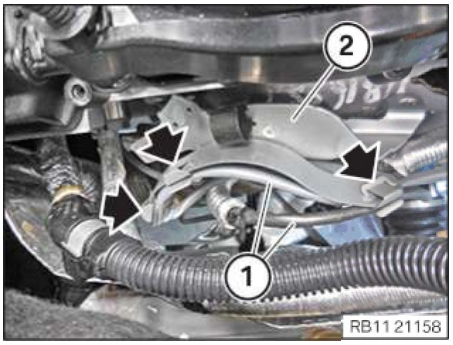


- Tighten down screw (1).

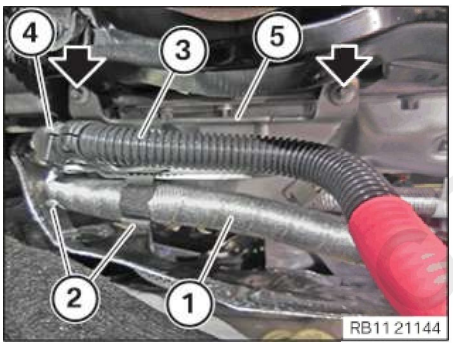
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

47 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

48 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

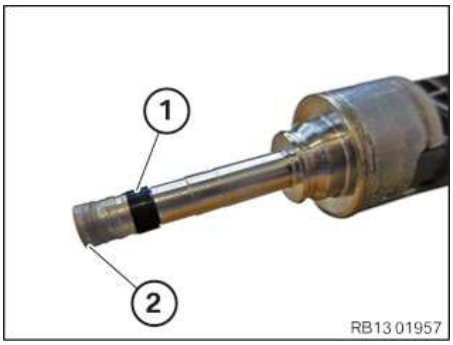
- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

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TECHNICAL INFORMATION

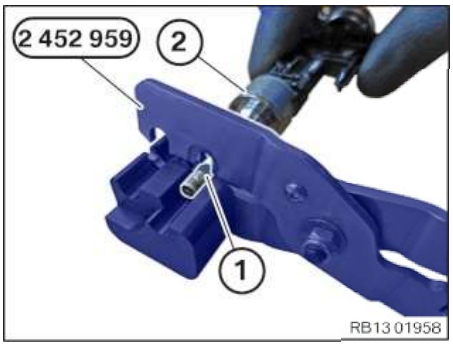
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

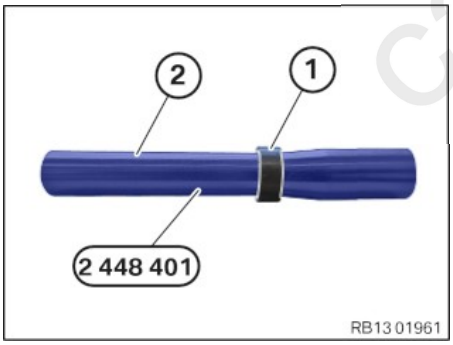


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

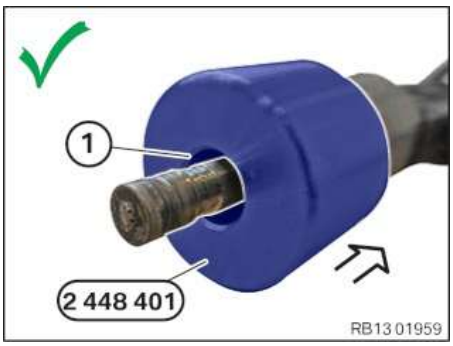
  (1) Installation cone

  (2) Sliding sleeve

  (3) Assembly sleeve



- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

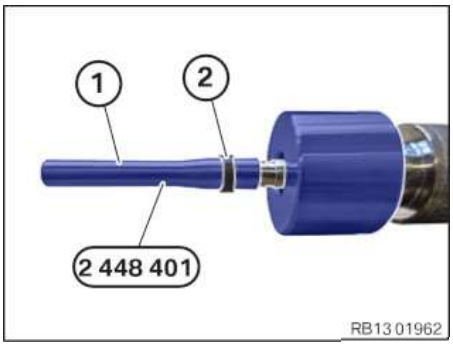
  The larger diameter of the assembly sleeve (1) must point to the injector tip.

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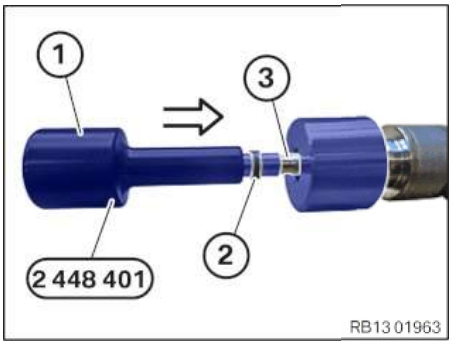


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

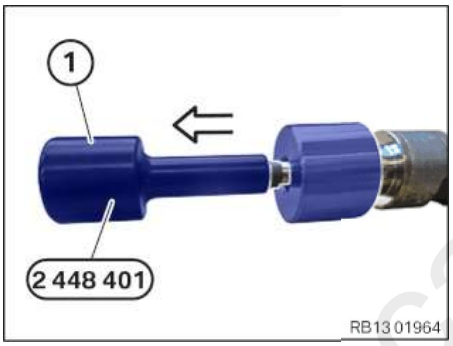
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



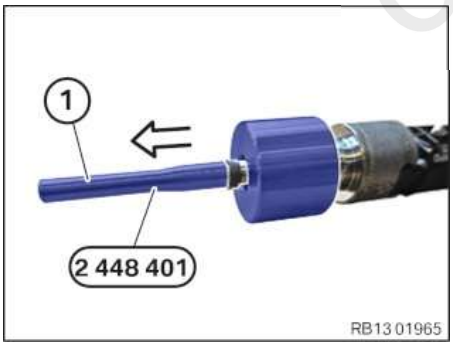
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



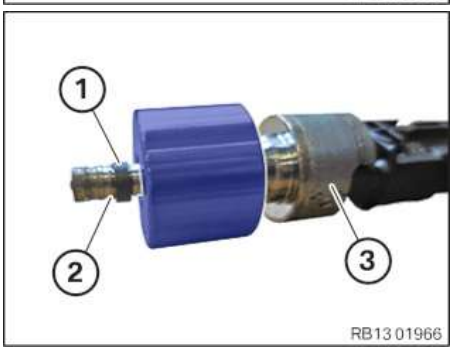
- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.



- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

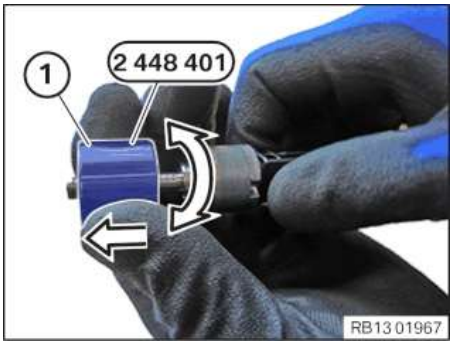


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.



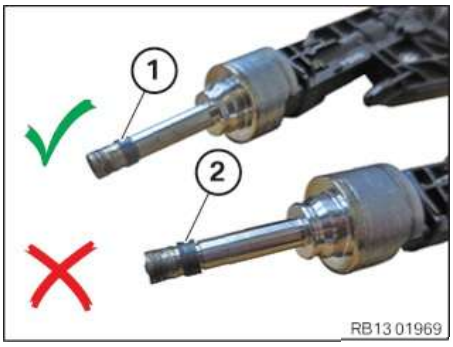
- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.

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- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

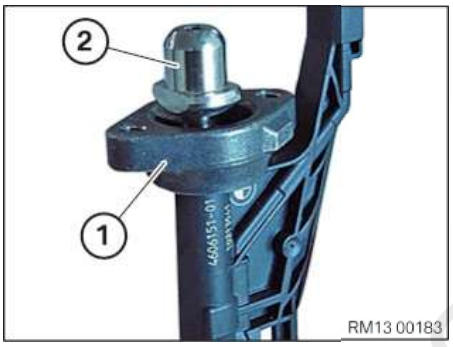


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

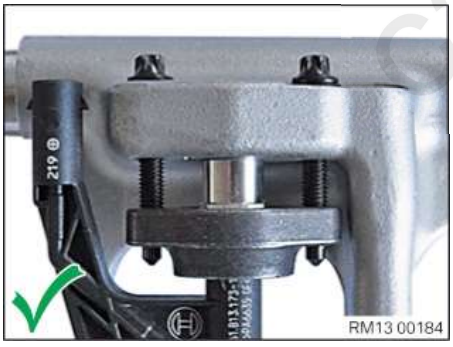
49 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.

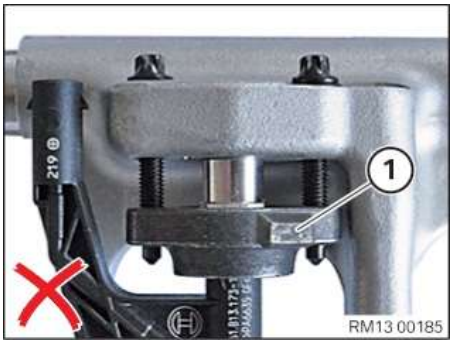


- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

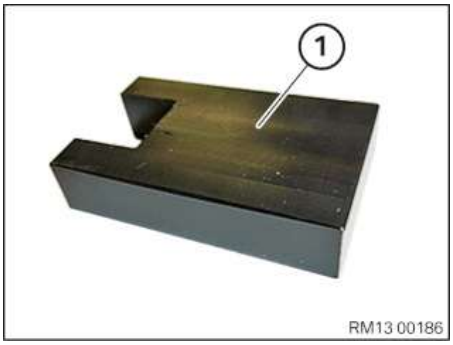
  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.

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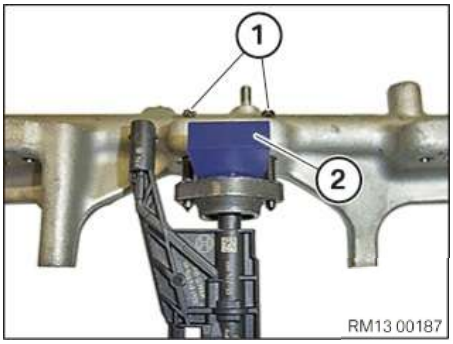
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)

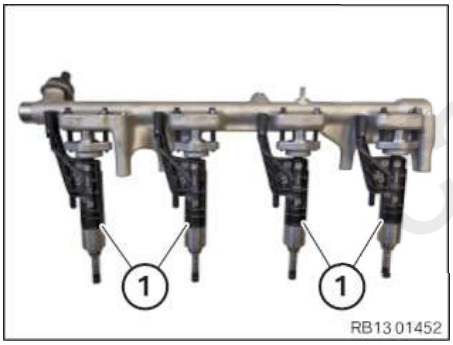
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.

- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



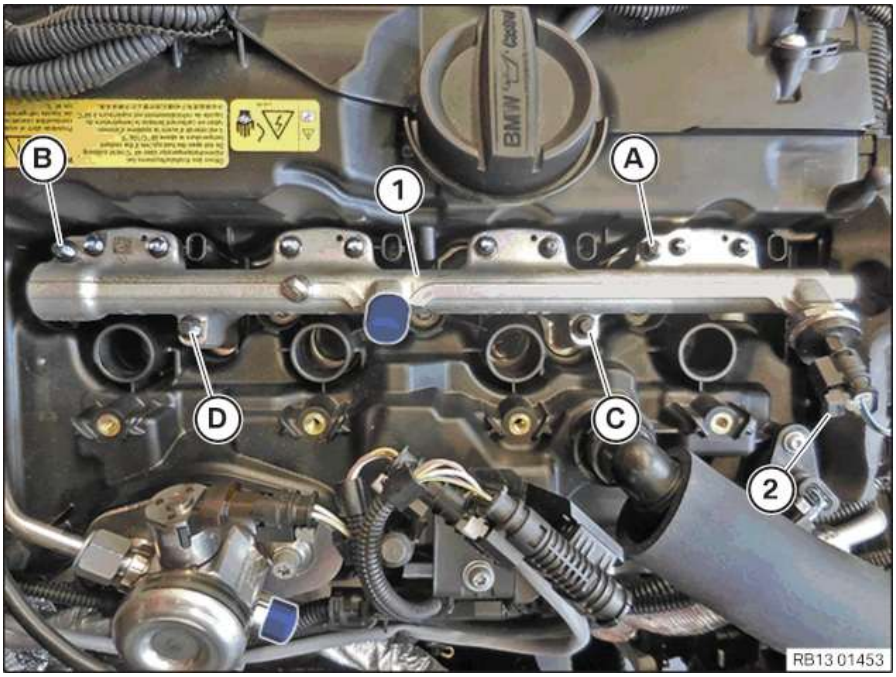
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

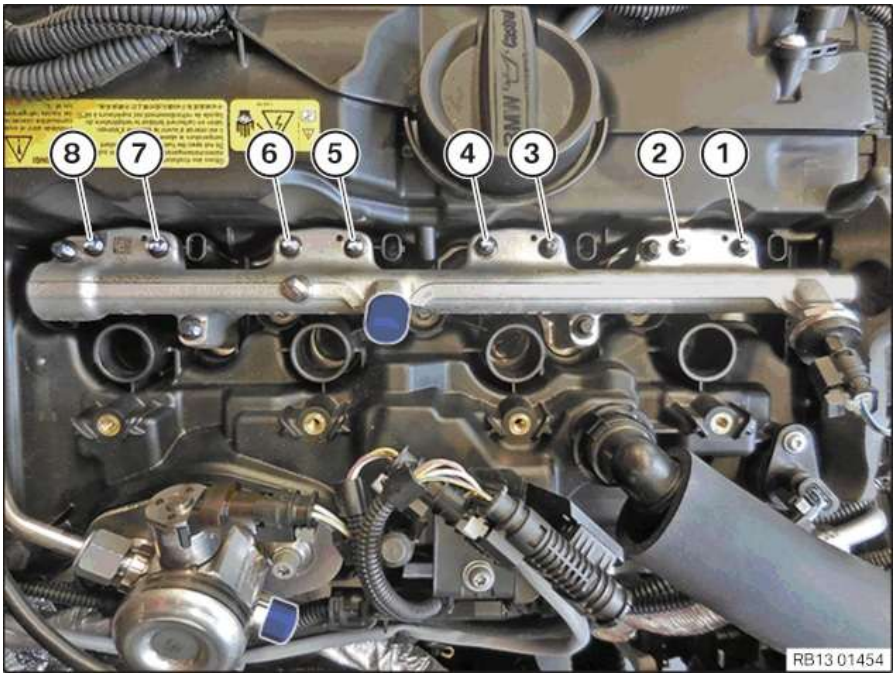
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

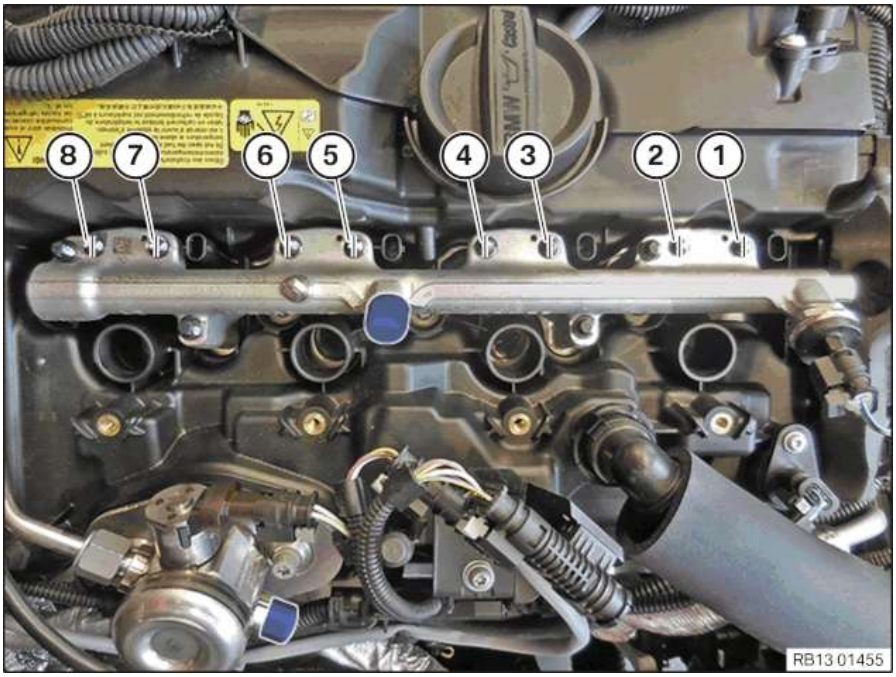
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

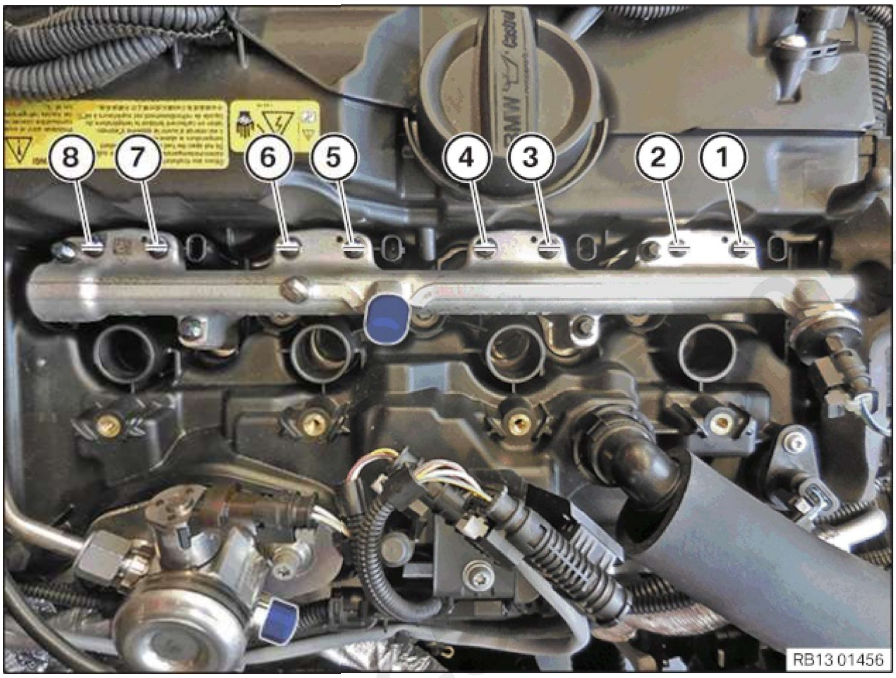
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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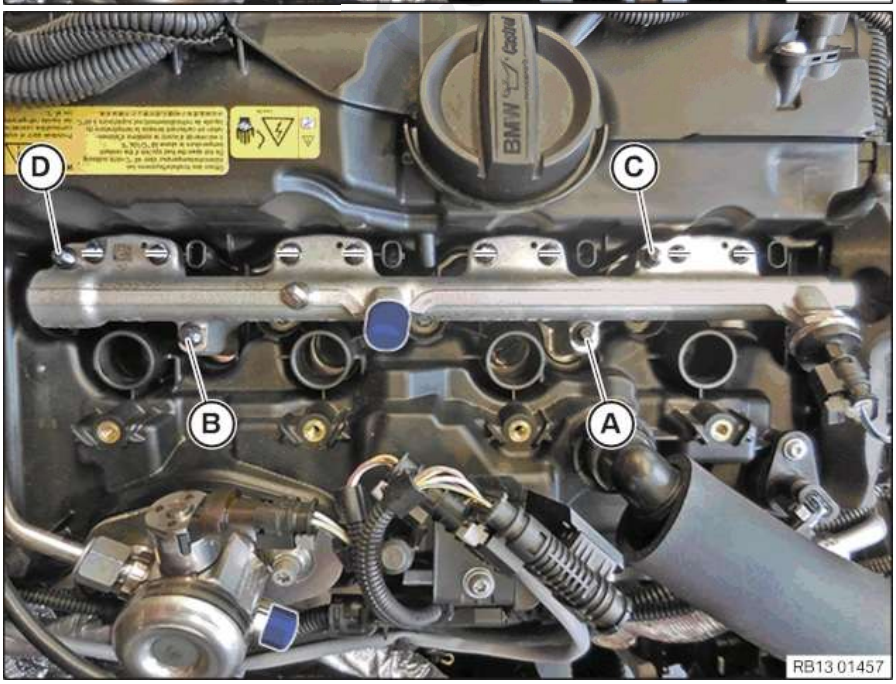


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

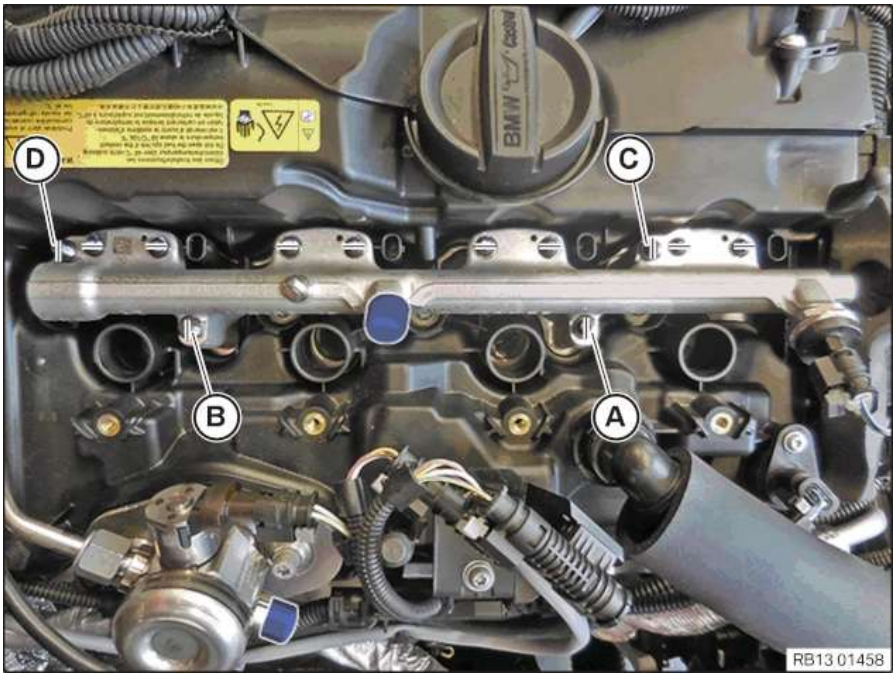
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

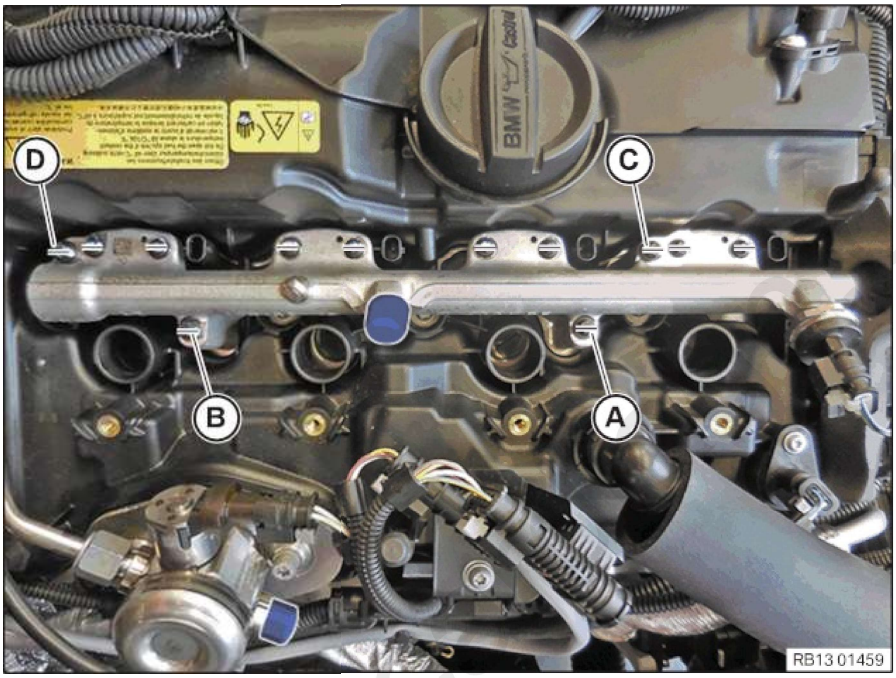
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

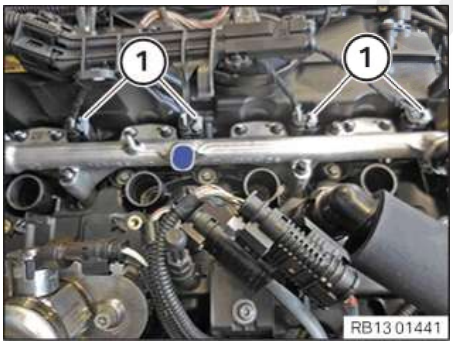


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



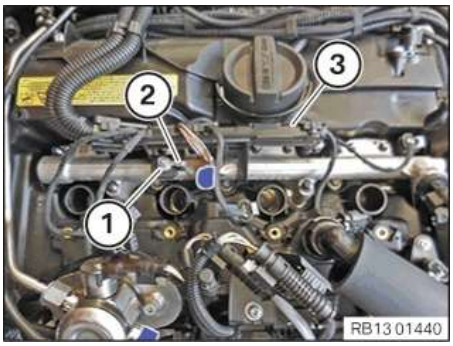
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

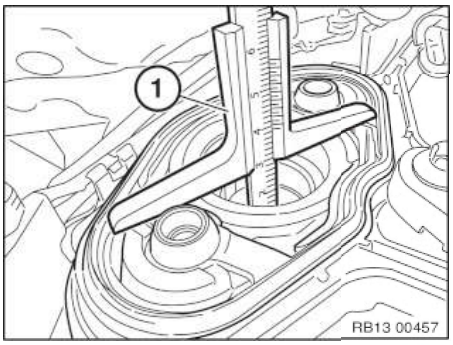
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

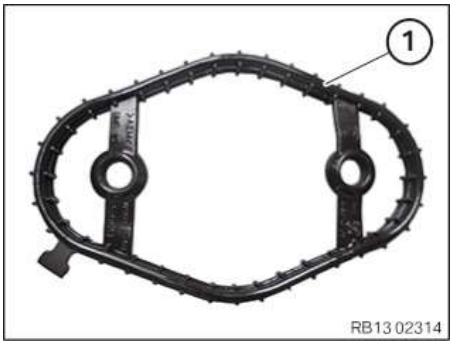
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

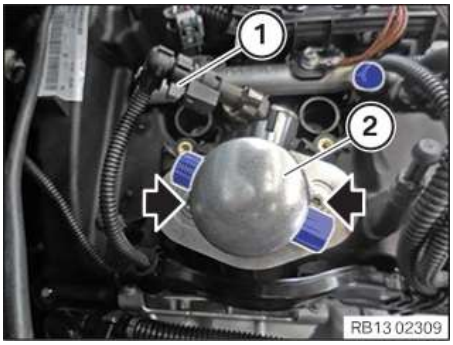
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

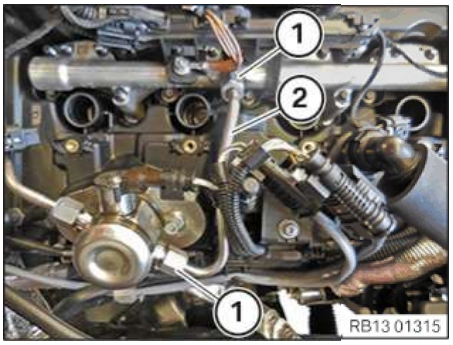
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

51 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

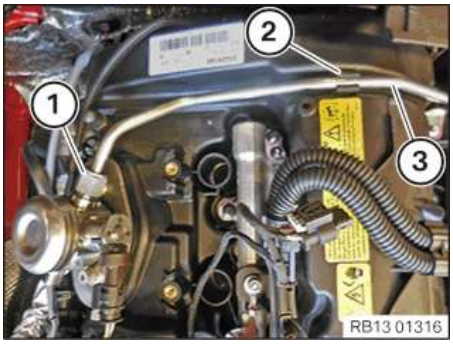
52 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

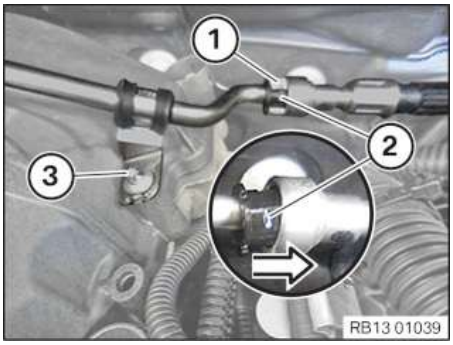


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

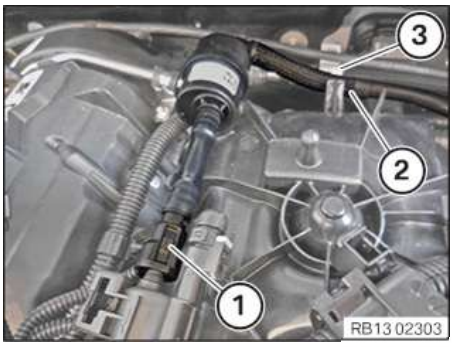
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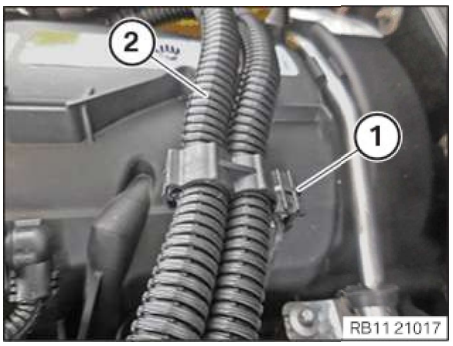
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

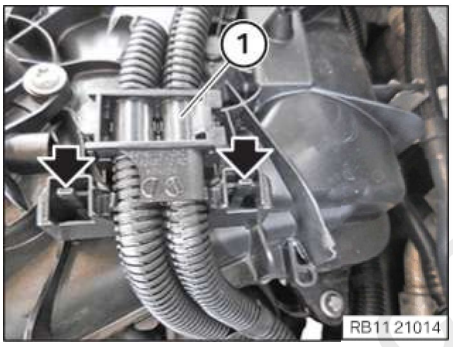
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

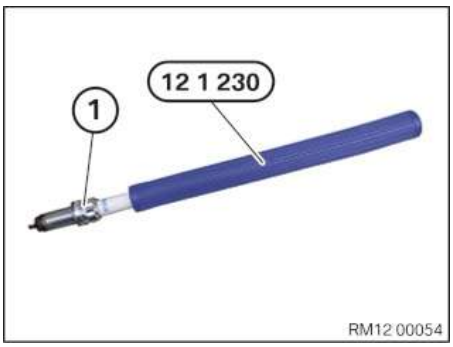


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

53 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

Spark plugs

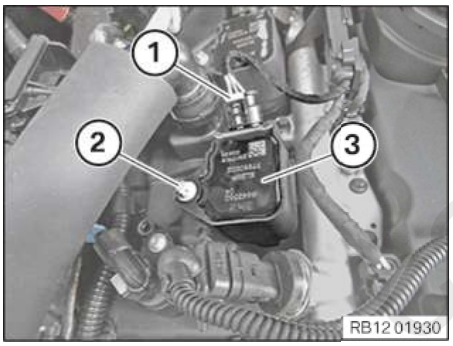
M12x1.25		Tightening torque	23 Nm

54 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



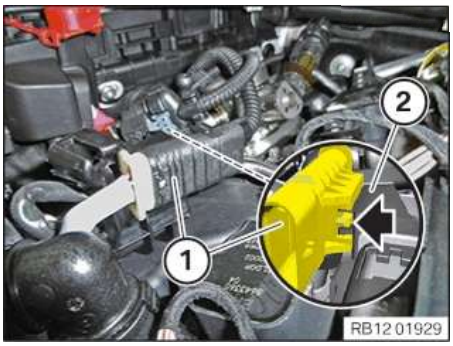
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

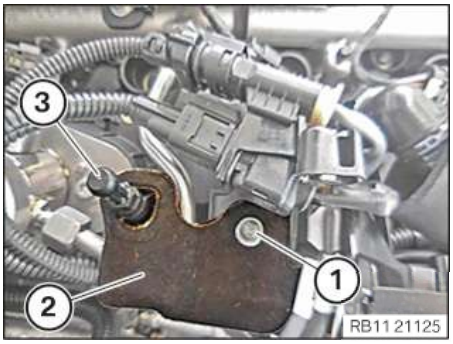
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

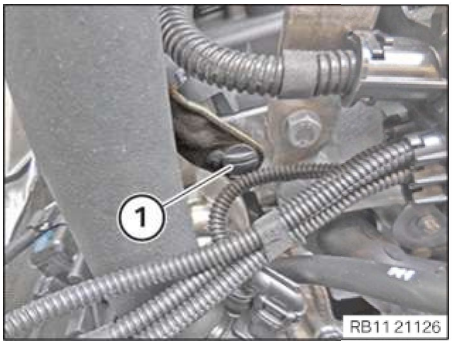
55 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

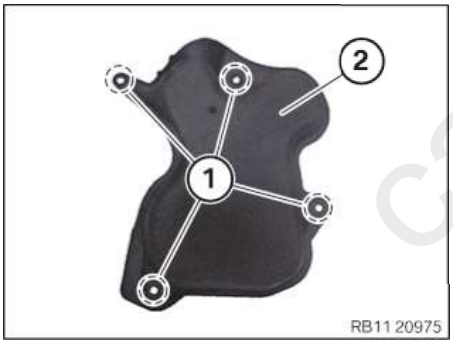
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



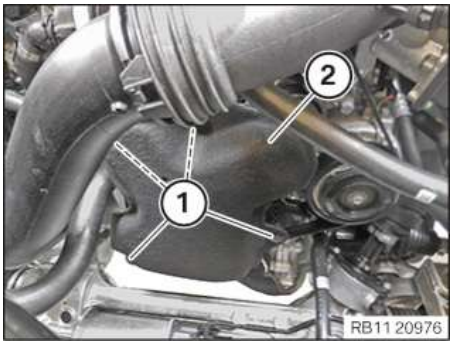
- Secure the clip (1).

56 – Install the acoustic cover for the engine at the front



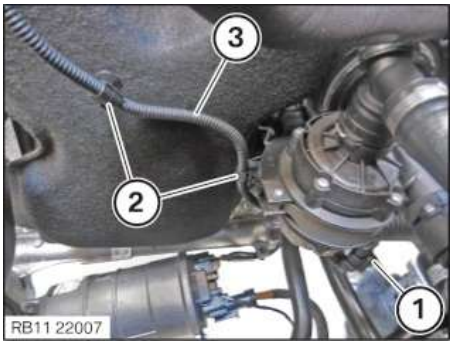
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



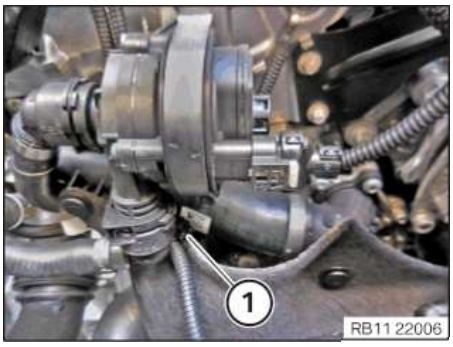
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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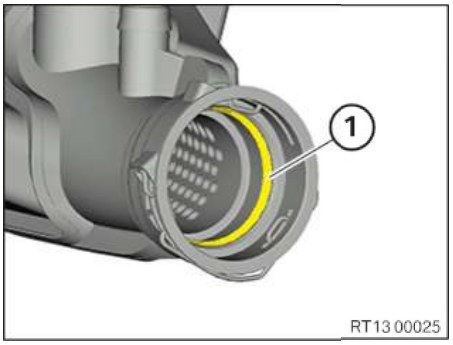
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

57 – Installing the clean air pipe with resonator

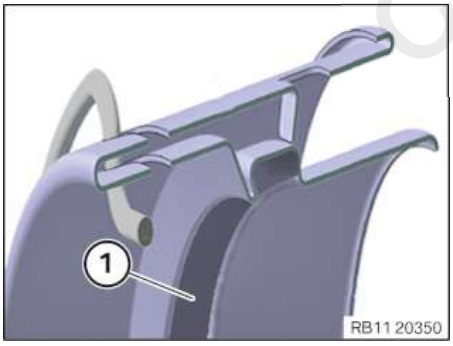


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

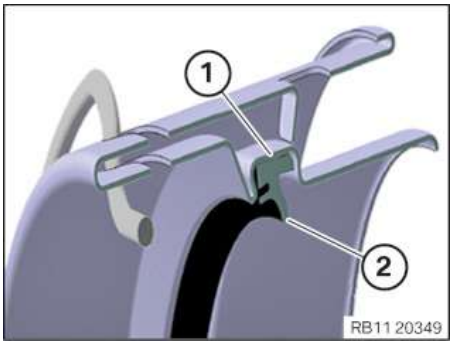
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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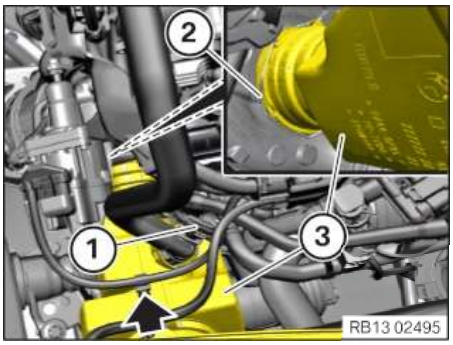
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

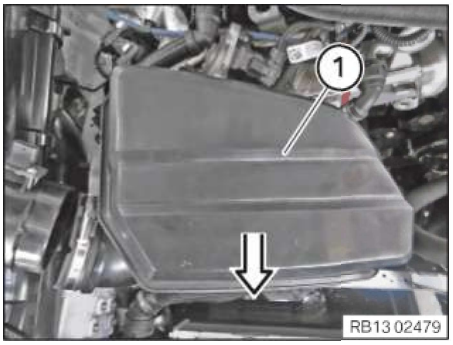
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



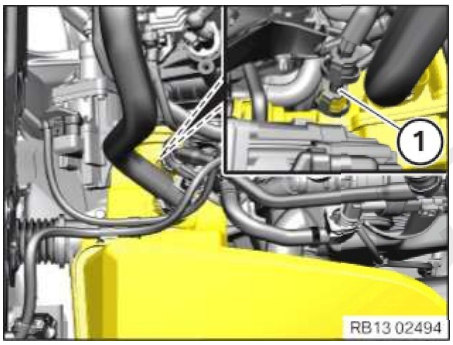
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

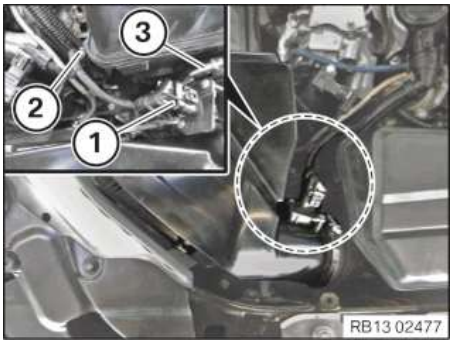
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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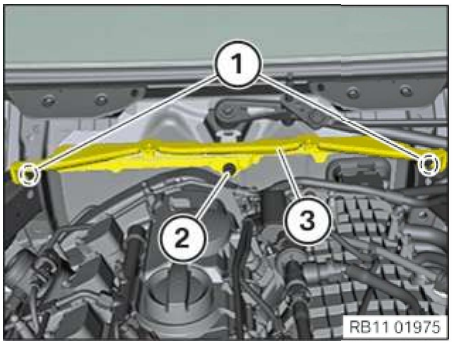
- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

58 – Disconnecting all battery earth leads



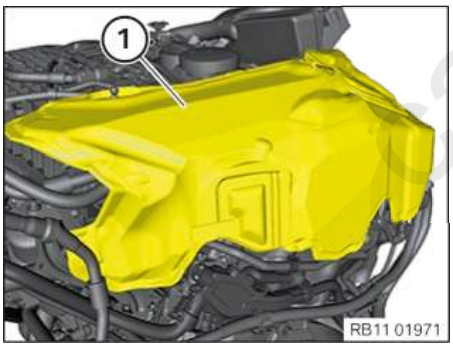
- See additional information.

59 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

60 – Installing acoustic cover at rear



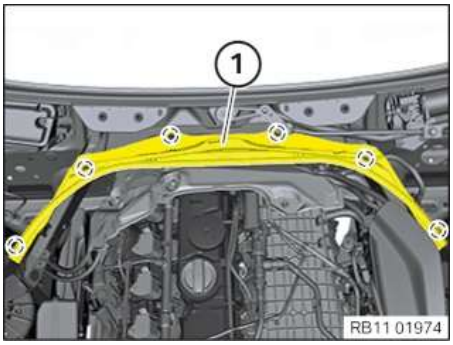
- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

61 – Installing the centre bulkhead upper part

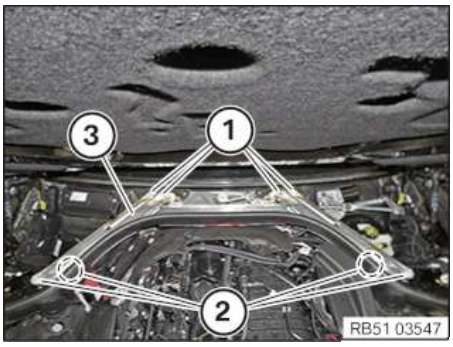
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- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

		Tightening torque	3 Nm



- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

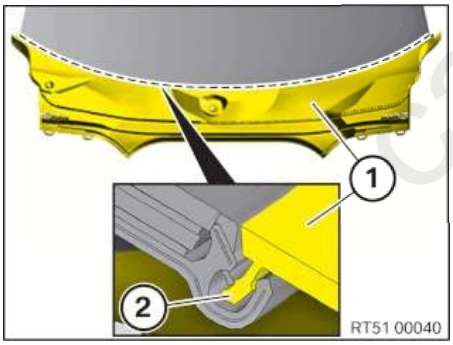
62 – Installing cowl panel cover

RISK OF DAMAGE

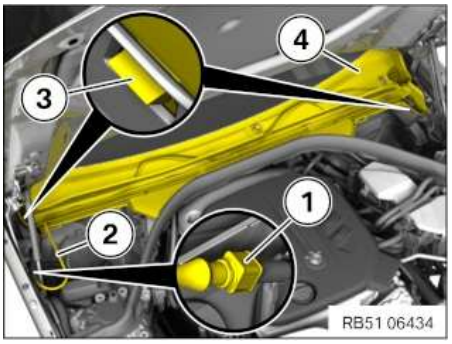
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

63 – Installing both wiper arms

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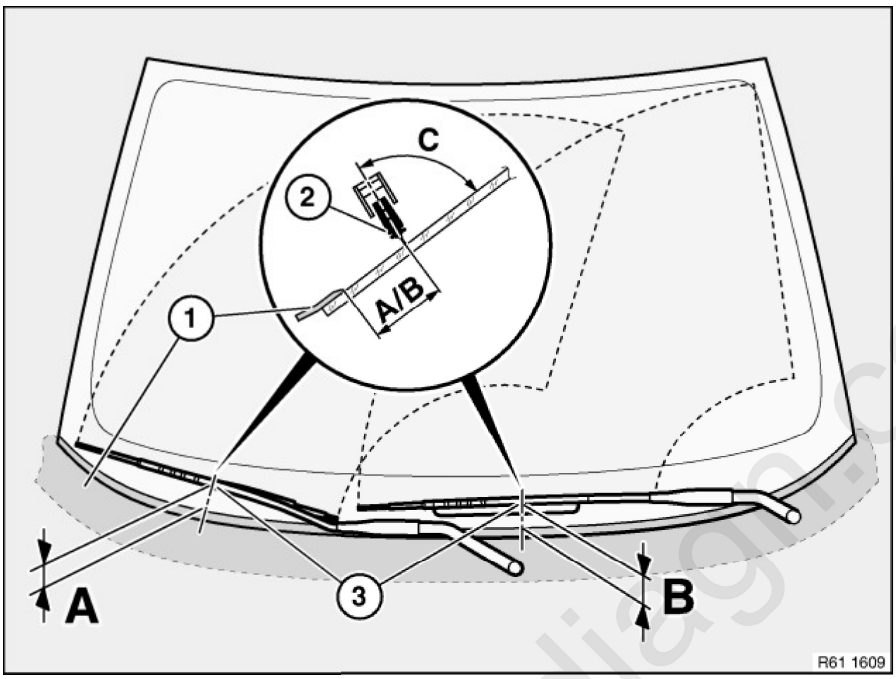
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

TECHNICAL INFORMATION

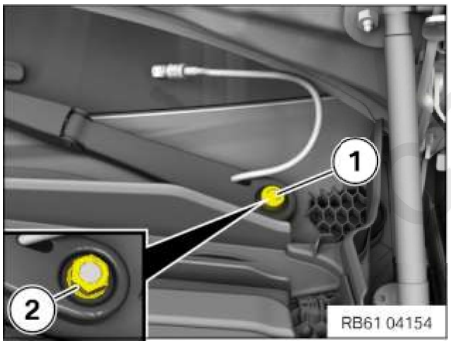
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

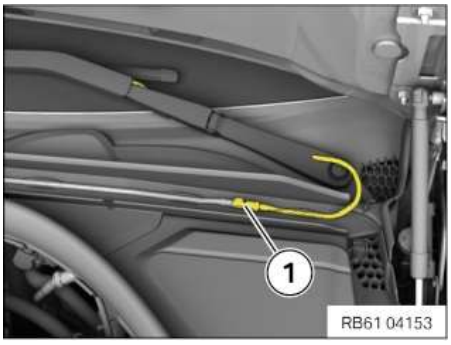


- Tighten nut (2).

Windscreen wiper arm

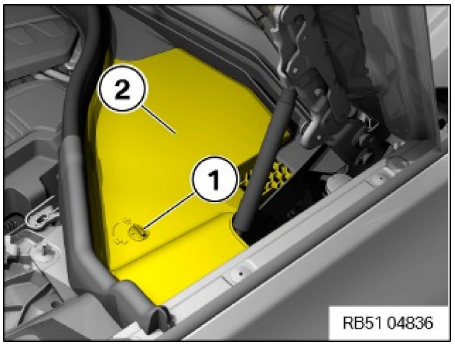
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



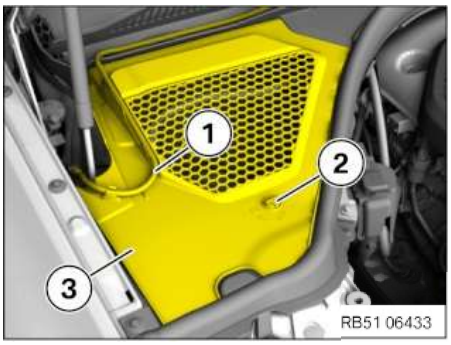
- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

64 – Install the cover of the engine compartment on the rear left



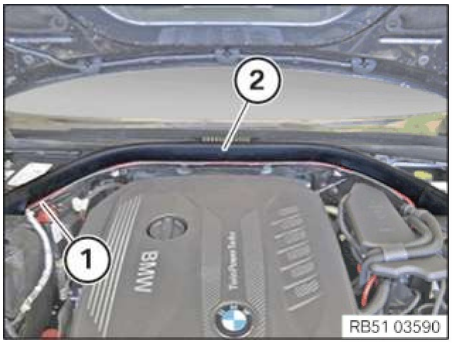
- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

65 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

66 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

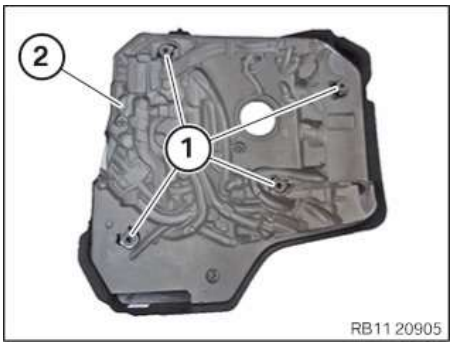
67 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

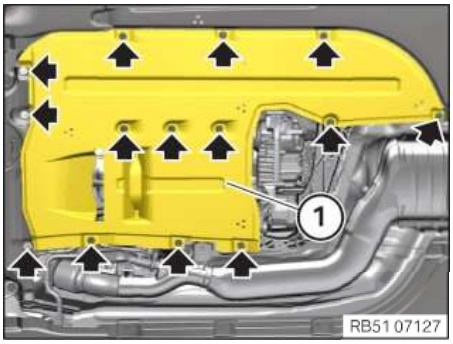
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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

68 – Installing underbody protection at rear



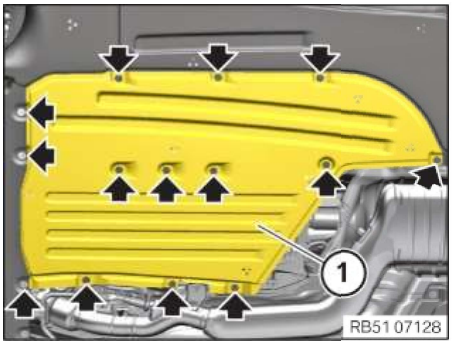
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

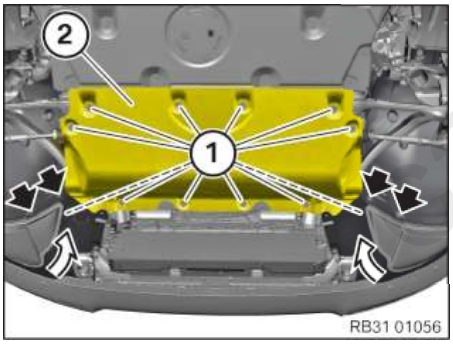
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

69 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

Underbody protection of the steering gear

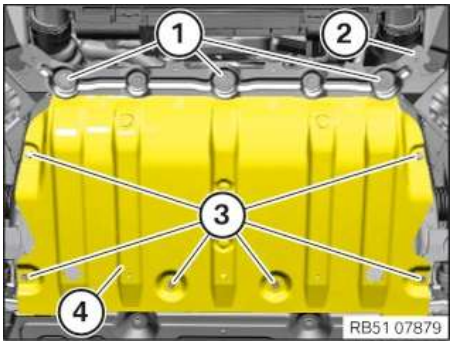
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm

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- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

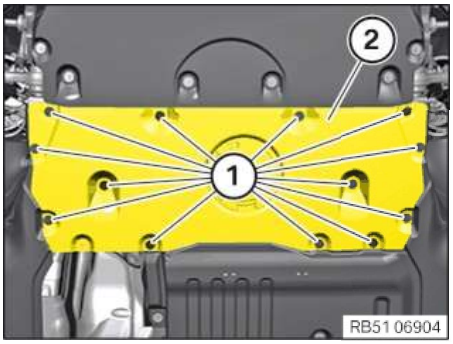
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

70 – Installing the centre underbody protection



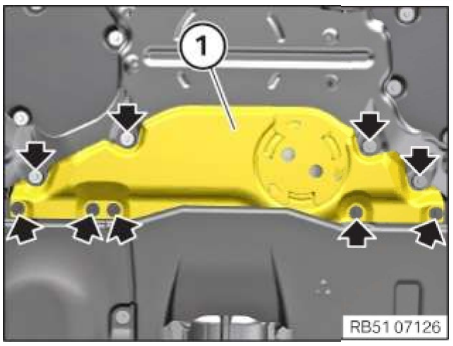
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

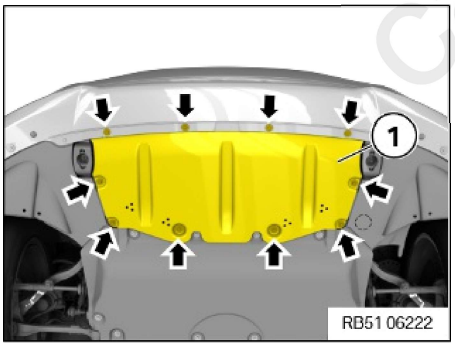
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

71 – Installing the front underbody protection



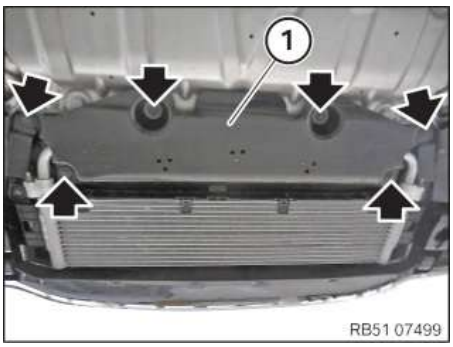
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 2:**

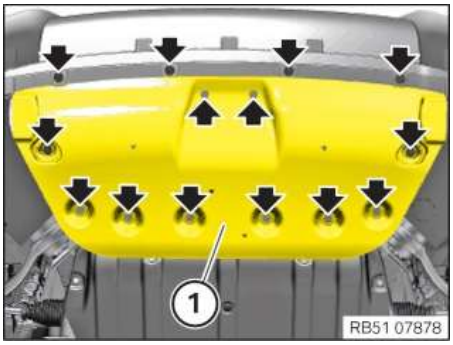
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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- **Version 3:**

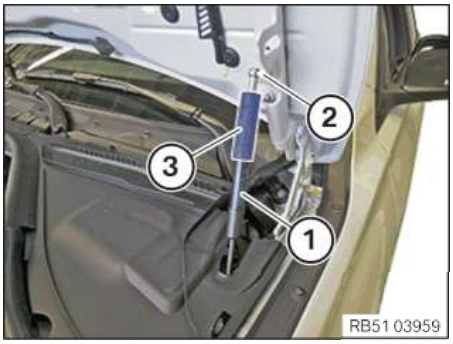
  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

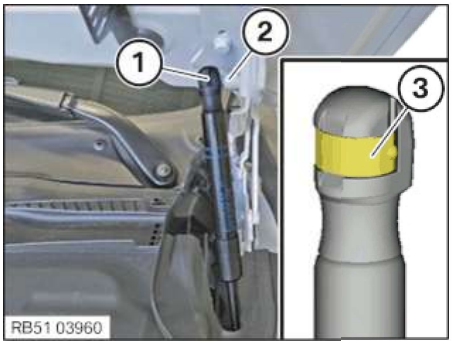
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

72 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Basic carrier to cylinder head — Used in step 293743

M6		Tightening torque	8 Nm

Test gauge to basic carrier — Used in step 293743

M6		Tightening torque	8 Nm

VANOS central valve to camshaft — Used in step 3940

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 42

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Cylinder head cover to cylinder head — Used in step 44

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

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Wiring harness section of engine to cylinder head cover — Used in step 44

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 4447

6X18		Tightening torque	6 Nm

Heat shield to cylinder head — Used in step 46

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 46

M6 x 12		Tightening torque	8 Nm

Ground cable to rail — Used in step 49

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 50

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 51

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 52

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 52

M6 screw		Tightening torque	6,5 Nm

Spark plugs — Used in step 53

M12x1.25		Tightening torque	23 Nm

Ignition coil — Used in step 54

Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover — Used in step 55

TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 57

Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead — Used in step 61

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 61

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 61

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm — Used in step 63

Combination hexagon nut		Tightening torque	35 Nm

Underbody protection — Used in step 6870

Hexagon screw		Tightening torque	3 Nm

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Underbody protection of the steering gear — Used in step 69

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 69

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 69

M10		Tightening torque	56 Nm

Underbody protection front — Used in step 71

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

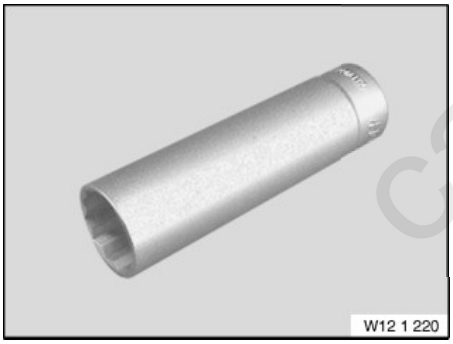
2 360 895 Pin wrench



Common — Used in step 1245

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

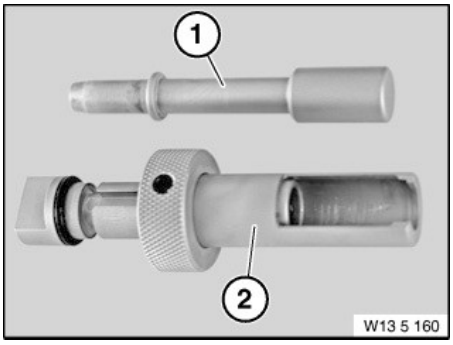
0 495 560 (12 1 220) Socket



Common — Used in step 1653

Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

0 496 567 (13 5 161) Fastener

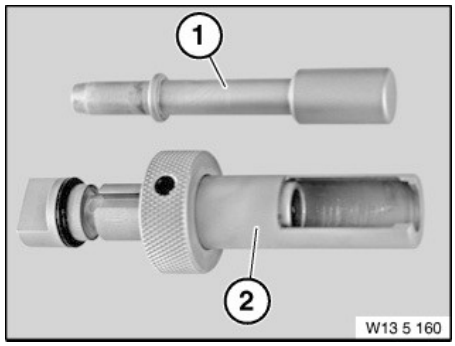


Common — Used in step 19

Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 568 (13 5 162) Fastener

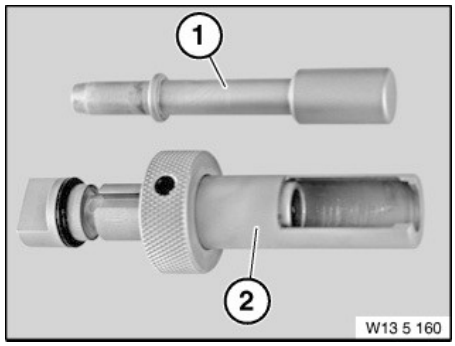


Common Used in step 19

Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 565 (13 5 160) Fastener



Common Used in step 19

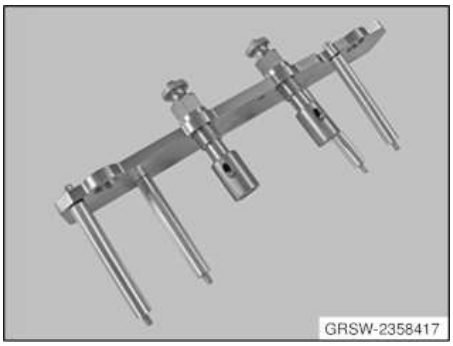
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

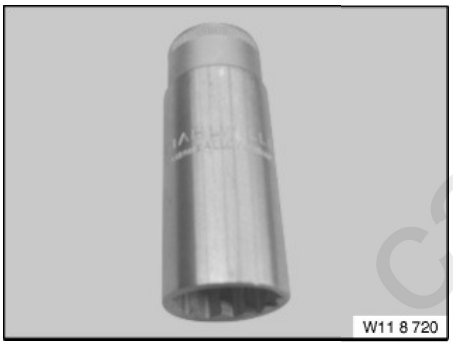
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2 358 417 Device



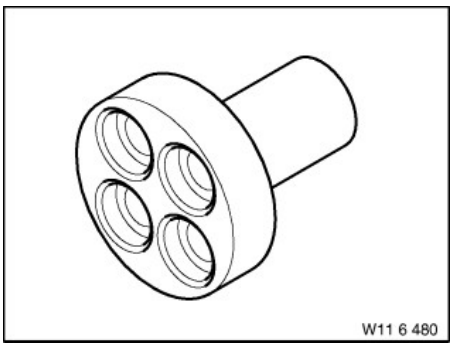
Common	Used in step 20
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 20
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

0 493 380 (11 6 480) Connector



Common	Used in step 29414350
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

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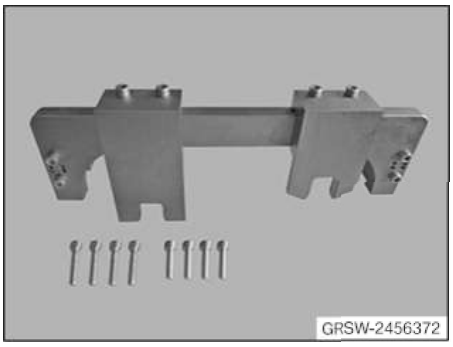
2 288 380 Locating stud



Common Used in step 294143

Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common Used in step 2936374143

Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common Used in step 293643

Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 855 Ratchet handle



Common Used in step 31343940

Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

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2 450 487 Socket



Common	Used in step 31343940
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

2 455 654 Tensioning tool



Common	Used in step 3841
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 452 959 Pliers



Common	Used in step 48
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 448 401 Fitting aid



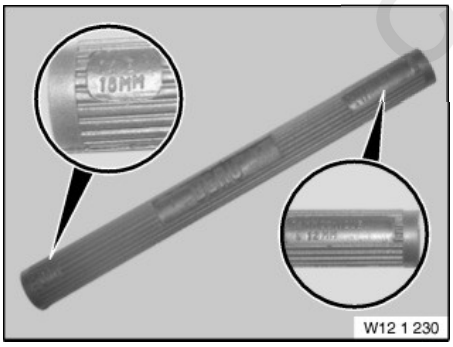
Common	Used in step 48
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 49
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 065 (12 1 230) Fitting aid



Common	Used in step 53
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 63
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Links

Repair instructions	Used in step

61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	158
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	158
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
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61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 20 900 Disconnecting and connecting battery earth lead	158
61 35 ... Notes on ESD protection (Electro Static Discharge)	12
61 35 ... Notes on ESD protection (Electro Static Discharge)	121520
13 53 ... Clean the cylinder head around the injectors due to grit / dust	20
61 13 ... Unlocking and disconnecting different plug connections	202444

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11 37 005 Removing and installing/replacing eccentric shaft

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

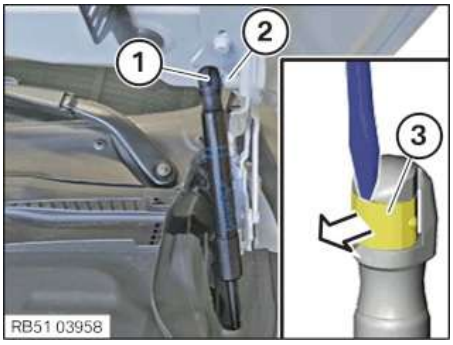
Engine compartment lid is open.

CAUTION

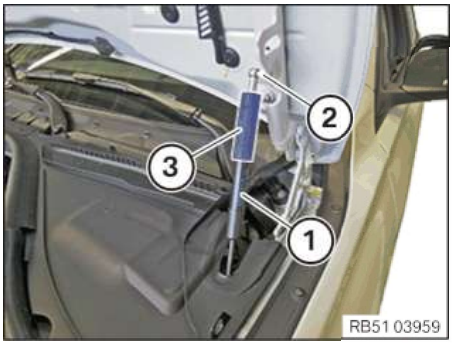
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

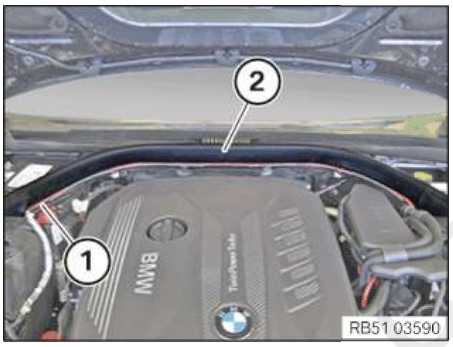


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

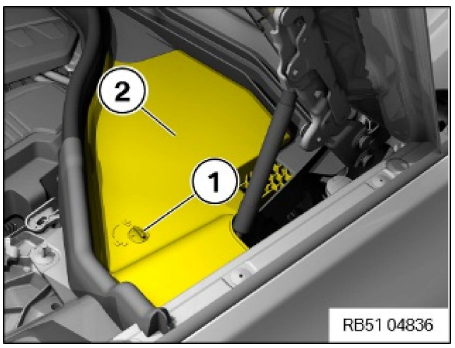
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

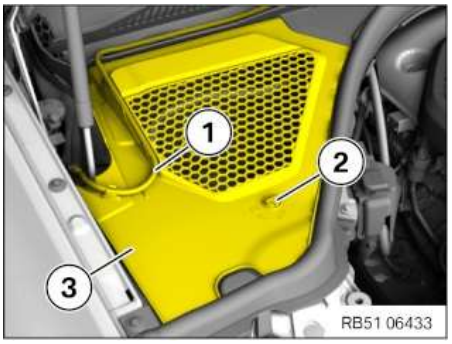
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

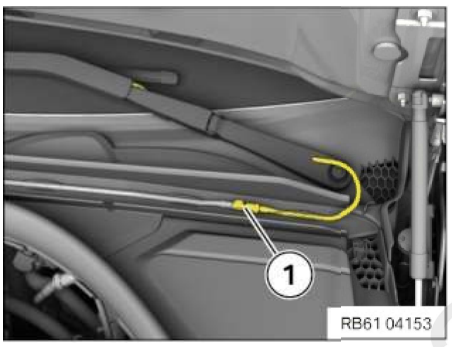
▶ **Remove the wiper arm**

RISK OF DAMAGE

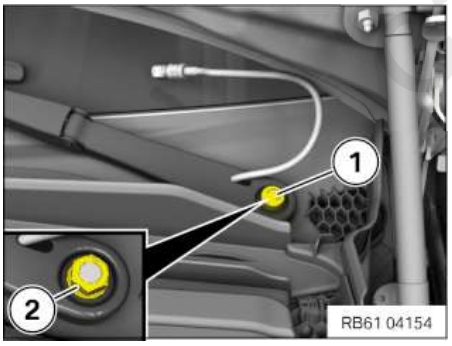
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

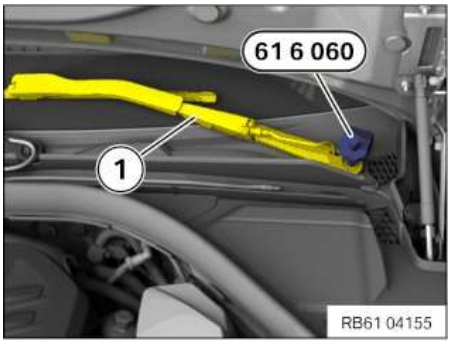
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



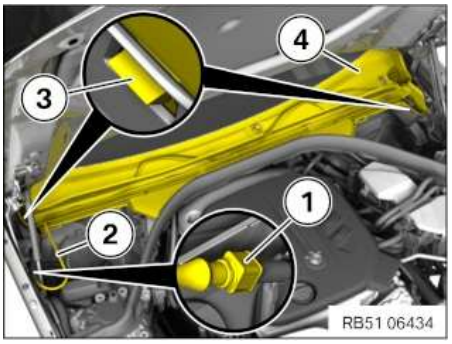
- Remove the protective cap (1).
- Loosen nut (2).



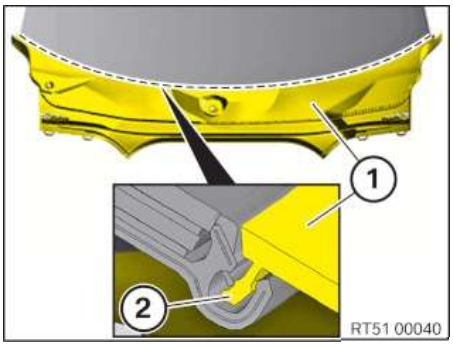
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

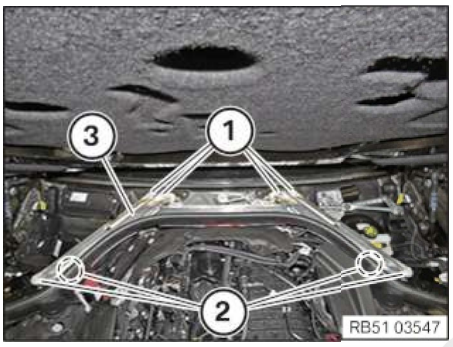


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

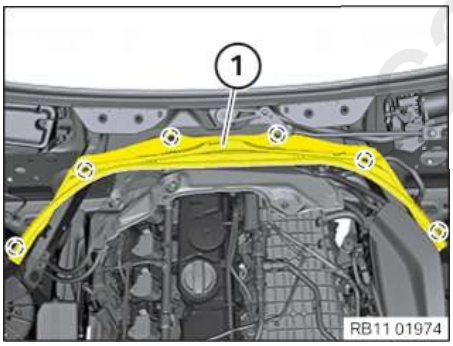
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

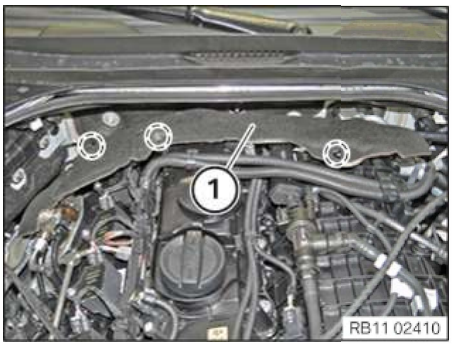
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



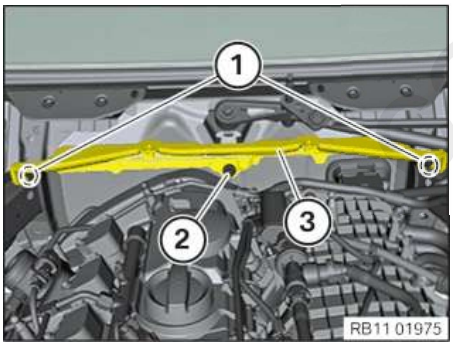
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing both actuators

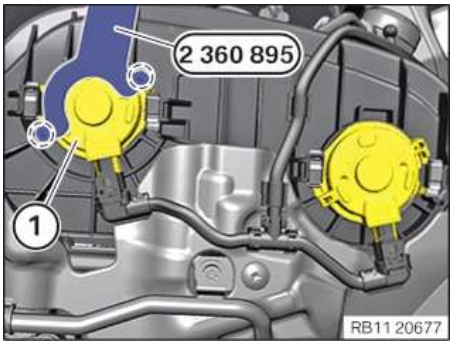
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

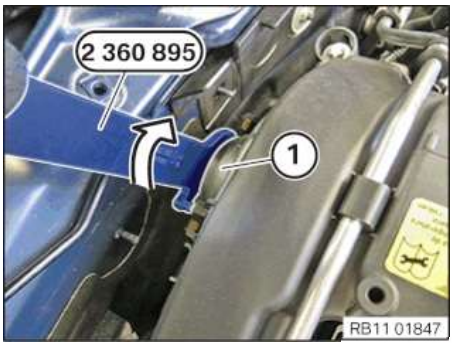
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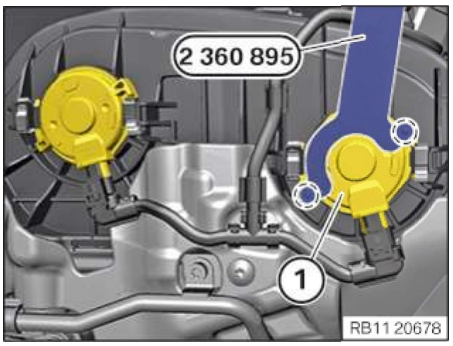
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



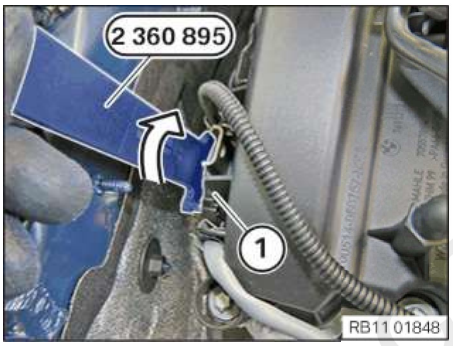
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



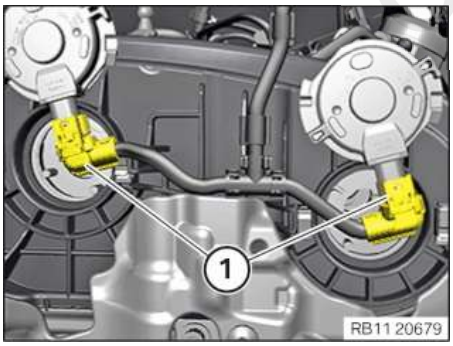
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

13 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

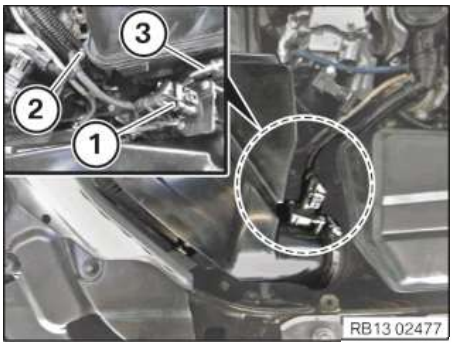
Risk of burning!

- Perform all work only on components that have cooled down.

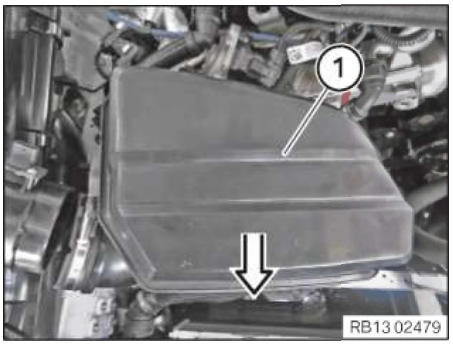
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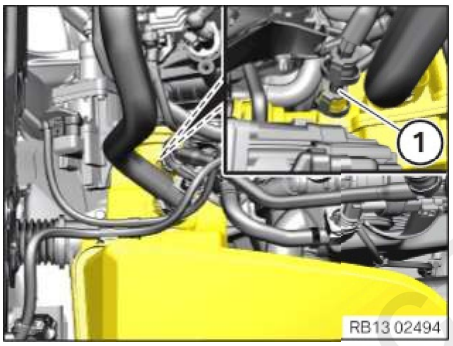
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



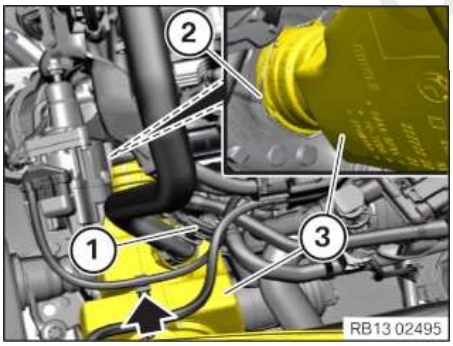
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



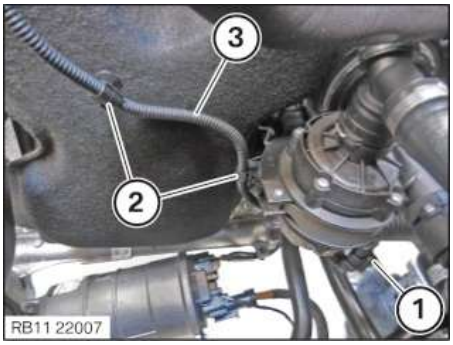
- Unlock and disconnect the tank ventilation line (1).



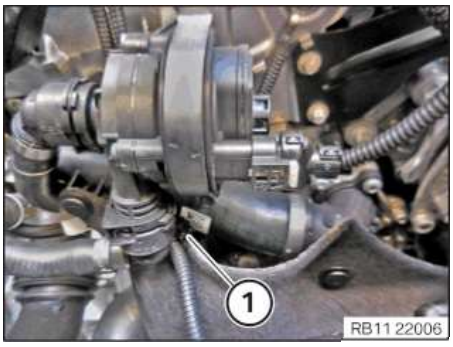
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

14 – Removing the acoustic cover for the engine at the front

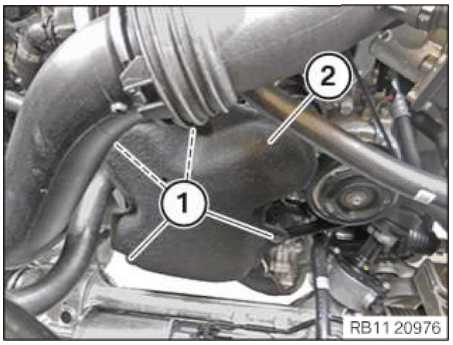
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

15 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

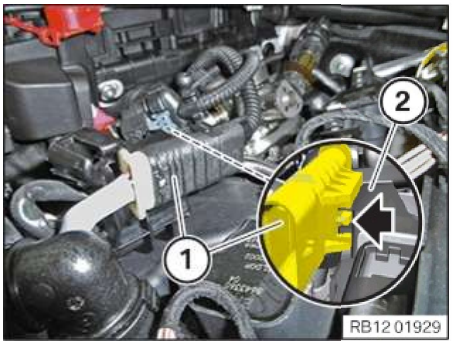
Electrostatic discharge.

Damage to or destruction of electrical components.

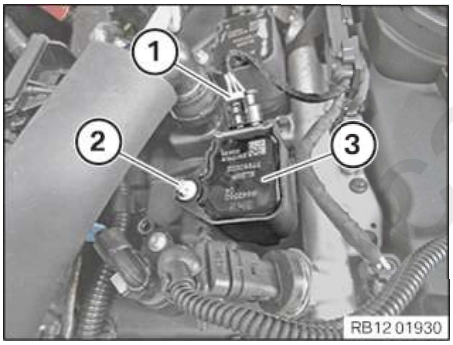
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.



- Unlock connector (1) (arrow) and disconnect it from holder (2).



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

16 – Removing all spark plugs

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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CAUTION

Swirling dirt particles caused by compressed air.

Danger of injury!

- Collect dirt particles, e.g. when blowing out, use cloth to do so.

- Wear safety goggles.

TECHNICAL INFORMATION

Clean spark plug slot with compressed air.

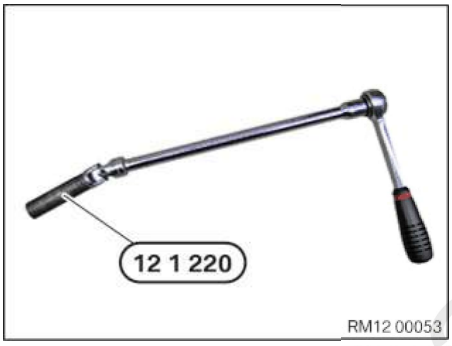
The spark plug shaft must be cleaned using compressed air after having removed the ignition coils and before removing the spark plugs. After having removed the spark plugs, once again check the sealing surface for contamination and (if necessary) clean using a moist cloth or clean using compressed air.

Deposits that are not removed according to instructions may enter the combustion chamber and lead to uncontrolled combustion. Remaining deposits on the spark plug sealing surfaces may lead to leaks and the spark plugs may come loose during engine operation.

Spark plug threads must not be greased or oiled. Insufficiently tightened spark plugs may cause leaks and the sparks plugs may come loose during engine operation.

NOTICE

The description is for one component only. The procedure is identical for all further components.



TECHNICAL INFORMATION

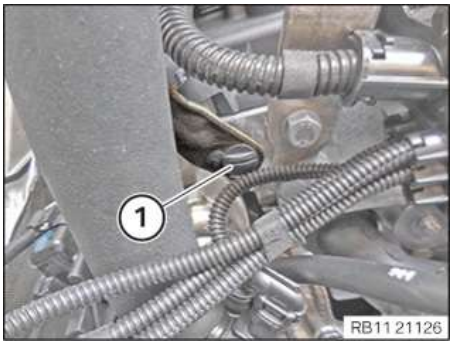
Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Mount the special tool 0 495 560 (12 1 220) on a pivoting extension.

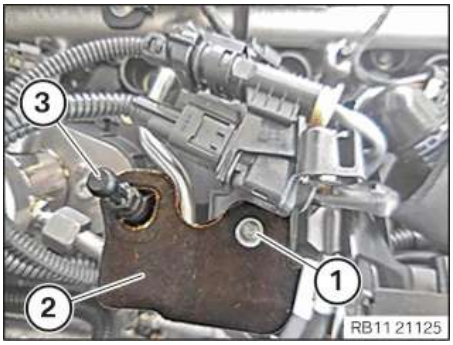


- Unscrew spark plugs with the special tool 0 495 560 (12 1 220) and a pivoting extension.

17 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).



- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

18 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

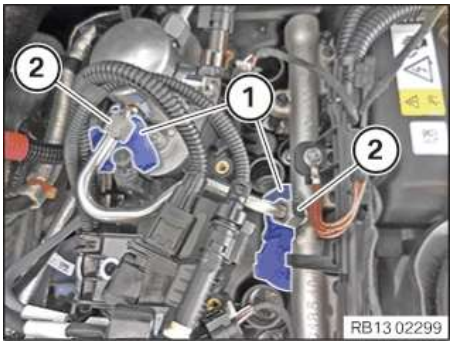
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

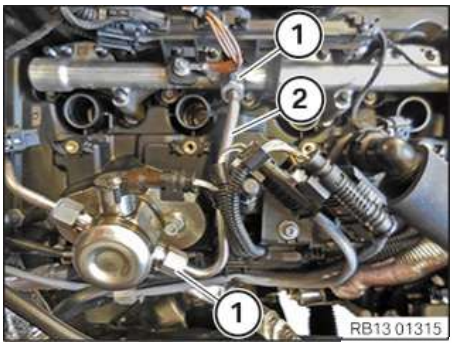


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

19 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

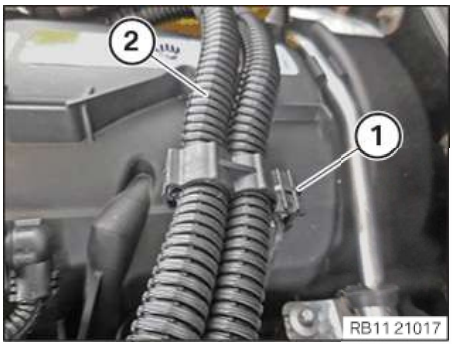
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

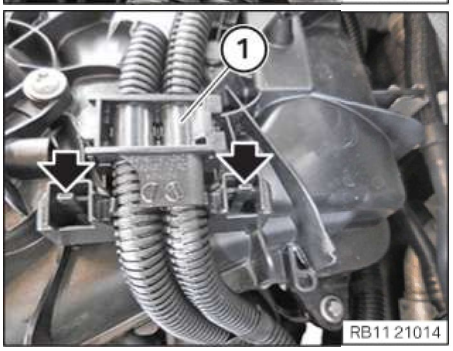
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

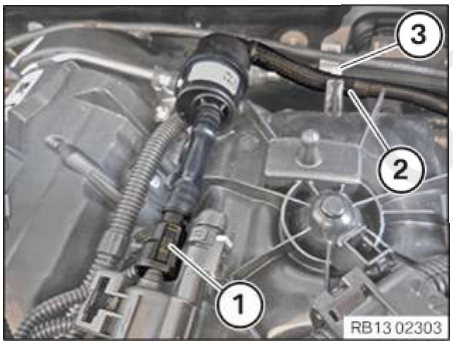
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



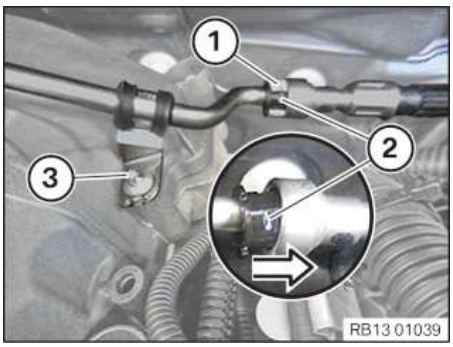
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

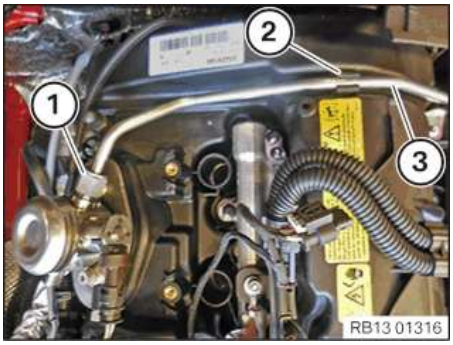


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

20 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

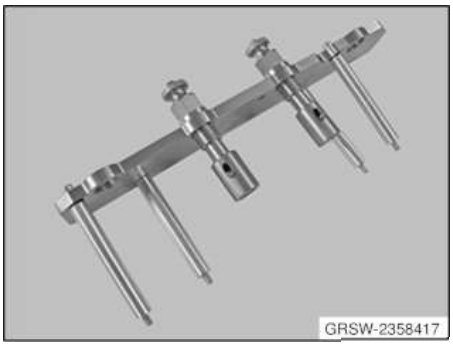
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



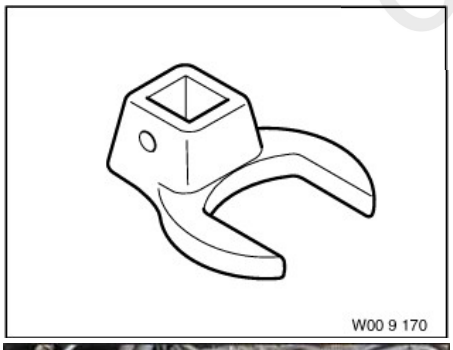
- Prepare special tool 2 358 417.



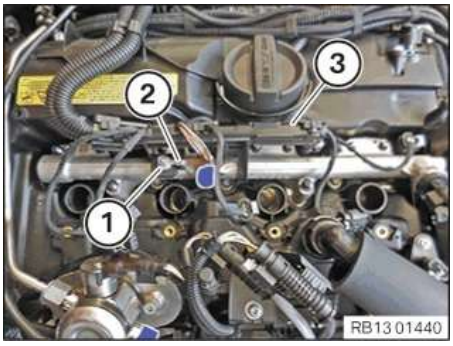
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

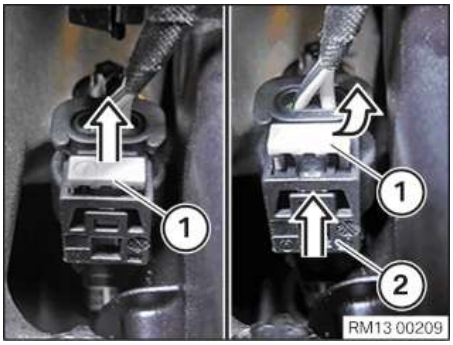


- Prepare special tool .

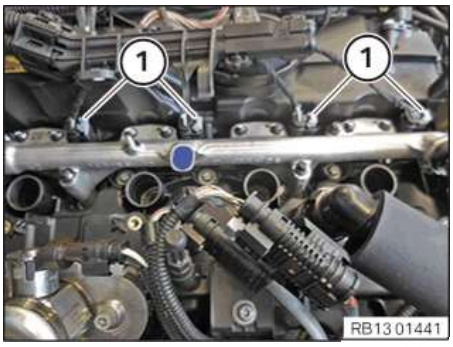


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



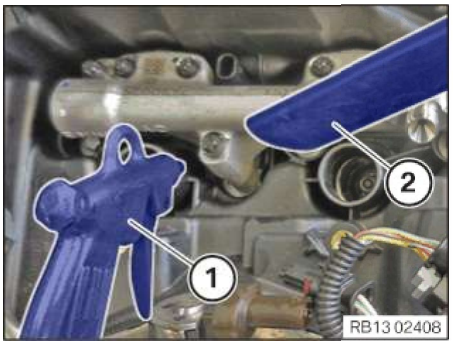
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

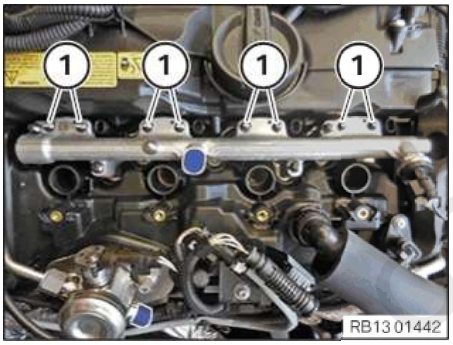


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

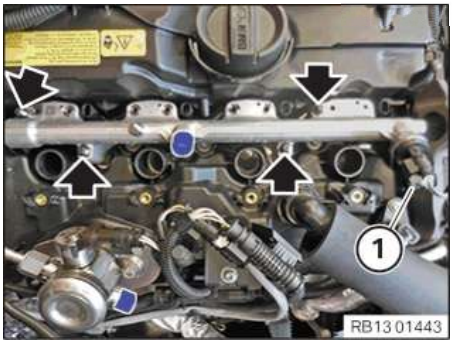
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



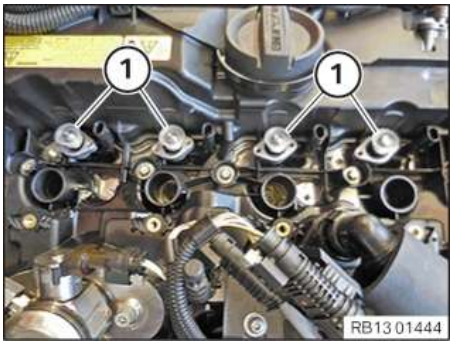
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

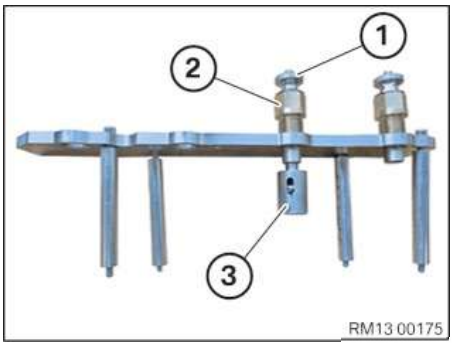
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

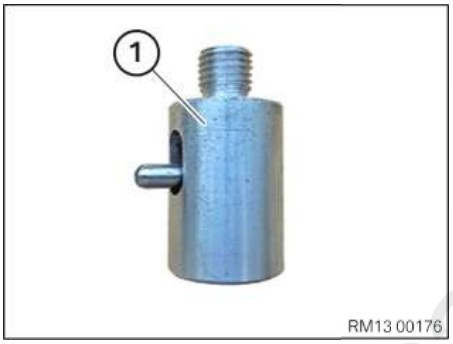
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

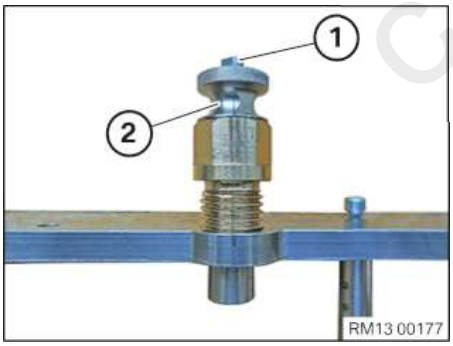
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

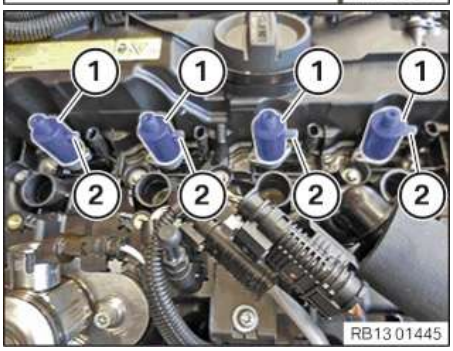
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



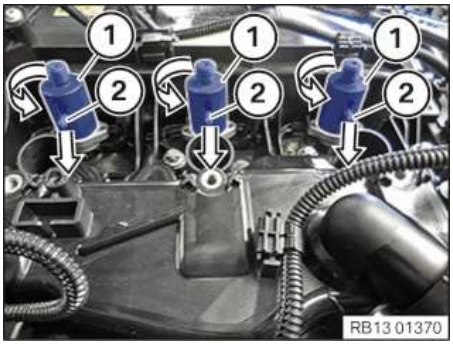
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



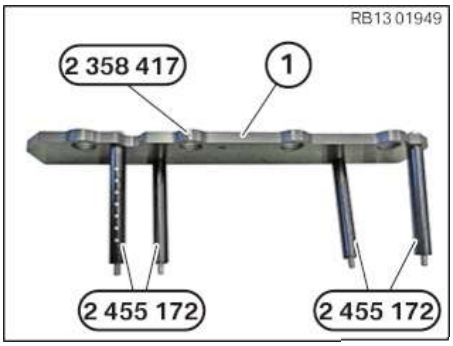
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

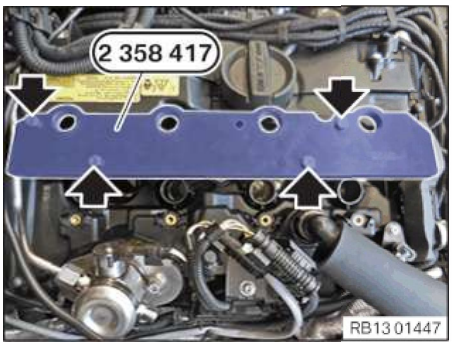
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



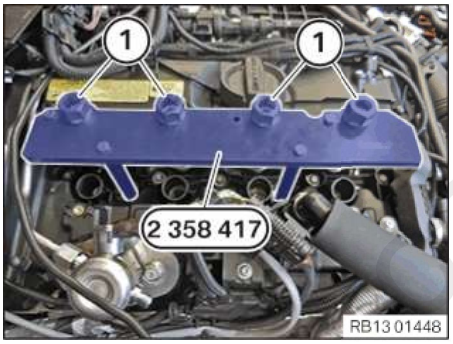
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

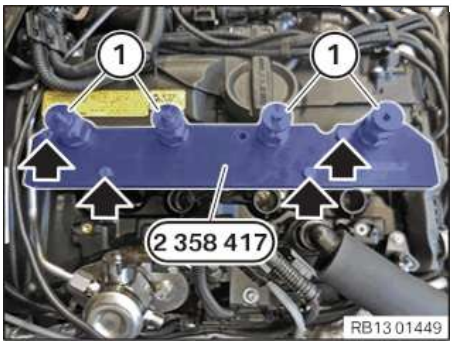
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

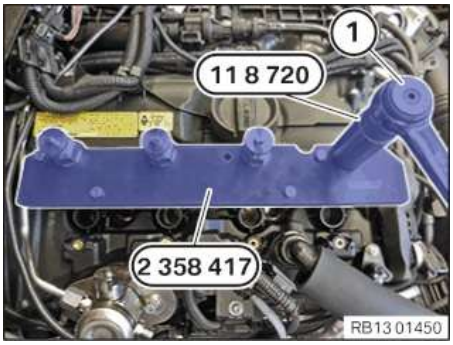
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

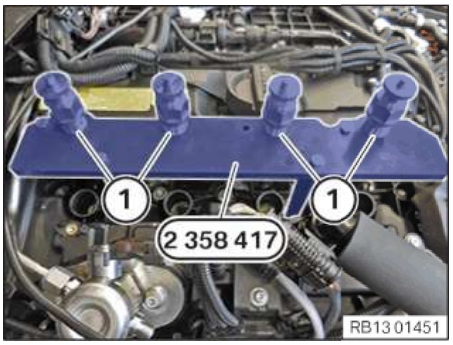


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

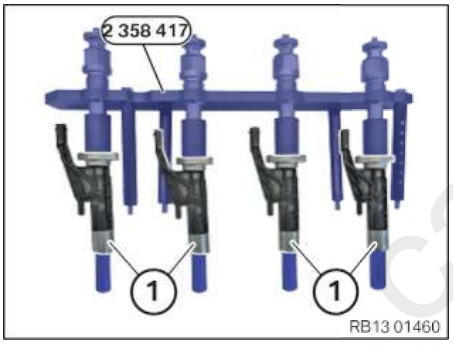
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

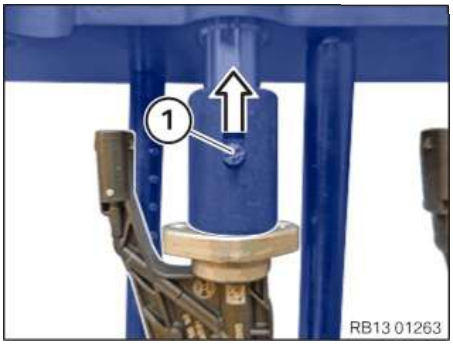


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

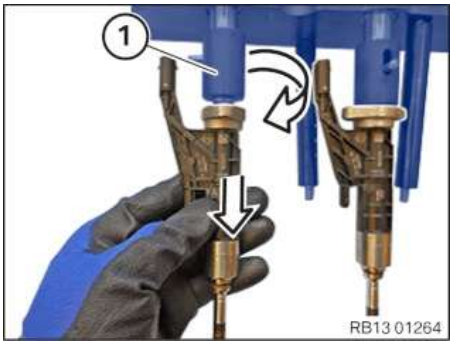


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

21 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

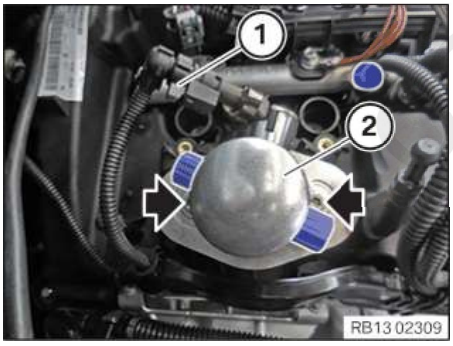
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

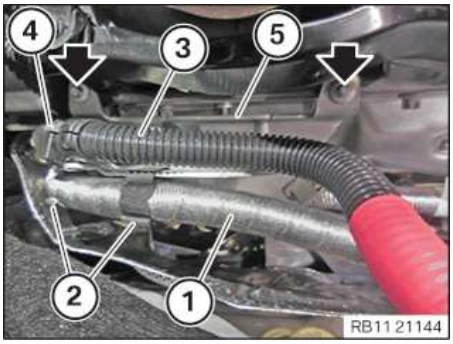
The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.

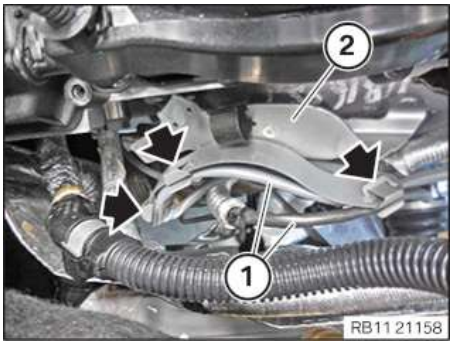


- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

22 – Remove the holder of the positive battery cable



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

23 – Remove the heat shield on the cylinder head

WARNING

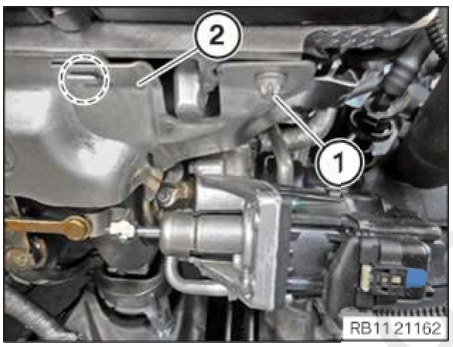
Hot surfaces.

Risk of burning!

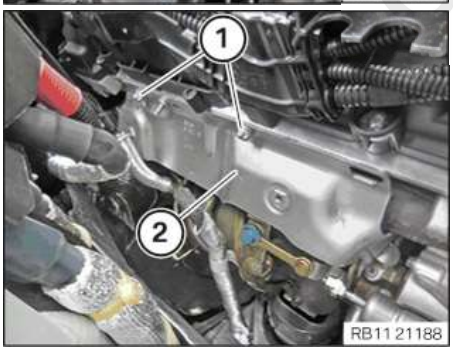
- Perform all work only on components that have cooled down.



- Loosen screw (1).



- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

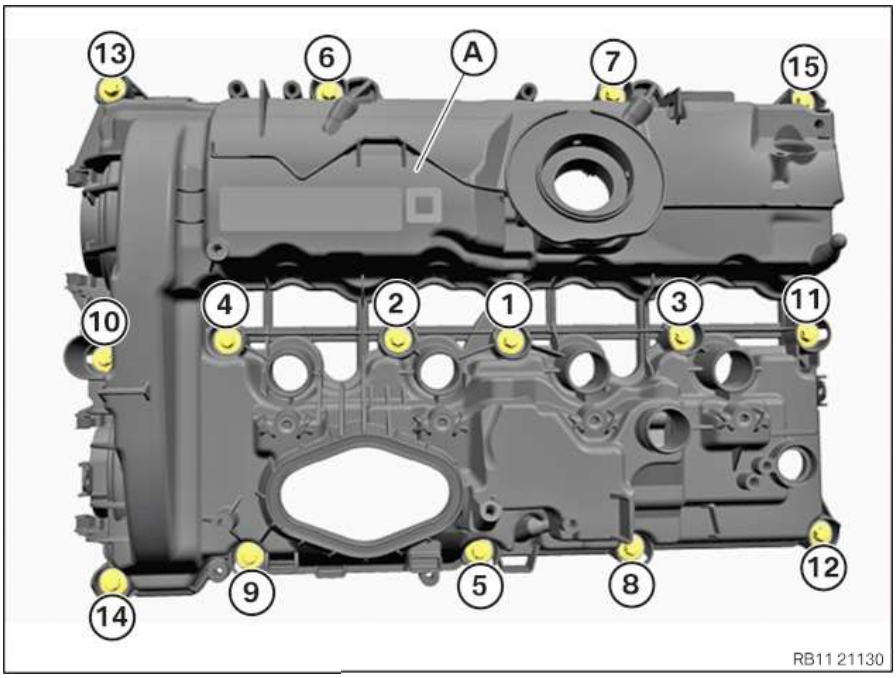


- Loosen screws (1).
- Feed out and remove the heat shield (2).

24 – Removing the cylinder head cover

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Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

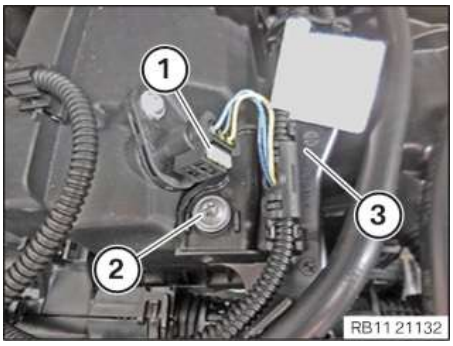
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

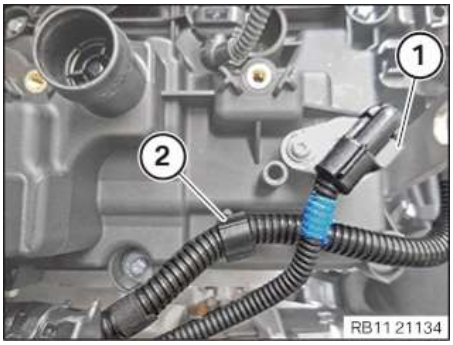
- Do not pull on the wires when disconnecting connectors and plug connections.



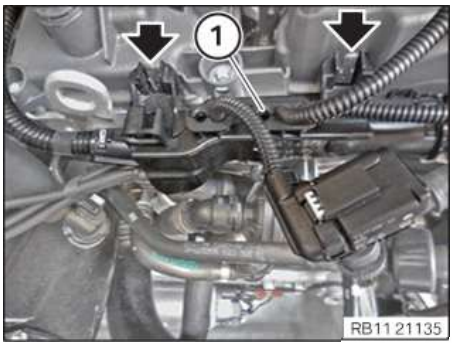
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



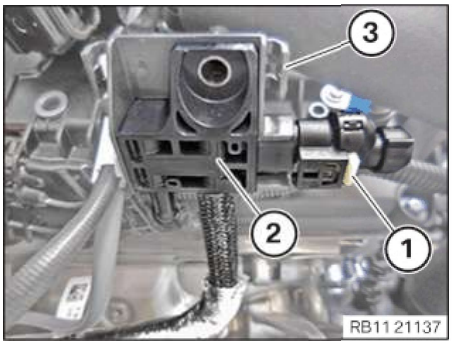
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



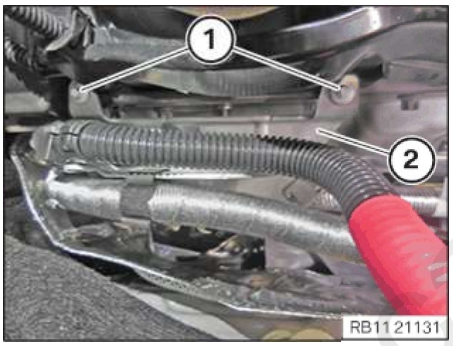
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



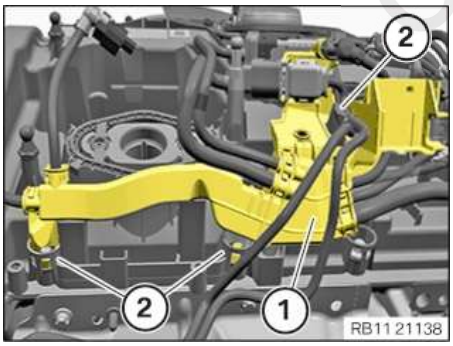
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



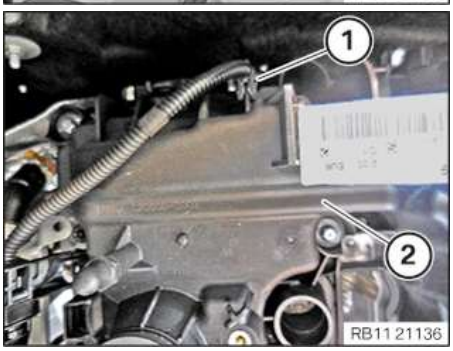
- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.



- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

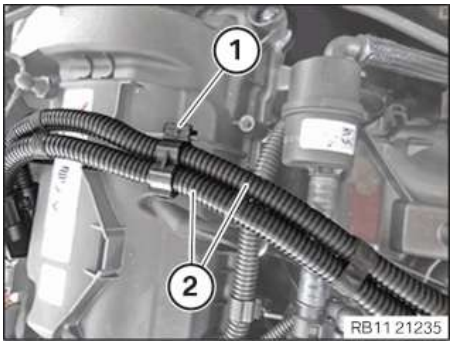


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

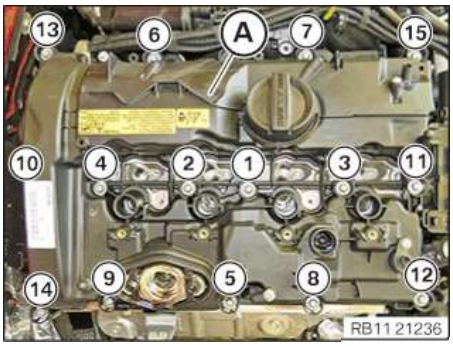


- Loosen clamp (1).

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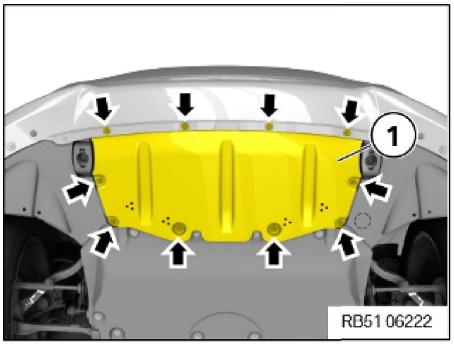


- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

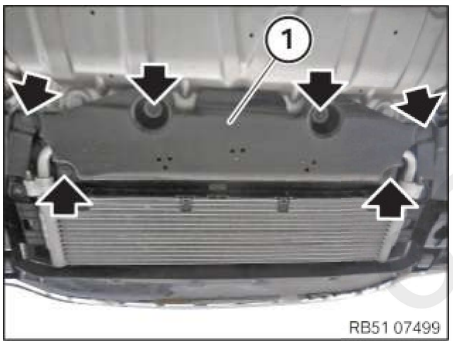
25 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

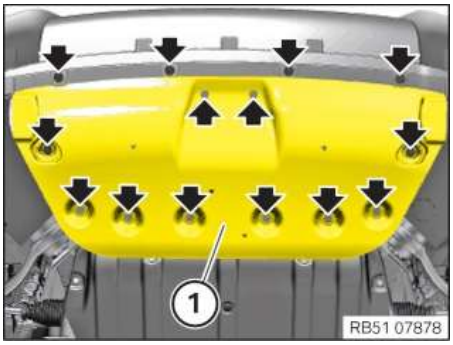
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

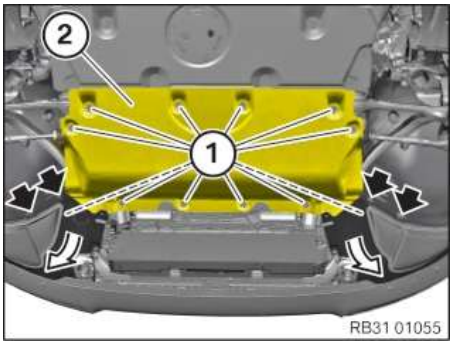


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

26 – Remove the underbody protection of the steering gear



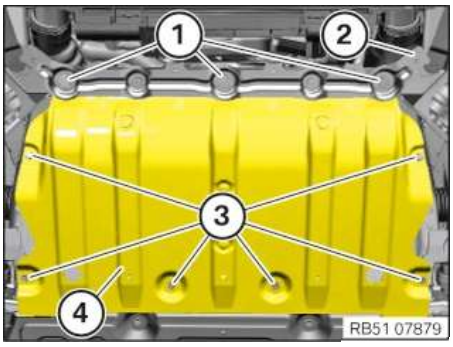
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

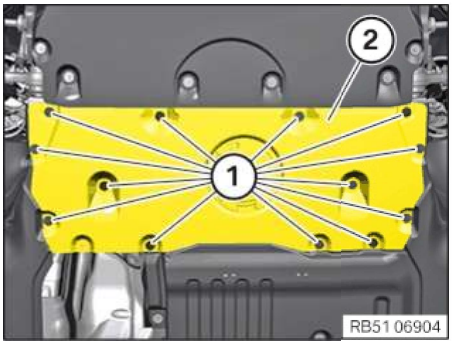
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

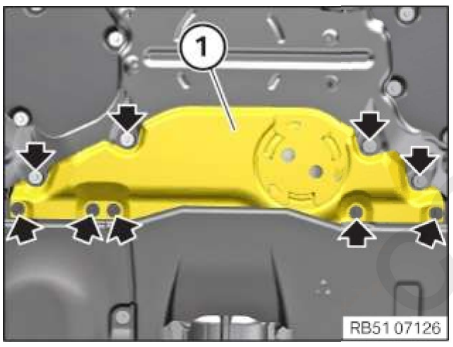
27 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

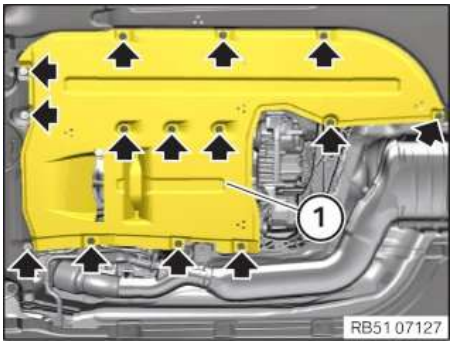


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

28 – Remove rear underbody protection

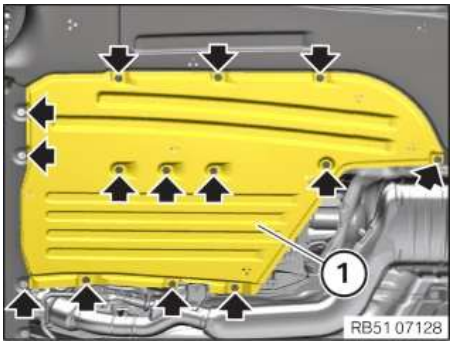


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

29 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

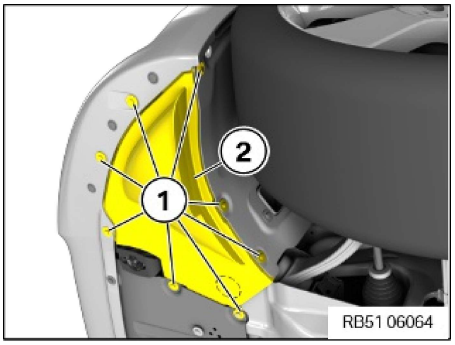
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

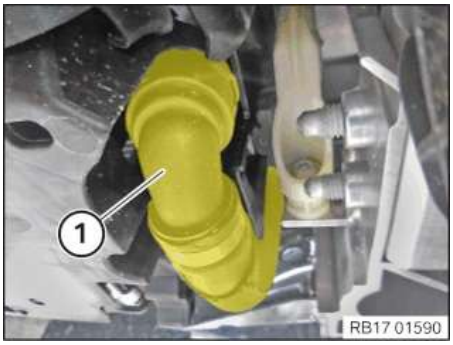


- Loosen sealing cap (1).



- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

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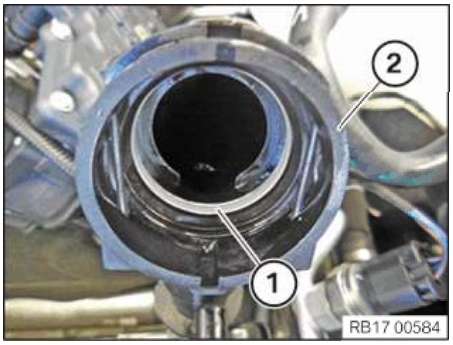


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

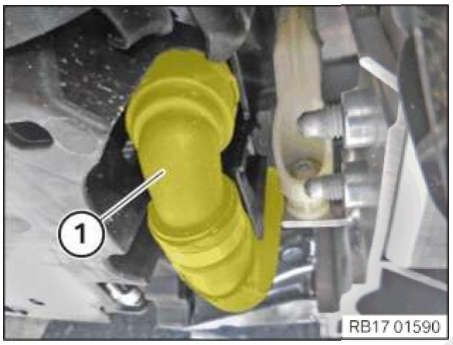
30 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

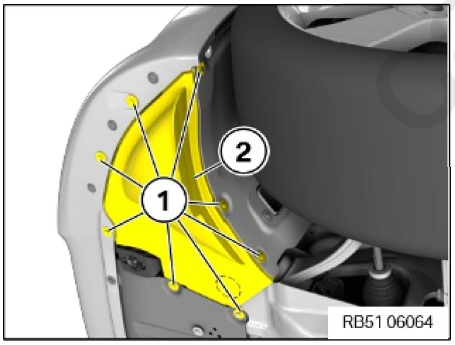


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

31 – Removing the DME control unit

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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

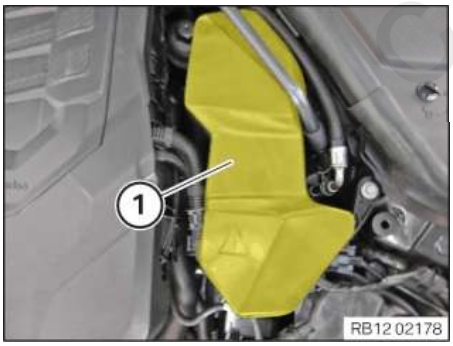
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

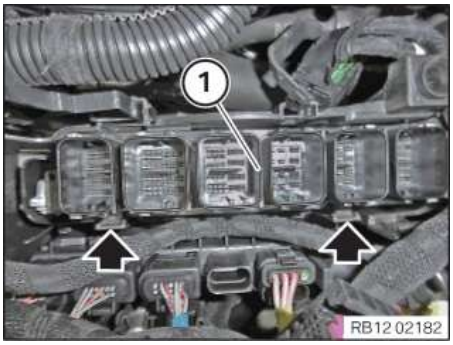


- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).

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- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

32 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

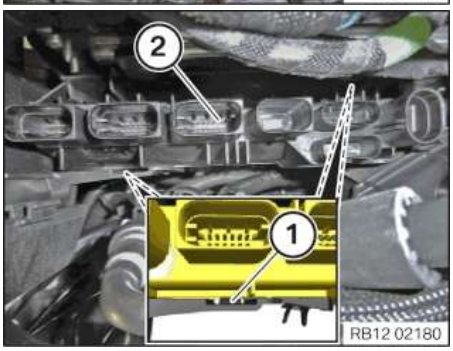
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



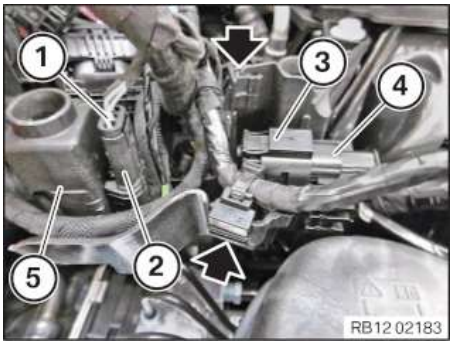
- Unlock and disconnect plug connections (1).



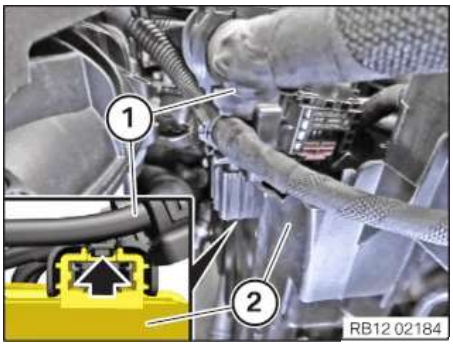
- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

33 – Removing the control unit holder

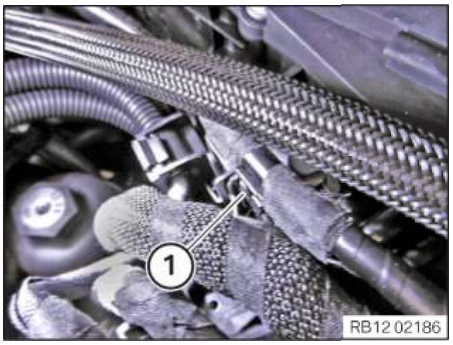
bardiag.com



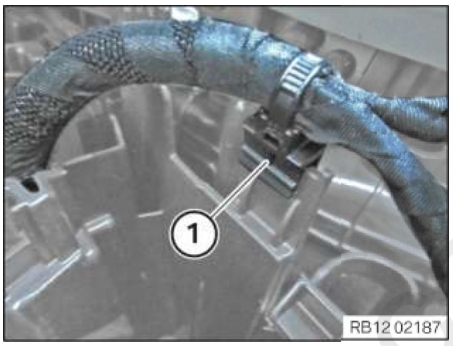
- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).



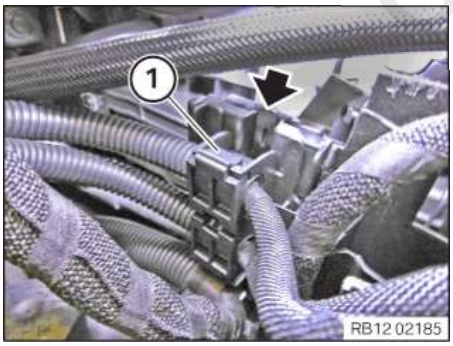
- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).



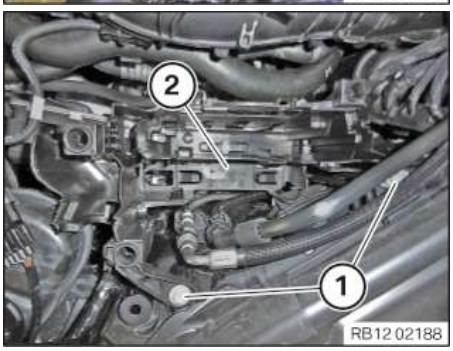
- Loosen clamp (1).



- Loosen clamp (1).



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

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34 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

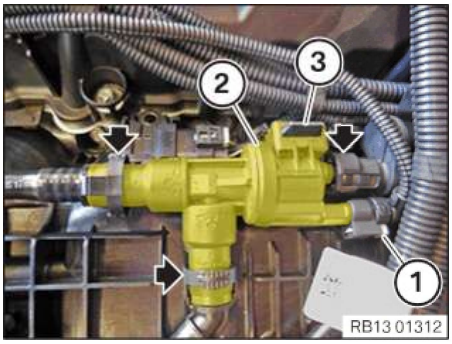
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

35 – Removing the intake plenum

RISK OF DAMAGE

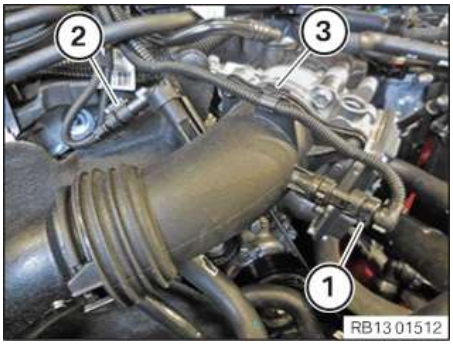
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

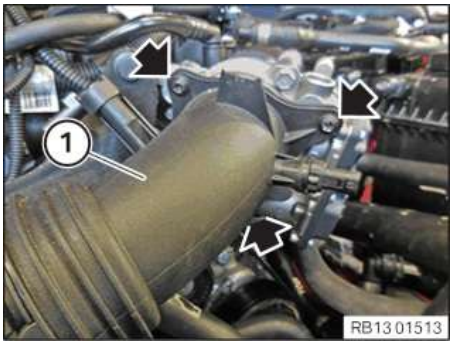
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

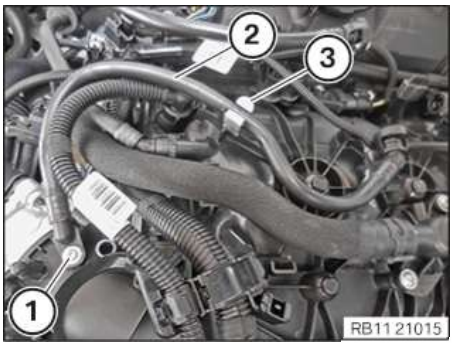


- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).

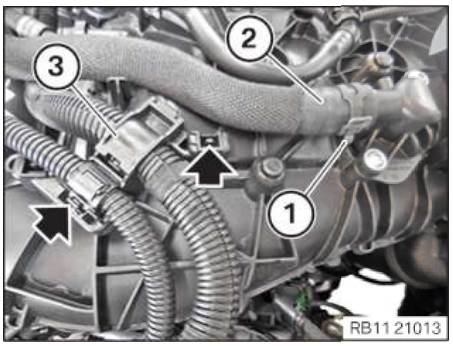
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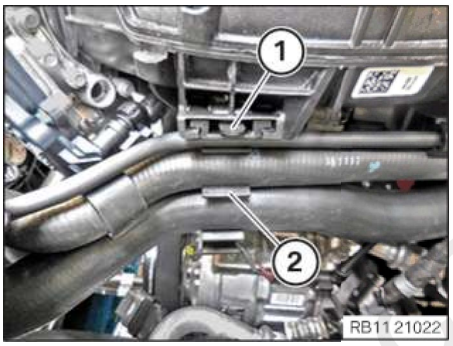
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



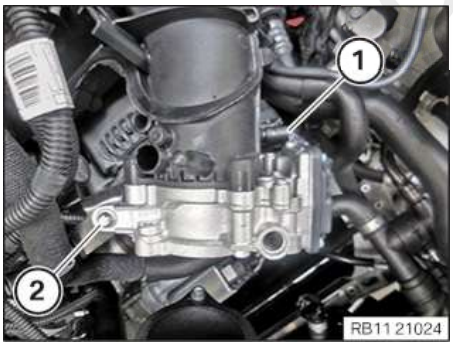
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



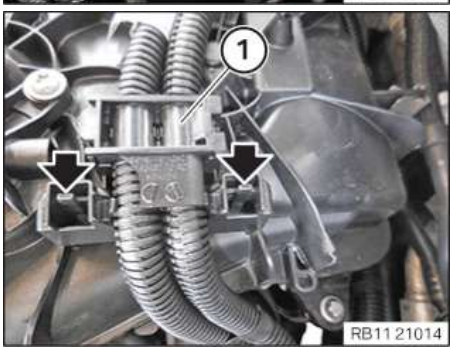
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

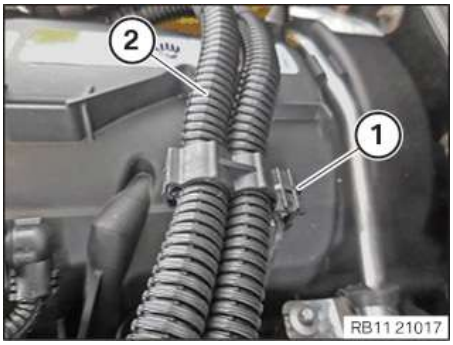


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

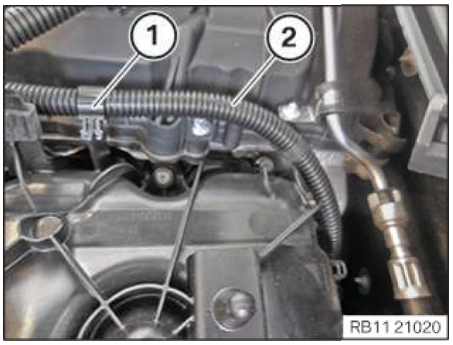
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- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



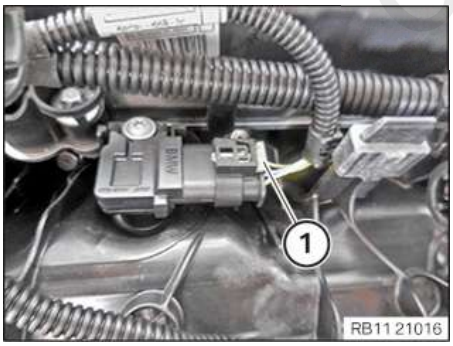
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



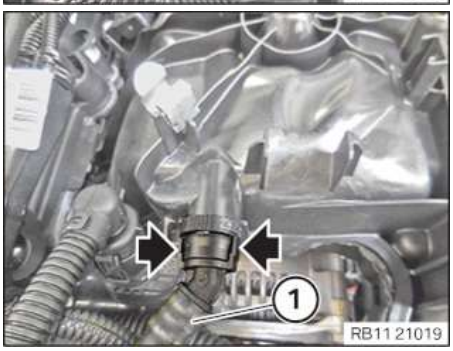
- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.



- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

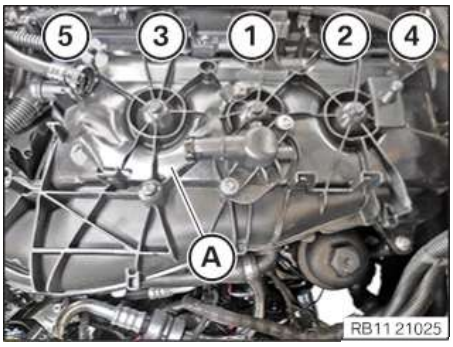


- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.

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- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.

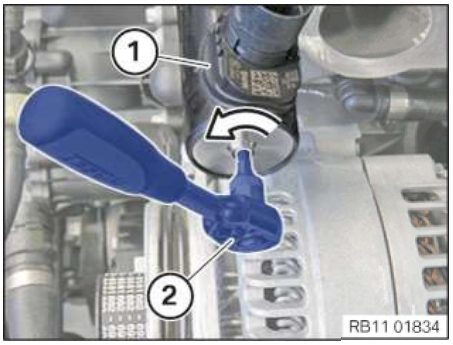


TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

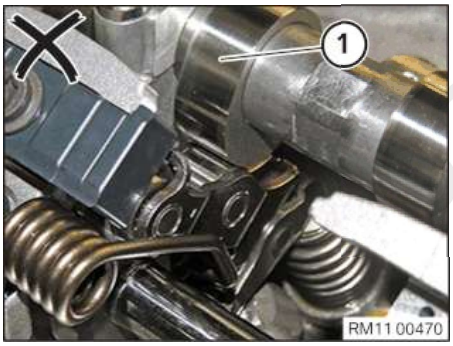
- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

36 – Adjusting the servomotor to minimum lift



- Slowly adjust the eccentric shaft with the servomotor (1) to the minimum lift using the tool (2).

37 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

38 – Remove all torsion springs

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

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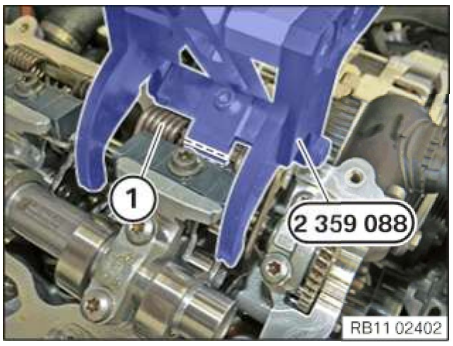
TECHNICAL INFORMATION

- Wear safety goggles.

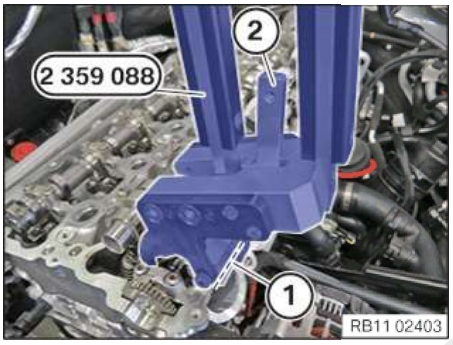


- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)



- Open the special tool 2 359 088 and position it at the torsion spring (1).



- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.

Check

- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.



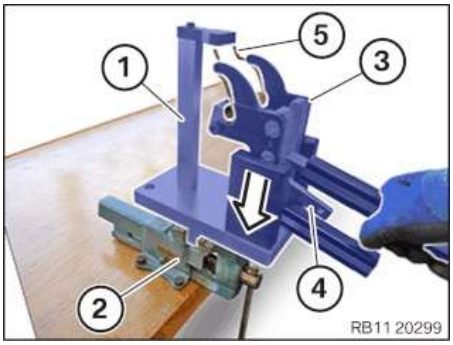
Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.

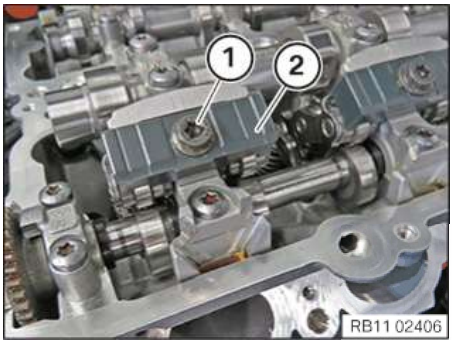
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- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

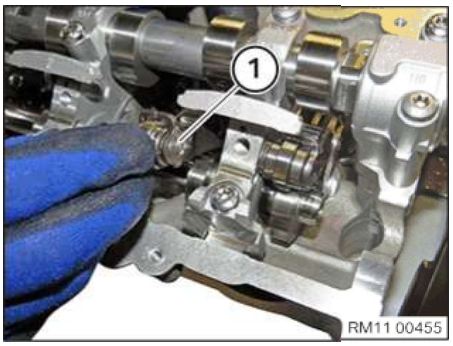
  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

39 – Removing all gates



- Loosen screw (1).
- Remove the gate (2) and place it arranged in order into 0 495 105 (11 4 480).
- Repeat the step for all the gates.

40 – Removing all intermediate levers



- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

41 – Block the engine with the special tool in TDC firing position



- Thread the sealing cap (1) out and remove.



RISK OF DAMAGE

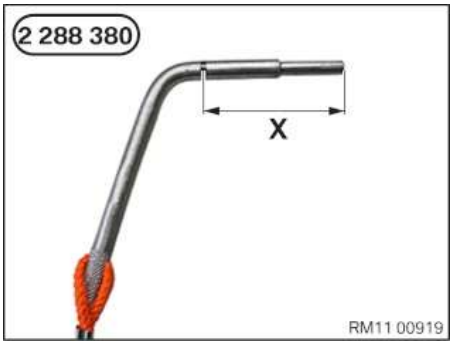
Damage to the engine.

The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.

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- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

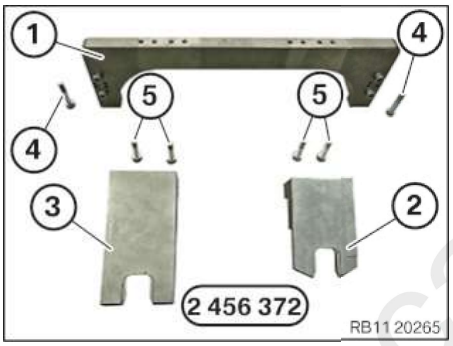
  The TDC firing position of cylinder 1 was **not** reached.



- **Vehicles with automatic transmission:**

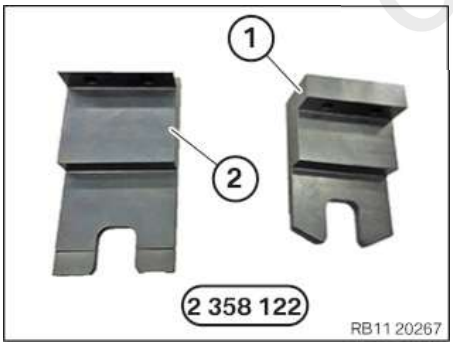
  Special tool 2 288 380 has been **correctly** positioned.

  The engine is in the TDC firing position of cylinder 1.



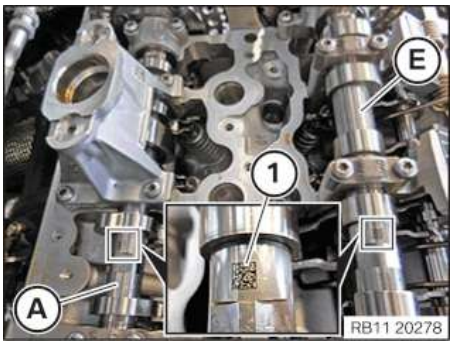
- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



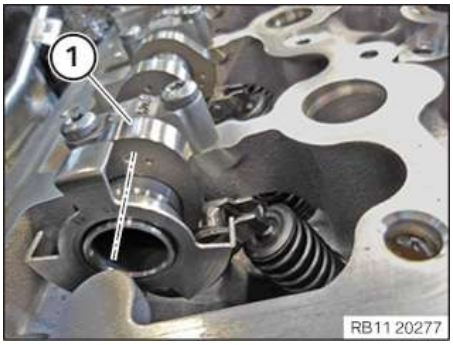
- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft

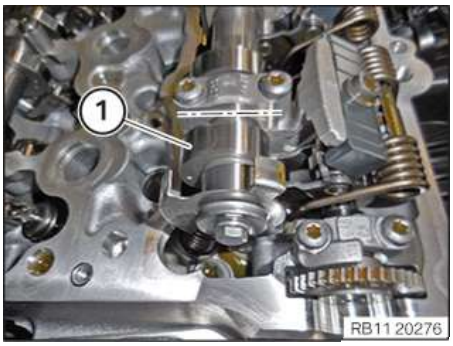


- Make sure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) are legible from above.

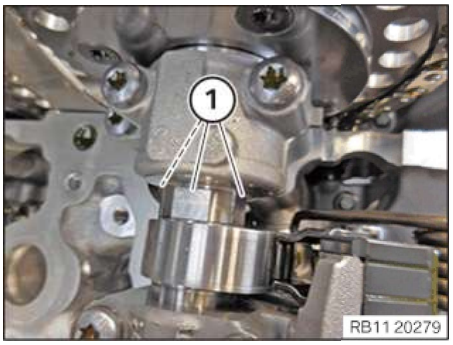
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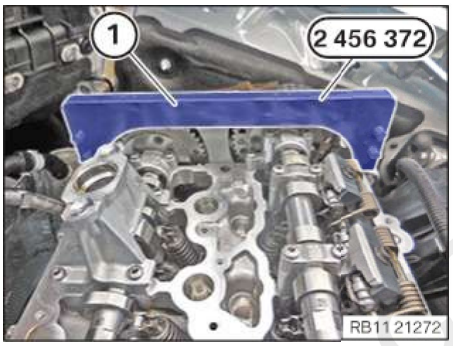
- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



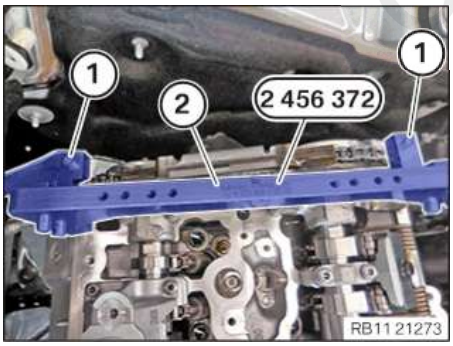
- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.



- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



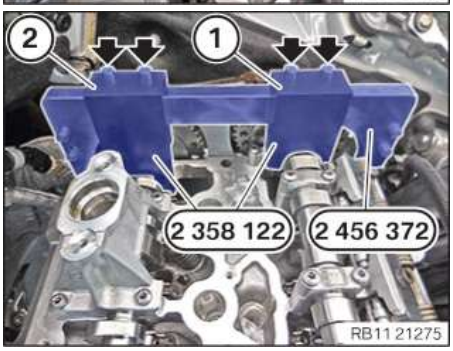
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

M6		Tightening torque	8 Nm



- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

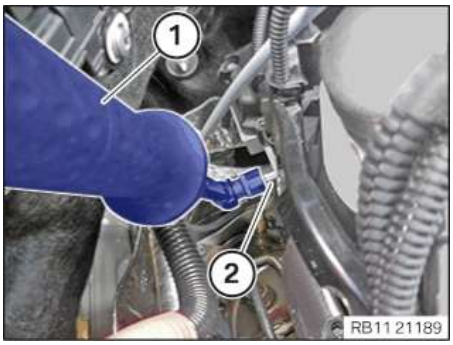
M6		Tightening torque	8 Nm

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42 – Removing chain tensioner

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- A small amount on engine oil emerges when removing the chain tensioner (2), have a cleaning cloth ready.
- Release the chain tensioner (2) with conventional tools (1).



- Feed out and remove the chain tensioner (1).

43 – Releasing the VANOS central valve of the intake adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

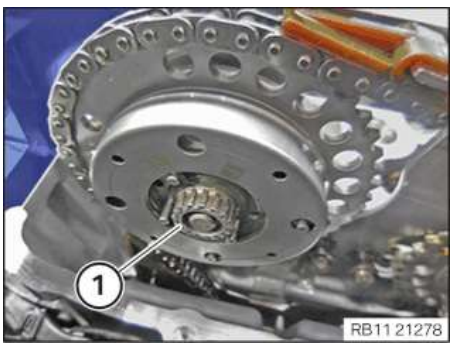


NOTICE

The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the intake adjuster.

44 – Removing the VANOS central valve of the intake adjuster



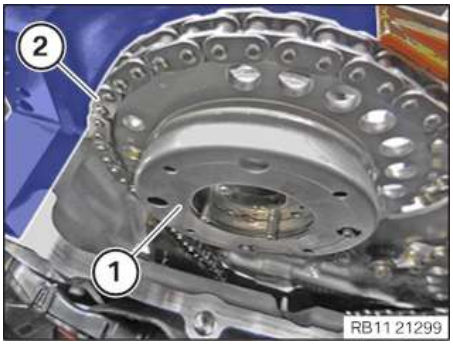
- Guide out and remove the VANOS central valve (1) of the intake adjuster.

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45 – Removing intake adjuster

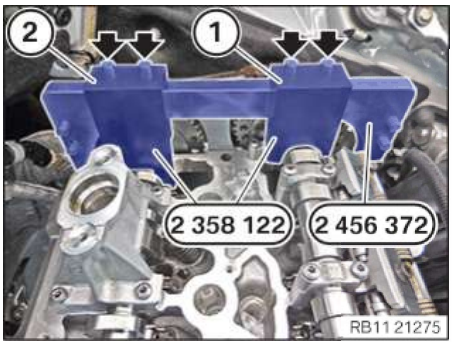
NOTICE

The figure shows the rear side of the engine.



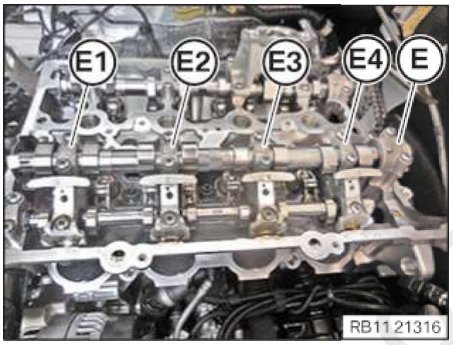
- Guide out the intake adjuster (1) from the timing chain (2) and remove.

46 – Remove the test gauges to fix the camshafts



- Remove screws (arrows).
- Guide out and remove test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier of the set of special tools 2 456 372.
- Guide out and remove test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier of the set of special tools 2 456 372.

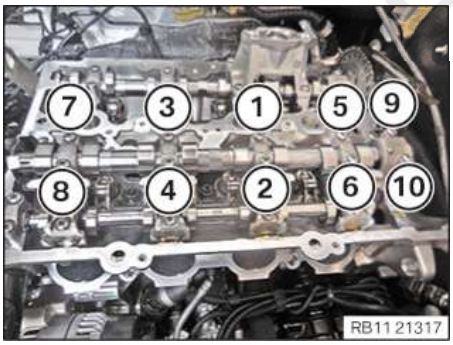
47 – Remove intake camshaft



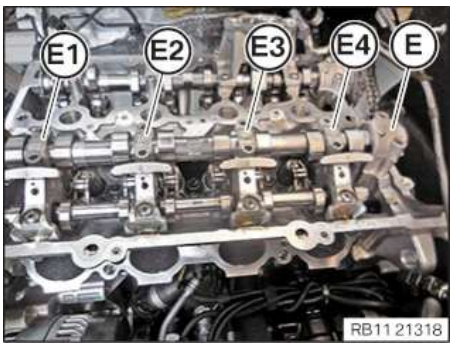
- Make sure that the exhaust camshaft bearing cap is placed in the correct position in the special tool 0 495 105 (11 4 480).

Note: The intake camshaft bearing caps can be read from the intake side and are identified by **E1**, **E2**, **E3 E4** and **E**.

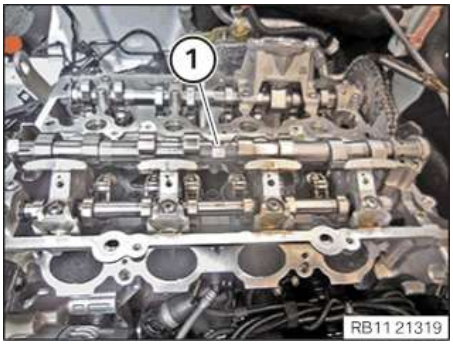
Note: Intake camshaft bearing cap **E** is a thrust bearing.



- Loosen all screws on the intake camshaft bearing caps in sequence from (10) to (1).



- Remove the intake camshaft bearing caps (E1), (E2), (E3), (E4), (E) place them in order in the special tool 0 495 105 (11 4 480).



- Guide out the intake camshaft (1) in the direction of arrow and remove it.

48 – Removing the servomotor for the eccentric shaft

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

RISK OF DAMAGE

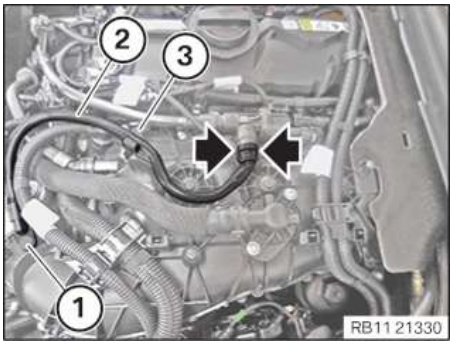
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

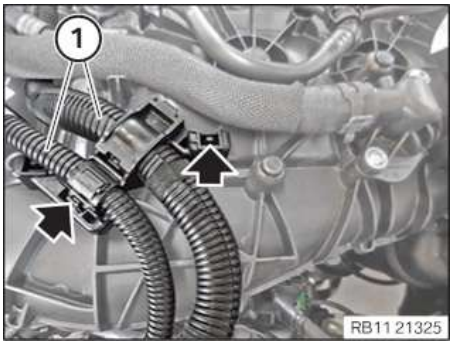
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

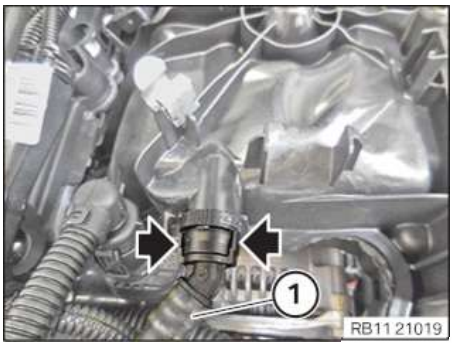


- Unlock the locks (arrows).
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.

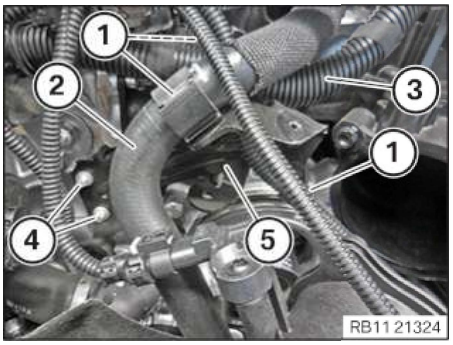
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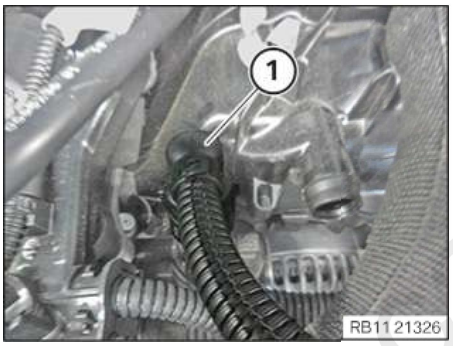
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



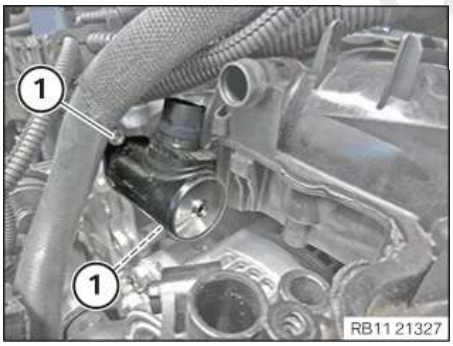
- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



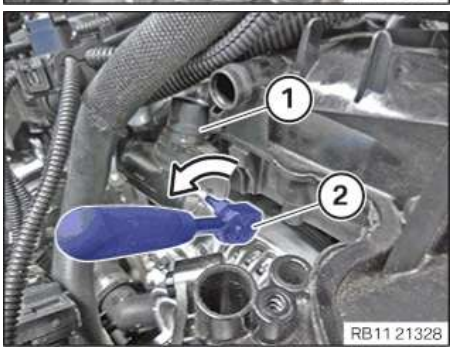
- Unlock and loosen the clamps (1).
- Feed out coolant line (2) and place to one side.
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.
- Loosen screws (4).
- Guide out and remove holder (5).



- Unlock plug connection (1) and disconnect.



- Loosen screws (1).



- Turn the drive shaft of the servomotor (1) with a standard tool (2) in the direction of the arrow.
- Make sure that the drive shaft of the servomotor (1) is not turned beyond the end stop of the eccentric shaft.
- Guide out and remove the servomotor (1).
- Catch and dispose of emerging engine oil.

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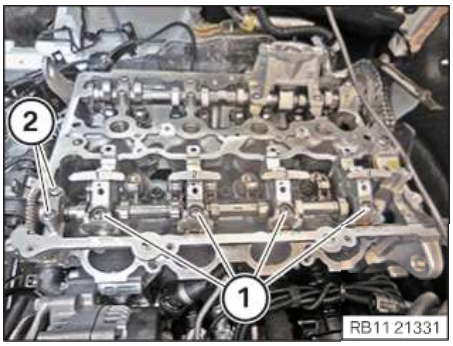
49 – Remove eccentric shaft

RISK OF DAMAGE

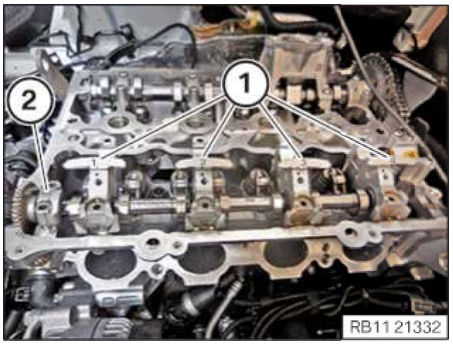
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

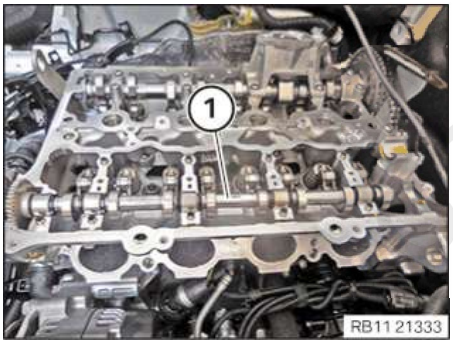
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Loosen screws (1).
- Loosen screws (2).



- Feed out bearing supports (1) and lay them in order in the special tool 0 495 105 (11 4 480) .
- Feed out all bearing caps (2) and lay them in order in the special tool 0 495 105 (11 4 480).



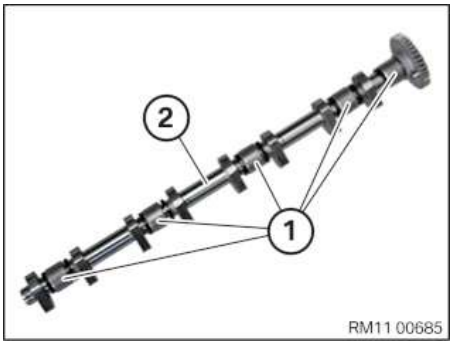
- Guide out the eccentric shaft (1) toward the top and remove it.

50 – Install eccentric shaft

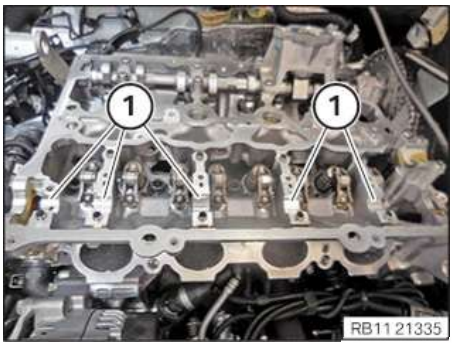


- Check all guide bushes in the **marked** area for damage, renew damaged guide bushes if required.

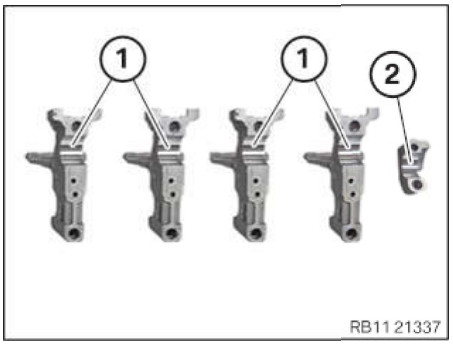
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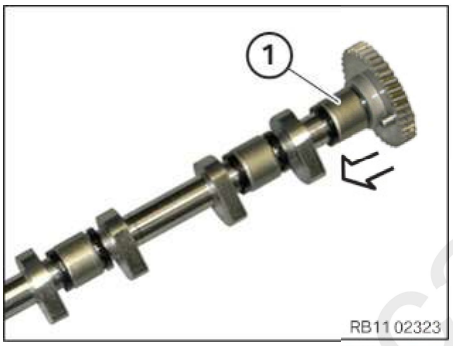
- Check all needle bearings (1) of the eccentric shaft (2) for ease of movement.
- Renew the eccentric shaft (2) in case of tight needle bearings (1).
- Coat needle bearing (1) with new engine oil.



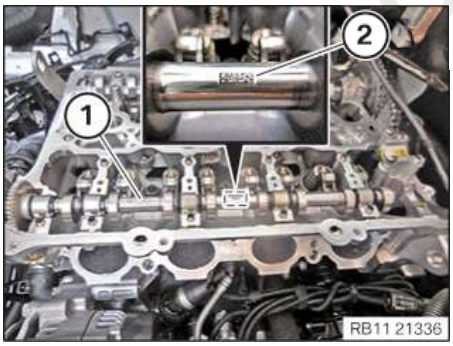
- Clean all bearing positions (1) in the cylinder head and coat with fresh engine oil.



- Clean bearing positions of the bearing supports (1) and coat with fresh engine oil.
- Clean bearing position of the bearing cap (1) and coat with fresh engine oil.

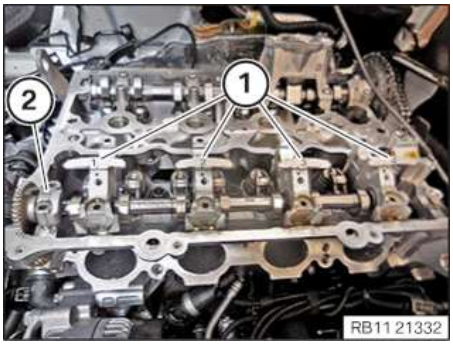


- Push needle bearing (1) up to the limit position in direction of arrow before installing the eccentric shaft.



- Insert eccentric shaft (1) into the cylinder head, such that the mark (2) points upwards.

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RISK OF DAMAGE

Engine damage caused by incorrectly installed bearing shells and bearing supports.

Engine damage may result from incorrectly installing bearing shells and bearing supports.

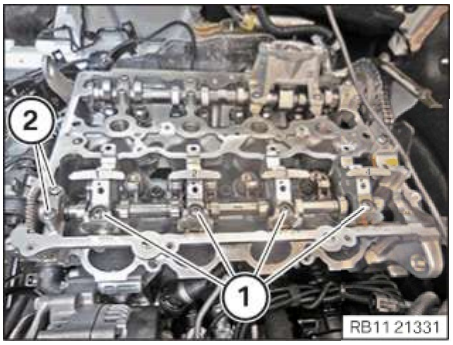
- Always install all bearing shells and bearing supports in the same position from which they were removed.

- Feed in bearing support (1) and install.

  All the bearing supports (1) **must** be installed again in the **position** from where the bearing supports (1) were removed.

- Pull in bearing cap (2) and install.

Note: The bearing cap **2** is provided with a limit position.



- Tighten down screws (1) and (2) uniformly.

Eccentric shaft to bearing support/cylinder head

M6		10 Nm

POSTPROCESSES

51 – Installing servomotor for the eccentric shaft

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

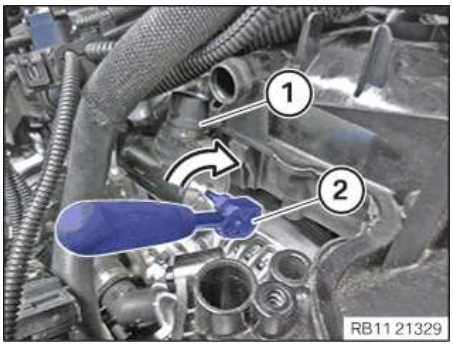
- Route all cables without abrasions, do not trap and crush.



- Renew sealing ring (1).

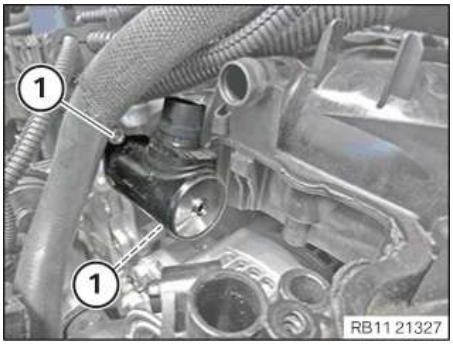
  Parts: Sealing ring

- Guide in and install sealing ring (1) up to the limit position on the housing.



- Insert the servomotor (1) to the gearing on the cylinder head.
- Turn the drive shaft of the servomotor (1) in the direction of the arrow with a standard tool (2) until the servomotor (1) is flush with the cylinder head.

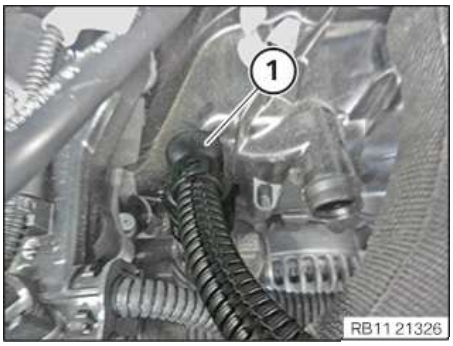
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- Tighten the screws (1).

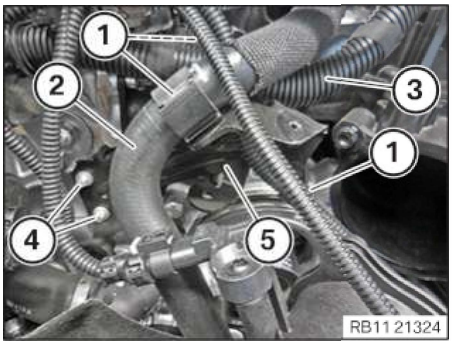
Electrical servomotor to cylinder head

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

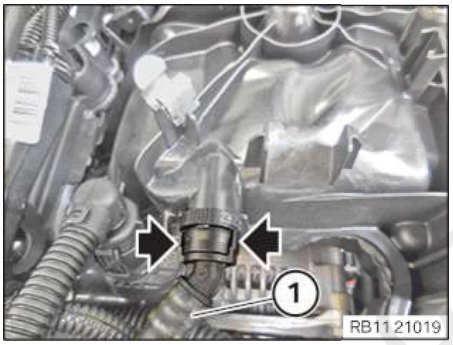


- Insert and install the holder (5).
- Tighten down screws (4).

Manifold support for intake air to cylinder head

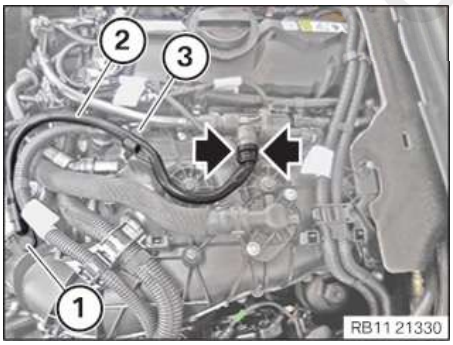
M6X16		Tightening torque	8 Nm

- Guide in and install wiring harness section (3) for sensor system 2.
- Feed in and install coolant line (2).
- Connect and lock the clamps (1).
- Make sure the clamps (1) engage audibly.



- Insert and install the tank ventilation line (1).

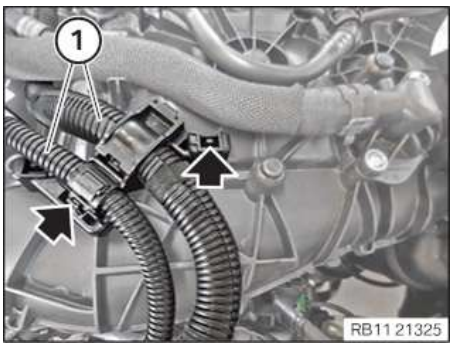
  The locks (arrows) must engage audibly.



- Insert and install the tank ventilation line (2).
- Make sure that you can hear the locks (arrows) engage.
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

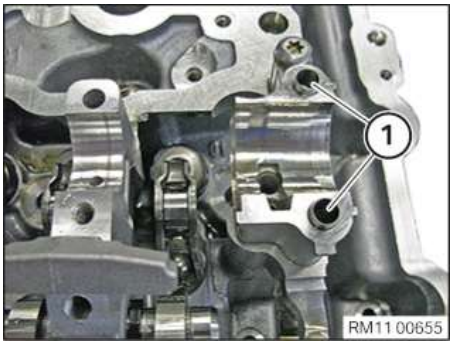
Oval-head screw		Tightening torque	3 Nm



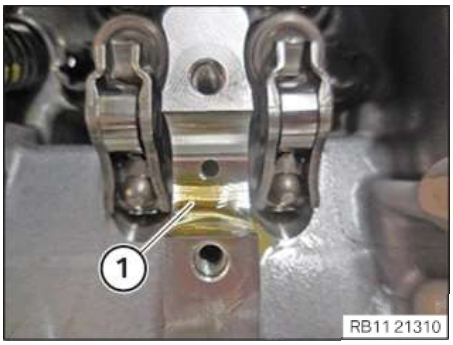
- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

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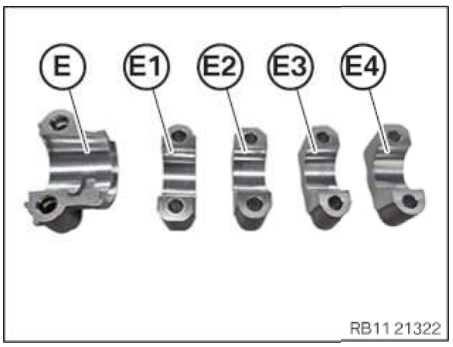
52 – Install intake camshaft



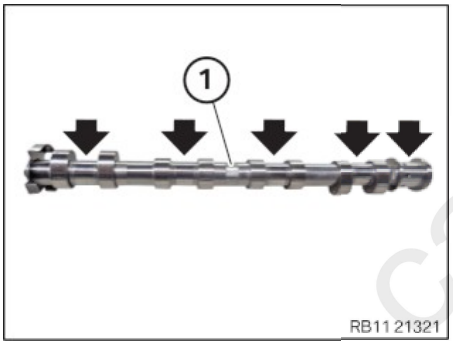
- Check the fitting sleeves (1) for correct fit and damage and replace where required.



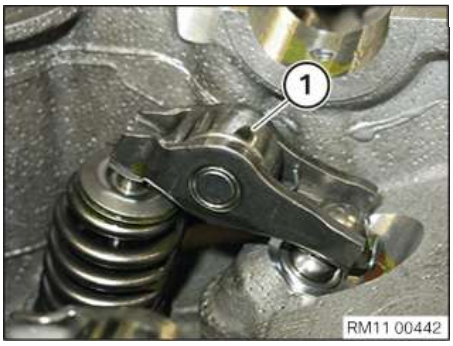
- Coat all bearing positions (1) with fresh engine oil.



- Clean all the bearing positions of the intake camshaft bearing caps (E1), (E2), (E3), (E4) and (E) and coat with engine oil.

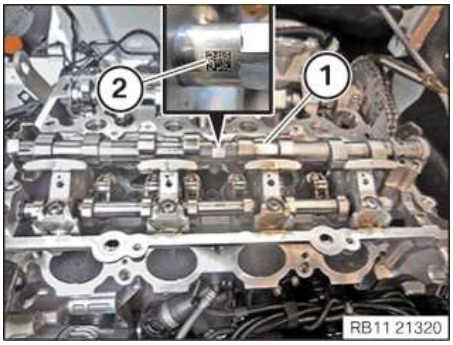


- Clean all bearing positions (arrows) of the intake camshaft (1) and coat with engine oil.

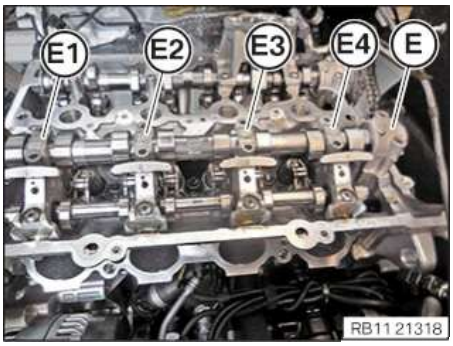


- Ensure the **correct** fit of the roller cam followers (1) before mounting the intake camshaft.
- Coat roller cam follower (1) with **new** engine oil.

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- Insert the intake camshaft (1) into the cylinder head so that the mark (2) points up.



- Position the intake camshaft bearing cap on the cylinder head.

Note: The intake camshaft bearing caps can be read from the intake side and are identified by **E1**, **E2**, **E3 E4** and **E**.

Note: Intake camshaft bearing cap **E** is a thrust bearing.

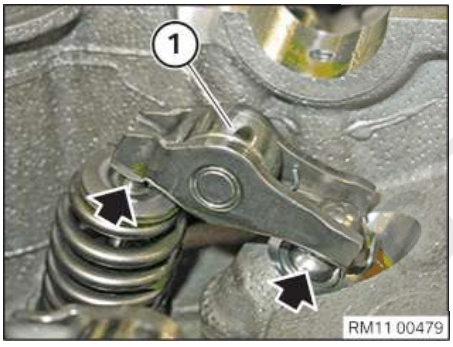


- Press intake camshaft bearing cap down and hand-tighten the bolts incrementally in sequence (1) to (10).
- Join bolts in sequence (1) to (10) **in half turns**.
- **Observe jointing torque.**
- **Tighten** all bolts in sequence from (1) to (10).

Intake camshaft to cylinder head

M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

53 – Checking installation position of roller cam followers

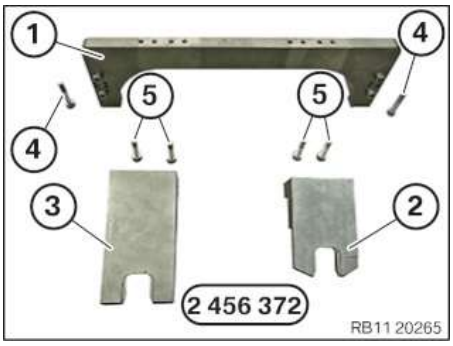


TECHNICAL INFORMATION

The rocker arms may slip slightly when the camshaft is positioned. Make sure rocker arms are correctly positioned on the hydraulic valve clearance compensating elements and on valves.

- Make sure the mounting orientation (arrows) of the roller cam followers (1) is correct.

54 – Adjust the camshafts with the special tool



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier

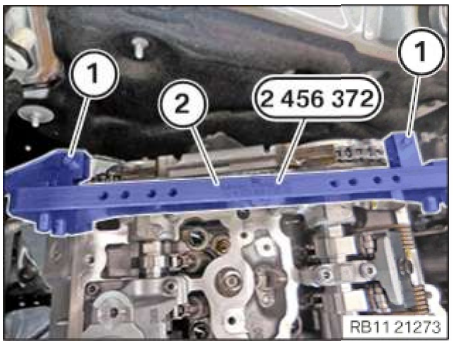
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- Use the setting gauge 0.7 ° (1) from the set of special tools 2 456 372 to adjust the intake camshaft.
- Use the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 to adjust the exhaust camshaft.



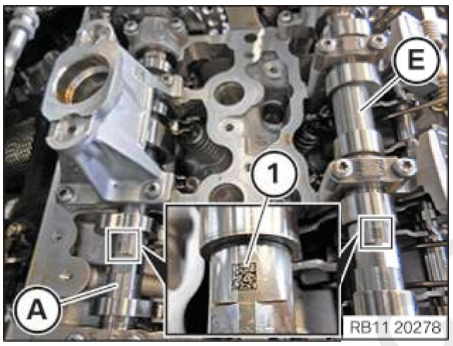
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



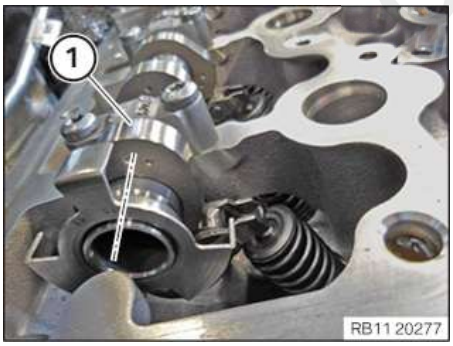
- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

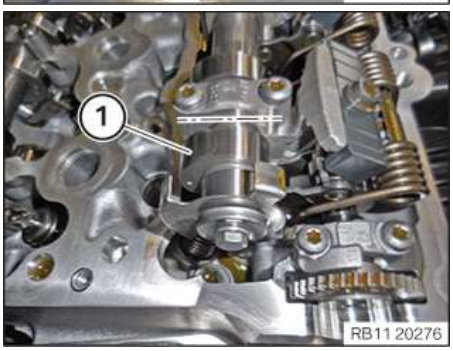
M6		Tightening torque	8 Nm



- Turn the intake camshaft (E) and the exhaust camshaft (A) to the correct position so that the marks (1) can be read from above.

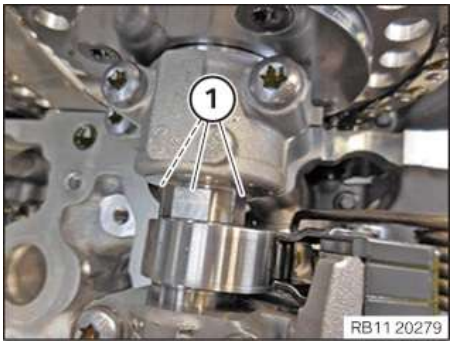


- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.

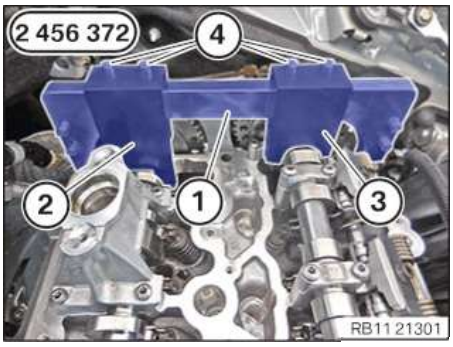


- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

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- Ensure that the flattened areas (1) on the intake camshaft and the exhaust camshaft point upwards.



- Position the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Position the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) from the set of special tools 2 456 372.
- Tighten down screws (4).

Test gauge to basic carrier

M6		Tightening torque	8 Nm

55 – Installing the intake adjuster

NOTICE

The figure shows the rear side of the engine.

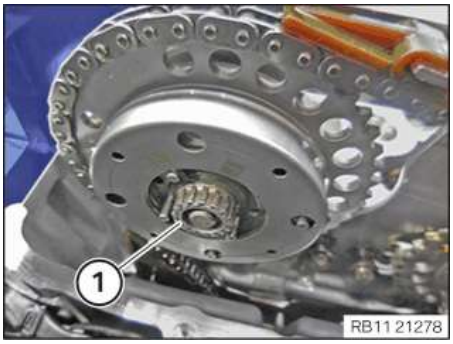


- Keep intake adjuster (1) marked IN ready.



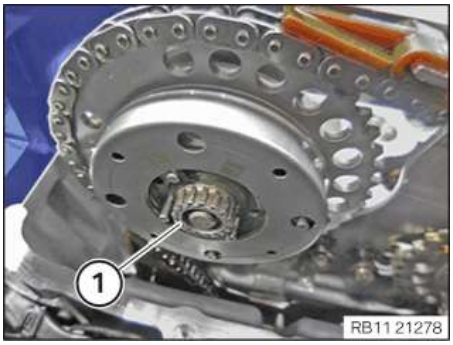
- Feed in intake adjuster (1) in the timing chain (2) and position on the intake camshaft .

56 – Install the VANOS central valve of the intake adjuster

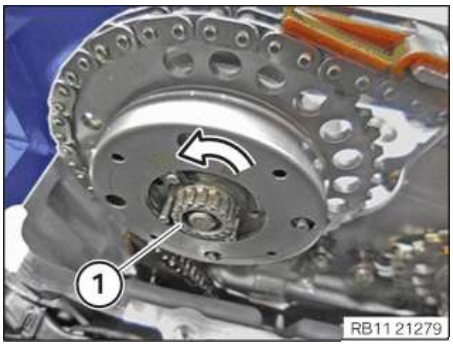


- Guide in the VANOS central valve (1) of the intake adjuster and install.

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- Hand-tighten the VANOS central valve (1) of the intake adjuster.

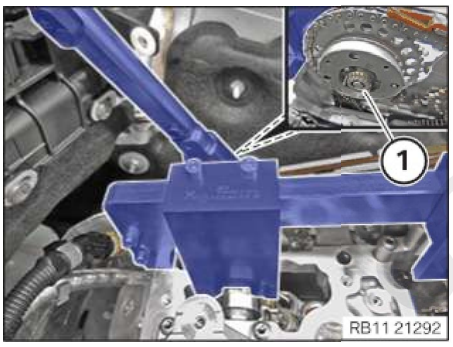


- Release the VANOS central valve (1) of the intake adjuster in the **direction of the arrow** by 60 °.

57 – Releasing VANOS central valve of the exhaust camshaft adjuster



- To release the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with the special tool 2 450 487.

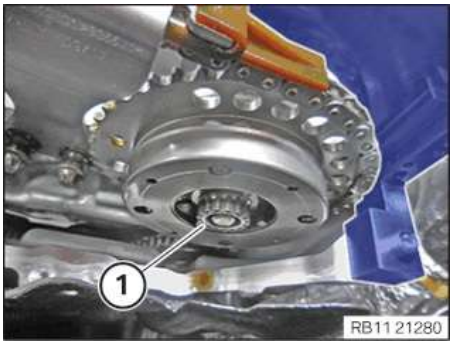


NOTICE

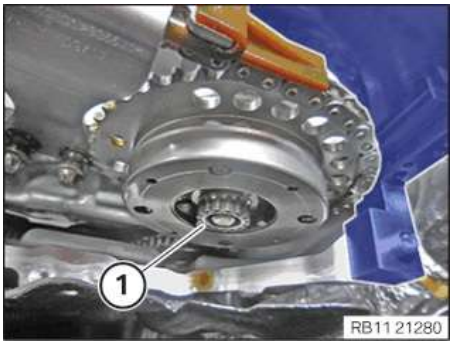
The figure shows the rear side of the engine.

- Release the VANOS central valve (1) of the exhaust camshaft adjuster.

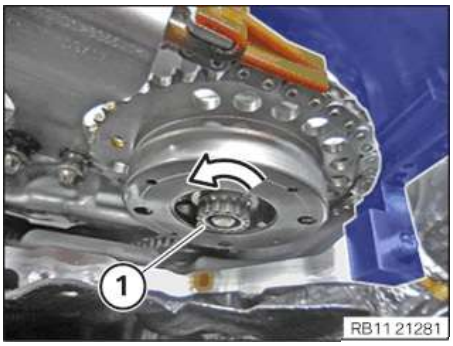
58 – Installing the VANOS central valve of the exhaust camshaft adjuster



- Guide in the VANOS central valve (1) of the exhaust camshaft adjuster and install.

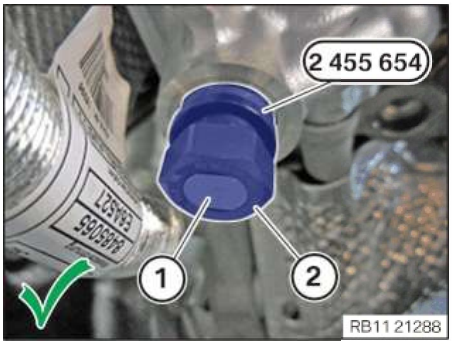


- Hand-tighten the VANOS central valve (1) of the exhaust camshaft adjuster.



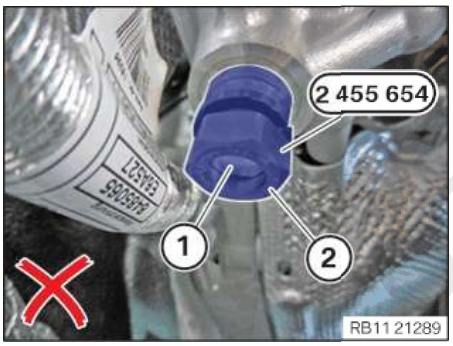
- Release the VANOS central valve (1) of the exhaust camshaft adjuster in the **direction of the arrow** by 60 °.

59 – Pretension the timing chain with the special tool



- Make sure that the timing chain is **correctly** pre-tensioned with the special tool 2 455 654.

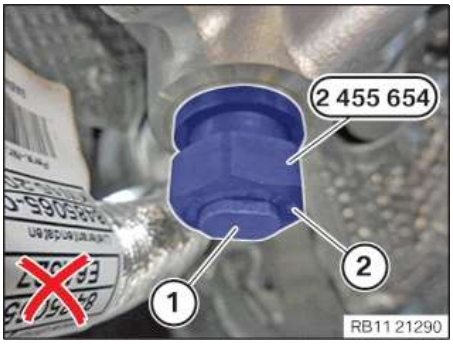
  The pin (1) must align **precisely** with housing (2).



- Make sure that the preload of the timing chain is no **insufficient**.

  The preload is insufficient when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.



- Make sure that the preload of the timing chain is not **too high**.

  The preload is too high when the pin (1) of the special tool 2 455 654 is not aligned flush with the housing (2).

  The timing chain is **not correctly** pre-tensioned.

60 – Tightening the VANOS central valve of the intake adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.



- Tighten the VANOS central valve (1) of the intake adjuster.

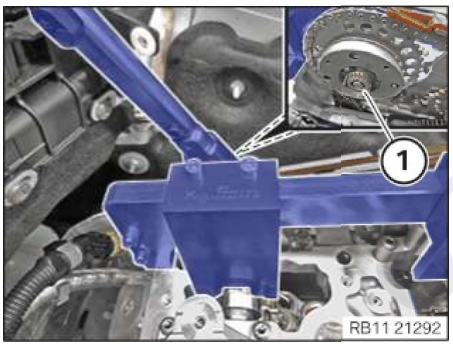
VANOS central valve to camshaft

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

61 – Tightening the VANOS central valve of the exhaust camshaft adjuster



- To tighten the VANOS central valve (1), use the reversible ratchet (2) from the special tool 0 496 855 with special tool 2 450 487.

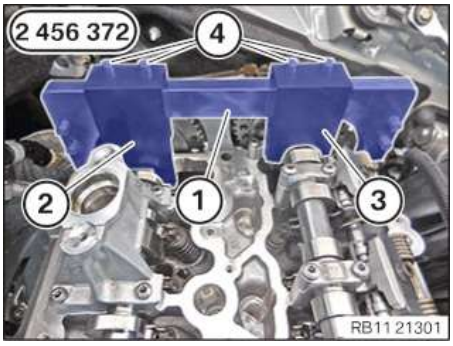


- Tighten the VANOS central valve (1) of the exhaust camshaft adjuster.

VANOS central valve to camshaft

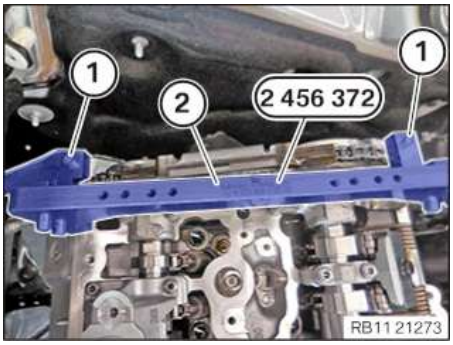
M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

62 – Disassembling all special tools

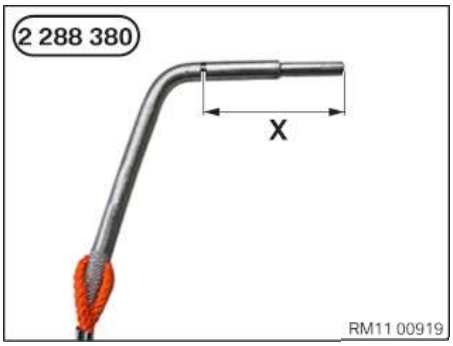


- Unscrew the bolts (4) from the set of special tools 2 456 372.
- Feed out the setting gauge 0.5 ° (2) from the set of special tools 2 456 372 between the exhaust camshaft and the basic carrier (1) and remove.
- Feed out the setting gauge 0.7 ° (3) from the set of special tools 2 456 372 between the intake camshaft and the basic carrier (1) and remove.

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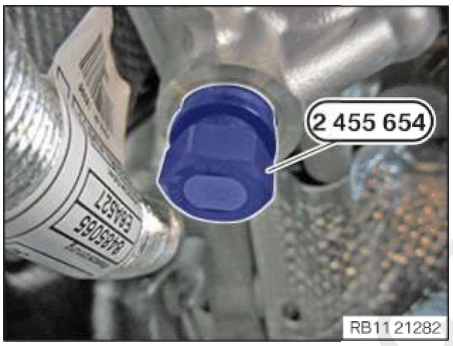
- Unscrew the bolts (1) from the set of special tools 2 456 372.
- Thread the basic carrier (2) out of the special tool 2 456 372 and remove.



- Guide the special tool 2 288 380 out and remove.



- Guide the special tool 0 493 380 (11 6 480) out and remove.



- Guide the special tool (1)2 455 654 out and remove.

63 – Install chain tensioner

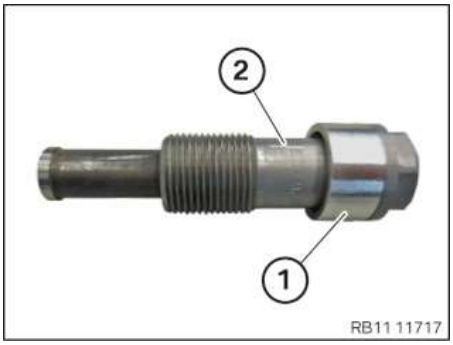
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Drain the oil chamber in the chain tensioner when reusing the chain tensioner.
- Place the chain tensioner on a level support and slowly compress and release it again in the direction of the arrow.
- Catch and dispose of emerging engine oil.
- Repeat process twice.

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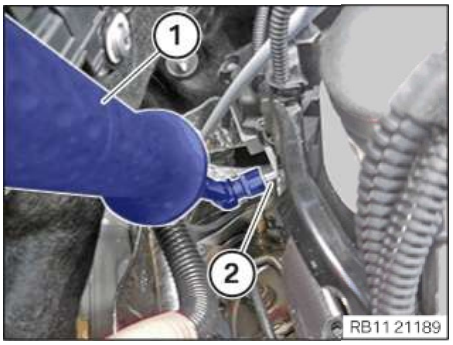


- Renew the sealing sleeve (1).

  Parts: Sealing sleeve
- Guide the sealing sleeve (1) onto the chain tensioner (2) and install.



- Insert and install the chain tensioner (1).

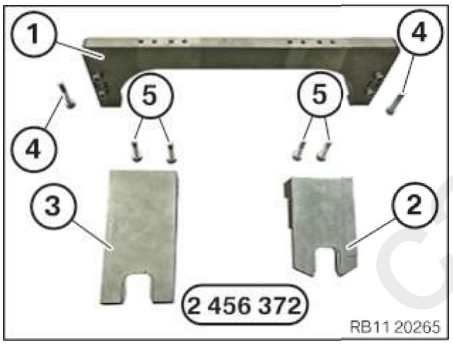


- Tighten the chain tensioner (2) using commercially available tools (1).

Chain tensioner to cylinder head

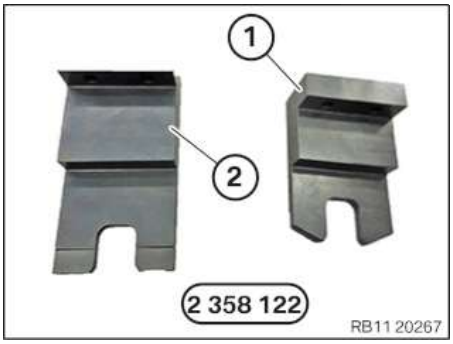
Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

64 – Checking camshaft timing



- Overview of the set of special tools 2 456 372:

Number	Description
1	Basic carrier
2	Setting gauge to adjust the intake camshaft
3	Setting gauge to adjust the exhaust camshaft
4	Basic carrier screws on cylinder head
5	Screw gauge on basic carrier



- Overview of the test gauges from the set of special tools 2 358 122:

Number	Description
1	Test gauge to fix the intake camshaft
2	Test gauge to fix the exhaust camshaft

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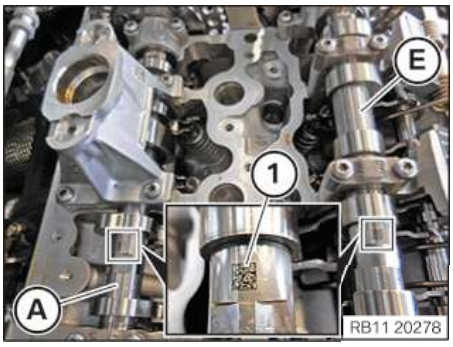
RISK OF DAMAGE

Damage to the engine.

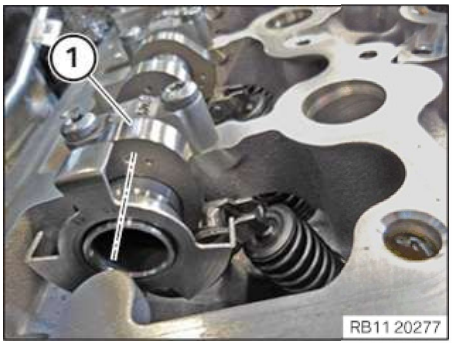
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

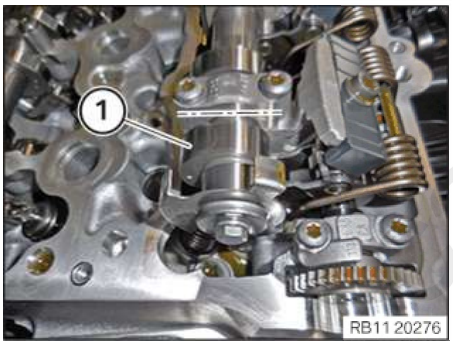
- Turn the engine in **direction of arrow** with the special tool 0 493 380 (11 6 480) to the TDC firing position of **cylinder 1**.



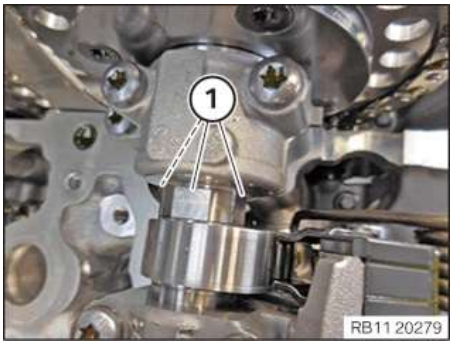
- Ensure that the marks (1) on the intake camshaft (E) and the exhaust camshaft (A) can be read from above.



- Ensure that the cam (1) on the exhaust camshaft on **cylinder 1** points to the inside right at a slight angle.



- Ensure that the cam (1) on the intake camshaft on **cylinder 1** points to the left at an angle.

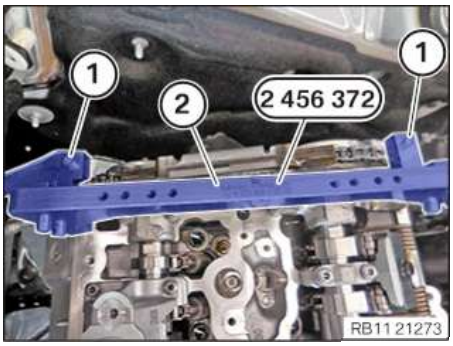


- Make sure that the flattened areas (1) on the intake and exhaust camshafts point upwards.

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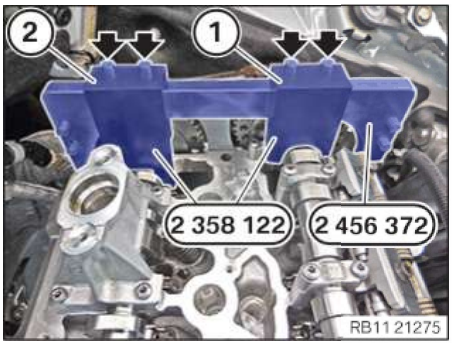
- Position the basic carrier (1) from the set of special tools 2 456 372 on the cylinder head.



- Tighten the screws (1) from the set of special tools 2 456 372 on the basic carrier (2).

Basic carrier to cylinder head

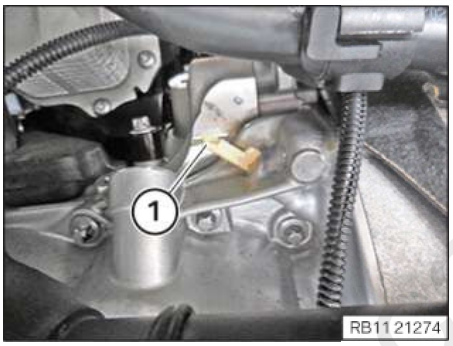
M6		Tightening torque	8 Nm



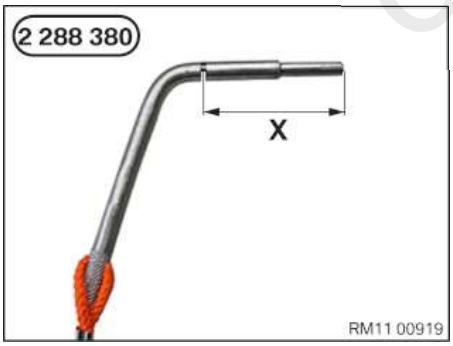
- Position the test gauge (1) from the set of special tools 2 358 122 between the intake camshaft and the basic carrier from the set of special tools 2 456 372.
- Position the test gauge (2) from the set of special tools 2 358 122 between the exhaust camshaft and the basic carrier from the set of special tools 2 456 372.
- Tighten screws (arrows).

Test gauge to basic carrier

M6		Tightening torque	8 Nm



- Thread the sealing cap (1) out and remove.



- **Vehicles with automatic transmission:**

  Dimension (X) = 66 mm

  The special tool 2 288 380 must be inserted in the dowel hole to dimension (X).



- **Vehicles with automatic transmission:**

  Special tool 2 288 380 **incorrectly** positioned.

  The TDC firing position of cylinder 1 was **not** reached.

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- **Vehicles with automatic transmission:**

  Special tool 2 288 380 has been **correctly** positioned.

  The engine **is in the** TDC firing position of cylinder 1.

65 – Checking the intermediate lever classification



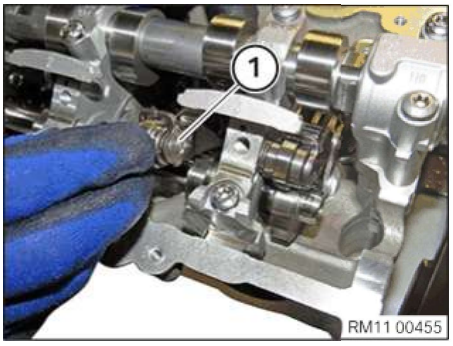
TECHNICAL INFORMATION

All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

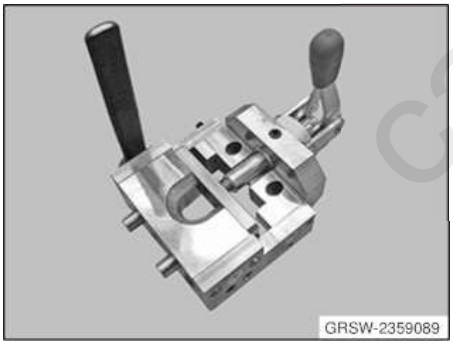
- Check classification (arrow) of intermediate lever.

66 – Installing all intermediate levers

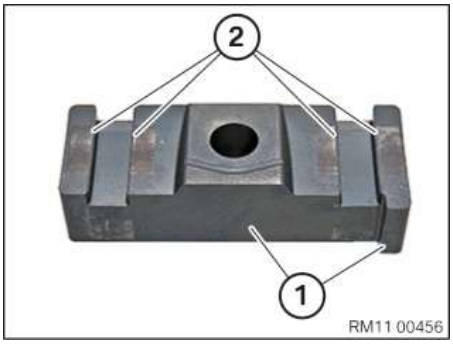


- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

67 – Installing all gates

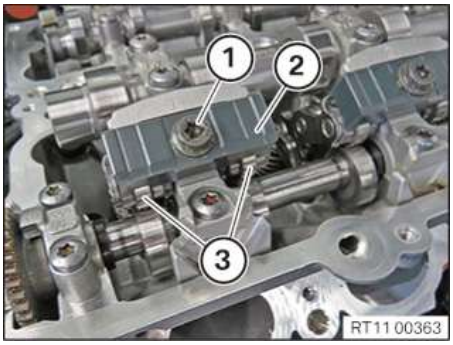


- Have the special tool 2 359 089 ready.

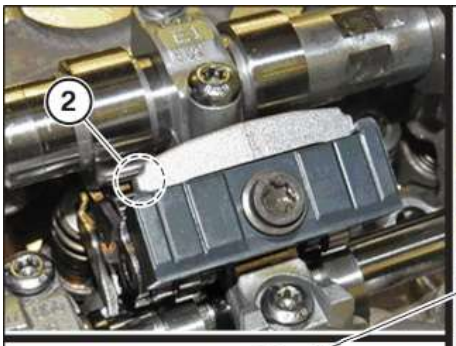


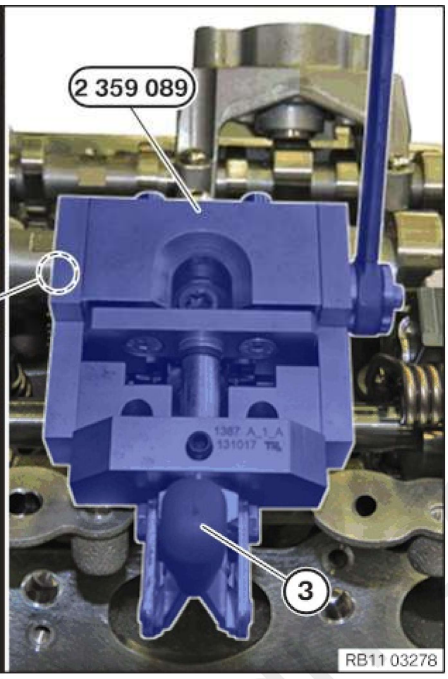
- Clean contact surfaces (1) and (2) off oil, grease and dirt.

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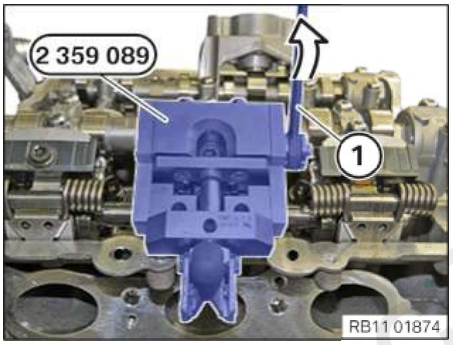


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.





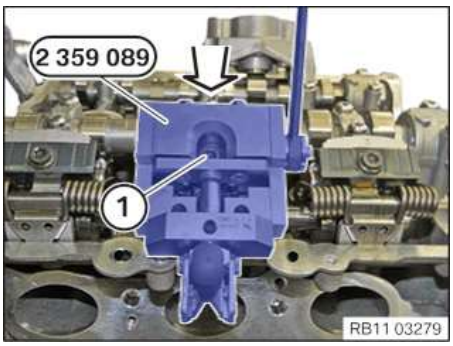
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1) in the direction of the arrow.



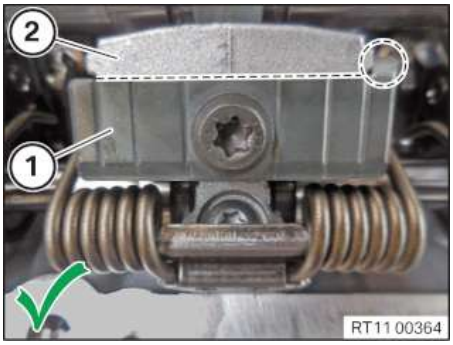
- Make sure that the special tool 2 359 089 rests flat against the cylinder head (arrows).



- Press the special tool 2 359 089 onto the cylinder head in the direction of the arrow.
- Tighten the bolt (1) at the same time.

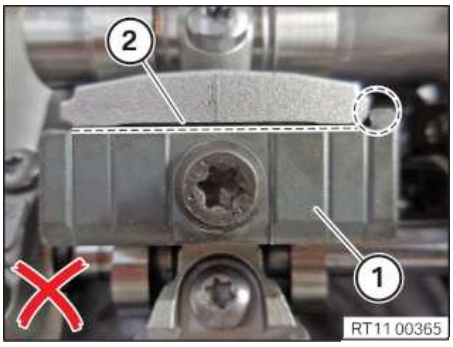
Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).

  Gate (1) is installed correctly in the marked area.



- Ensure that gate (1) rests **correctly** against bearing bracket (2).

  Gate (1) is installed incorrectly in the marked area.

- Repeat the step for all the gates.

68 – Install all torsion springs

CAUTION

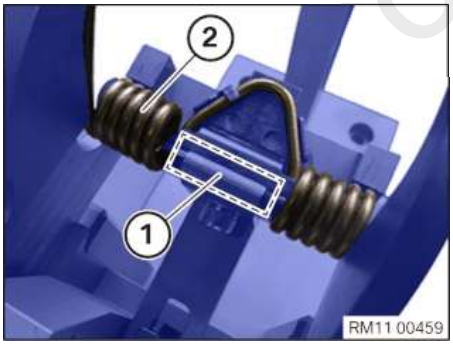
Spring preload.

Danger of injury!

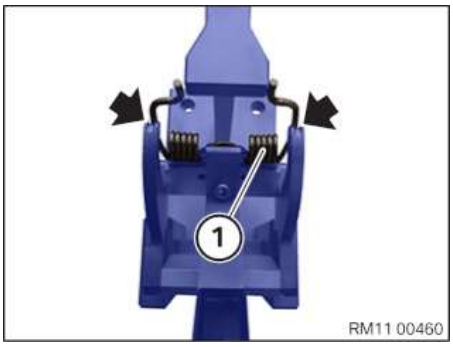
- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

- Wear safety goggles.

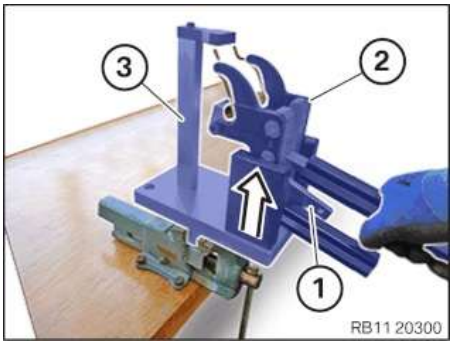


- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.



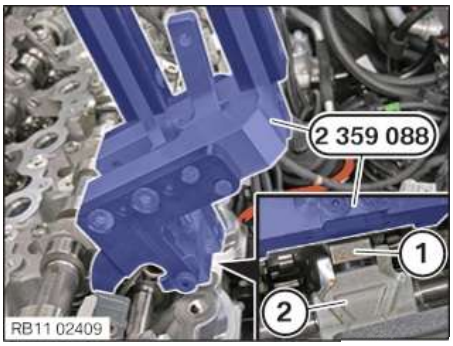
- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

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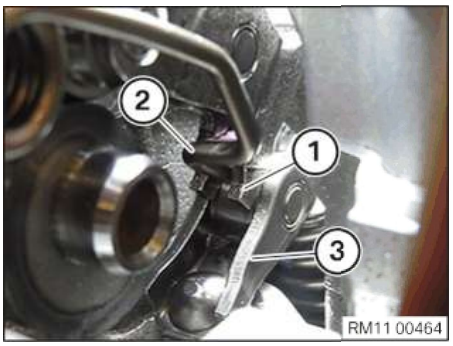


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the lever (1) audibly engages.

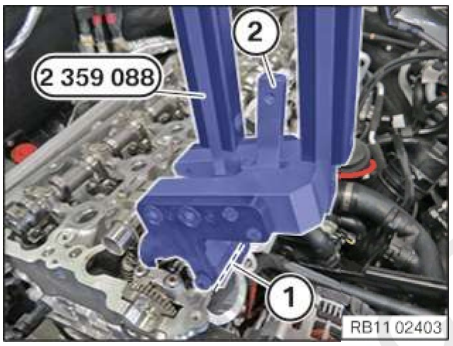
  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.



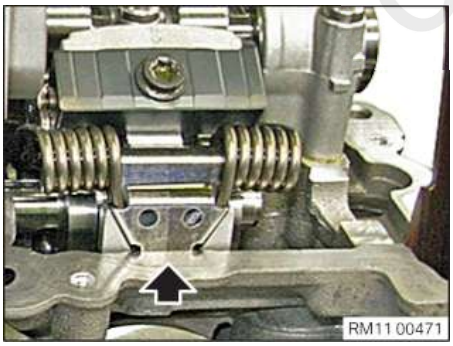
- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).



- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.



- Check the correct mounting orientation of the torsion spring (arrow).
- Repeat the operations for the remaining torsion springs.

69 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

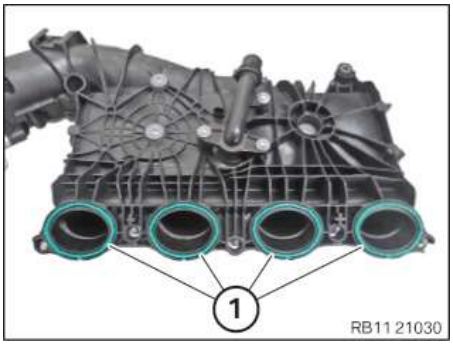
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

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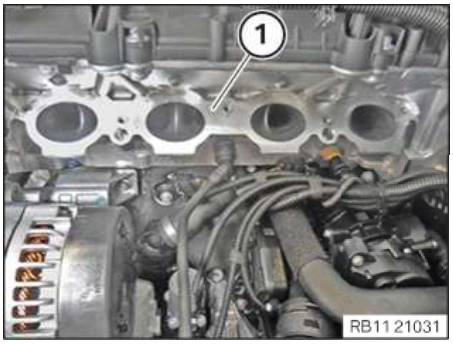
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

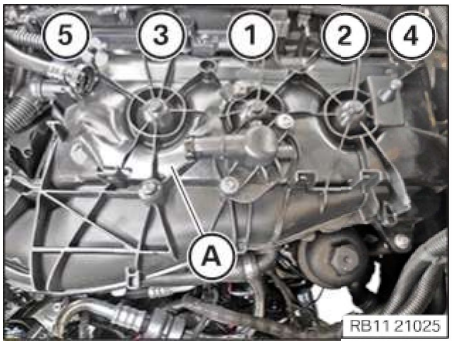


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.

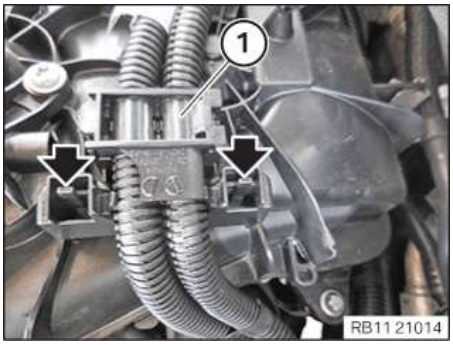


- Tighten down screw (1).

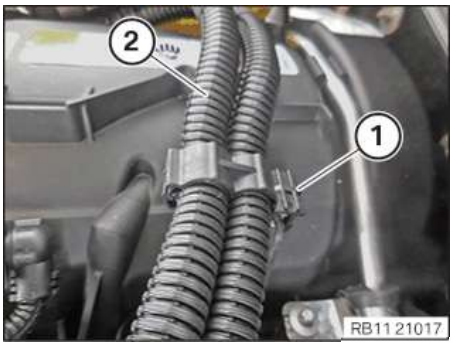
Intake plenum to support

M6X25		Tightening torque	8 Nm

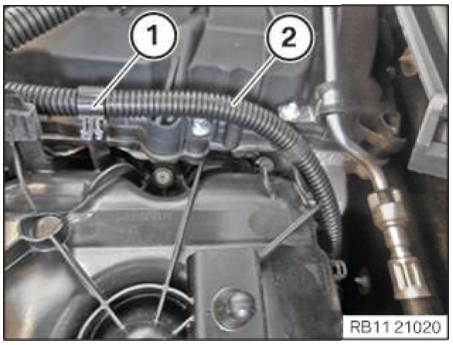
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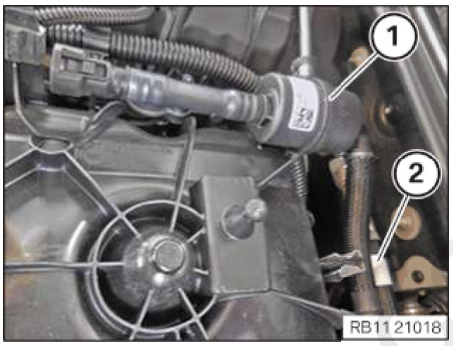
- Insert and install the wiring harness section (1) for the injectors and ignition coils.
  The locks (arrows) must engage audibly.



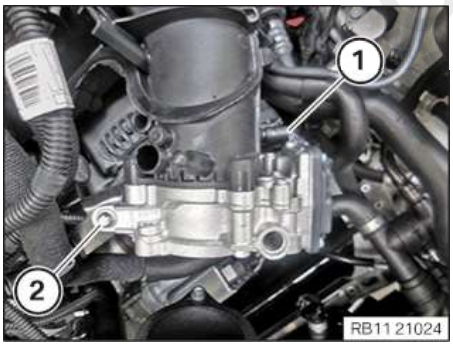
- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



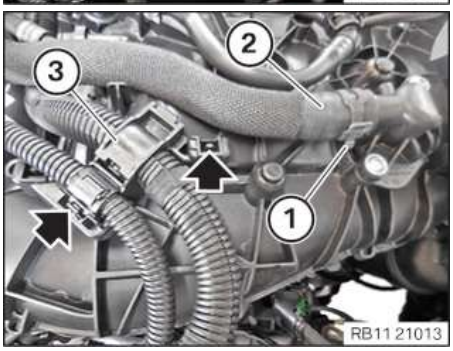
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

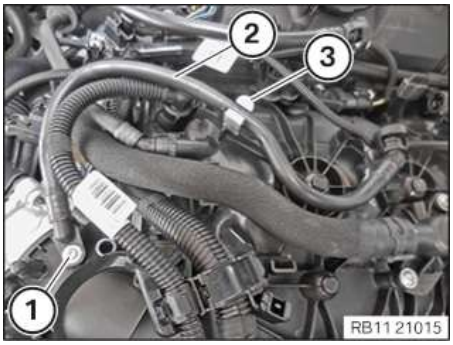
Throttle body to holder

M6X25		Tightening torque	8 Nm



- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

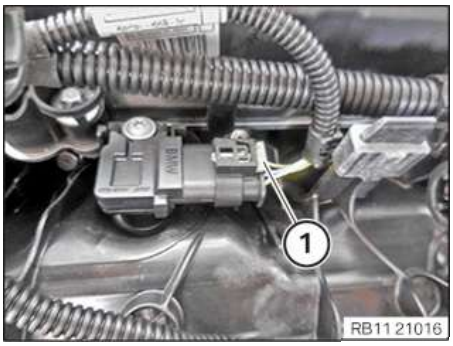
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- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

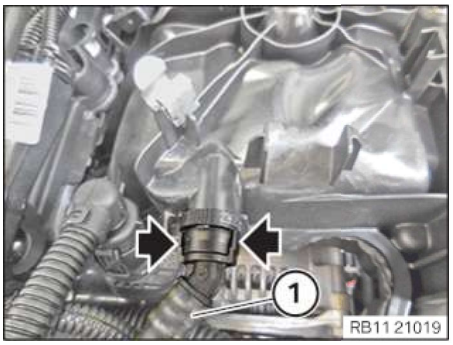
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



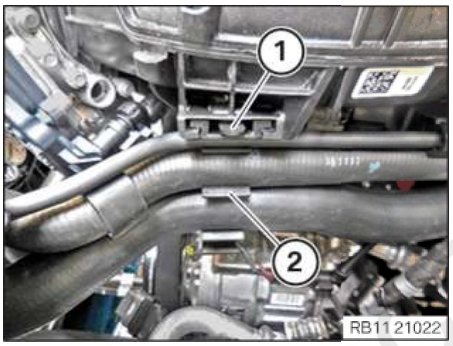
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

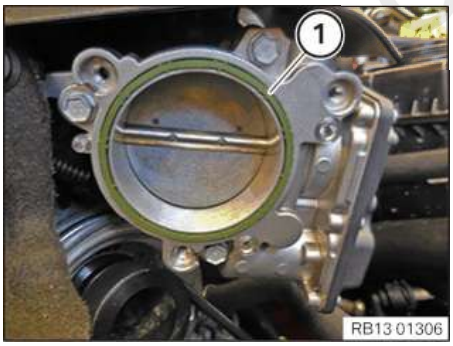


- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

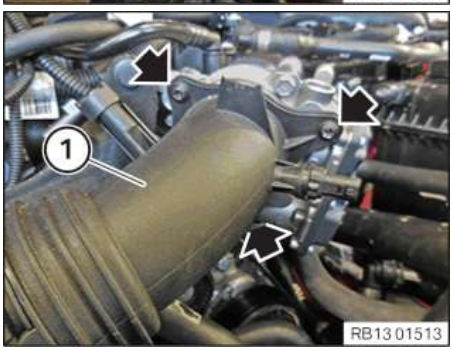


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

  Parts: Gasket

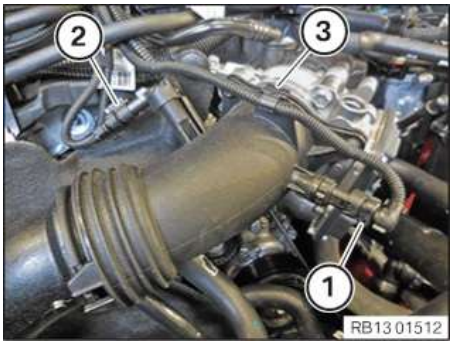


- Insert and install charge air line (1).
- Tighten screws (arrows).

Charge air line to throttle body

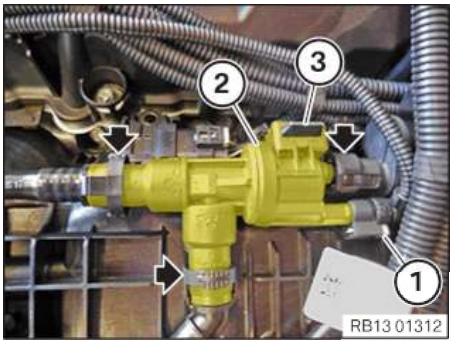
M6		Tightening torque	8 Nm

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- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

70 – Installing the tank vent valve

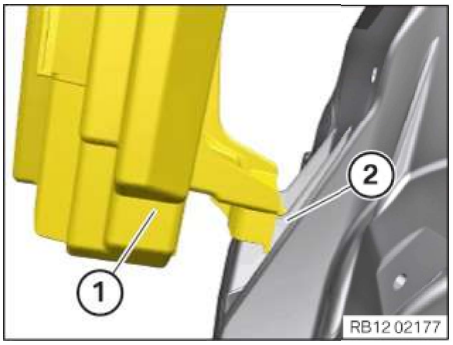


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

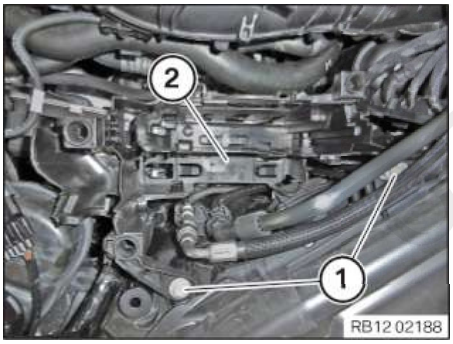
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

71 – Installing the control unit holder



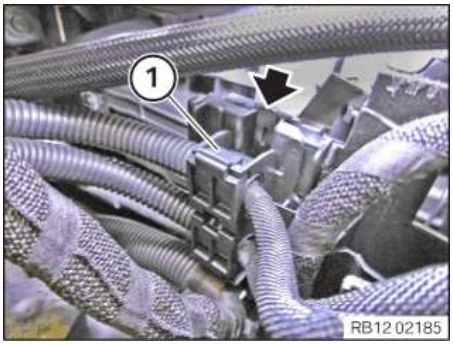
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

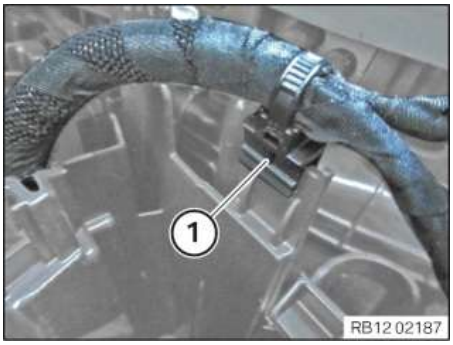
Hexagon screw		Tightening torque	8 Nm



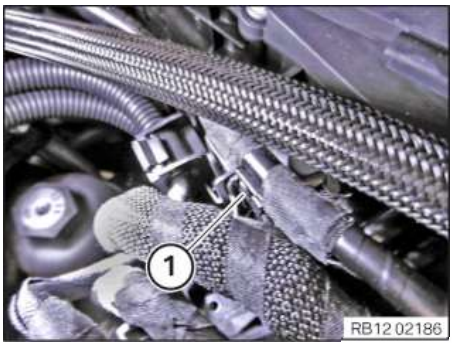
- Feed in and install the cable clip (1).

  Lock (arrow) must audibly engage.

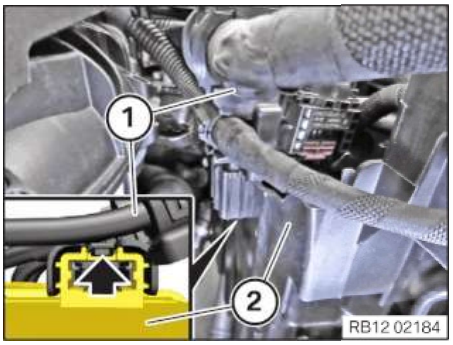
cardiagn.com



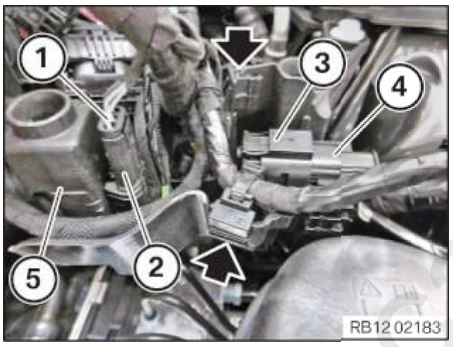
- Secure clamps (1).



- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

72 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

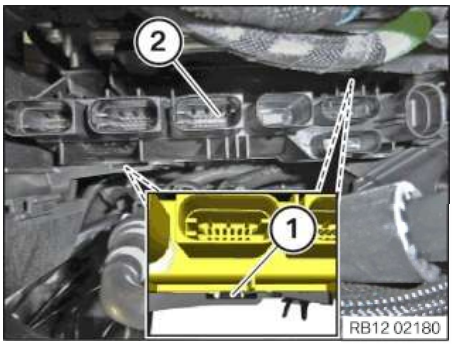
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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Insert and install the integrated supply module (PDM) (2).

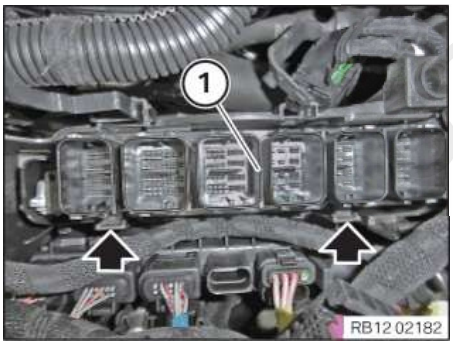
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



- Connect connectors (1) and lock.

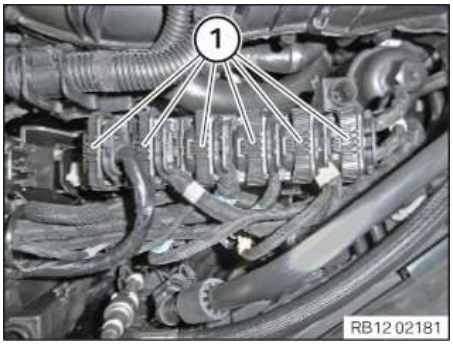
  The connectors (1) must engage audibly.

73 – Installing the DME control unit



- Feed in and install DME control unit (1).

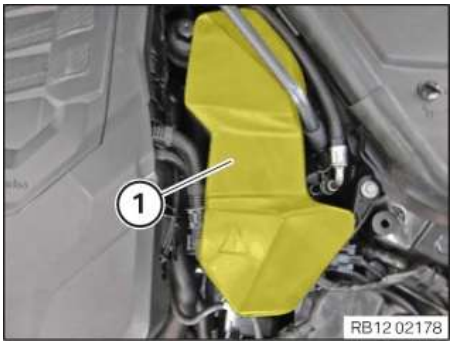
  The locks (arrows) must engage audibly.



- Connect connectors (1) and lock.

  All connectors (1) must engage audibly.

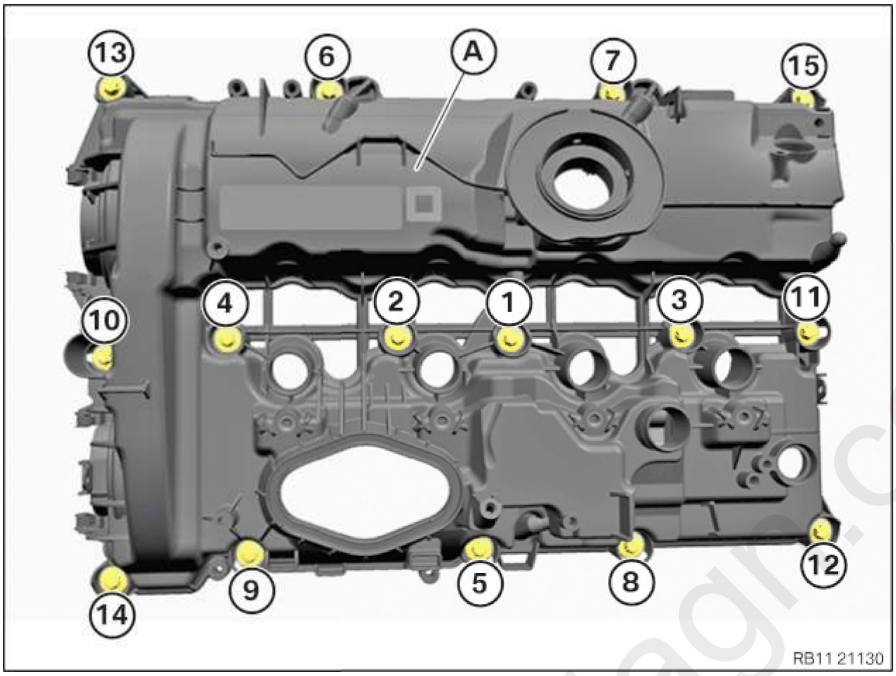
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- Insert and install cover (1) into guides.

74 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

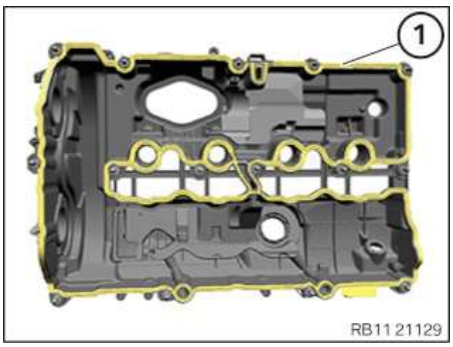
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

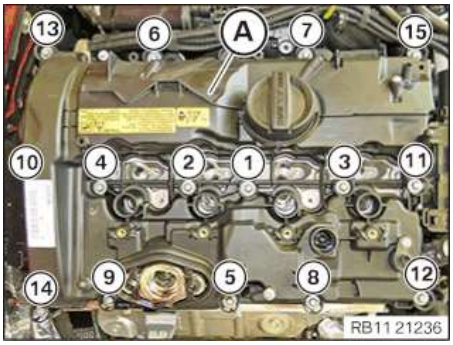
- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

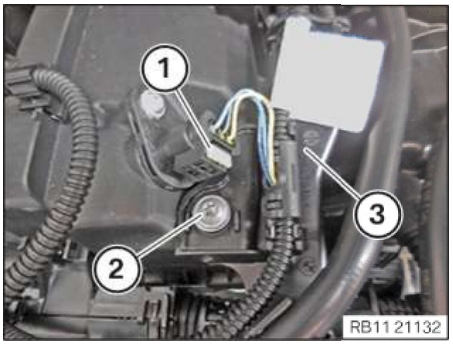
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

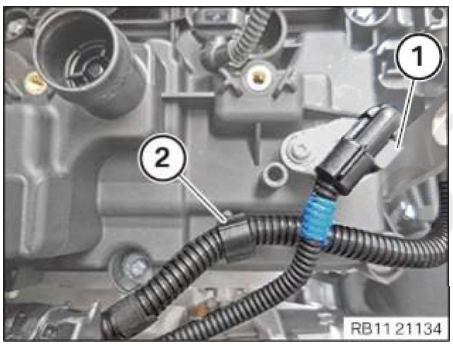


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

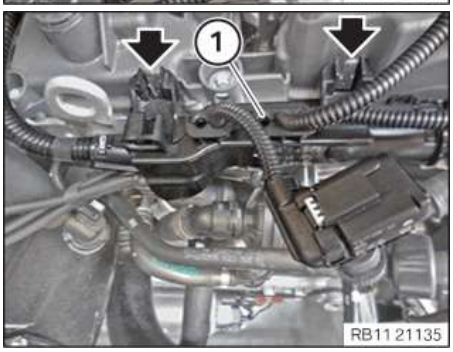
Wiring harness section of engine to cylinder head cover

M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

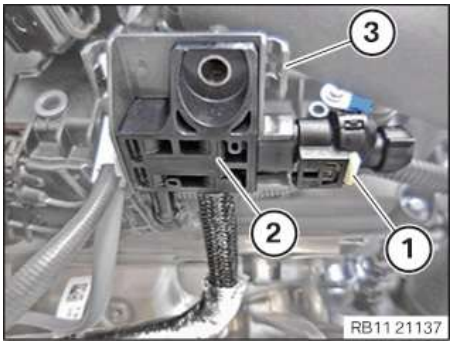


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

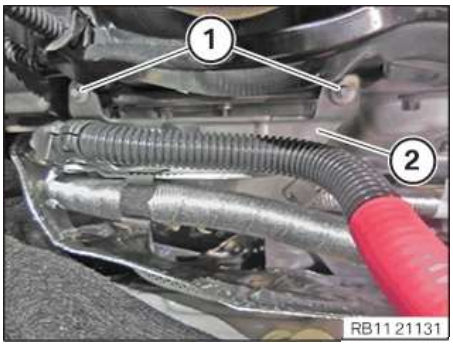


- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

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- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

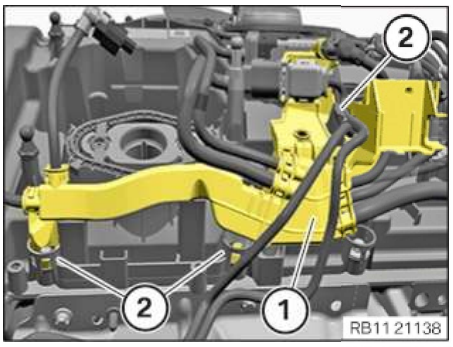
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

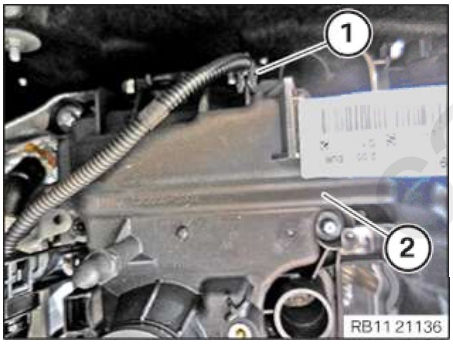
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

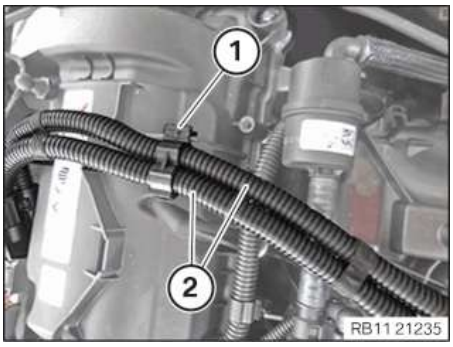
6X18		Tightening torque	6 Nm



- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.



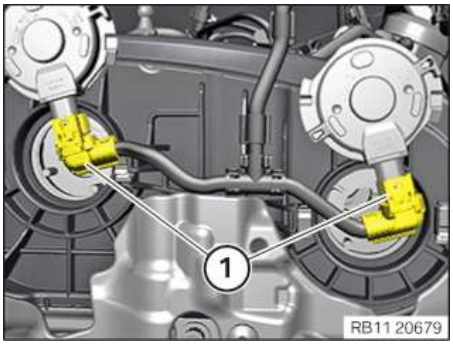
- Secure clamps (1).



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

75 – Installing both actuators

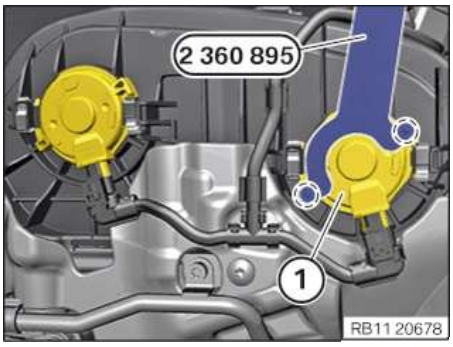
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NOTICE

The figure shows the rear side of the engine.

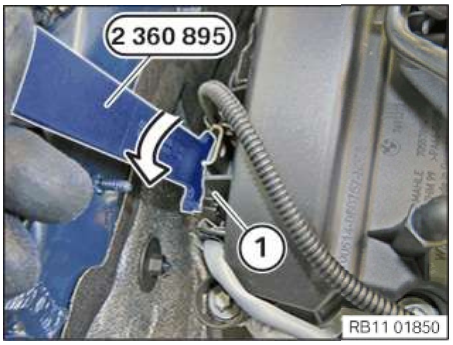
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



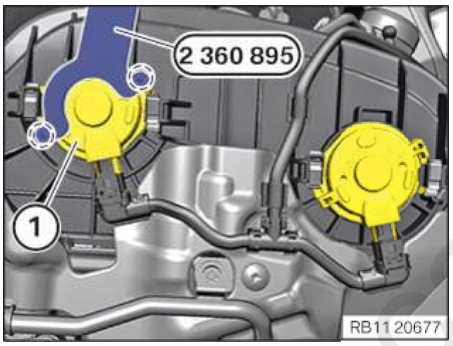
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



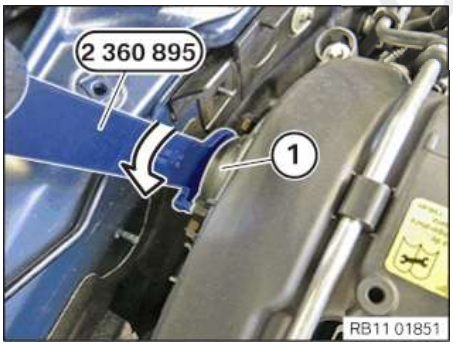
- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.



NOTICE

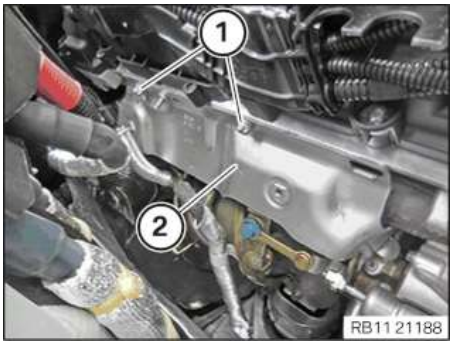
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

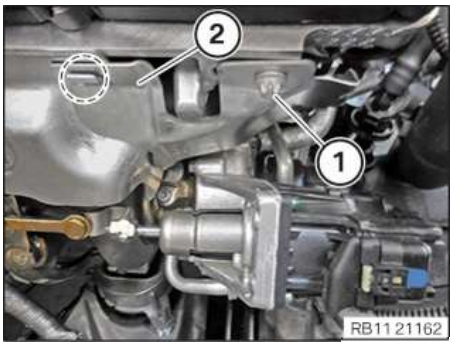
76 – Installing the heat shield on the cylinder head



- Thread in and position the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

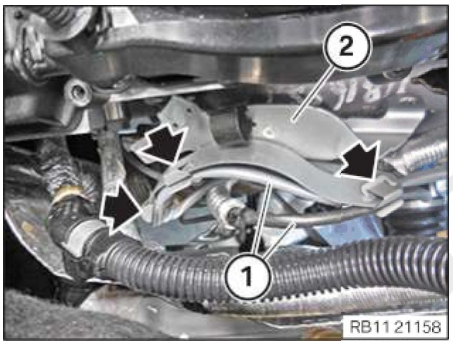


- Tighten down screw (1).

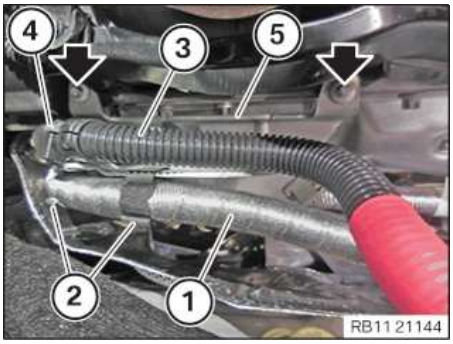
Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

77 – Install the holder of the positive battery cable



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

78 – Prepare the injectors for installation

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RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

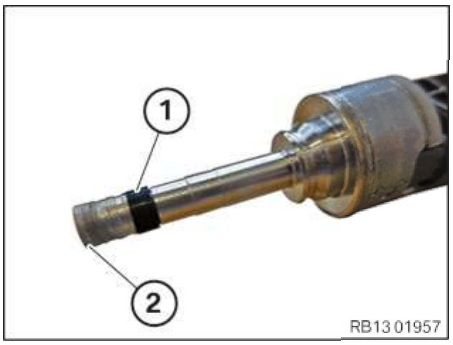
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

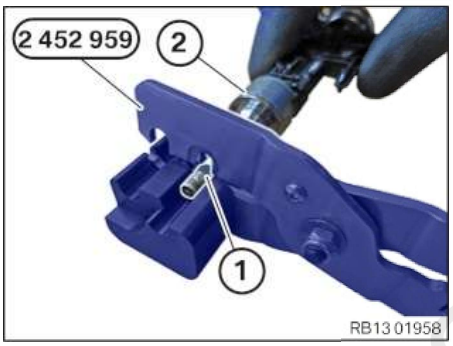
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.

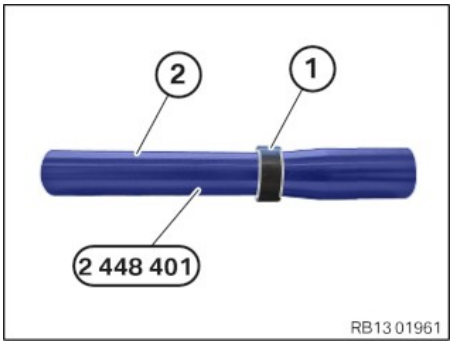


- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

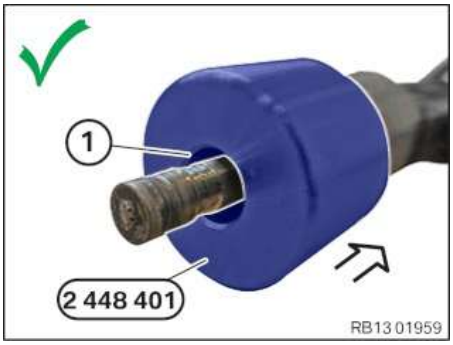
  (2) Sliding sleeve

  (3) Assembly sleeve



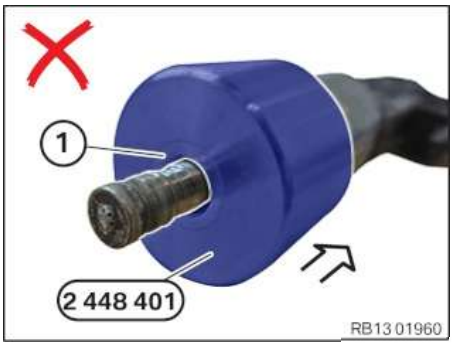
- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.

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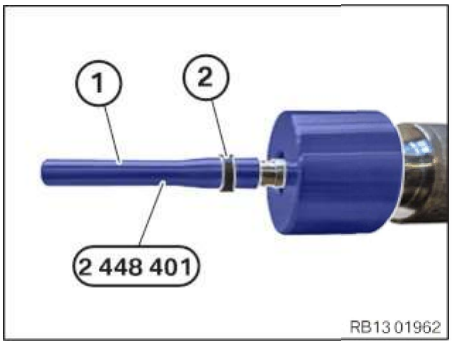
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

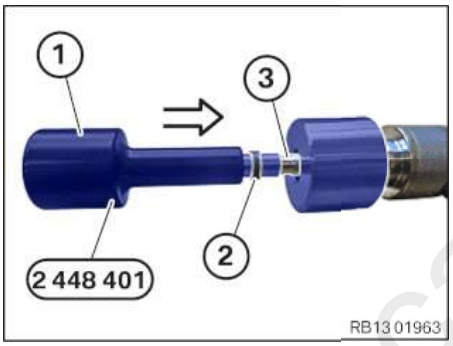


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

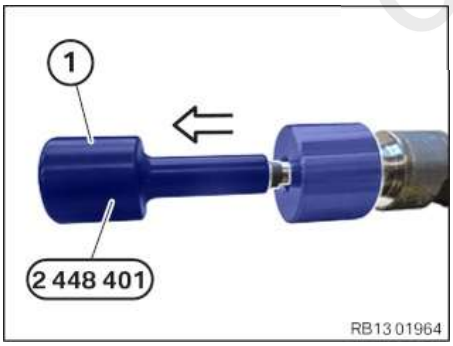
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



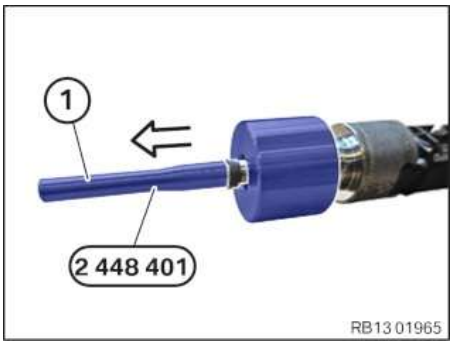
- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .



- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

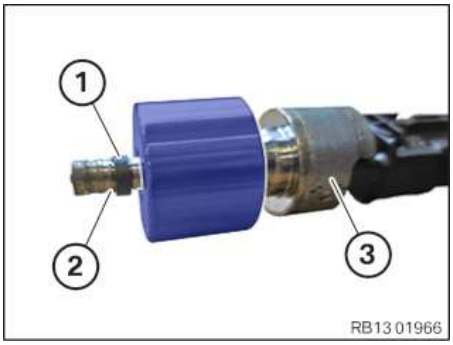


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

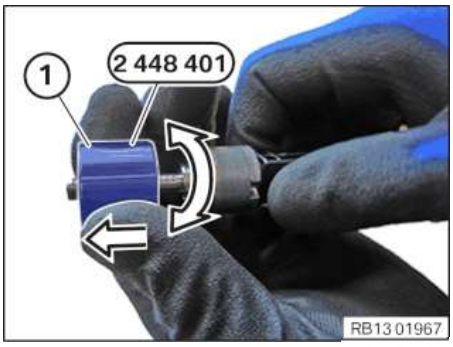


- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

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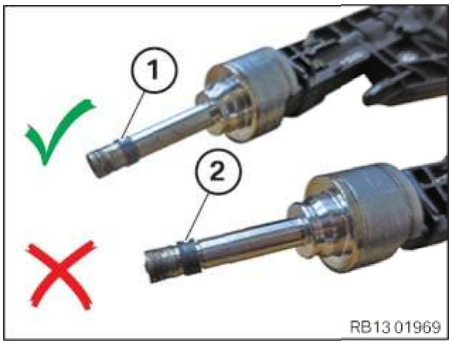


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

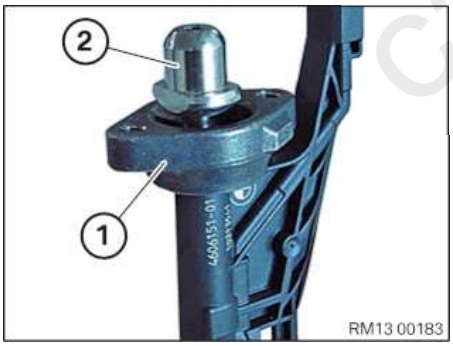


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

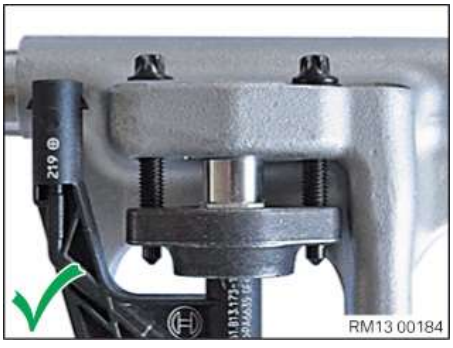
79 – Installing the rail with injectors

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



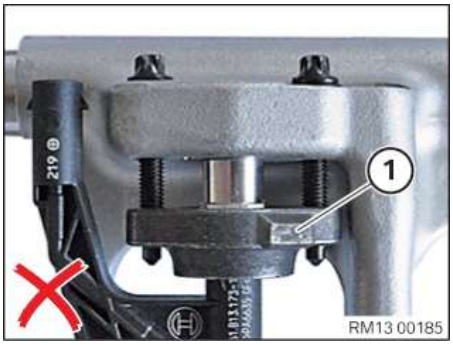
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.



- If applicable, note the position of the cast lug:

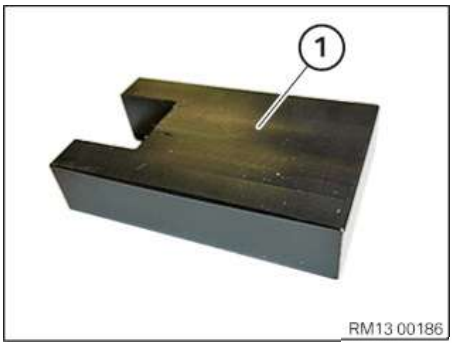
  The holder is mounted **correctly** when the cast lug is located at the rear.

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- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



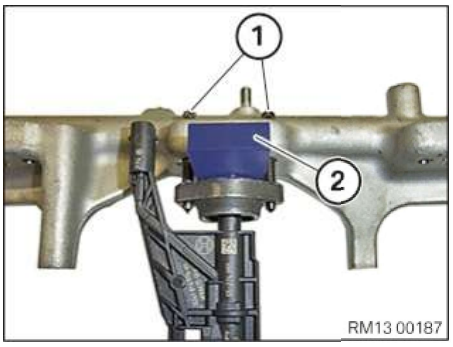
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

  Parts: Screws (M5x30)

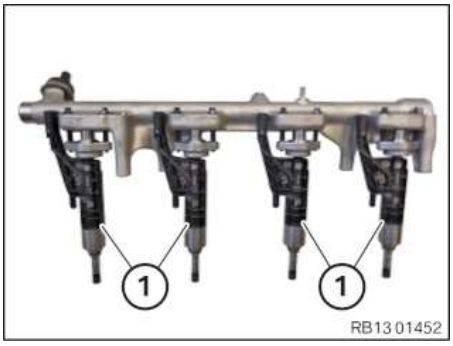
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.

- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



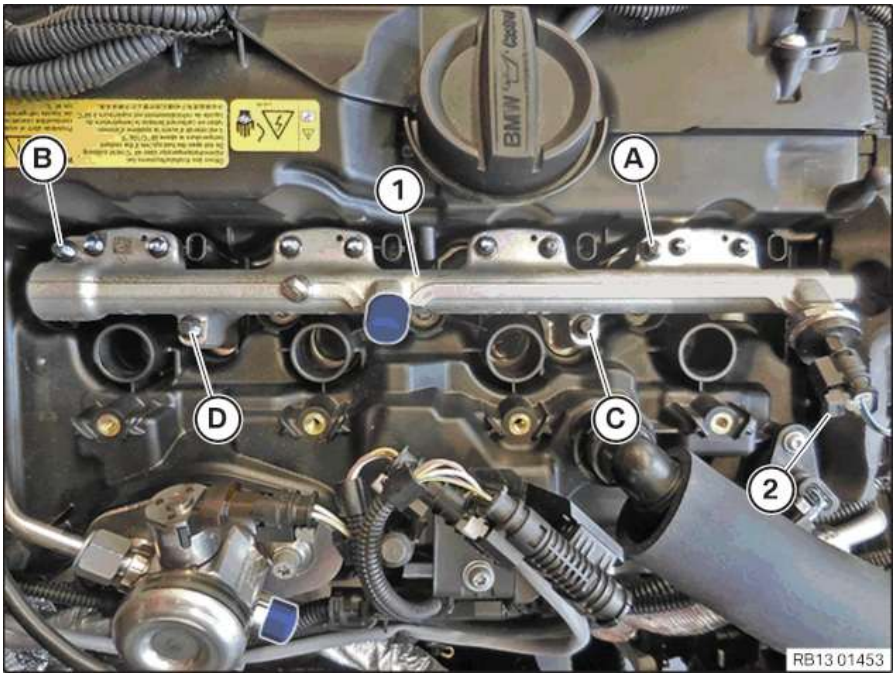
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.



- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.

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- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

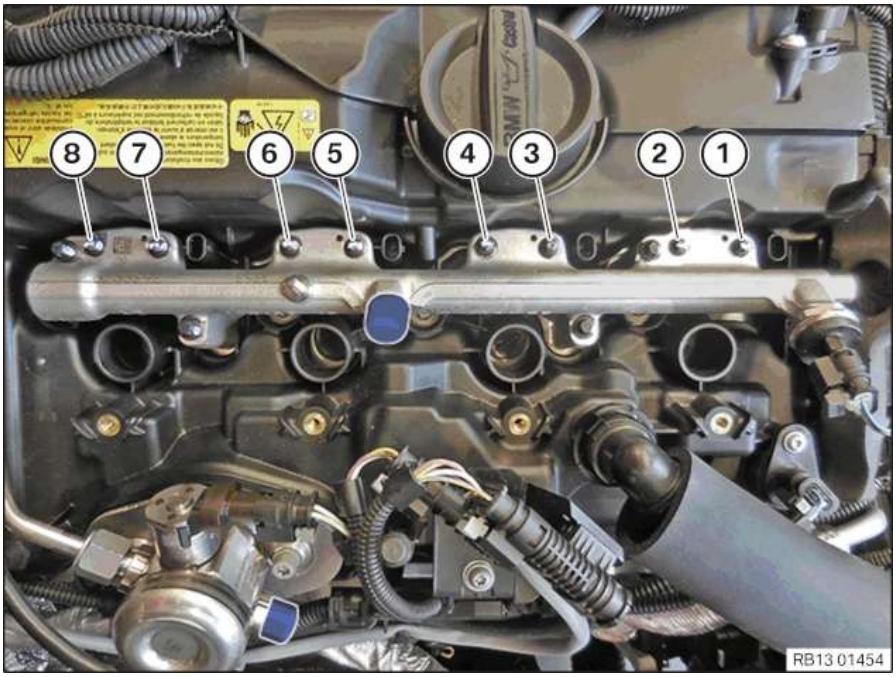
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

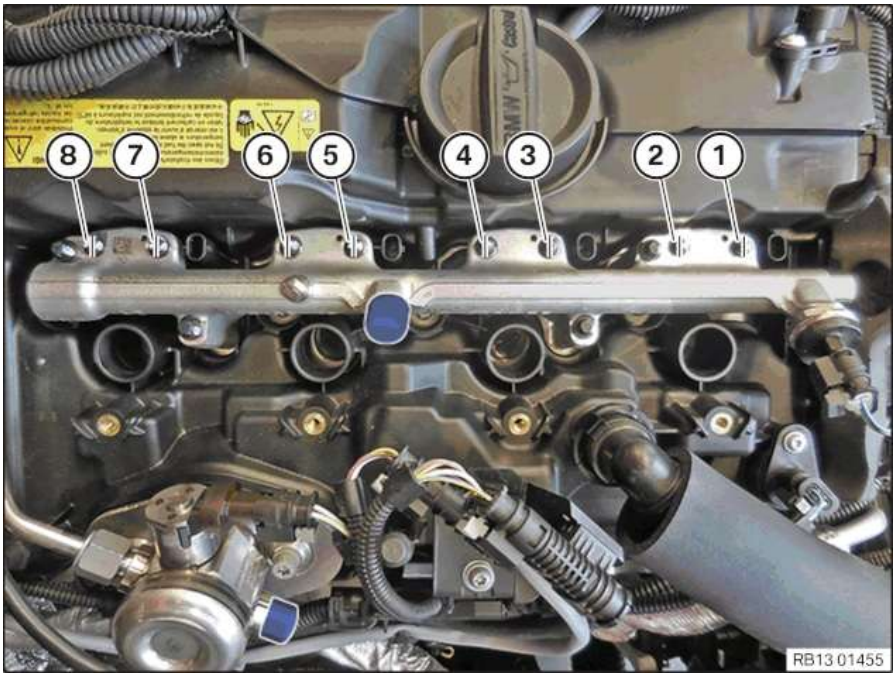
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

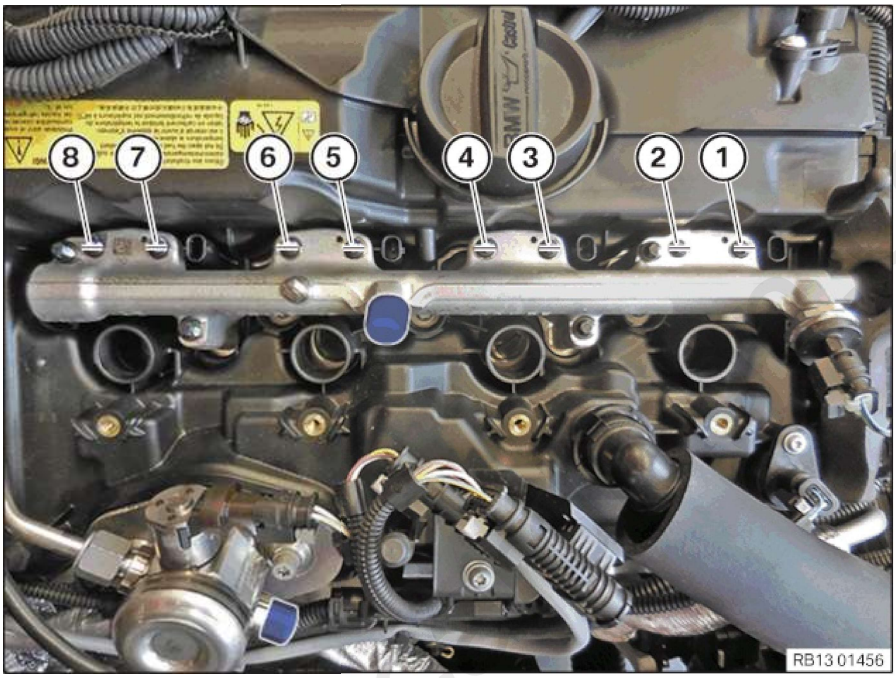
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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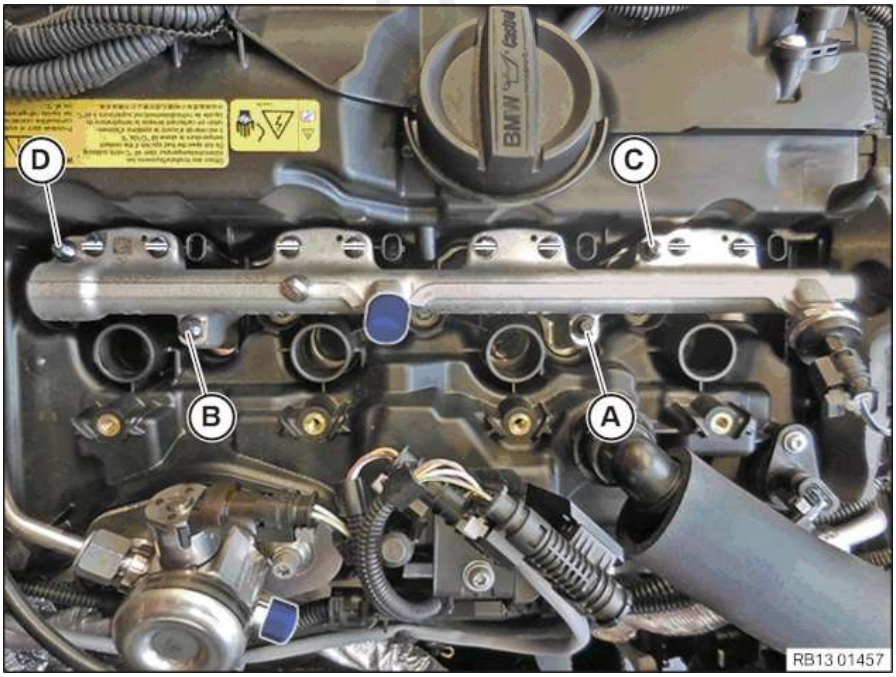


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

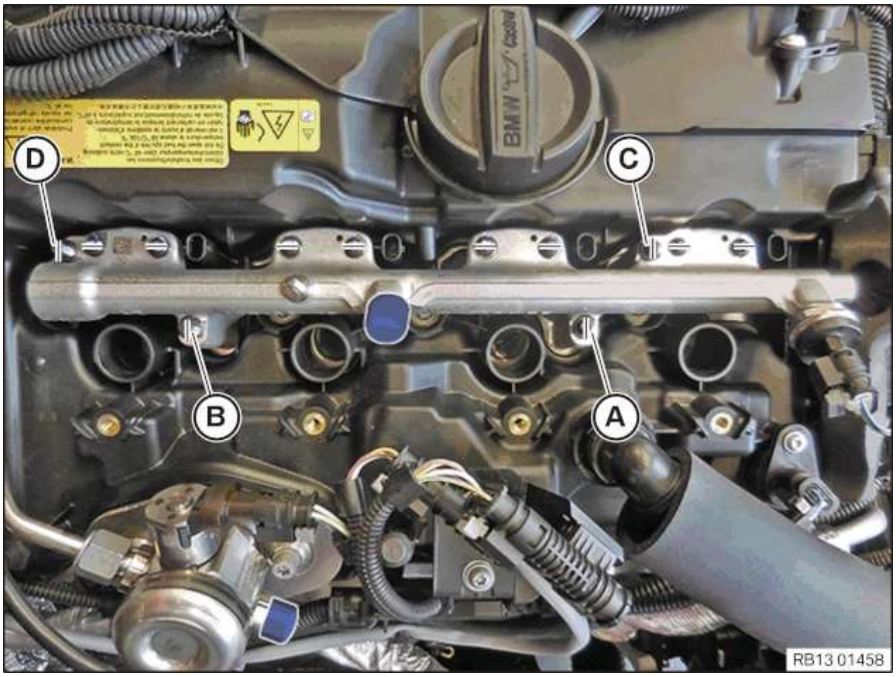
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

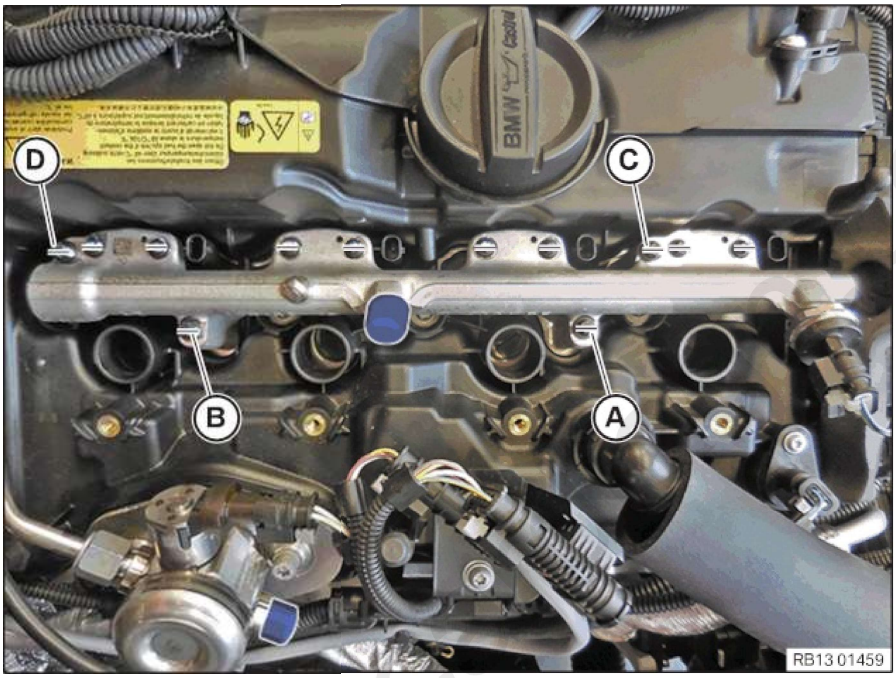
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

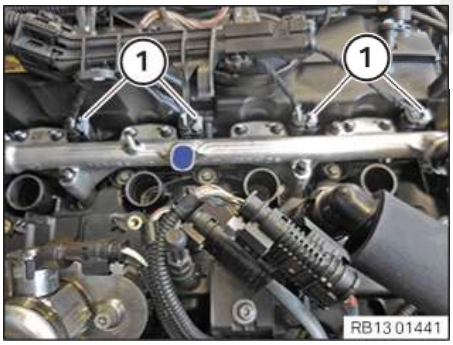


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



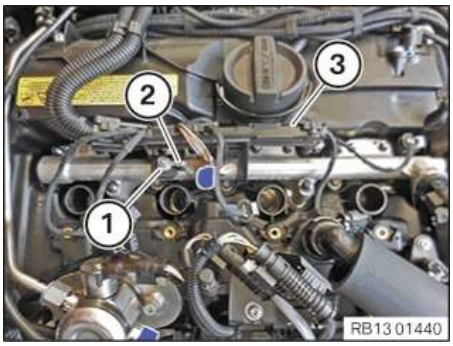
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

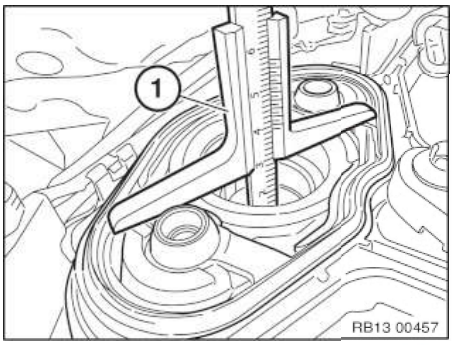
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

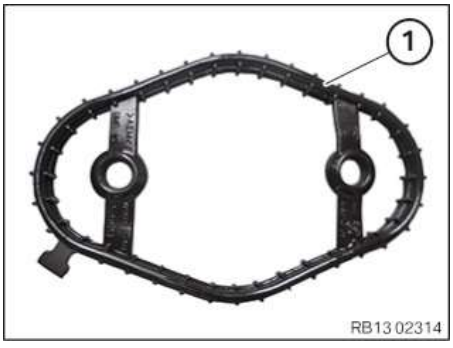
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

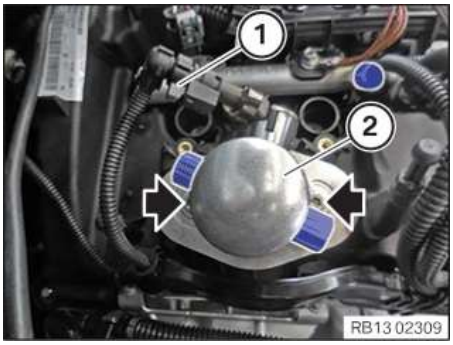
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

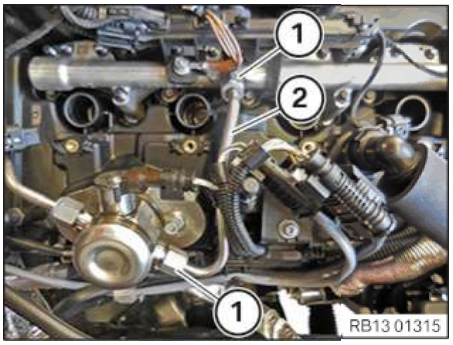
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

81 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

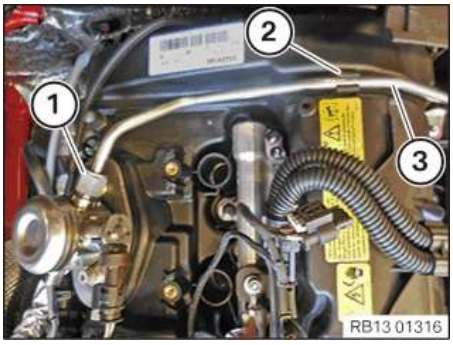
82 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

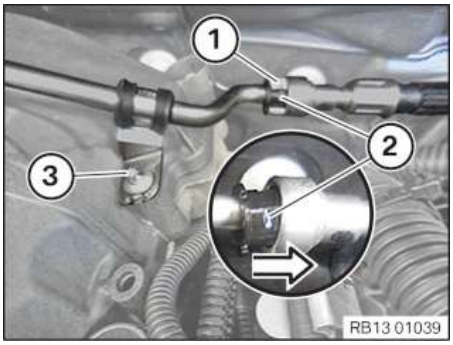


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

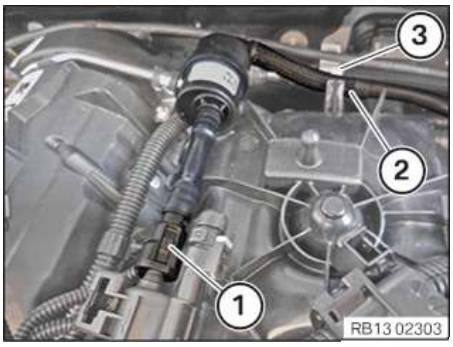
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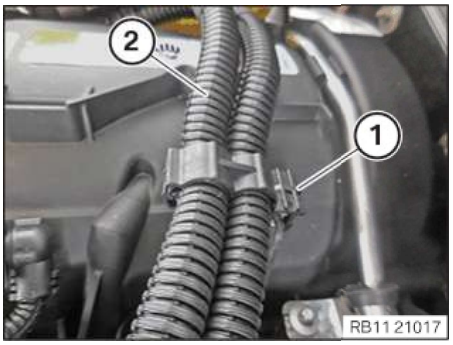
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

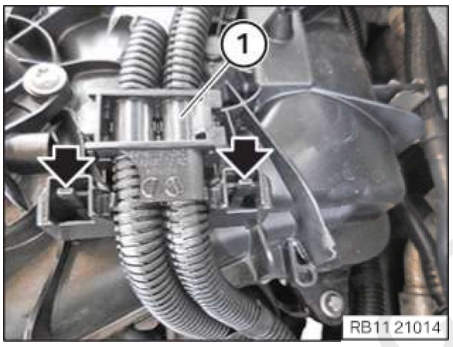
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).

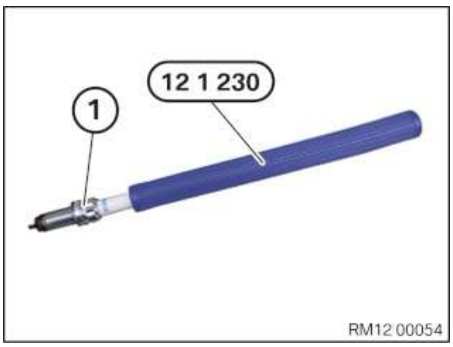


- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

83 – Installing all spark plugs

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Insert spark plug (1) into special tool 0 496 065 (12 1 230).

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TECHNICAL INFORMATION

Do not drop spark plug into spark plug shaft! This can lead to a reduction of the electrode gap and can thus impair smooth running of the engine, especially in idle position.

- Screw in the spark plugs in the engine with the special tool 0 496 065 (12 1 230) until hand-tight.



TECHNICAL INFORMATION

Exclusively swivelling extensions may be used for the reversible ratchet. Rigid mounting tool and variable plug connections with rigid option may not be used; there is a risk that the insulator breaks.

- Tighten the spark plugs with the torque wrench, the special tool 0 495 560 (12 1 220) and a swivelling extension.

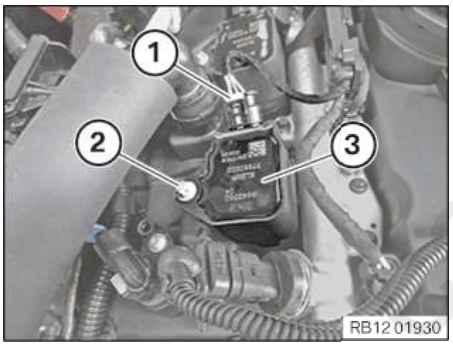
Spark plugs

M12x1.25		Tightening torque	23 Nm

84 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.



▸ **Install ignition coil.**

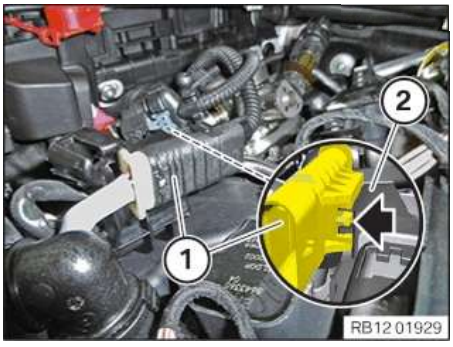
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Connect and lock connector (1) with holder (2) (arrow).

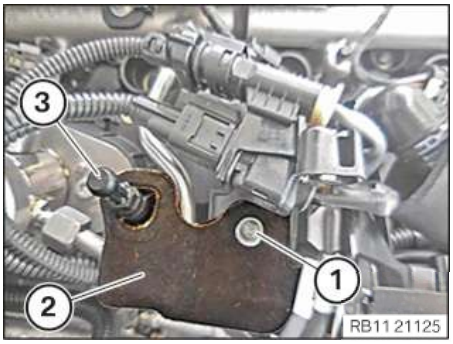
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

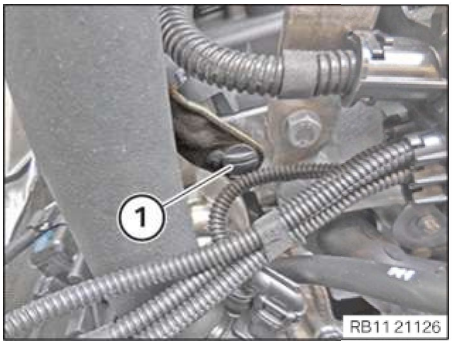
85 – Install the cylinder head cover acoustic cover



- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

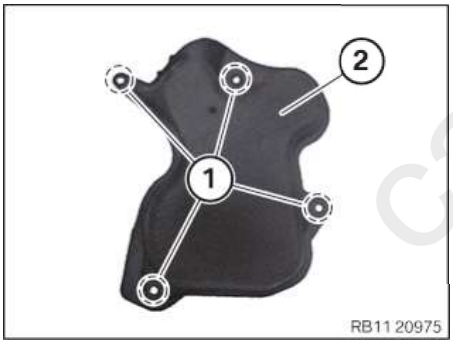
Acoustic cover (side) to cylinder head cover

TS6 x 20		8 Nm



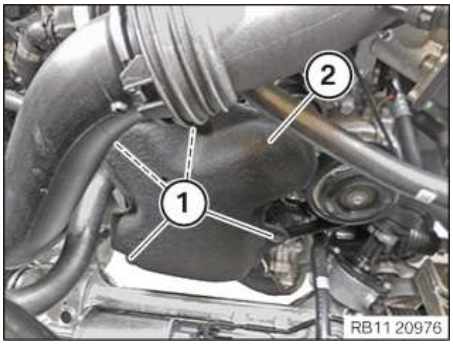
- Secure the clip (1).

86 – Install the acoustic cover for the engine at the front



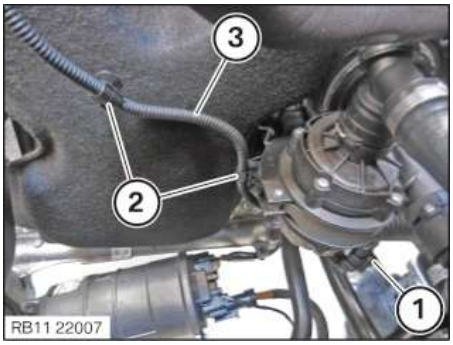
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



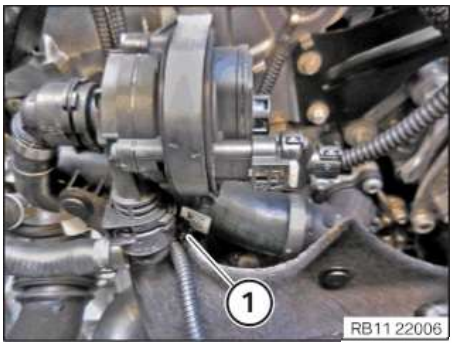
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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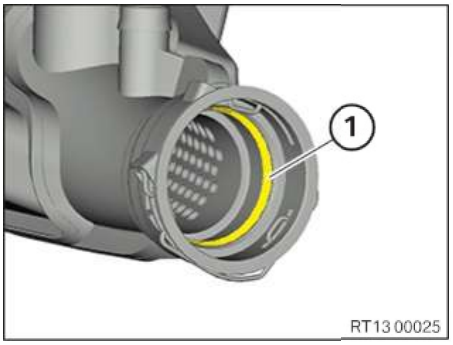
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

87 – Installing the clean air pipe with resonator

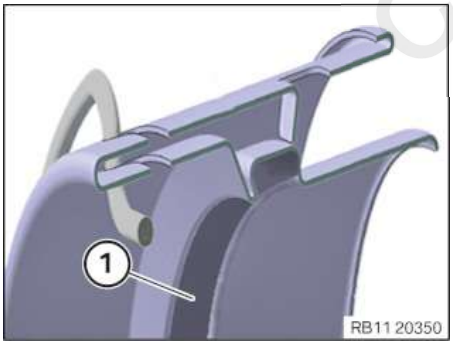


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

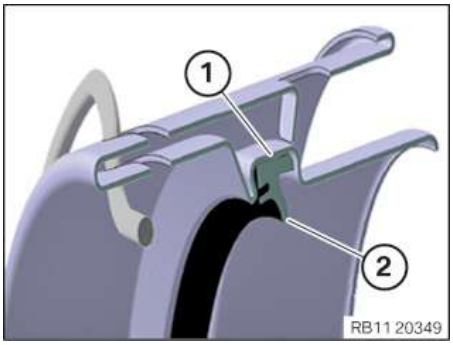
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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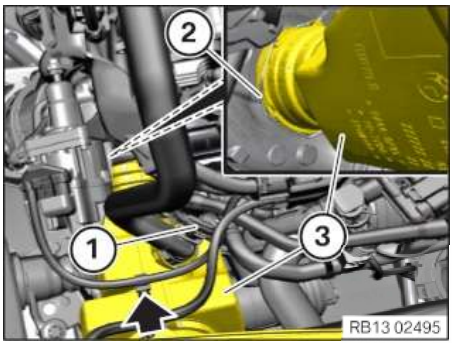
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

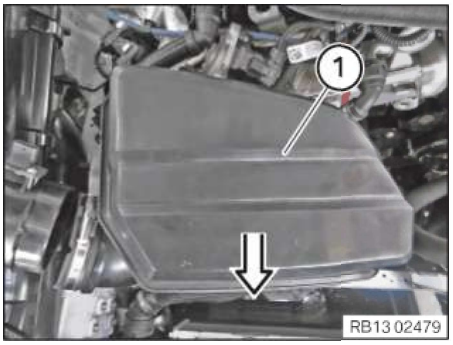
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



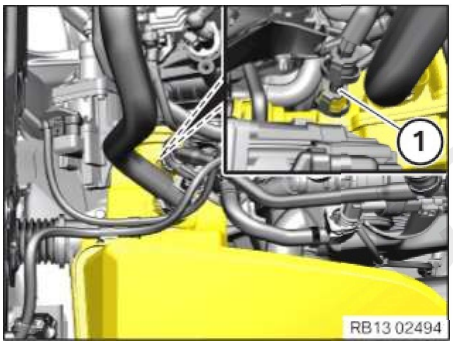
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

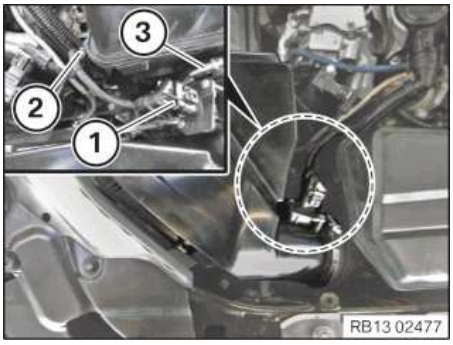
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

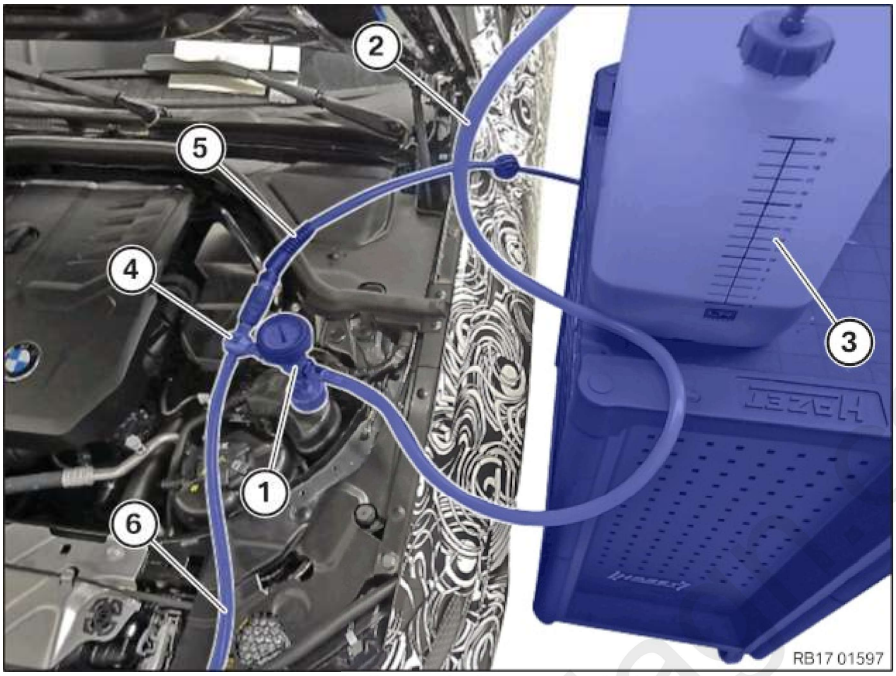
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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

88 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

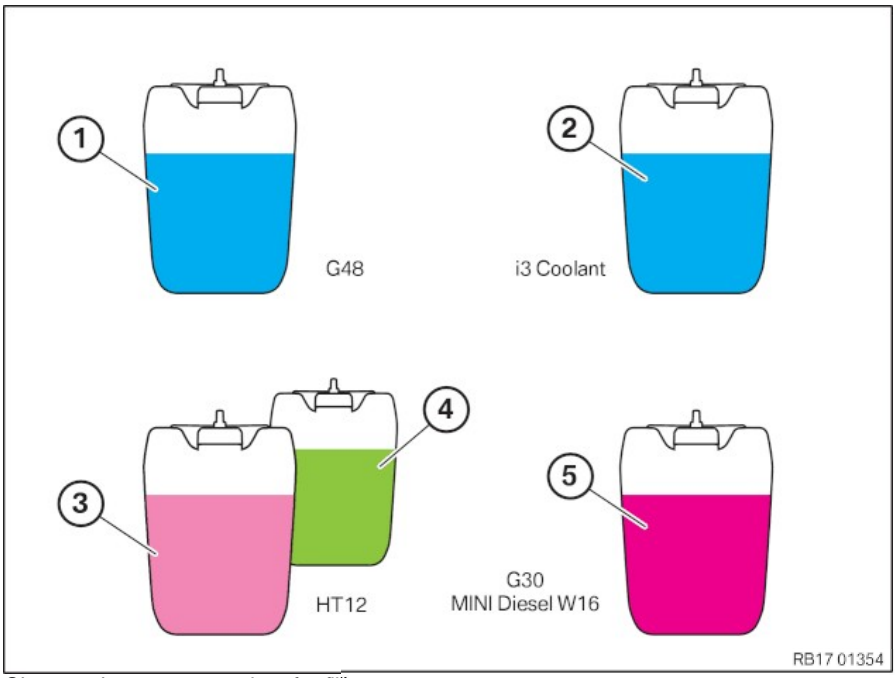
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

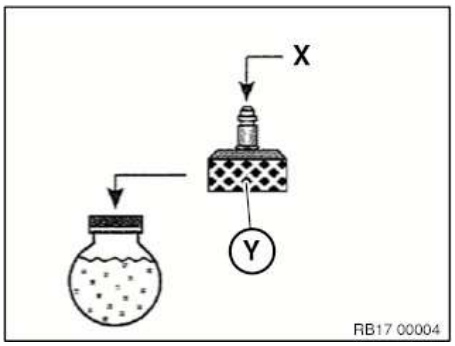
- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

Capacity of low-temperature coolant circuit G20

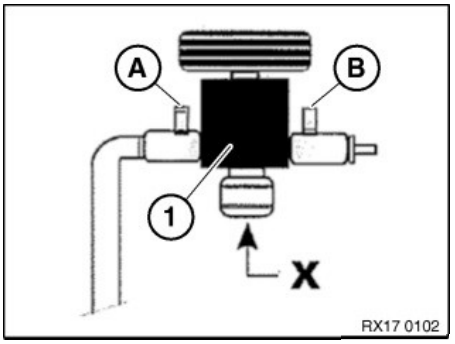
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

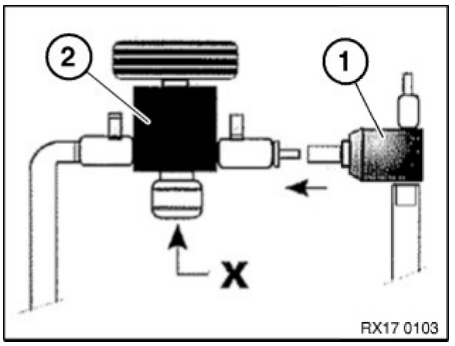
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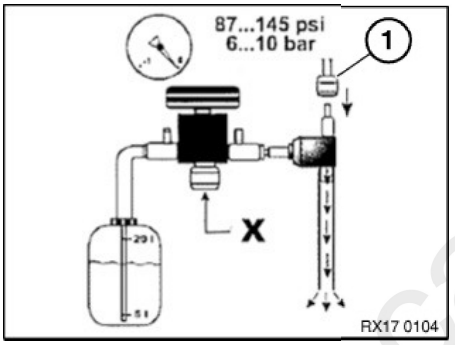
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



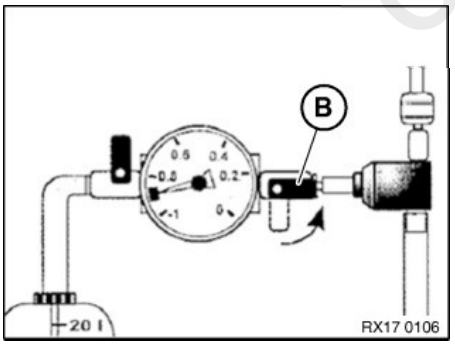
- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



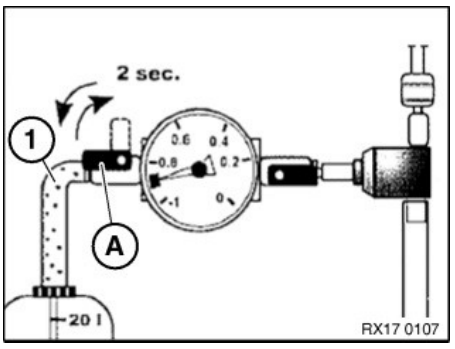
- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.



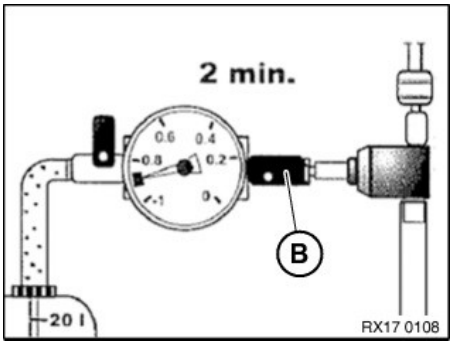
- Open shut-off valve (B).
  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

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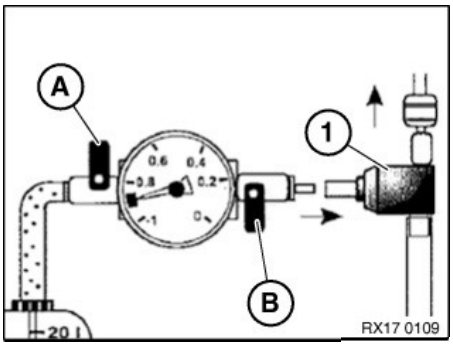


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

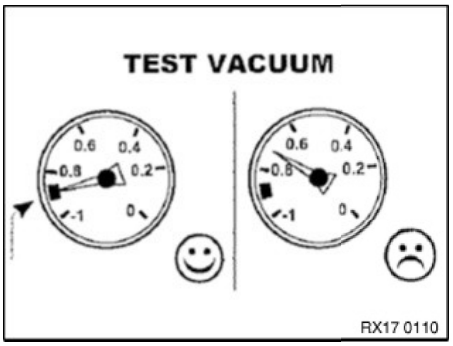
- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.



Result

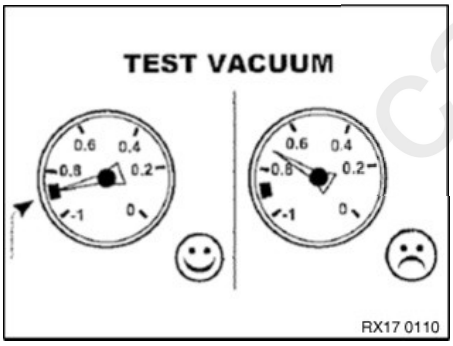
» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

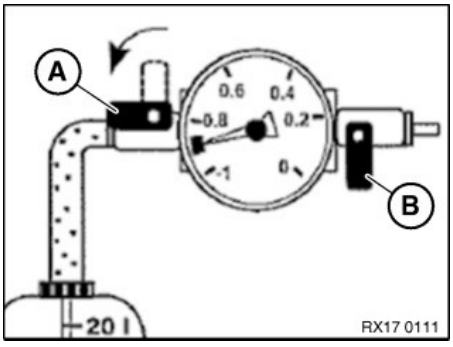


Result

» Vacuum remains constant.

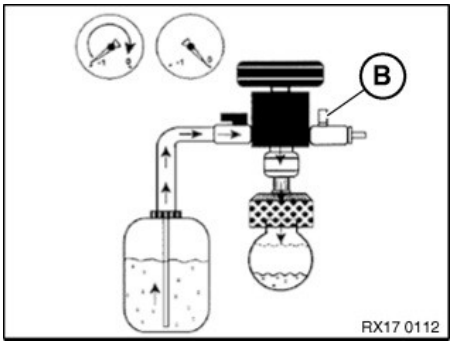
Measure

- Continue with filling.

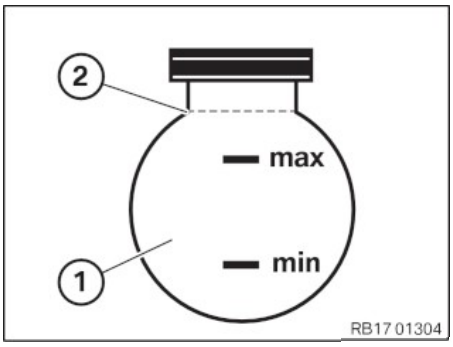


- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.

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- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

89 – Disconnecting all battery earth leads



- See additional information.

90 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

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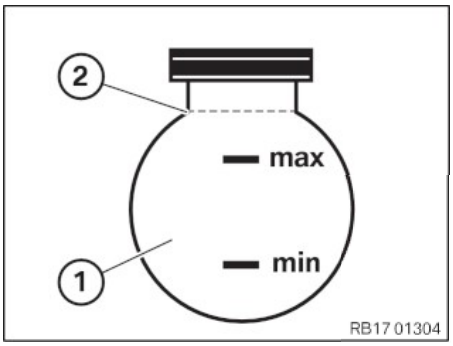
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

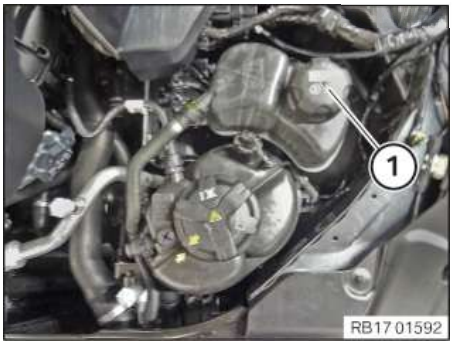
  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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TECHNICAL INFORMATION

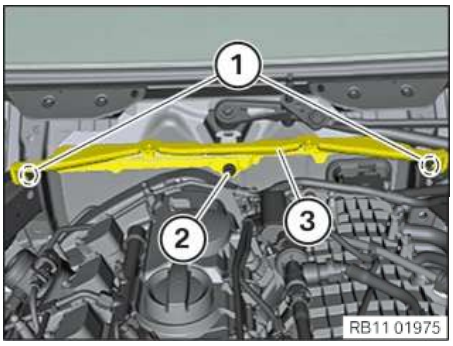
After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

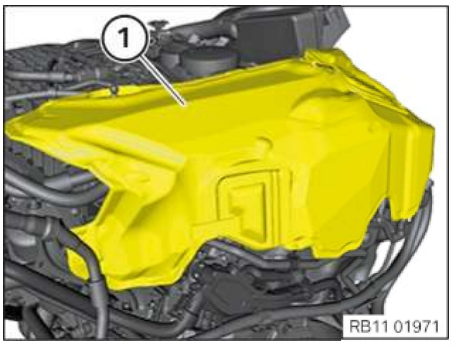
- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

91 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

92 – Installing acoustic cover at rear

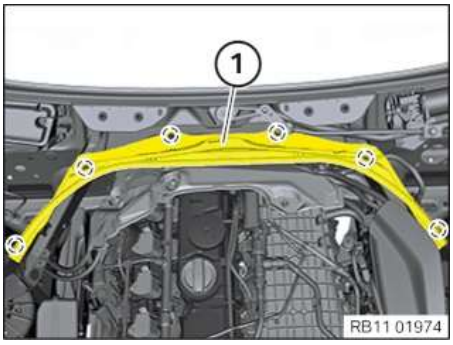


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

93 – Installing the centre bulkhead upper part

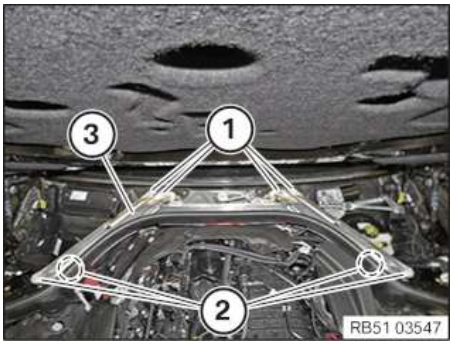


- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

	Tightening torque	3 Nm

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- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

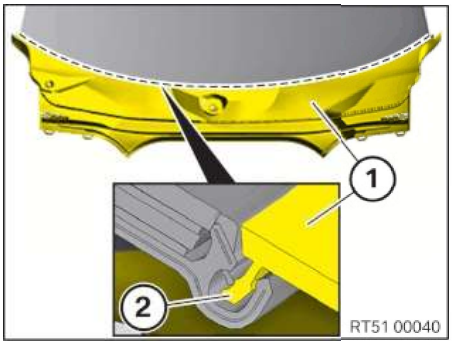
94 – Installing cowl panel cover

RISK OF DAMAGE

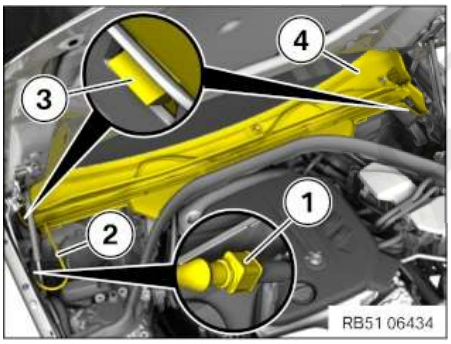
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

95 – Installing both wiper arms

NOTICE

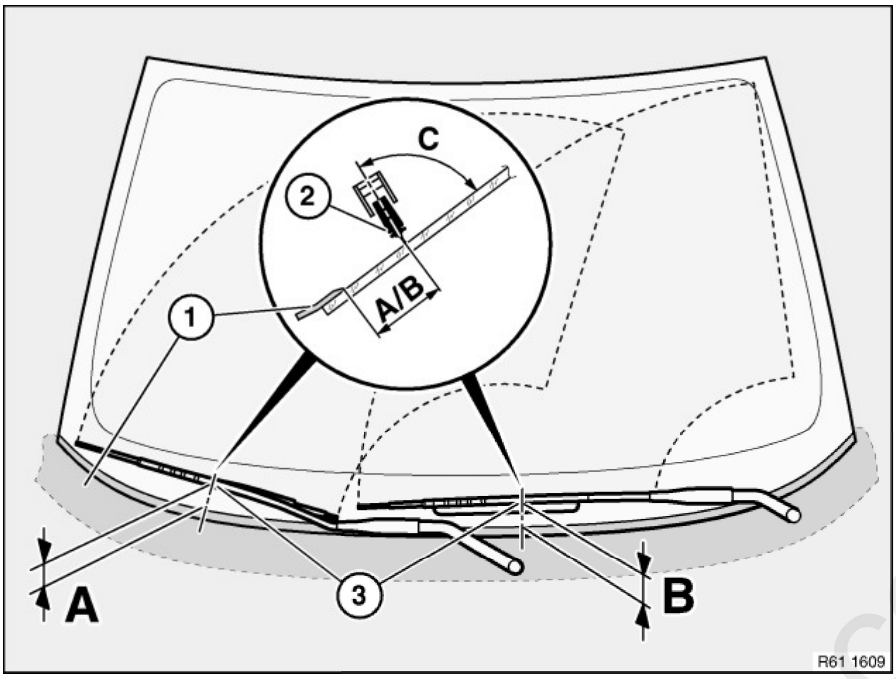
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

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TECHNICAL INFORMATION

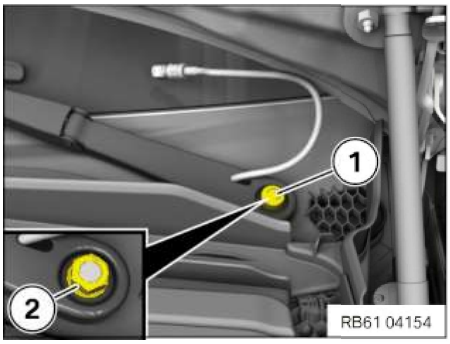
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

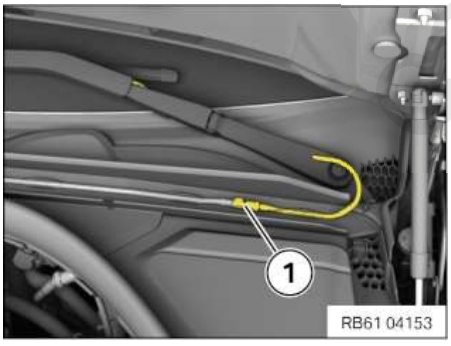


- Tighten nut (2).

Windscreen wiper arm

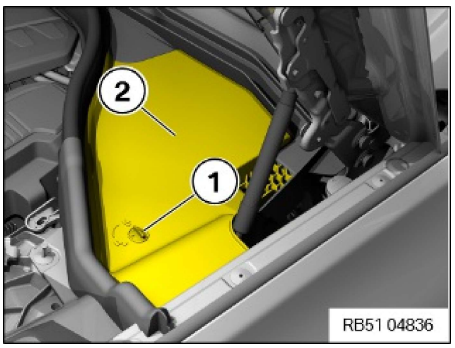
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

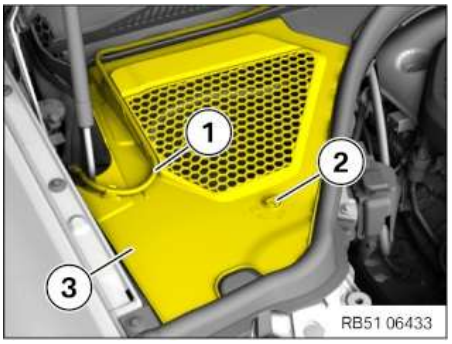
96 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

97 – Install the rear right engine compartment cover

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- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

98 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

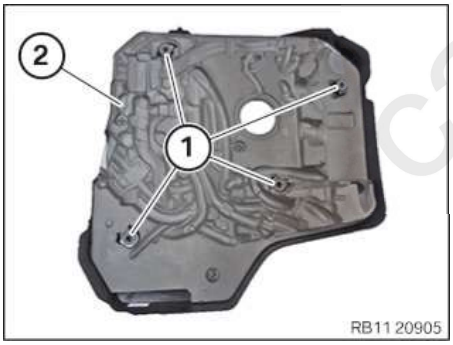
99 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

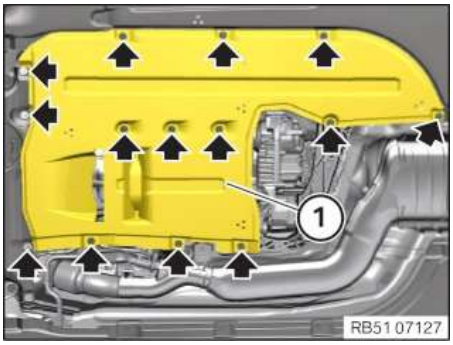


- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

100 – Installing underbody protection at rear

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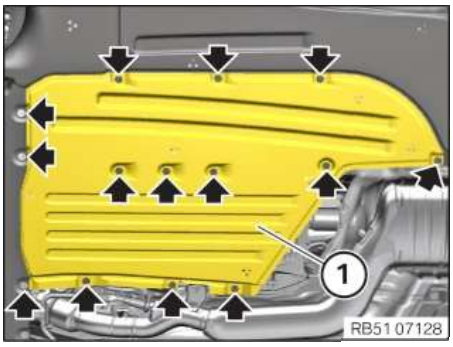
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

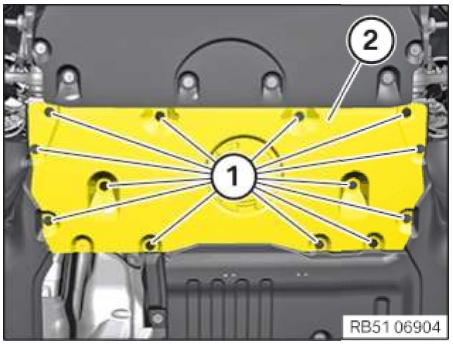
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

101 – Installing the centre underbody protection



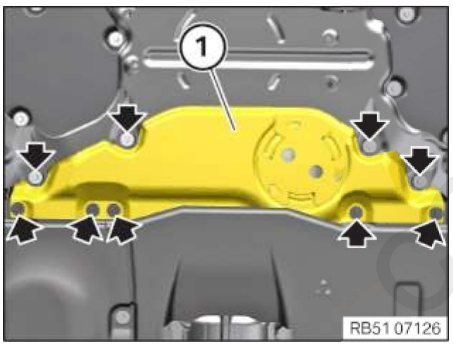
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

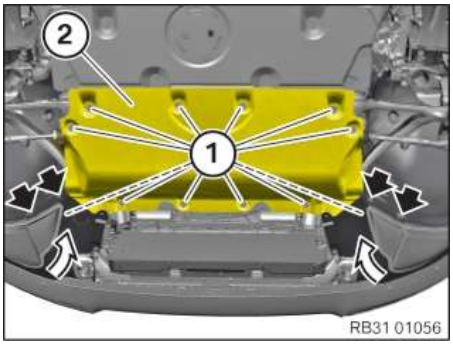
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

102 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

Underbody protection of the steering gear

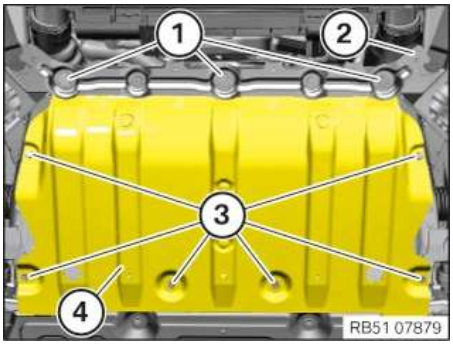
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm

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- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

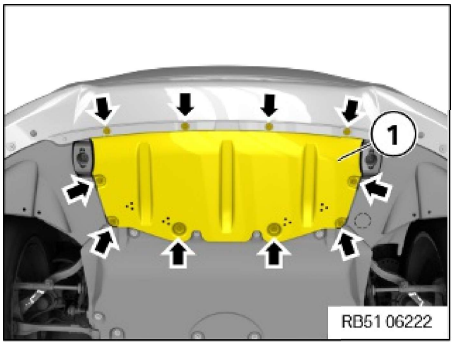
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

103 – Installing the front underbody protection



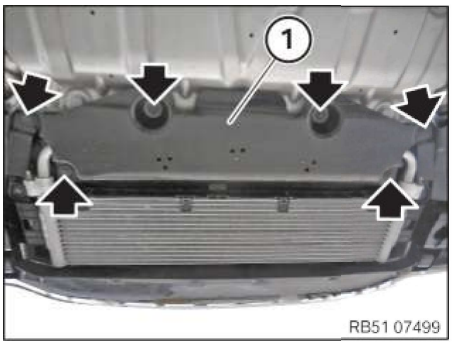
- **Version 1:**

Feed in the front underbody protection (1) towards the front under the bumper panel and position.

Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



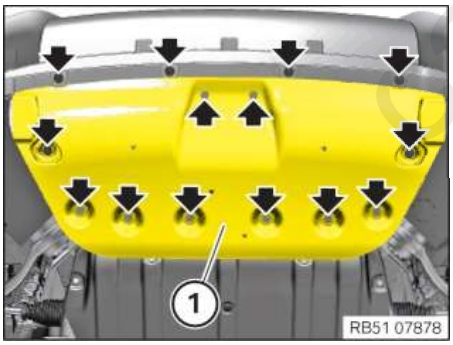
- **Version 2:**

Feed in and position the front underbody protection (1).

Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

Feed in and install front underbody protection (1).

Tighten screws (arrows).

Underbody protection front

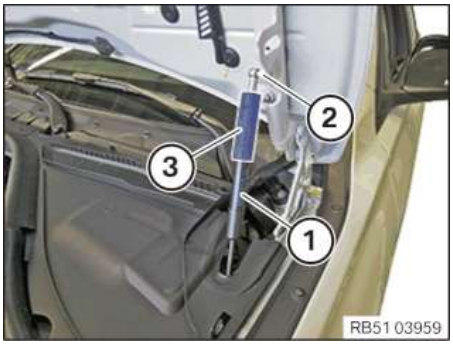
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

104 – Check engine oil level

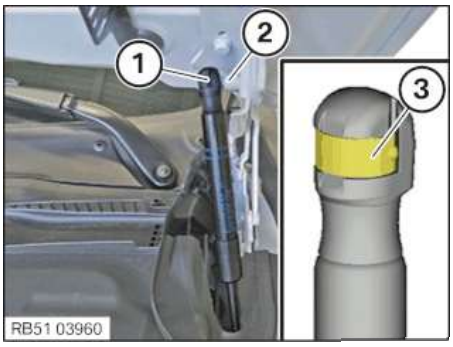
- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

105 – Take bonnet out of the service position

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- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side			Used in step 30
Hexagon screw for thermoplastic		Tightening torque	3 Nm

Basic carrier to cylinder head			Used in step 415464
M6		Tightening torque	8 Nm

Test gauge to basic carrier			Used in step 415464
M6		Tightening torque	8 Nm

Eccentric shaft to bearing support/cylinder head			Used in step 50
M6			10 Nm

Electrical servomotor to cylinder head			Used in step 51
M6		Tightening torque	8 Nm

Manifold support for intake air to cylinder head			Used in step 51
M6X16		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 5169
Oval-head screw		Tightening torque	3 Nm

Intake camshaft to cylinder head			Used in step 52
M6	***Observe tightening sequence,*** *mount bearing cap flush.*	Jointing torque	10 Nm
	Tighten the screws.	Tightening torque	10 Nm

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VANOS central valve to camshaft — Used in step 6061

M20 x 1.5		1. Jointing torque	10 Nm
		2. Jointing torque	30 Nm
		3. Jointing torque	50 Nm
		4. Angle of rotation	35 °

Chain tensioner to cylinder head — Used in step 63

Chain tensioner		Tightening torque	20 Nm
		Angle of rotation	40 °

Gate to bearing bracket — Used in step 67

M8			20 Nm

Intake plenum to cylinder head — Used in step 69

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 69

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 69

M6X25		Tightening torque	8 Nm

Charge air line to throttle body — Used in step 69

M6		Tightening torque	8 Nm

Control unit holder on spring strut dome — Used in step 71

Hexagon screw		Tightening torque	8 Nm

Cylinder head cover to cylinder head — Used in step 74

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 74

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 7477

6X18		Tightening torque	6 Nm

Heat shield to cylinder head — Used in step 76

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip — Used in step 76

M6 x 12		Tightening torque	8 Nm

Ground cable to rail — Used in step 79

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 80

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 81

M14		Tightening torque	33 Nm

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Fuel delivery line to high pressure pump			Used in step 82
M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover			Used in step 82
M6 screw		Tightening torque	6,5 Nm

Spark plugs			Used in step 83
M12x1.25		Tightening torque	23 Nm

Ignition coil			Used in step 84
Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover			Used in step 85
TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 87
Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead			Used in step 93
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 93
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 93
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 95
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection			Used in step 100101
Hexagon screw		Tightening torque	3 Nm

Underbody protection of the steering gear			Used in step 102
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 102
Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support			Used in step 102
M10		Tightening torque	56 Nm

Underbody protection front			Used in step 103
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

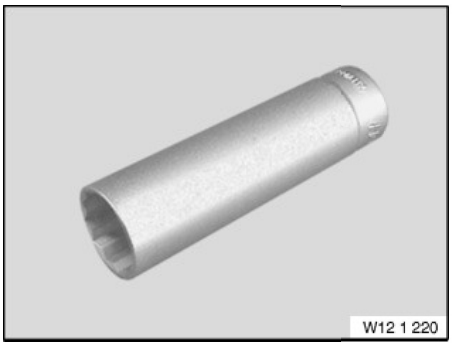
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2 360 895 Pin wrench



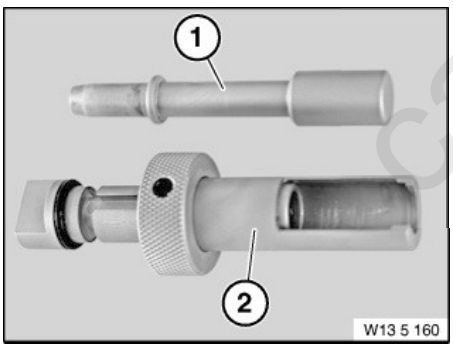
Common	Used in step 1275
Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 560 (12 1 220) Socket



Common	Used in step 1683
Usage	For removing and installing the spark plugs (WAF 14 bihexal).
Included in the tool or work	
Storage location	C18
Replaced by	
In connection with	
SI-Number	01 20 06 (299)

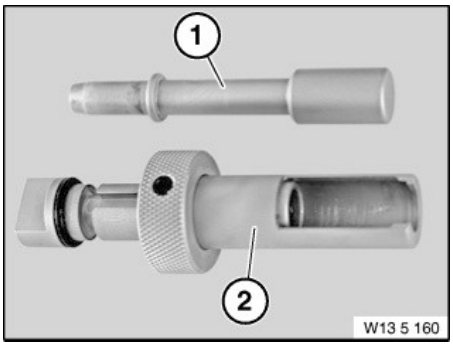
0 496 567 (13 5 161) Fastener



Common	Used in step 19
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

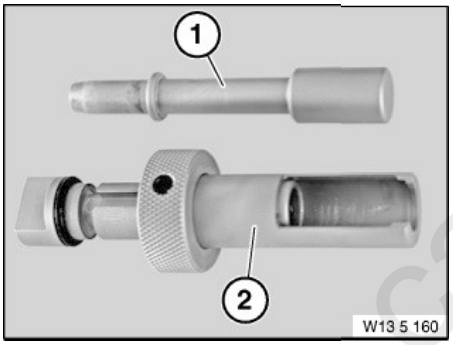
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0 496 568 (13 5 162) Fastener



Common	Used in step 19
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

0 496 565 (13 5 160) Fastener



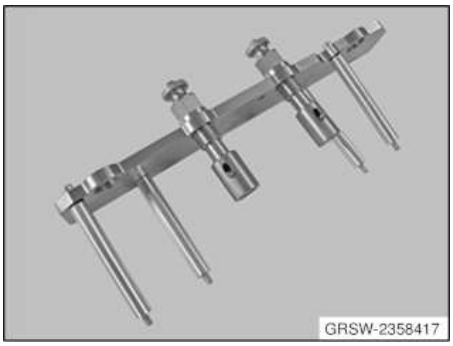
Common	Used in step 19
Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

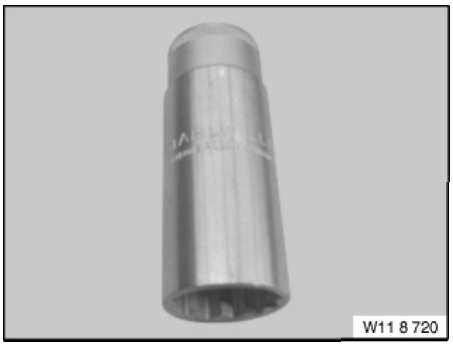
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2 358 417 Device



Common	Used in step 20
Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

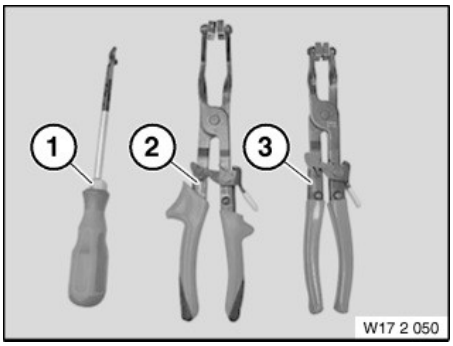
0 496 106 (11 8 720) Socket WAF 46



Common	Used in step 20
Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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0 495 794 (17 2 050) Pliers



Common Used in step 3569

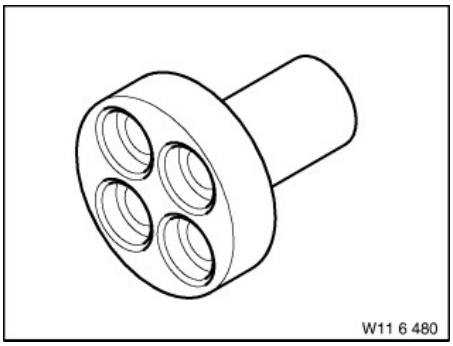
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 493 380 (11 6 480) Connector



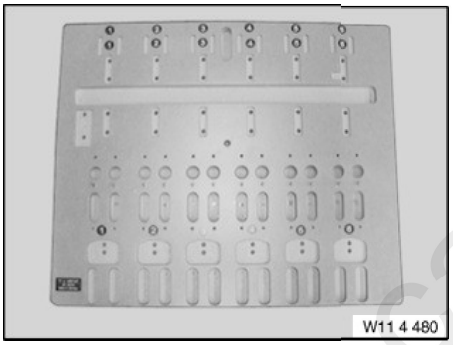
Common	Used in step 3741626480
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

2 359 088 Device



Common	Used in step 3868
Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 105 (11 4 480) oddments tray



Common	Used in step 3839404749
Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

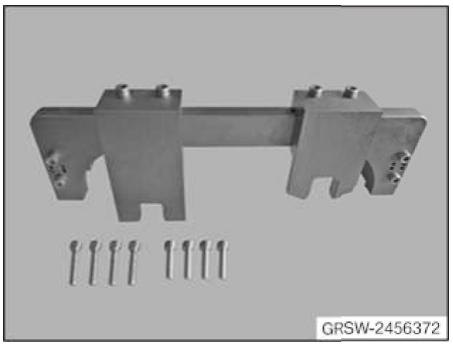
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2 288 380 Locating stud



Common	Used in step 416264
Usage	For disconnecting the crankshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 04 14 (071)

2 456 372 Gauge



Common	Used in step 4146546264
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B57
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 122 Gauge



Common	Used in step 414664
Usage	For securing camshaft at TDC. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 496 855 Ratchet handle



Common	Used in step 43576061
Usage	Insert reversible ratchet with nut for installation and disassembly of the VANOS- SW22. (only in longitudinal installation). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A55
Replaced by	
In connection with	
SI-Number	01 34 15 (306)

2 450 487 Socket



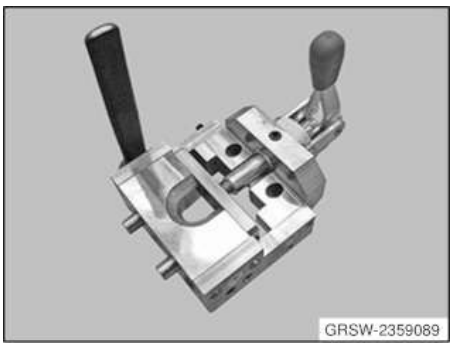
Common	Used in step 43576061
Usage	For removing and installing the VANOS adjuster. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	B55
Replaced by	
In connection with	0496855
SI-Number	01 07 17 (487)

2 455 654 Tensioning tool



Common	Used in step 5962
Usage	To pretension the timing chain when adjusting the timings. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 359 089 Device



Common	Used in step 67
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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2 452 959 Pliers



Common	Used in step 78
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



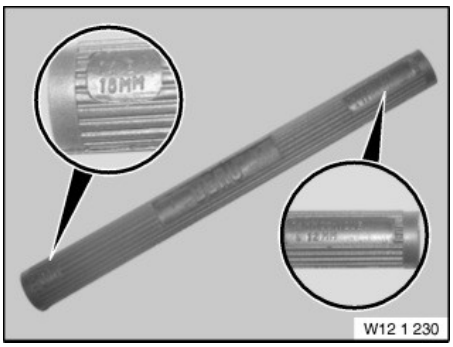
Common	Used in step 78
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 358 022 Gauge



Common	Used in step 79
Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

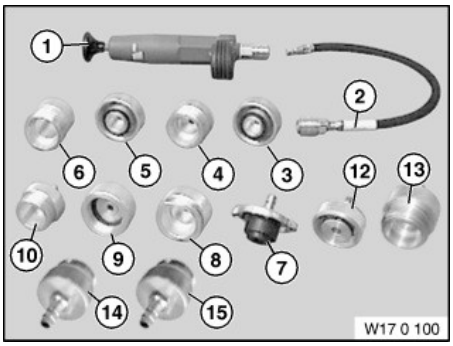
0 496 065 (12 1 230) Fitting aid



Common	Used in step 83
Usage	Fitting aid for spark plug installation. Original BERU ZMH 001 rubber hose 0 890 00 001.
Included in the tool or work	
Storage location	individual
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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0 494 417 (17 0 100) Tester



Common Used in step 88

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 95
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Capacity of low-temperature coolant circuit G20	Used in step 88
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	3173

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	189
61 20 900 Disconnecting and connecting battery earth lead	189
61 20 900 Disconnecting and connecting battery earth lead	189
61 20 900 Disconnecting and connecting battery earth lead	189
61 20 900 Disconnecting and connecting battery earth lead	189
61 20 900 Disconnecting and connecting battery earth lead	189
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17 00 ... Notes for working on cooling system.	88

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Operating materials	Used in step
Main group 17	88

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11 37 010 Removing and installing/replacing intermediate levers

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

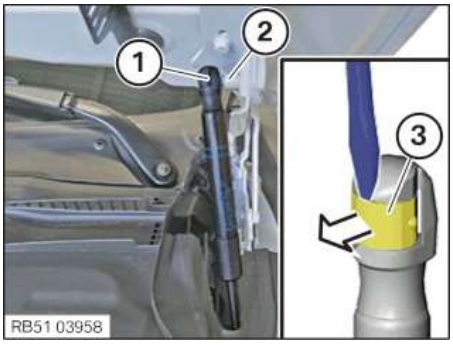
Engine compartment lid is open.

CAUTION

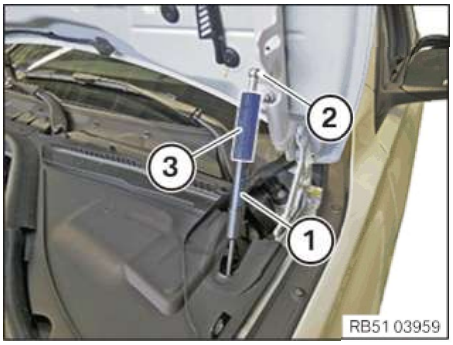
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

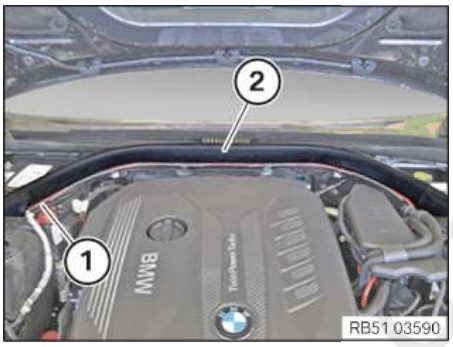


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

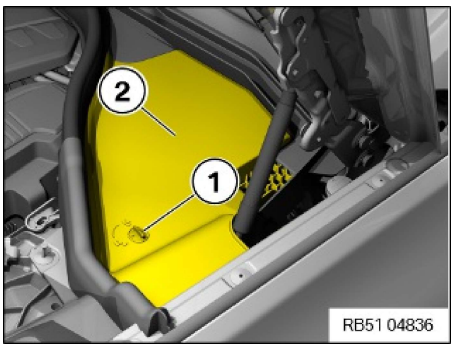
- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

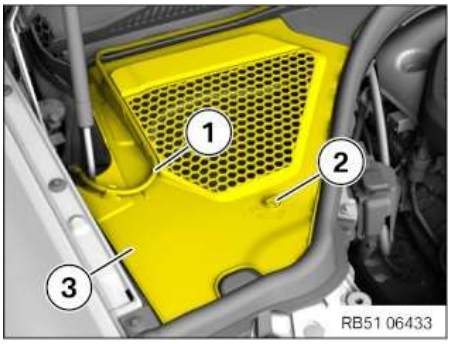
4 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

5 – Remove the cover of the rear right engine compartment

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- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

6 – Removing both wiper arms

NOTICE

Description is for left component only. Procedure on the right side is identical.

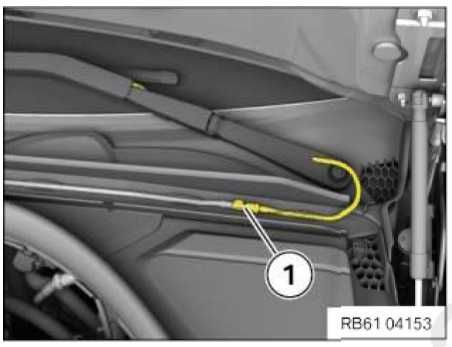
▶ **Remove the wiper arm**

RISK OF DAMAGE

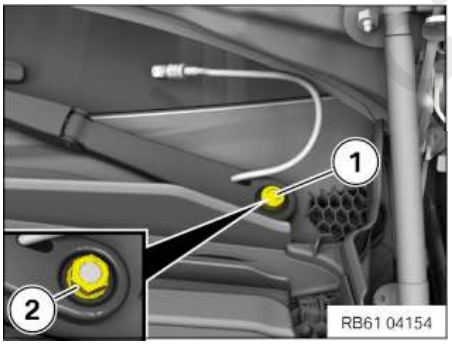
Damage to wiper console

While removing the wiper arms without using special tool, the wiper console can break.

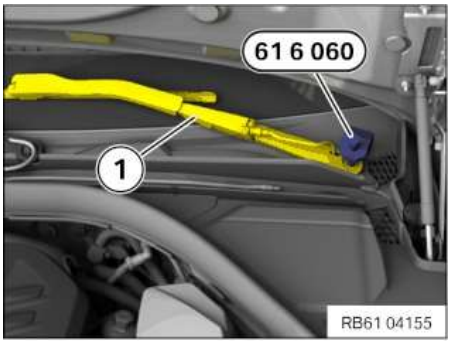
- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do not lift off wiper arm, else the wiper console may break on the predetermined breaking point for the pedestrian protection.



- Disconnect the windscreen wash hose(1) at the separation point and remove from the cowl guide.



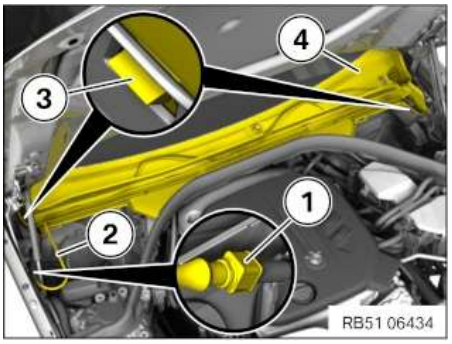
- Remove the protective cap (1).
- Loosen nut (2).



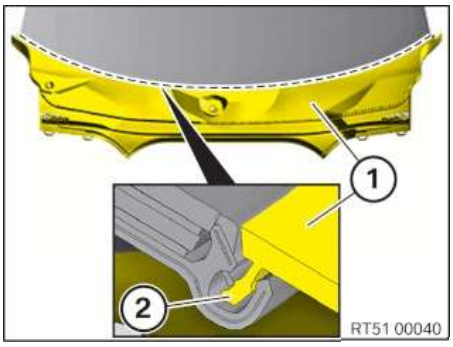
- Pull off the wiper arm (1) using special tool .

7 – Remove cowl panel cover

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- Release snap fastener of the washer fluid hose (1) and put the washer fluid hose(2) to one side.
- Unclip clips (3) on the cowl panel cover (4).

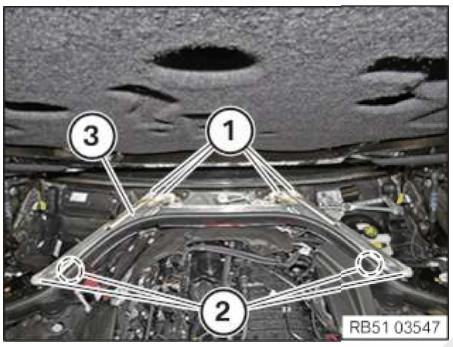


- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

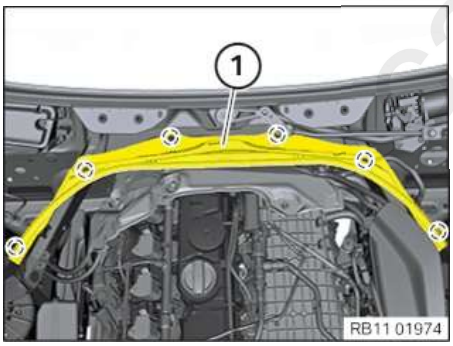
8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

Driving without the strut brace/front end or tension strut is not permitted.



- **If installed:** Remove tension strut on spring strut dome.
- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

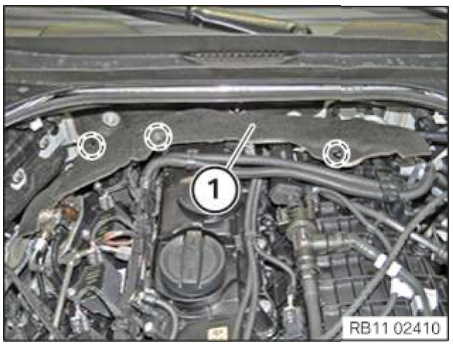
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



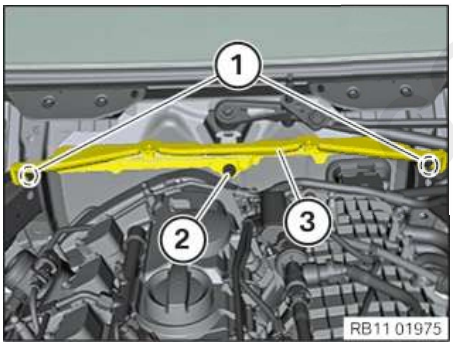
- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

11 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

12 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

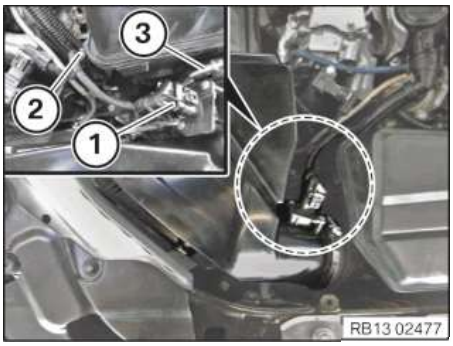
Risk of burning!

- Perform all work only on components that have cooled down.

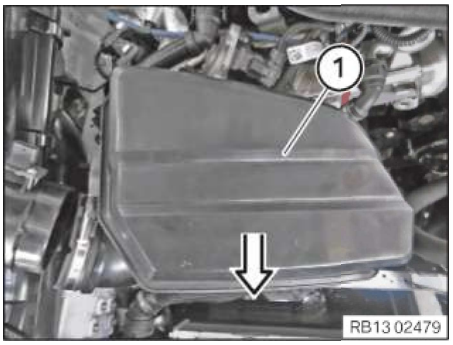
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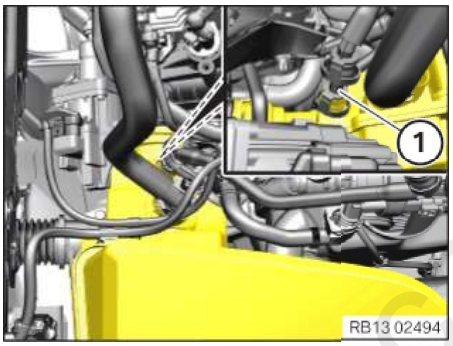
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



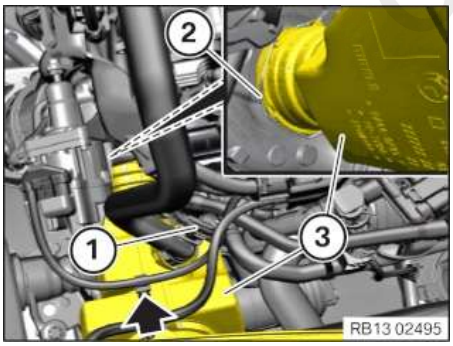
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



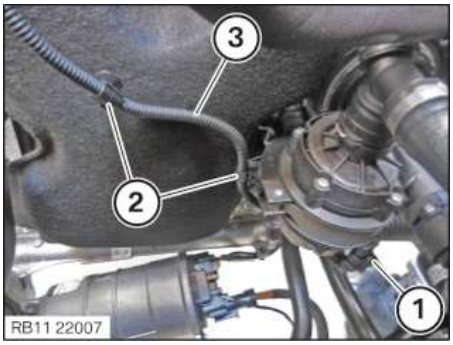
- Unlock and disconnect the tank ventilation line (1).



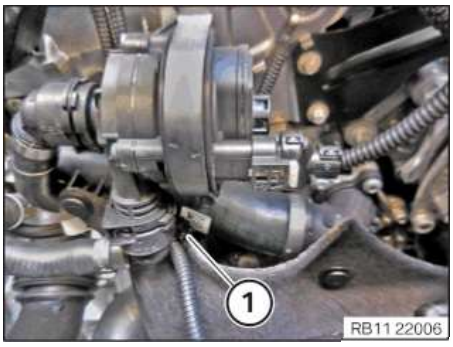
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

13 – Removing the acoustic cover for the engine at the front

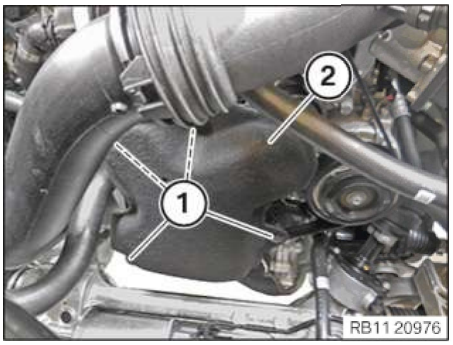
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

14 – Remove all ignition coils.

NOTICE

The description is for one component only. The procedure is identical for all further components.

▸ **Removing the ignition coil**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the ignition coil.

The silicone hose of the ignition coil must not be contaminated by fuel as this can lead to failure of the ignition coil.

- Cover ignition coils using suitable covers when working on the fuel system, if necessary remove them.
- Do not oil or grease the silicone tube of the spark plug connector. The silicone tube is coated with talc to reduce the pulling forces.

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RISK OF DAMAGE

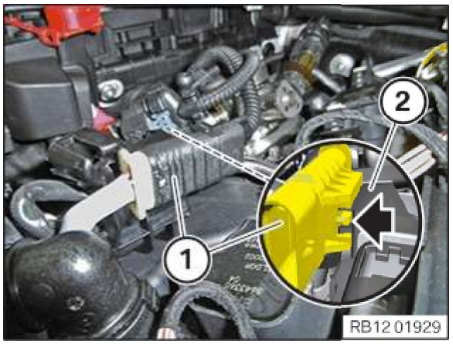
Electrostatic discharge.

Damage to or destruction of electrical components.

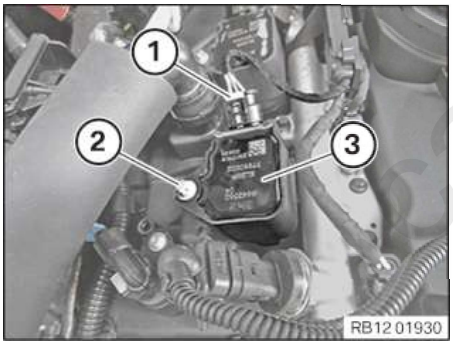
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock plug connection (1) and disconnect.

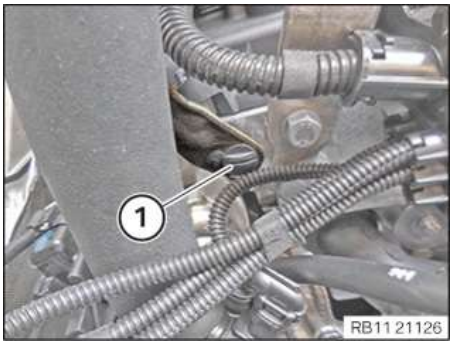


- Unlock connector (1) (arrow) and disconnect it from holder (2).



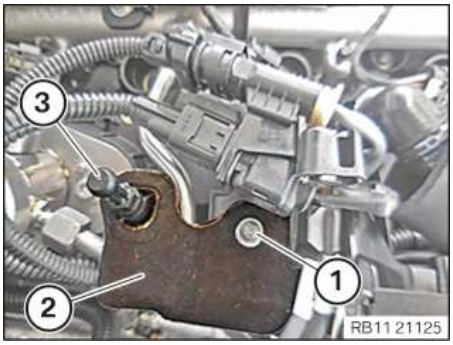
- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove ignition coil (3).

15 – Removing the cylinder head cover acoustic cover



- Loosen clip (1).

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- Loosen screw (1).
- Guide the acoustic cover (2) out of the ball pin (3) and remove.

16 – Remove the high pressure line between the high pressure pump and the rail

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

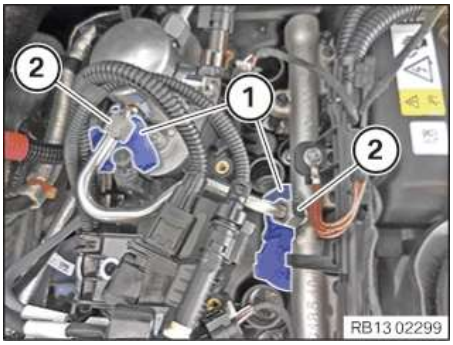
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

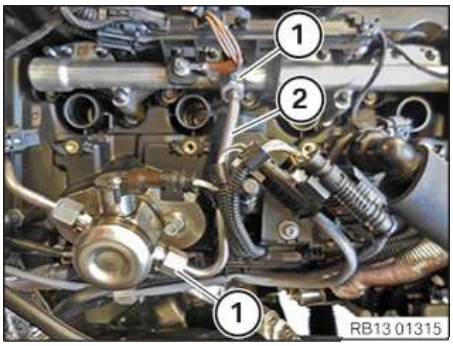


- Have the special tool ready.

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- Position a lint-free cleaning cloth (1) on the union nuts (2).
- Release union nuts (2).
- Catch and dispose of escaping fuel.
- Feed out and dispose of the lint-free cleaning clothes (1).



- Release the union nuts (1) completely.
- Feed the high pressure line (2) out and remove.



- Seal all openings with the special tool .

17 – Remove fuel delivery line

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

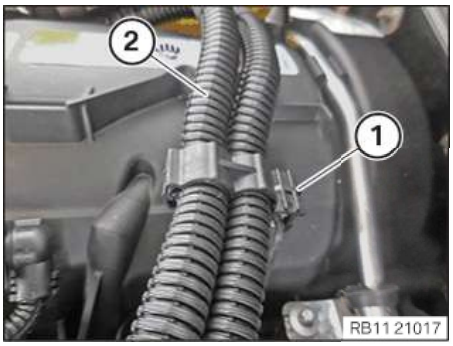
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

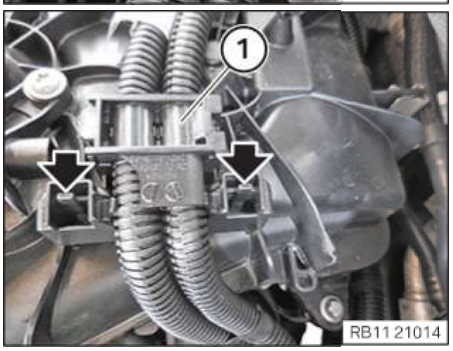
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

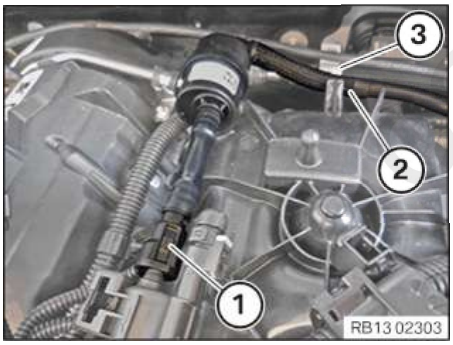
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



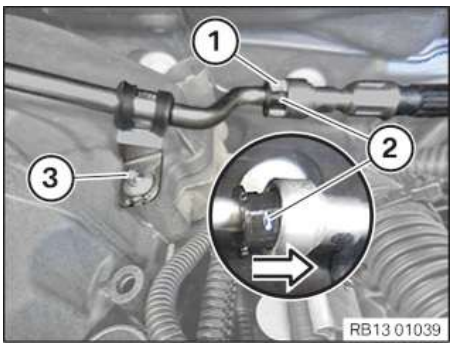
- Loosen clamp (1).
- Guide out wiring harness section (2) for the injectors and ignition coils and place it aside.



- Unlock the locks (arrows).
- Guide out wiring harness section (1) for the injectors and ignition coils and place it aside.

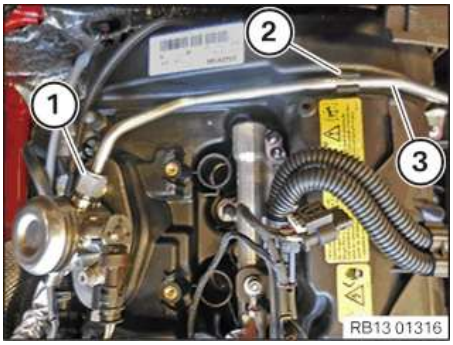


- Unlock and loosen lock (1).
- Guide tank ventilation line (2) out of clamp (3) and place it aside.



- Unlock and loosen clamp (1).
- Unlock and remove the snap fastener (2) in the direction of the arrow.
- Catch and dispose of escaping fuel.
- Seal the fuel lines with special tools 0 496 567 (13 5 161) and 0 496 568 (13 5 162) from the set of special tools 0 496 565 (13 5 160).
- Loosen screw (3).

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- Slacken the union nut (1) on the high pressure pump.
- Catch and dispose of escaping fuel.
- Seal all openings with the special tool .
- Guide the fuel feed line (3) out and remove.
- Make sure that the rubber damper (2) is not lost.

18 – Removing the rail with injectors

RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Twist the injectors with a maximum torsional movement of 13 Nm.

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Electrostatic discharge.

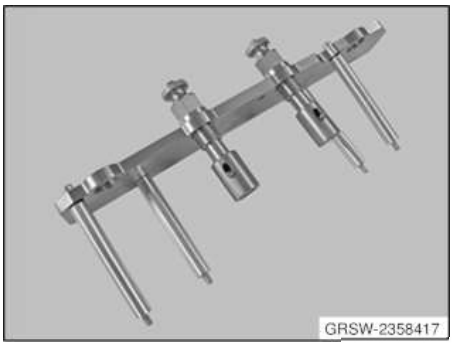
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Prepare special tool .



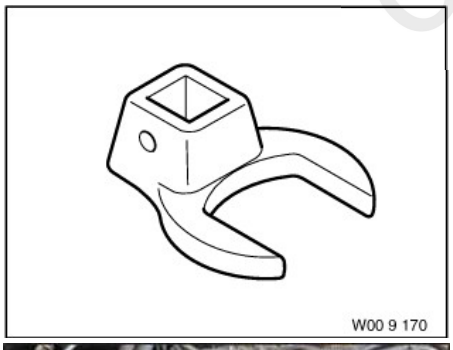
- Prepare special tool 2 358 417.



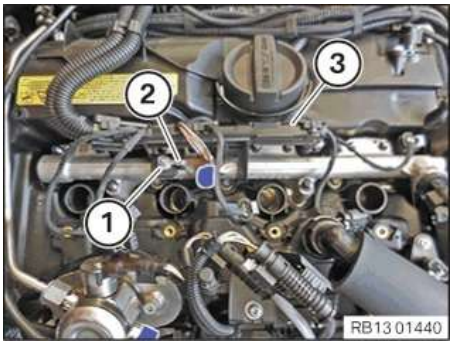
- Prepare special tool .



- Prepare special tool 0 496 106 (11 8 720).

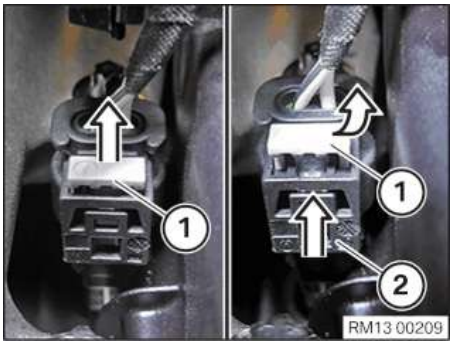


- Prepare special tool .

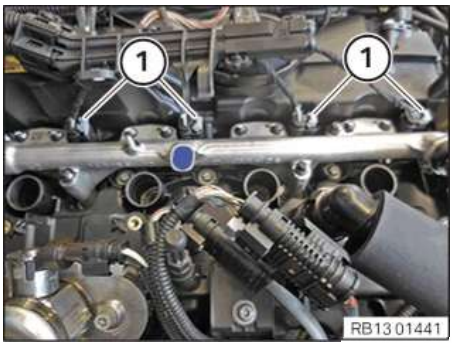


- Loosen nut (1).
- Feed out ground cable (2) and set it aside.
- Feed out cable channel (3) and set it aside.

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- Unlock lock (1) in direction of arrow from the top.
- Press lock (1) together and release.
- Pull off connector (2) from the injectors.



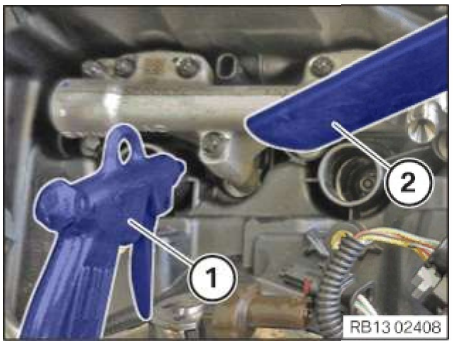
RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

- Unlock and release all connectors (1) of the injectors.

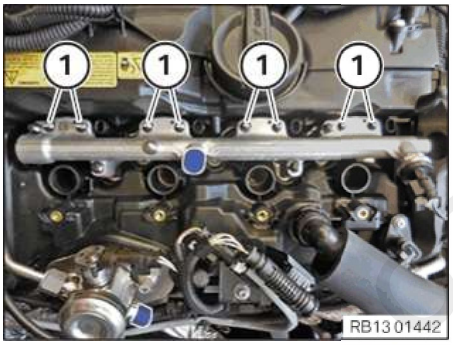


TECHNICAL INFORMATION

In case of dusty / sandy operating conditions of the vehicle, the injector shafts must be cleaned before removal.

For additional information see: 13 53 ... Cleaning the cylinder head in the area of the injectors in case of sandy / dusty contamination

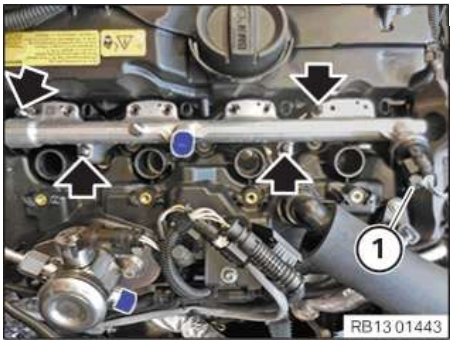
- Before releasing the high pressure lines: Blow out the injector shafts with air gun (1) with a little pressure.
- At the same time, use an **explosion-proof** vacuum cleaner (2) to draw off the dirt particles.



- Unscrew and remove the screws (M5x30) (1).

  Do **not** reuse screws (M5x30) (1).
- Renew the bolts (M5x30) (1).

  Parts: Screws (M5x30)
- Catch and dispose of escaping fuel with suitable materials.



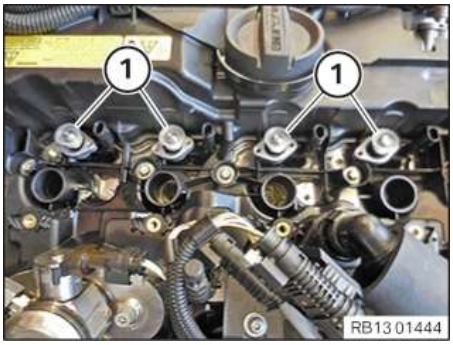
- Unscrew and remove screws (M6x70) (arrows).

  Do **not** reuse the screws (M6x70) (arrows).
- Renew the screws (M6x70) (arrows).

  Parts: Screws (M6x70)
- Unlock plug connection (1) and disconnect.
- Remove the rail in upward direction.

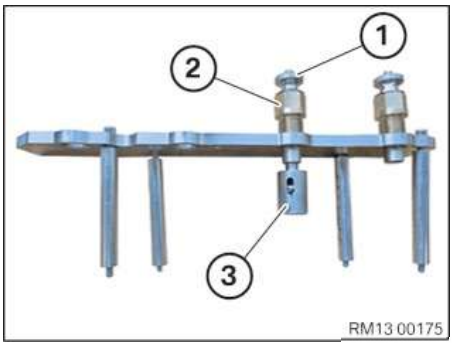
  The injectors remain in the cylinder head.

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- Remove the gaskets (1).

  The seals (1) are only needed for the initial assembly at the plant and will **not** be reinstalled.



RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

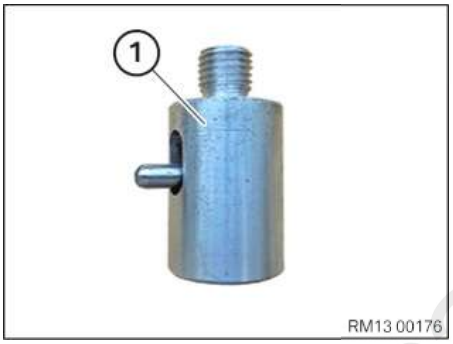
- Twist the injectors with a maximum torsional movement of 13 Nm.

- In the event that the specified value for the tensile force is exceeded: Replace injectors.
- Use special tool 2 358 417 with special tool (spacer sleeves) to remove the injectors.

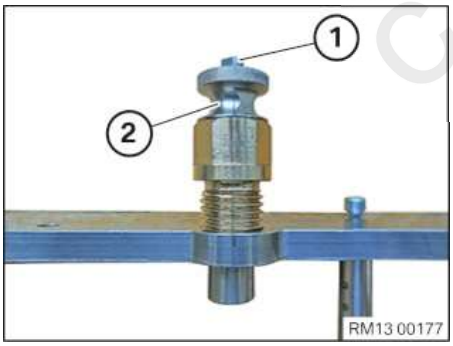
  Special tool 2 358 417 and spacer sleeves are used to ensure that the tensile force is not exceeded.

  The special tool 2 358 417 consists of:

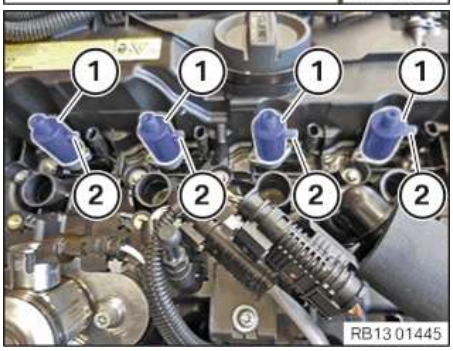
  - (1) Threaded sleeves
  - (2) Pull-out thread (left-hand thread)
  - (3) Fixture for the injector



- Unscrew the fixture for the injectors (1) from the special tool 2 358 417.



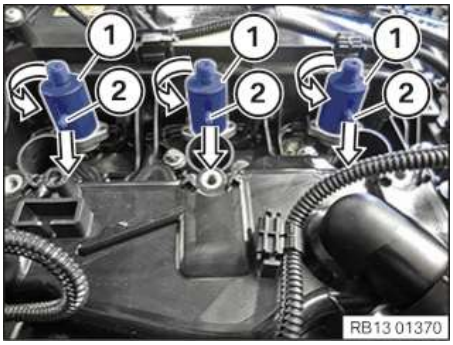
- Press the lock (1) in and remove threaded sleeve (2) from the special tool 2 358 417.



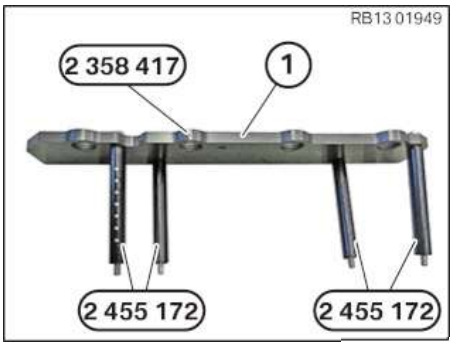
- Install all fixtures (1) for the injectors.

  The fixtures (1) are not locked when the levers (2) are up.

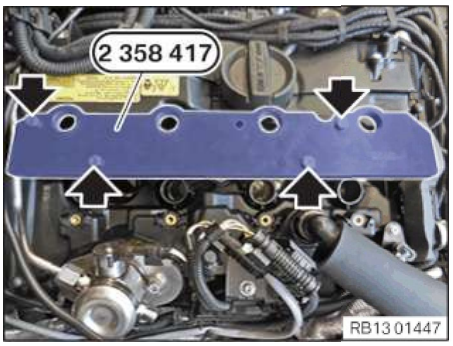
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- Turn the fixtures (1) in the direction of the arrow by **90°** and lock the levers (2) downward.



- Prepare panel (1) from special tool 2 358 417 with spacer sleeves .



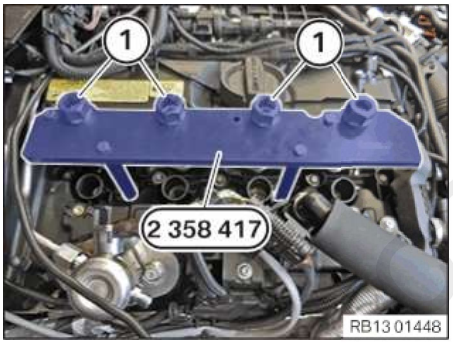
RISK OF DAMAGE

Damage to injectors.

Excessive force may damage the injector and this means having to renew the injector.

- Do not use the puller plate as a support.

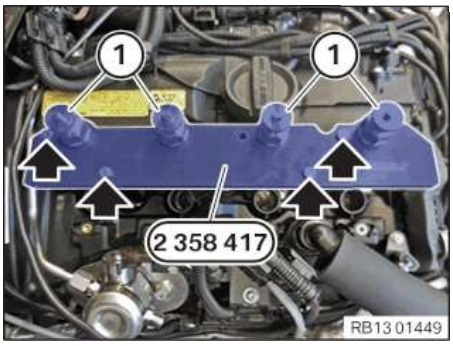
- Attach special tool 2 358 417 with spacer sleeves on the cylinder head.
- Hand-tighten the bolts (arrows).



TECHNICAL INFORMATION

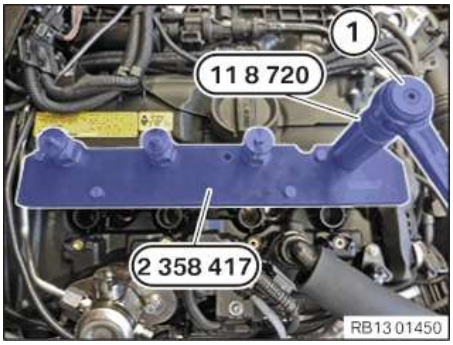
The extraction thread is a left-hand thread.

- Screw in pull-out thread (1) on the special tool 2 358 417fully.



- Insert the threaded sleeves (1) again and screw threaded sleeves completely onto the fixtures for the injectors.
- Tighten the screws (arrows) on the special tool 2 358 417 to 5 Nm.

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- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool 0 496 106 (11 8 720) until the injectors of **cylinder 1,3,4** are pulled out.

TECHNICAL INFORMATION

If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

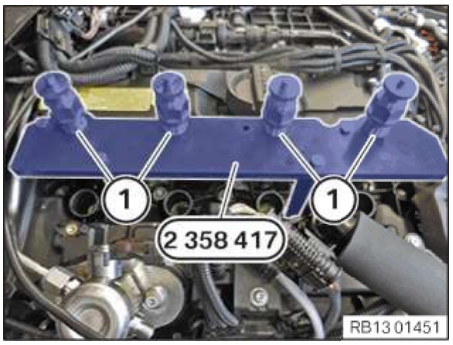


- Adjust torque wrench (1) to 13 Nm **by turning it clockwise** .
- Turn torque wrench (1) in **clockwise** direction with special tool until the injector of **cylinder 2** is pulled out.

TECHNICAL INFORMATION

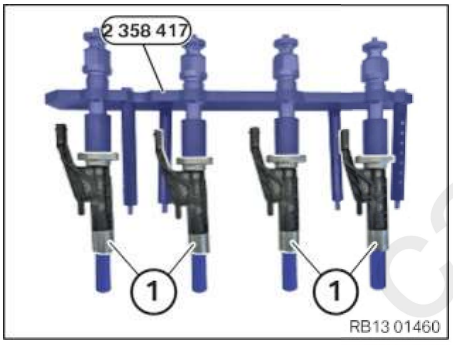
If the torque wrench makes a cracking noise when the injector is pulled out, **the injector must be renewed.**

- Disassemble all injectors individually.

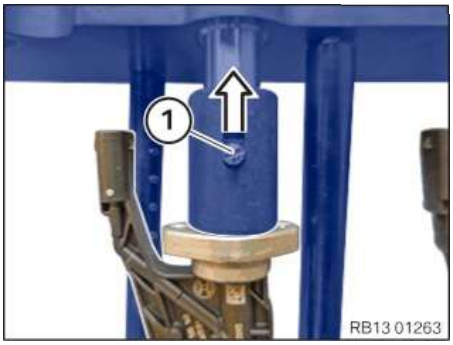


- Before removing the special tool 2 358 417 with the injectors, check if all the injectors were completely pulled out of the cylinder head.

  The threads of the pull-out thread must be completely visible.
- Loosen screws on special tool 2 358 417.



- Carefully remove special tool 2 358 417 with injectors (1) vertically upwards from the cylinder head.
- Place the combination of the special tool 2 358 417 and the injectors (1) flat onto a clean table.

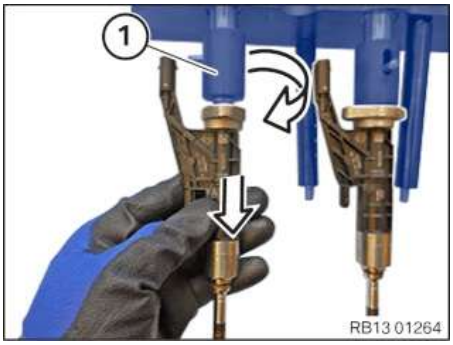


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Unlock the fixture lock (1) from the top.

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- Turn the unlocked fixture (1) by **90°**.
- Release and remove the injector downwards.

19 – Remove high pressure pump

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

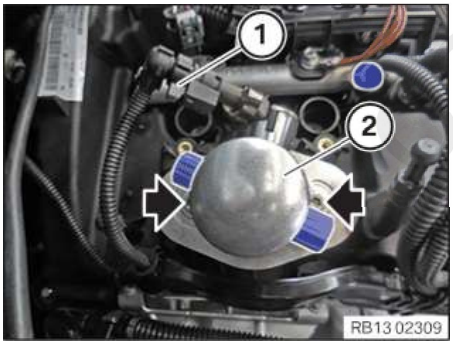
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Unlock plug connection (1) and disconnect.
- Unscrew the bolts (arrows) **in alternating order**.
- Have a rag ready and catch any engine oil that may emerge.
- Feed out high pressure pump (2) and remove.

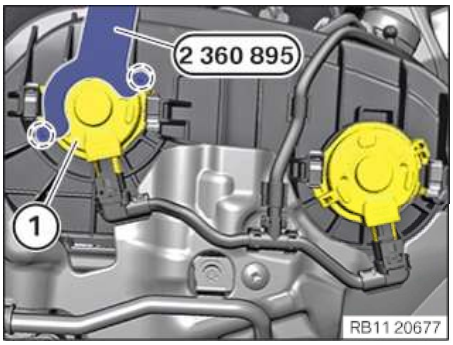
20 – Removing both actuators

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

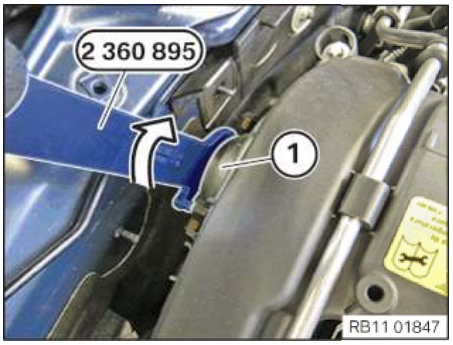
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



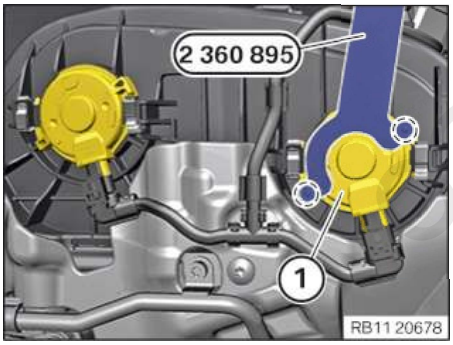
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.



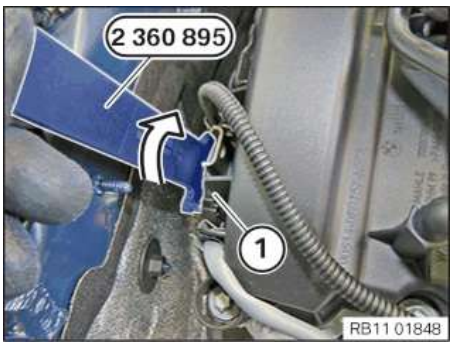
- Turn the actuator (1) on the intake side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.



NOTICE

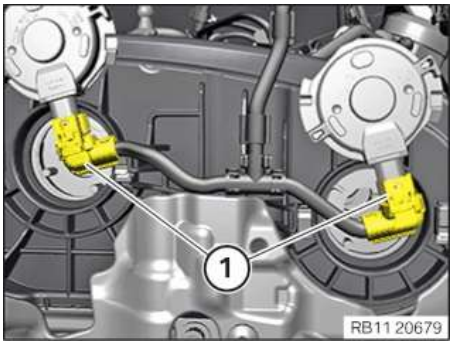
The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Turn the actuator (1) on the exhaust side with the special tool 2 360 895 by about 50° in the direction of arrow and release it.

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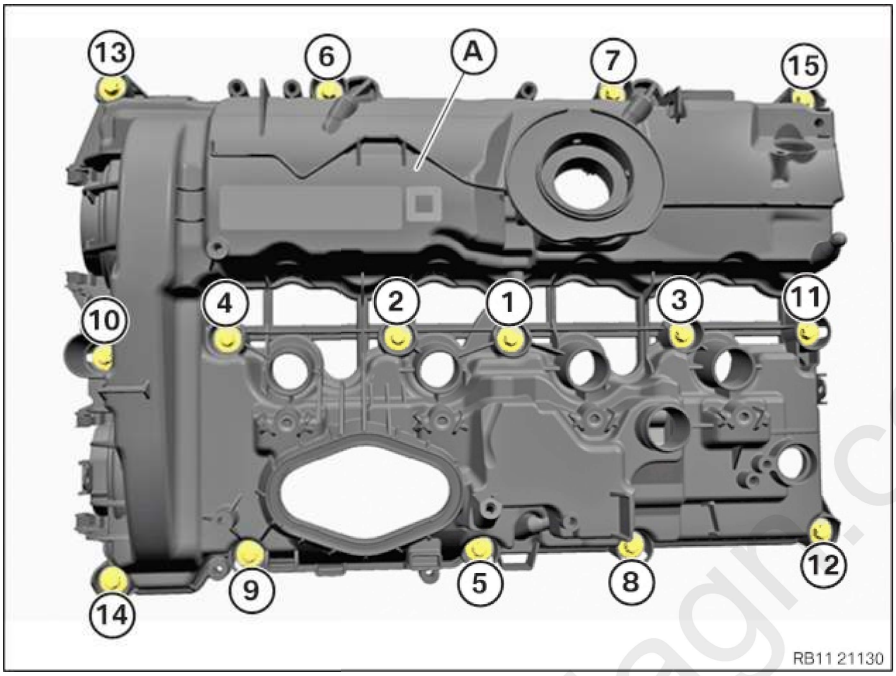
NOTICE

The figure shows the rear side of the engine.

- Unlock and disconnect both connectors (1).
- Feed out and remove both actuators.

21 – Removing the cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

A Cylinder head cover

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

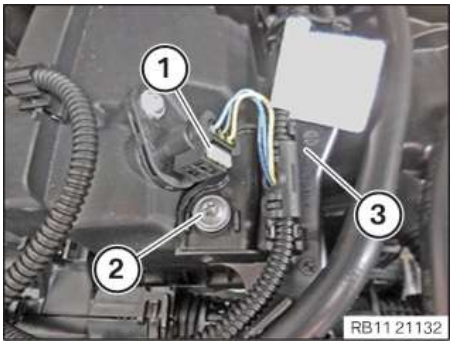
Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

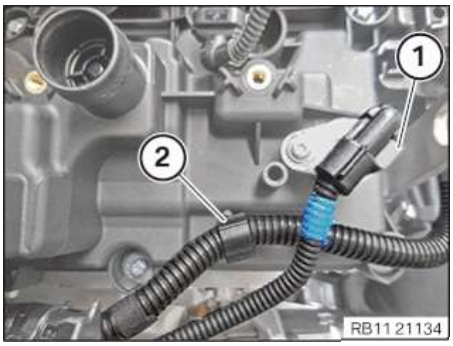


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

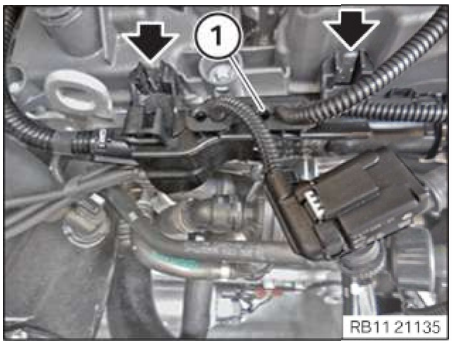
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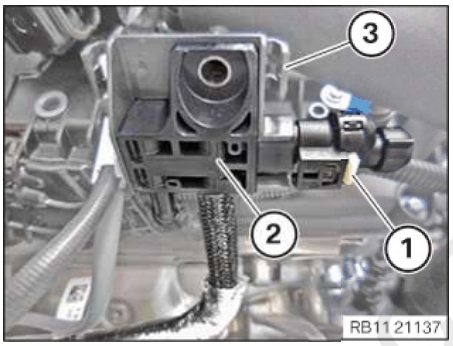
- Unlock and disconnect the plug connection (1) on the intake camshaft sensor.
- Loosen screw (2).
- Guide out the wiring harness section (3) for sensor system 1 and place to one side.



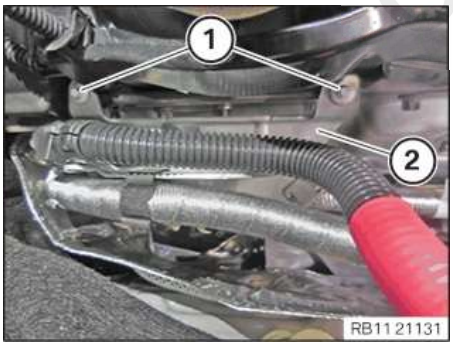
- Unlock and disconnect the plug connection (1) on the exhaust camshaft sensor.
- Unlock and loosen clamp (2).



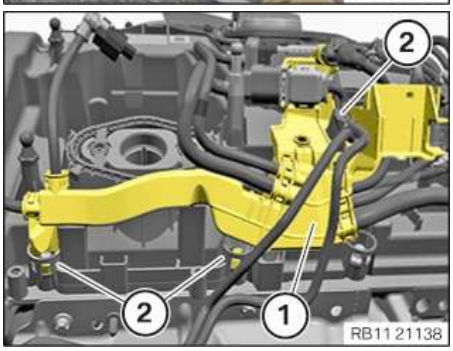
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



- Unlock plug connection (1) and disconnect.
- Feed out differential pressure sensor (2) from the holder (3) and place to one side.

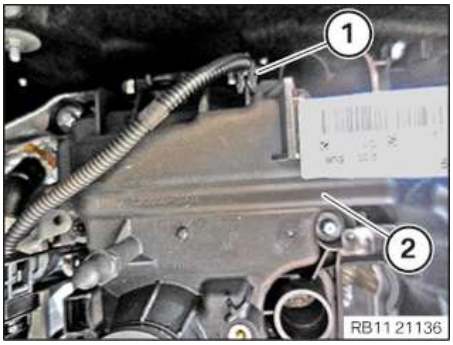


- Loosen screws (1).
- Feed out the bracket (2) of the positive battery cable and set it aside.

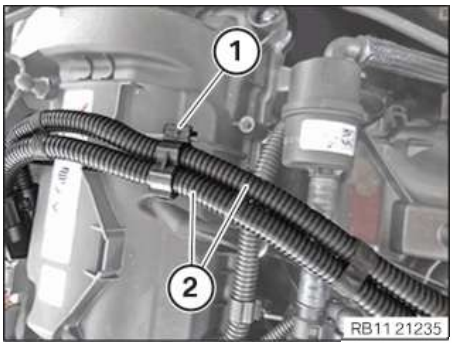


- Guide the wiring harness section (1) for the sensor system 2 out of the guides (2) and set it aside.

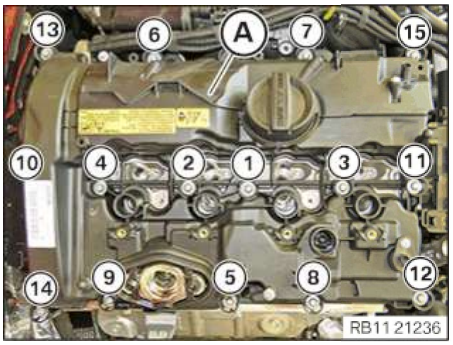
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- Loosen clamp (1).



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Loosen screws in the order (15) to (1).
- Guide the cylinder head cover (A) out and remove it.

22 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

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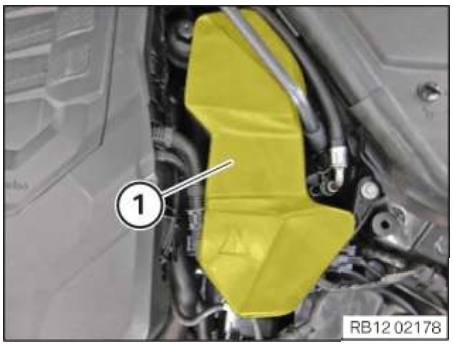
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

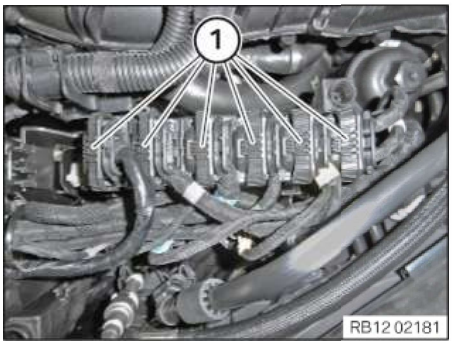
For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

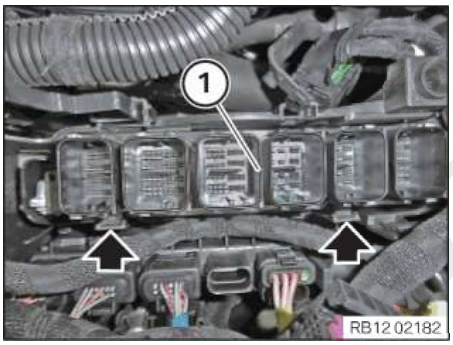
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.



- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

23 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

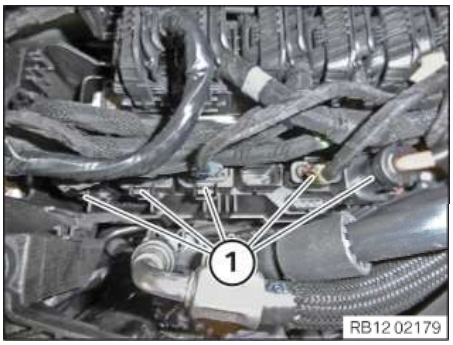
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RISK OF DAMAGE

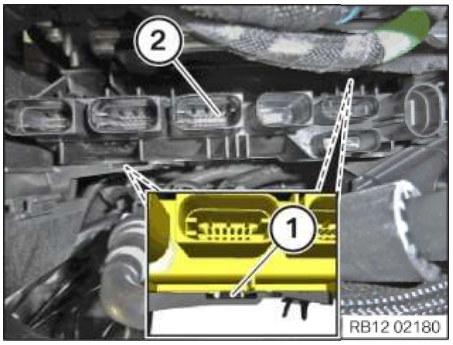
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

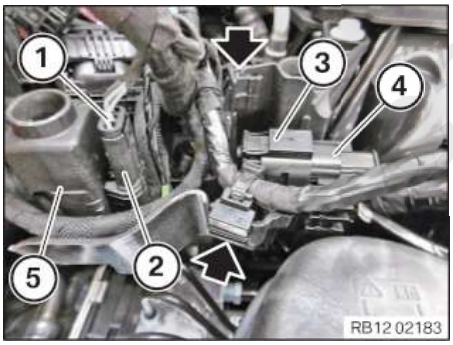


- Unlock and disconnect plug connections (1).

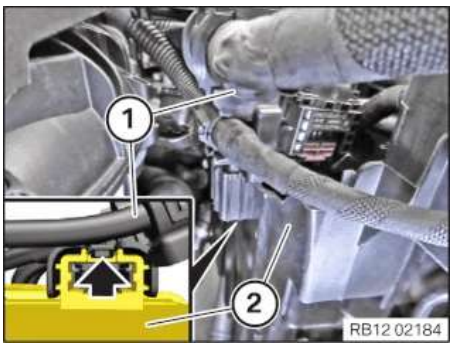


- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

24 – Removing the control unit holder

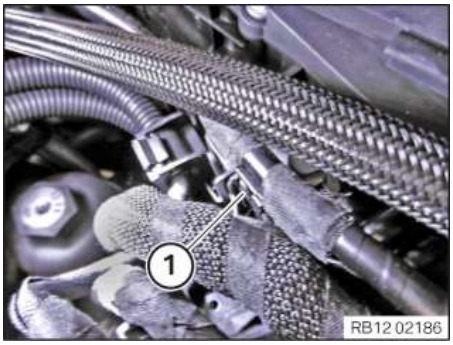


- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).

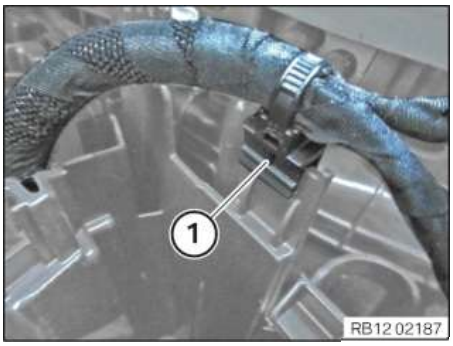


- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).

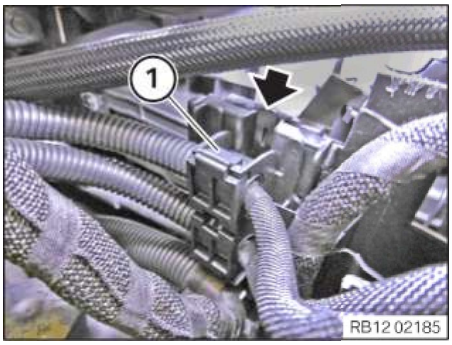
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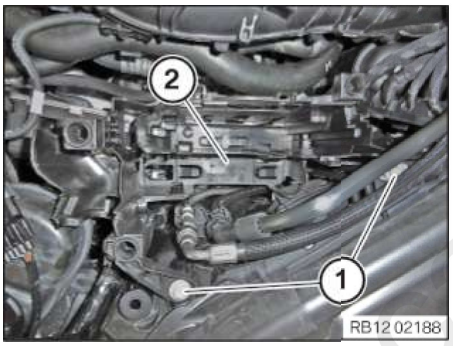
- Loosen clamp (1).



- Loosen clamp (1).



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

25 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

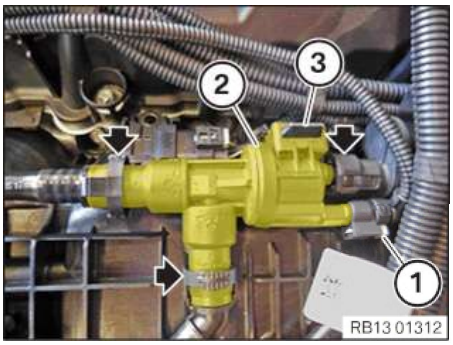
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RISK OF DAMAGE

Electrostatic discharge.

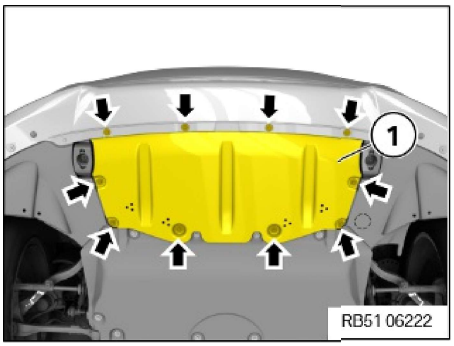
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

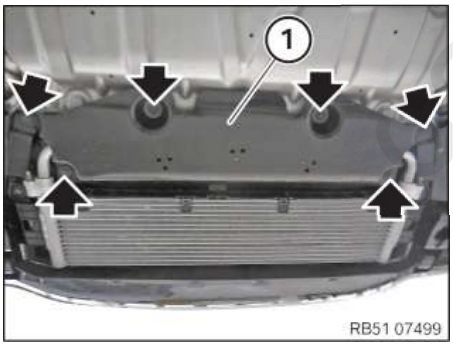
26 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

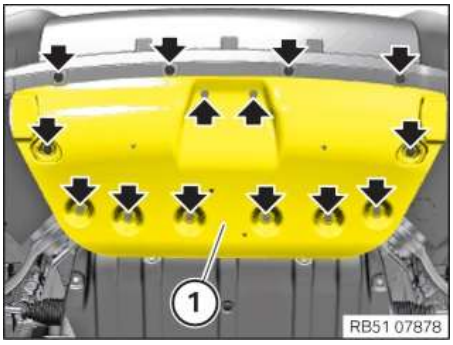
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.



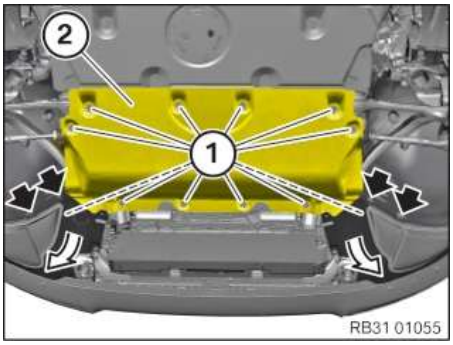
- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

27 – Remove the underbody protection of the steering gear

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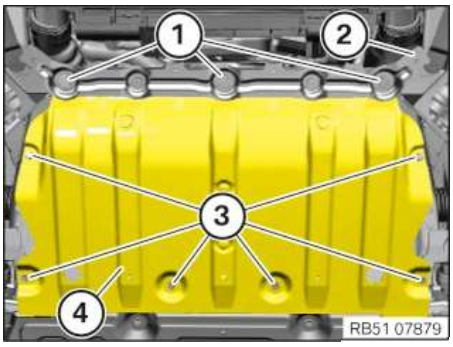
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

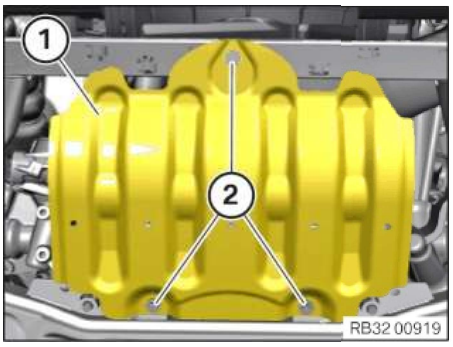
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

28 – If installed: Removing the steering start protection

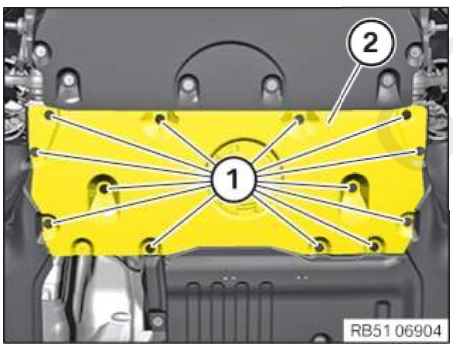
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

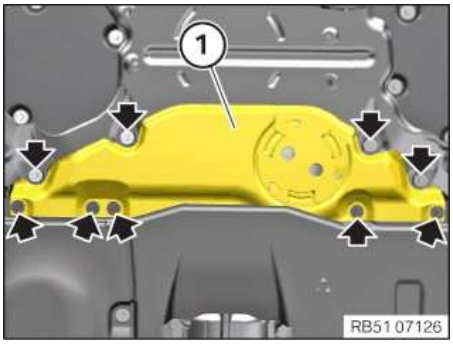
29 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



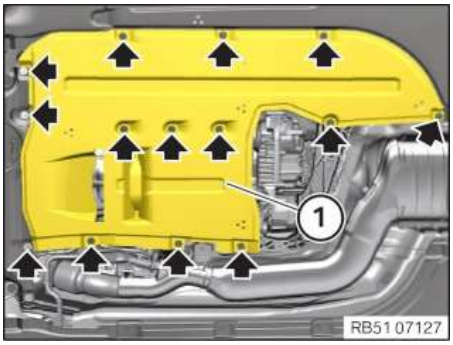
- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

30 – Remove rear underbody protection

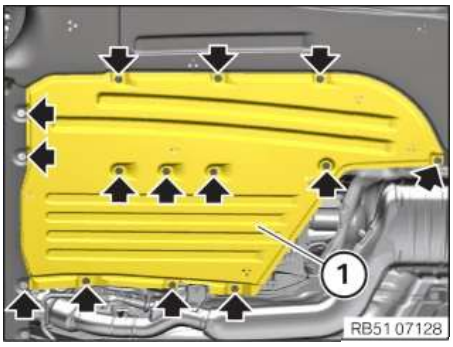
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- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

31 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

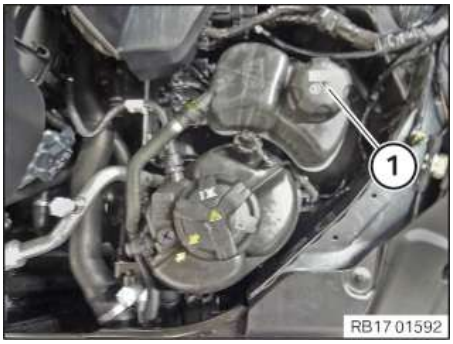
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

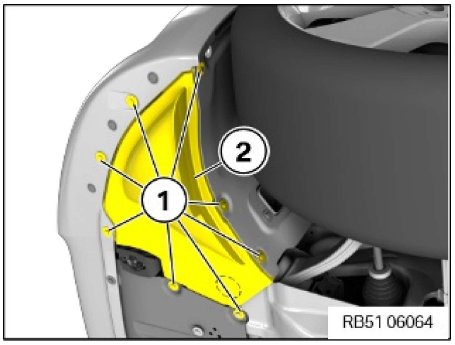
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

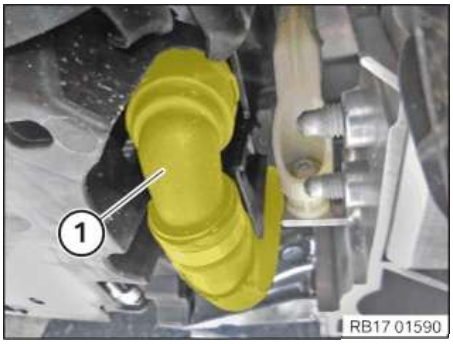


- Loosen sealing cap (1).

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- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

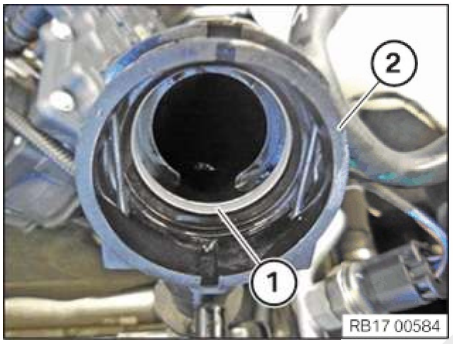


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

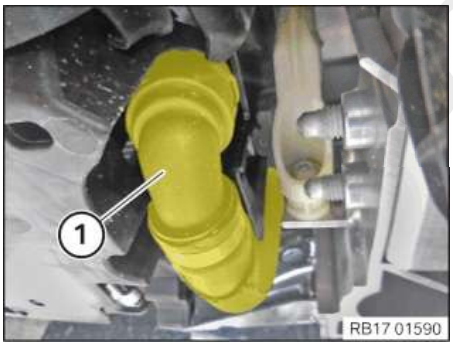
32 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

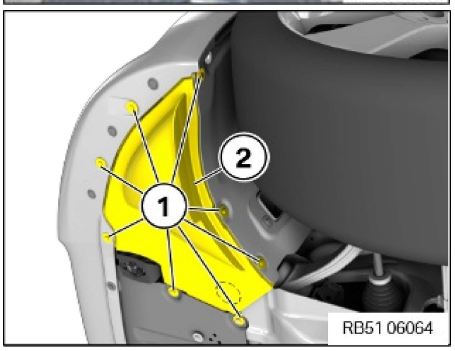


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

33 – Removing the intake plenum

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RISK OF DAMAGE

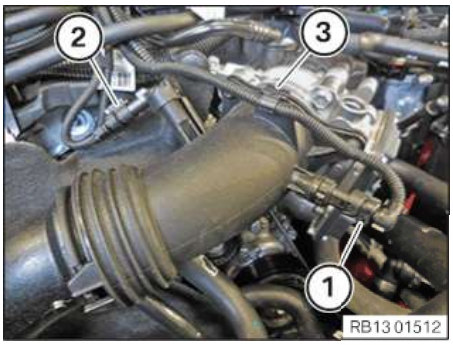
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

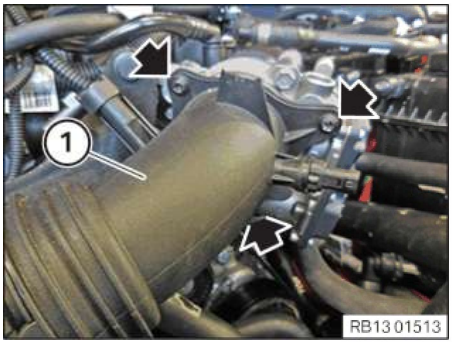
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

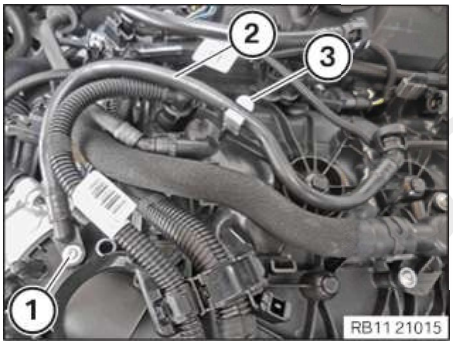
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



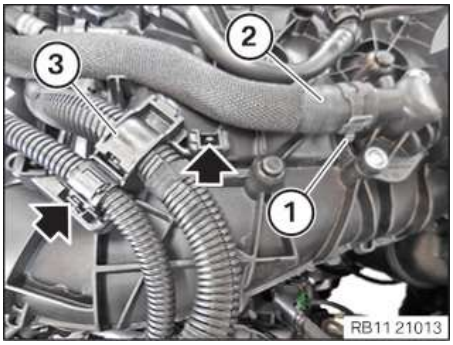
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.

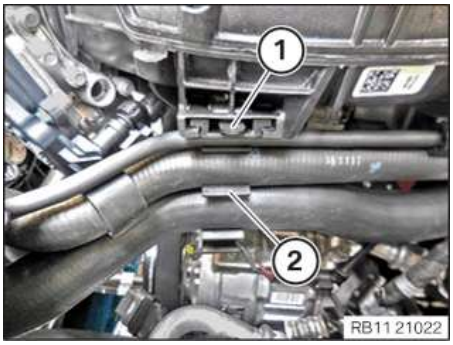


- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.

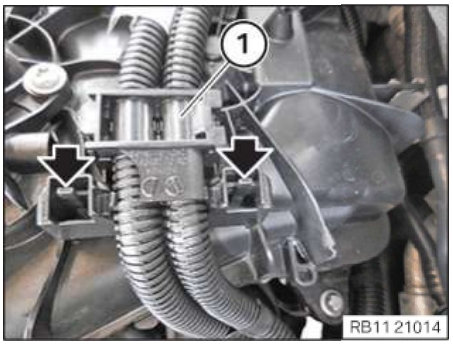
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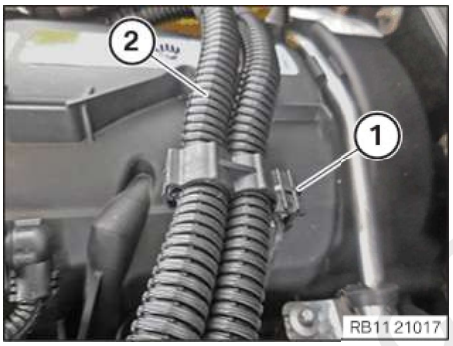
- Unlock the lock (1).
- Thread out holder (2) and set aside.



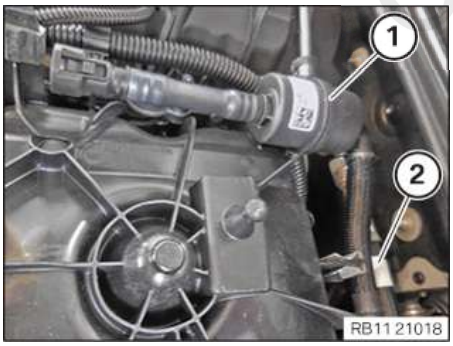
- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



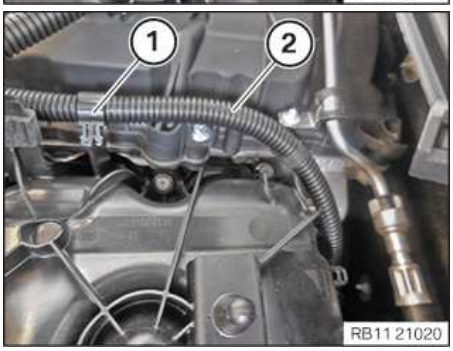
- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Guide tank ventilation line (1) out of clamp (2) and place it aside.

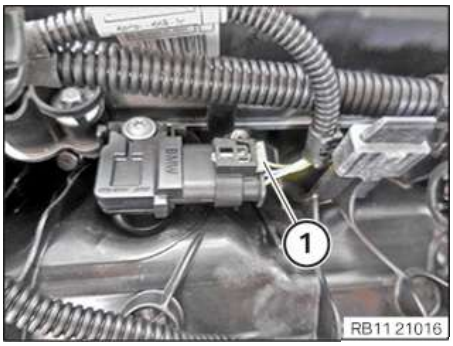


- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

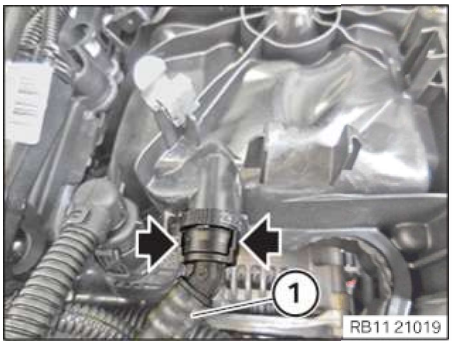
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- Loosen screw (1).



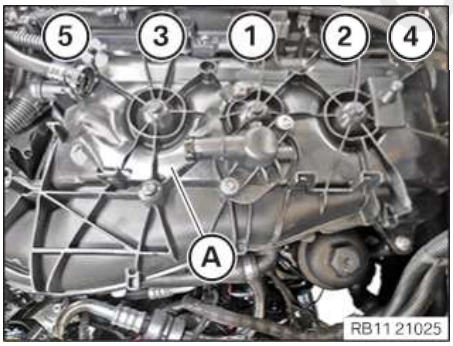
- Unlock plug connection (1) and disconnect.



- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



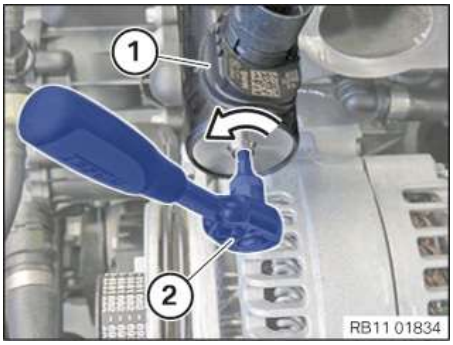
TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

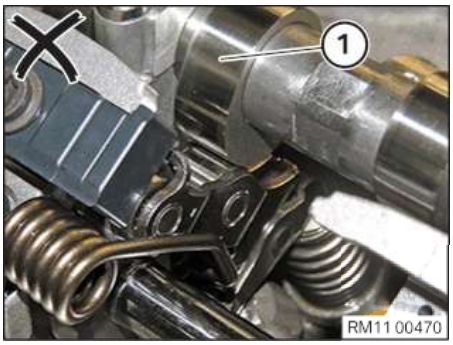
34 – Adjusting the servomotor to minimum lift

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- Slowly adjust the eccentric shaft with the servomotor (1) to the minimum lift using the tool (2).

35 – Checking the position of the intake camshaft



Check

- Check position of the intake camshaft on the respective cylinders.

Result

» Cam (1) of the intake camshaft runs on the intermediate lever.

Measure

- Continue to turn the engine at the vibration damper with the special tool 0 493 380 (11 6 480) in the direction of engine rotation.

36 – Remove all torsion springs

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

TECHNICAL INFORMATION

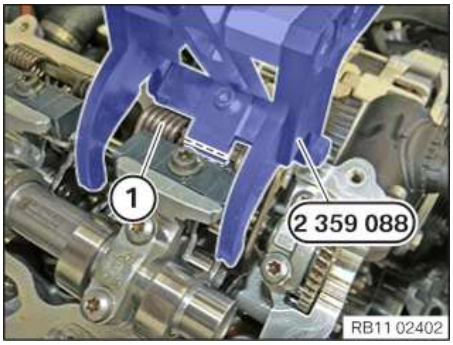
- Wear safety goggles.



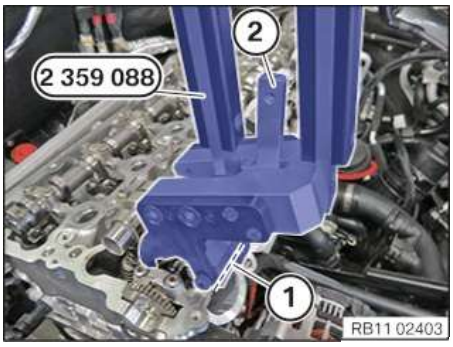
- Have the set of special tools 2 359 088 ready.

Number	Description
1	Clamping lever
2	Mounting for clamping lever (fitting aid)

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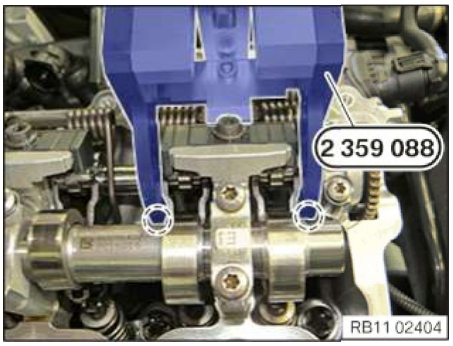


- Open the special tool 2 359 088 and position it at the torsion spring (1).



- Ensure that the special tool 2 359 088 lies flat in the area (1) on the cylinder head.
- Carefully close the clamping lever of the special tool 2 359 088 until the retaining hook (2) engages.

Check



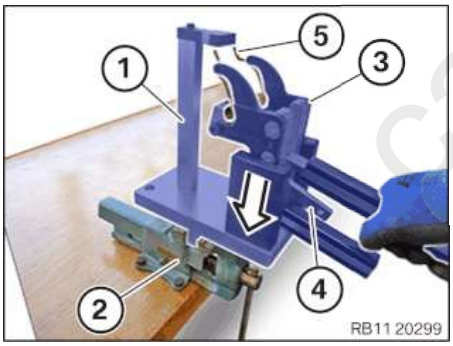
- Check if the special tool 2 359 088 is positioned correctly on the torsion spring.

Result

» Special tool 2 359 088 is not positioned correctly on the torsion spring.

Measure

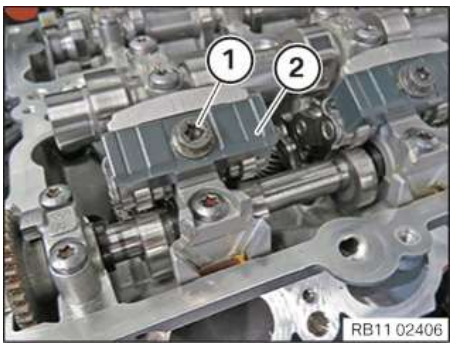
- Carefully release the clamping lever of the special tool 2 359 088 and repeat the process.



- Clamp fixture (1) of the special tool 2 359 088 in the vice (2).
- Position clamping lever (3) of special tool 2 359 088 with pre-tensioned torsion spring (5) in direction of arrow in the mounting (1) of the special tool 2 359 088.
- Carefully unlock retaining hook (4) of the special tool 2 359 088.

  The torsion spring (5) is relieved.
- Slowly open clamping lever (3) and remove the torsion spring (5).
- Place torsion spring (5) neatly into special tool 0 495 105 (11 4 480).
- Repeat the operations for the remaining torsion springs.

37 – Removing all gates

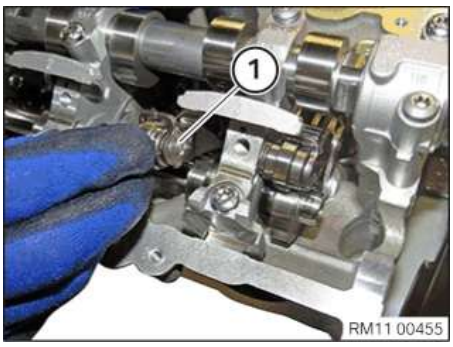


- Loosen screw (1).
- Remove the gate (2) and place it arranged in order into 0 495 105 (11 4 480).
- Repeat the step for all the gates.

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MAIN WORK

38 – Removing all intermediate levers



- Remove the intermediate lever (1) and arrange it in the special tool 0 495 105 (11 4 480) in order.
- Repeat the step for all intermediate levers (1).

39 – Checking the intermediate lever classification



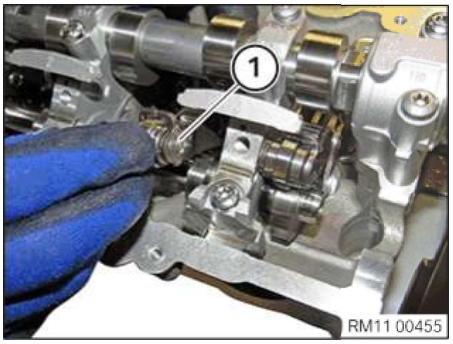
TECHNICAL INFORMATION

All intermediate levers are classified. Only one classification may be used per engine.

All intermediate levers must be installed in the same position in an engine which has already been in use.

- Check classification (arrow) of intermediate lever.

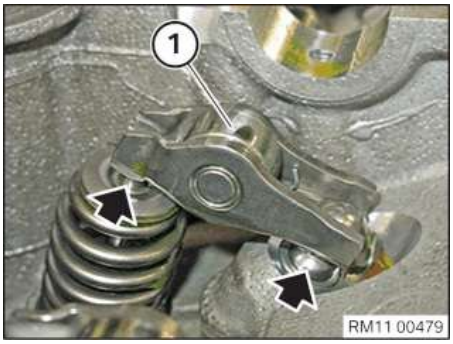
40 – Installing all intermediate levers



- Install intermediate lever (1).
- Repeat the step for all intermediate levers (1).

POSTPROCESSES

41 – Checking installation position of roller cam followers



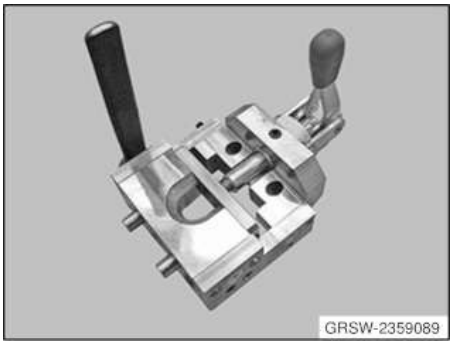
TECHNICAL INFORMATION

The rocker arms may slip slightly when the camshaft is positioned. Make sure rocker arms are correctly positioned on the hydraulic valve clearance compensating elements and on valves.

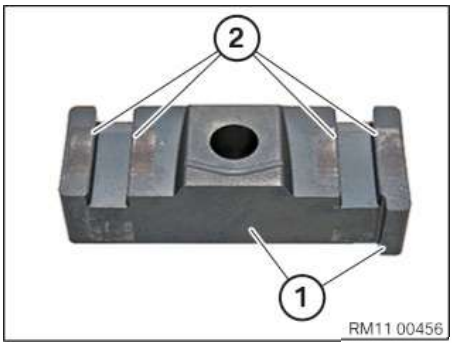
- Make sure the mounting orientation (arrows) of the roller cam followers (1) is correct.

42 – Installing all gates

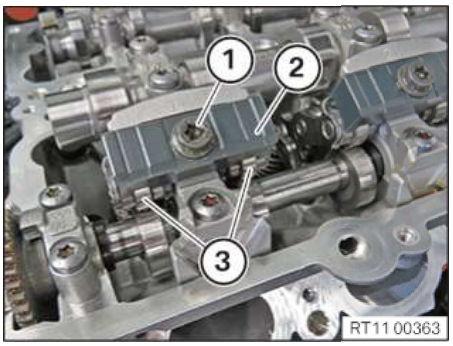
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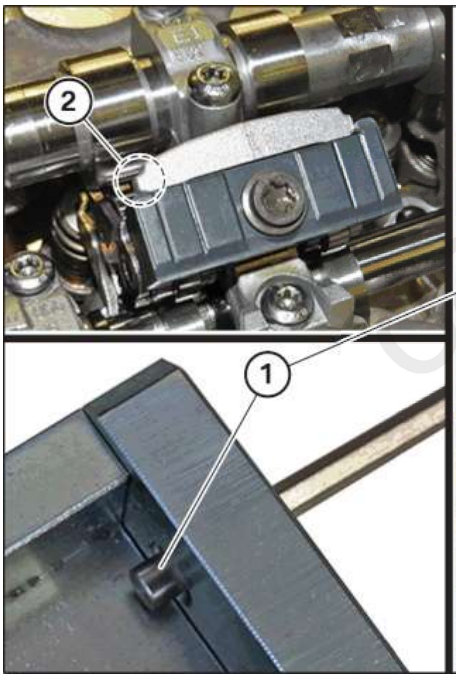
- Have the special tool 2 359 089 ready.

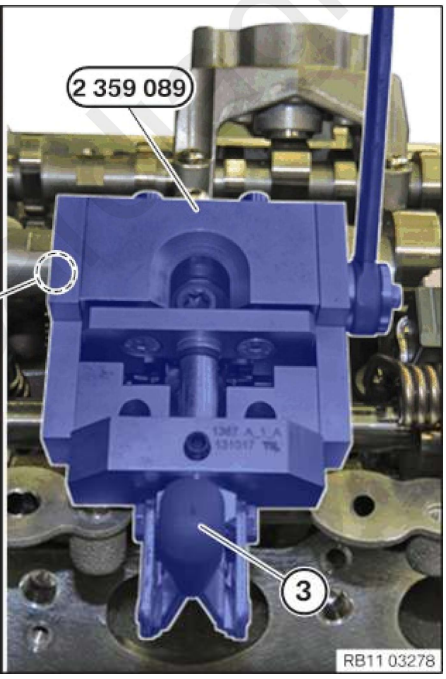


- Clean contact surfaces (1) and (2) off oil, grease and dirt.

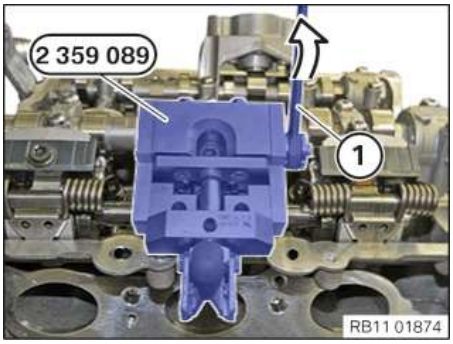


- Position the gate (2) and hand-tighten the bolt (1).
- Check that the intermediate lever (3) is in the correct mounting orientation.





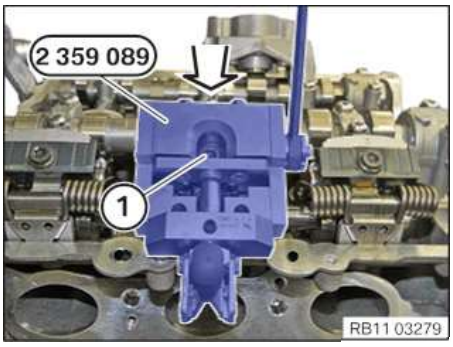
- Position the special tool 2 359 089 on the cylinder head.
- Pre-tension the gate with the lever (3).
- Abut the bolt (1) in the area (2).
- Make sure that the special tool 2 359 089 does not rotate during this process.



- Secure the gate with the lever (1) in the direction of the arrow.



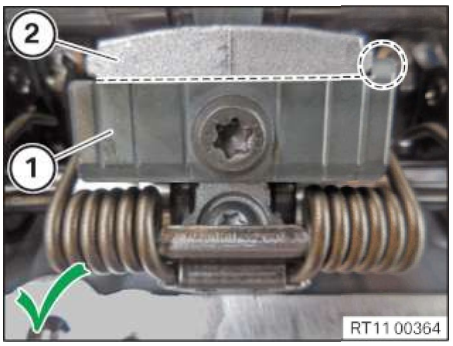
- Make sure that the special tool 2 359 089 rests flat against the cylinder head (arrows).



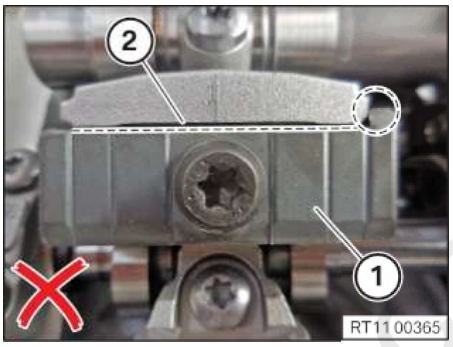
- Press the special tool 2 359 089 onto the cylinder head in the direction of the arrow.
- Tighten the bolt (1) at the same time.

Gate to bearing bracket

M8		20 Nm



- Make sure that gate (1) rests correctly against bearing bracket (2).
  Gate (1) is installed correctly in the marked area.



- Ensure that gate (1) rests **correctly** against bearing bracket (2).
  Gate (1) is installed incorrectly in the marked area**.**
- Repeat the step for all the gates.

43 – Install all torsion springs

CAUTION

Spring preload.

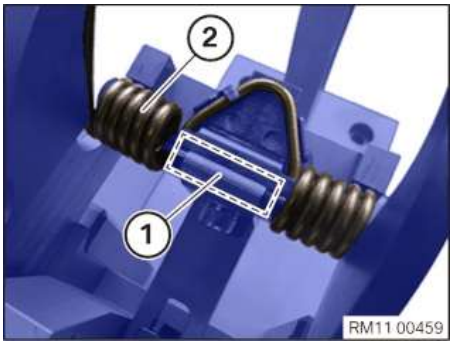
Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

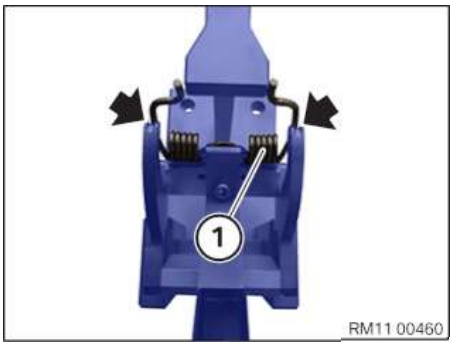
TECHNICAL INFORMATION

- Wear safety goggles.

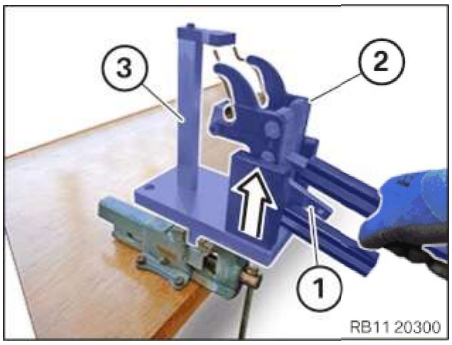
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- Insert the torsion spring (2) in the clamping lever of the special tool 2 359 088.
- Make sure that the torsion spring (2) is correctly positioned in the marked area (1) of the special tool 2 359 088.

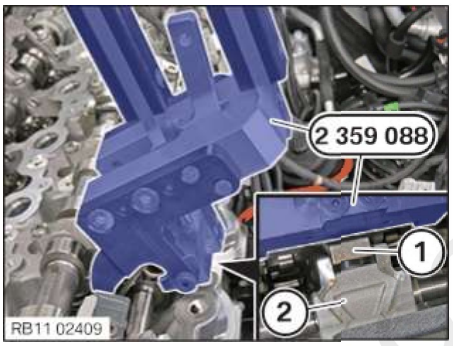


- Carefully close the clamping lever of the special tool 2 359 088 in the accompanying fixture until the retaining hook engages.
- Ensure that the torsion spring (1) lies correctly in the lateral guides (arrows) of the special tool 2 359 088 during tensioning.

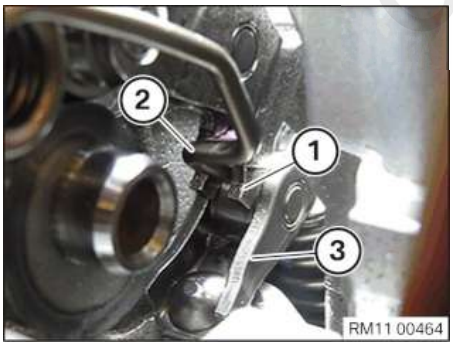


- Carefully close the clamping lever (2) of the special tool 2 359 088 in the fixture (3) until the lever (1) audibly engages.

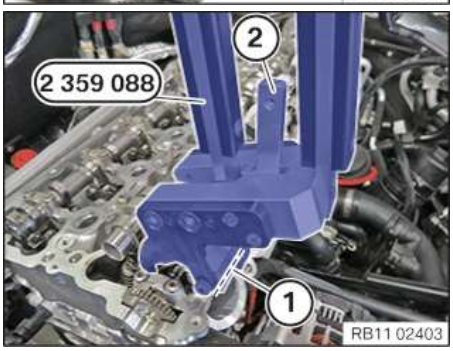
  The torsion spring is tensioned.
- **Carefully** take the clamping lever (2) of the special tool 2 359 088 with the stretched torsion spring out of the fixture (3) of the special tool 2 359 088 in the direction of arrow.



- Insert the torsion spring (1) with the special tool 2 359 088 in the cylinder head (2).

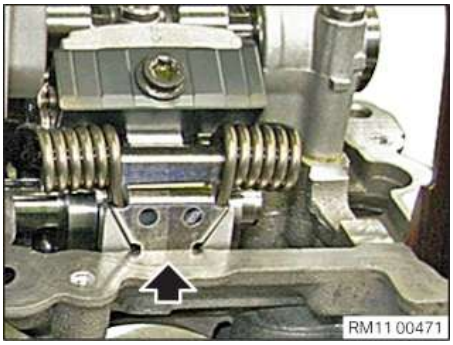


- Insert the torsion spring (2) into the intermediate levers (1).
- Check all roller cam followers (3) for correct installation position.



- Lay special tool 2 359 088 flat in the marked area (1).
- Press the clamping lever of the special tool 2 359 088 together until the retaining hook (2) unlocks.
- Carefully open the clamping lever of the special tool 2 359 088 until the torsion spring is completely relaxed.
- Remove special tool 2 359 088.

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- Check the correct mounting orientation of the torsion spring (arrow).

- Repeat the operations for the remaining torsion springs.

44 – Installing the intake plenum

RISK OF DAMAGE

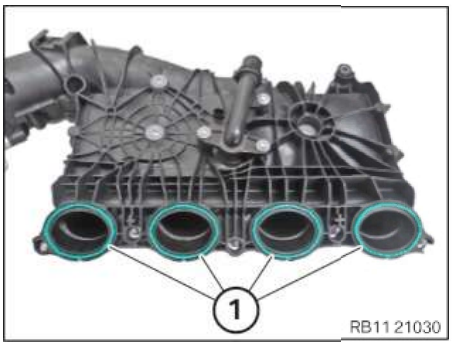
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

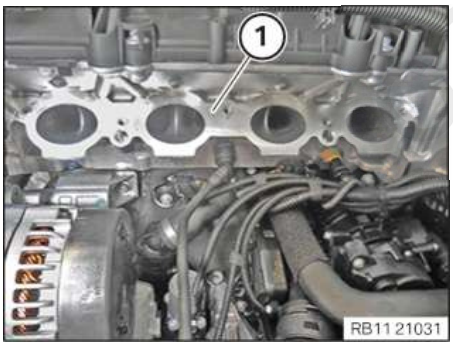
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

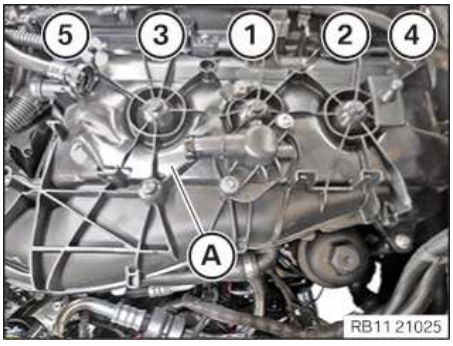


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm

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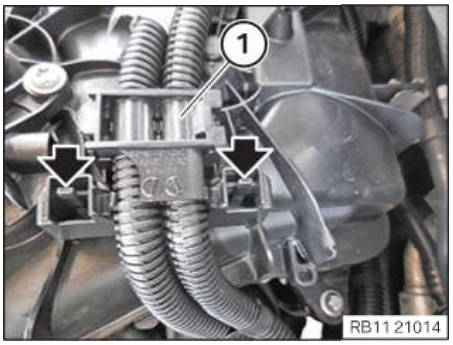
- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.



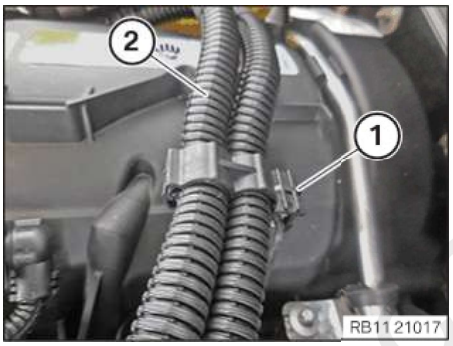
- Tighten down screw (1).

Intake plenum to support

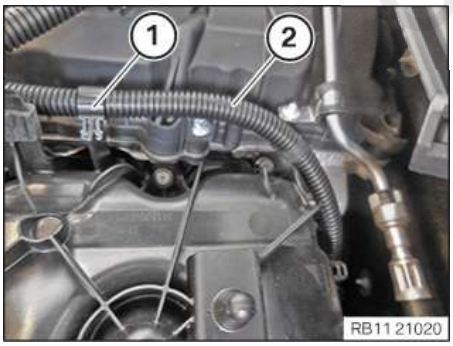
M6X25		Tightening torque	8 Nm



- Insert and install the wiring harness section (1) for the injectors and ignition coils.
  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

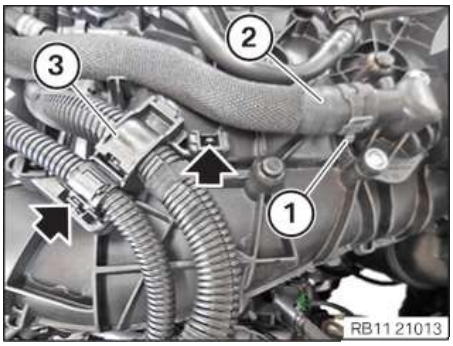
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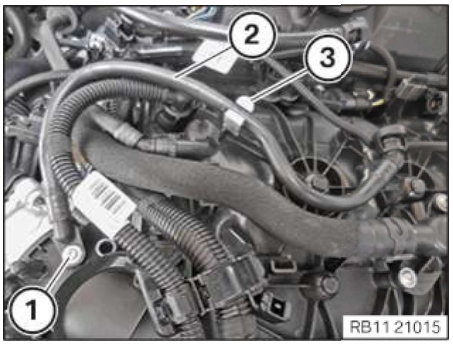
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



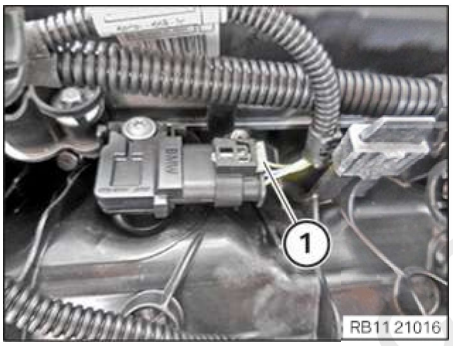
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

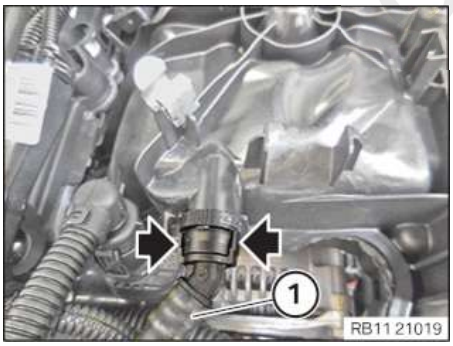
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



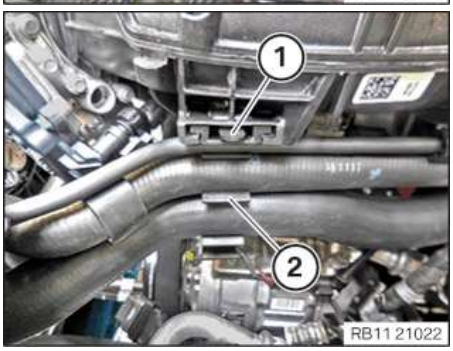
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



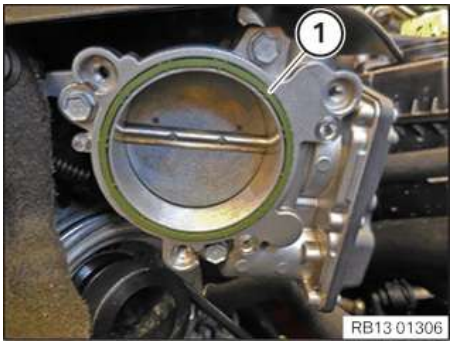
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.



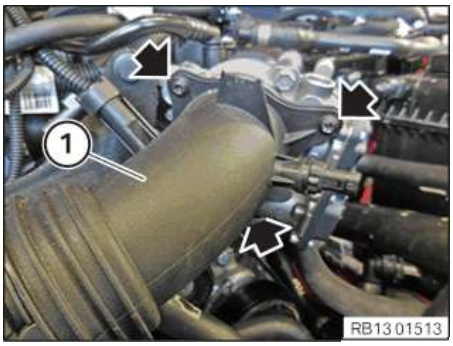
- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.

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- Renew the gasket (1).

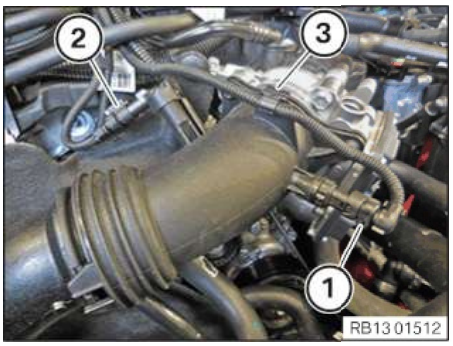
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

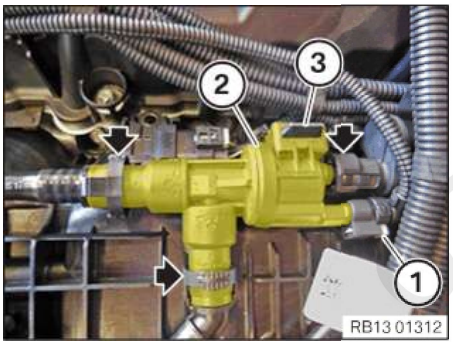
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

45 – Installing the tank vent valve

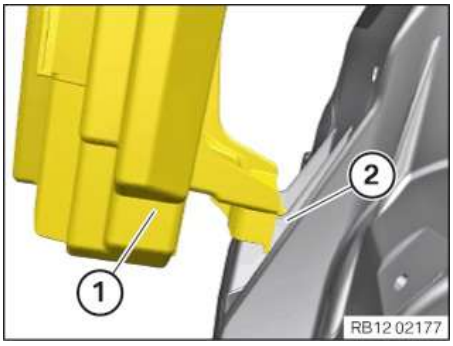


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

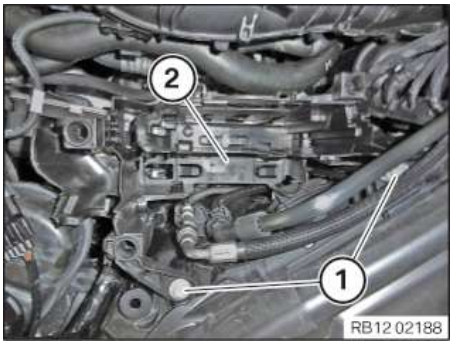
  The connector (1) must engage audibly.

46 – Installing the control unit holder



- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).

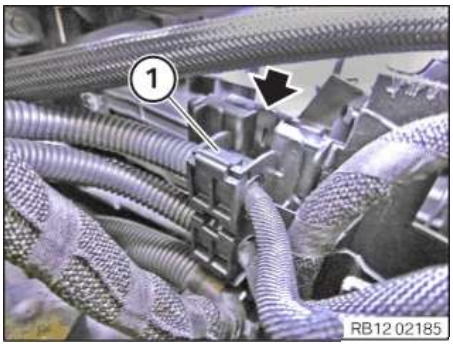
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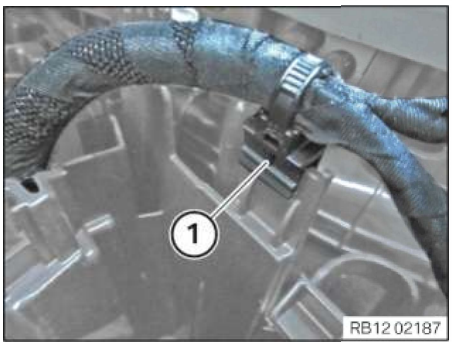
- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder on spring strut dome

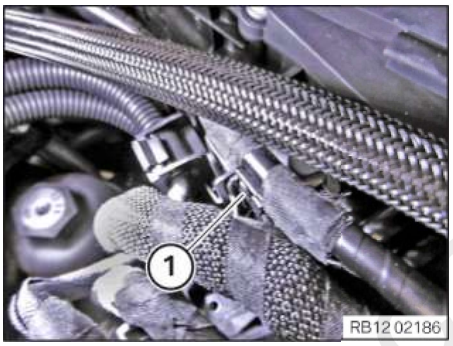
Hexagon screw		Tightening torque	8 Nm



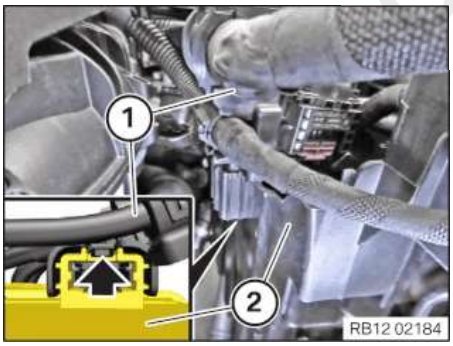
- Feed in and install the cable clip (1).
  Lock (arrow) must audibly engage.



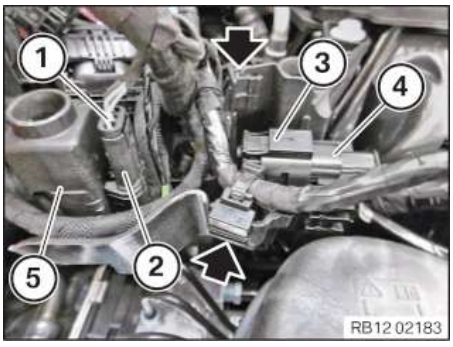
- Secure clamps (1).



- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

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47 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

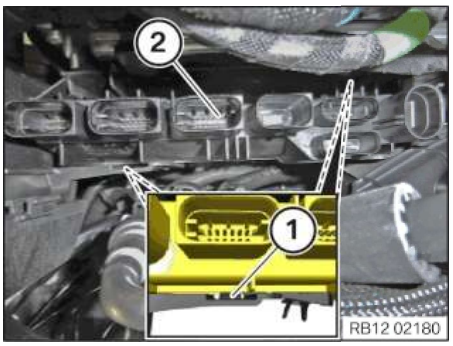
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

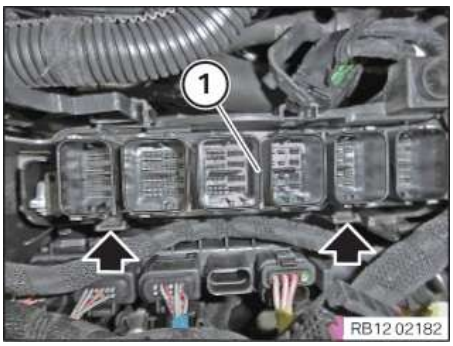


- Insert and install the integrated supply module (PDM) (2).
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



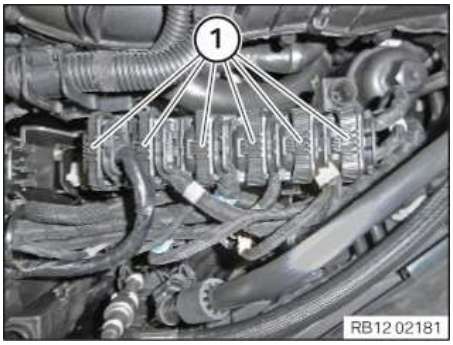
- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

48 – Installing the DME control unit



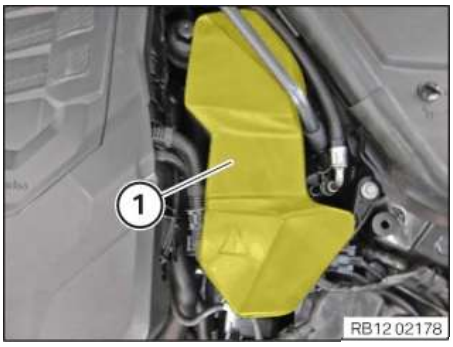
- Feed in and install DME control unit (1).
  The locks (arrows) must engage audibly.

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- Connect connectors (1) and lock.

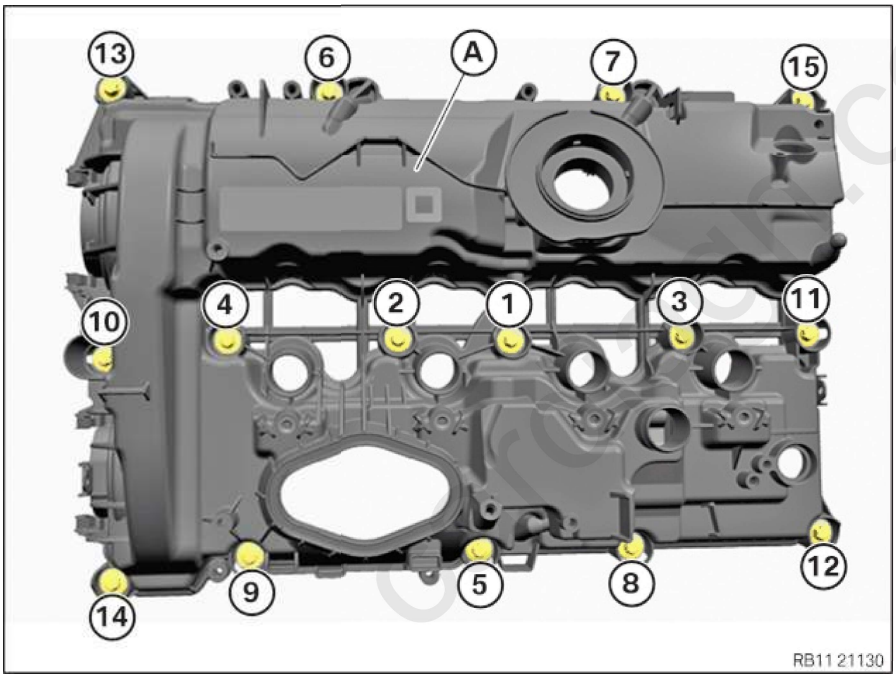
  All connectors (1) must engage audibly.



- Insert and install cover (1) into guides.

49 – Installing cylinder head cover

Overview: Bolts of the cylinder head cover



1 - 15 Bolts of the cylinder head cover

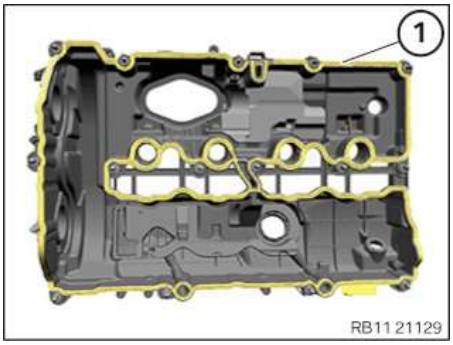
A Cylinder head cover

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

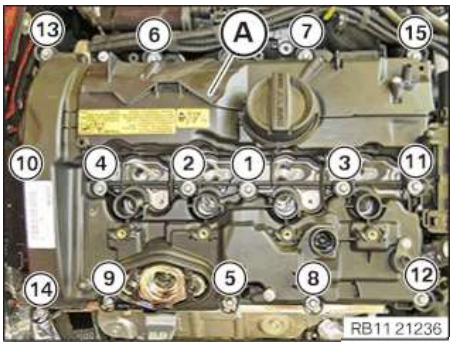
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Renew the profile seal (1).

  Parts: Profile seal
- Insert and install the profile seal (1).



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

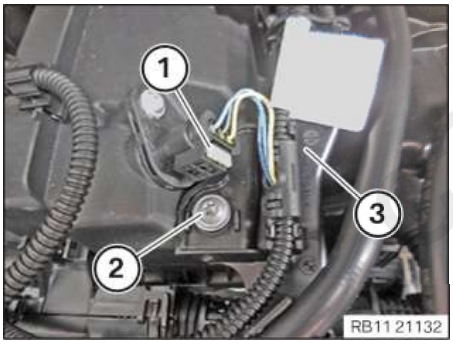
- Insert and install cylinder head cover (A).
- Tighten screws in the order (1) to (15).

Cylinder head cover to cylinder head

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

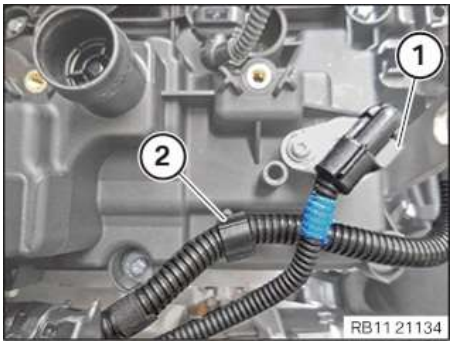


- Guide in and install wiring harness section (3) for sensor system 1.
- Tighten down screw (2).

Wiring harness section of engine to cylinder head cover

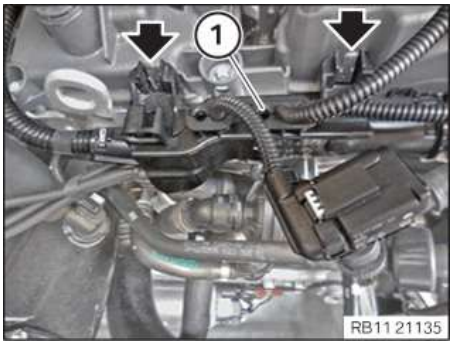
M6		Tightening torque	8 Nm

- Connect connector (1) on the intake camshaft sensor and lock it.
- Ensure that connector (1) on the intake camshaft sensor engages audibly.

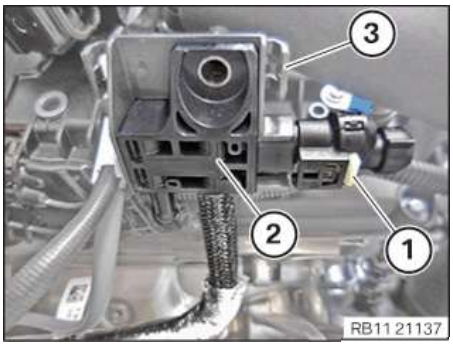


- Connect connector (1) on the exhaust camshaft sensor and lock it.
- Ensure that connector (1) on the exhaust camshaft sensor engages audibly.
- Secure clamps (2).

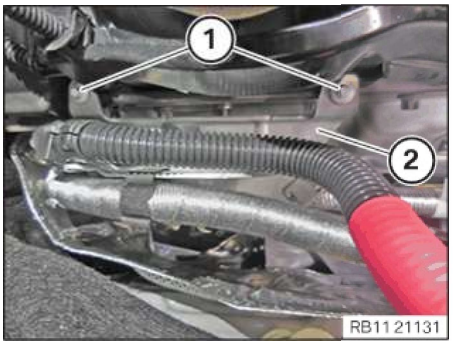
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- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Thread in differential pressure sensor (2) on the holder (3) and install.
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

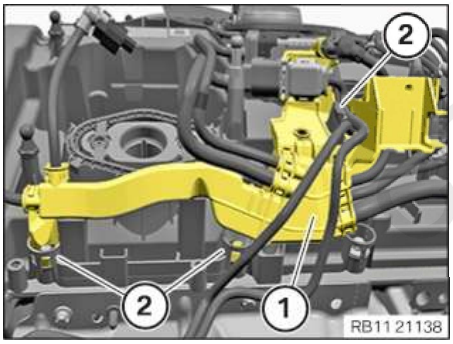
Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

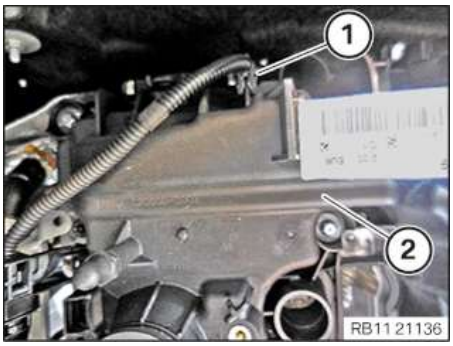
- Guide in and install holder (2) of the positive battery cable.
- Tighten the screws (1).

Holder, positive battery cable to cylinder head cover

6X18	Tightening torque	6 Nm

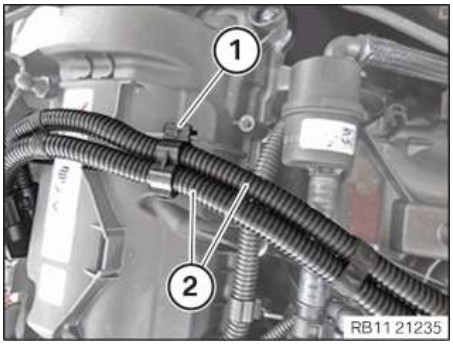


- Guide in the wiring harness section (1) for sensor system 2 from guides (2) and install it.



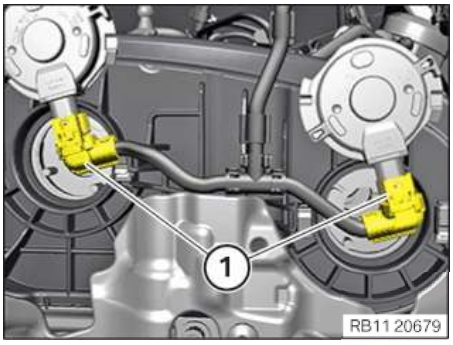
- Secure clamps (1).

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- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).

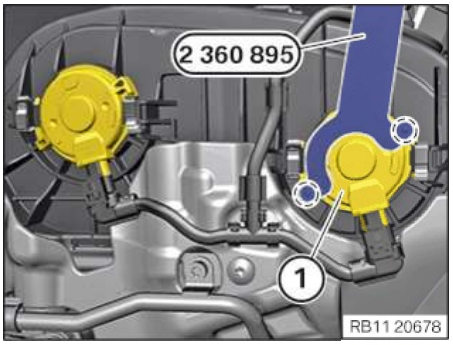
50 – Installing both actuators



NOTICE

The figure shows the rear side of the engine.

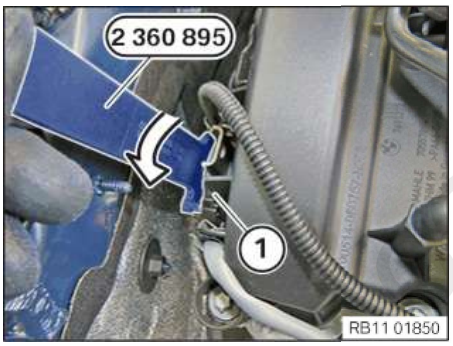
- Position both actuators.
- Connect and lock both connectors (1).
- Make sure the connectors (1) engage audibly.



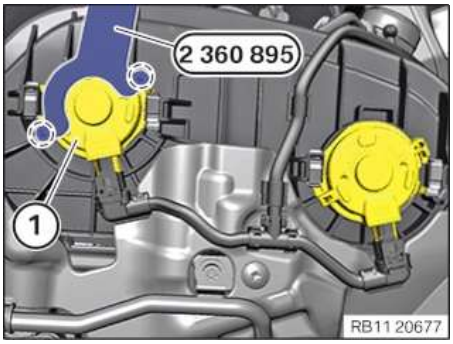
NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the exhaust side.



- Position the actuator (1) of the exhaust side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

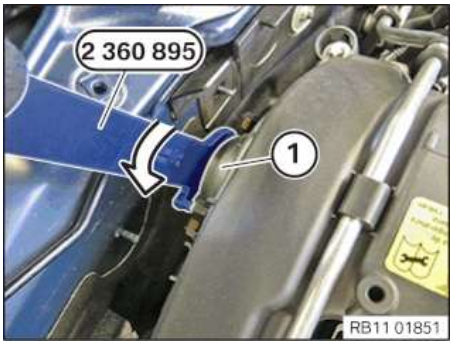


NOTICE

The figure shows the rear side of the engine.

- Position special tool 2 360 895 correctly on the actuator (1) of the intake side.

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- Position the actuator (1) of the intake side and turn it in the direction of arrow with the special tool 2 360 895 until the limit stops touch the clamps.

51 – Prepare the injectors for installation

RISK OF DAMAGE

Damage to the injector tips and Teflon ring.

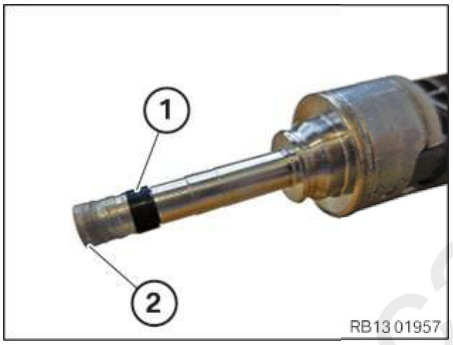
Improper handling of the injector tips and Teflon ring can lead to malfunctioning of the injector.

- Avoid mechanical contact with injector tip.
- When exchanging Teflon ring, hands and work surface must be clean and free of oil. Do not use any lubricating agents.
- Do not use fingernails to slide Teflon ring on.

TECHNICAL INFORMATION

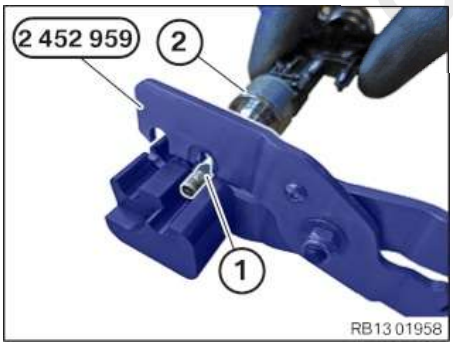
Before re-installing the injector, the Teflon ring must be renewed. Once a Teflon ring has been installed, it may not be re-used. New injectors are supplied with a new Teflon ring.

After the installation of a new Teflon ring on the injectors, the injector must be installed in the cylinder head within 10 minutes or protected with protective caps; otherwise, the Teflon ring will swell.



- Before installing the injectors: Renew the Teflon rings (1).

  Parts: Teflon rings
- Avoid mechanical contact with injector tip (2).



- Remove Teflon ring (1) by using special tool 2 452 959 from injector (2).
- If necessary, use a lint-free cloth to clean the cylindrical part of the injector tip. Do not use ultrasonic sound or other auxiliary materials.
- Do **not** clean the injector tip.



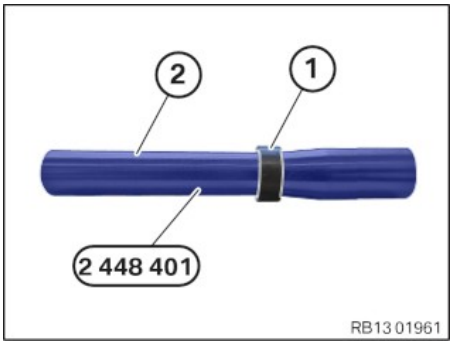
- For the installation of the new Teflon rings: Use the set of special tools 2 448 401:

  (1) Installation cone

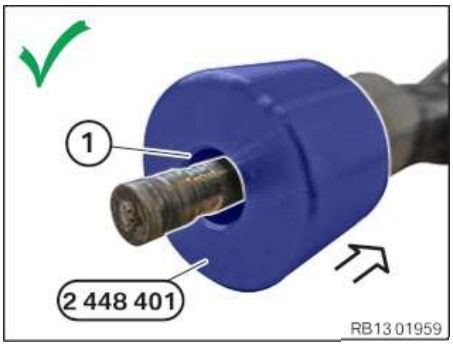
  (2) Sliding sleeve

  (3) Assembly sleeve

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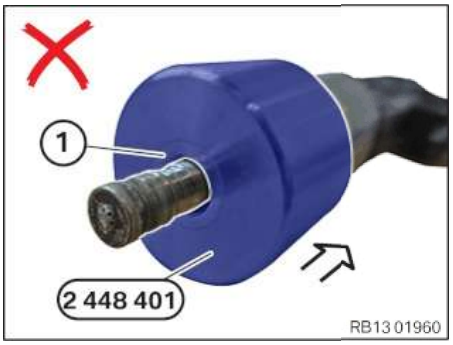


- Slide the new Teflon ring (1) onto the installation cone (2) from the set of special tools 2 448 401.



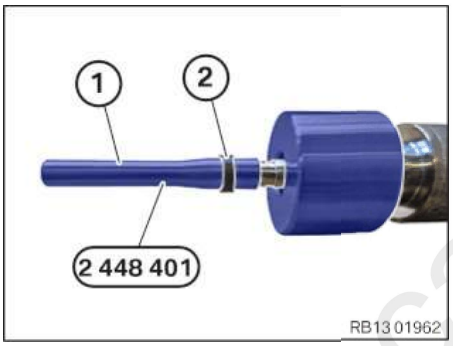
- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

  The larger diameter of the assembly sleeve (1) must point to the injector tip.

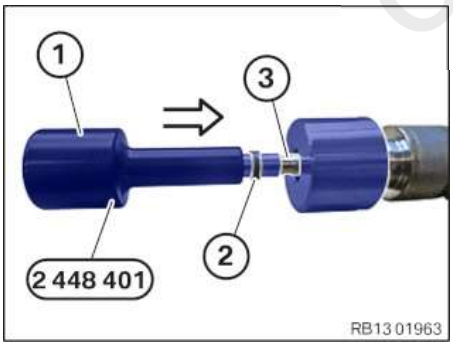


- Make sure the installation position of the assembly sleeve (1) from the set of special tools 2 448 401 is correct:

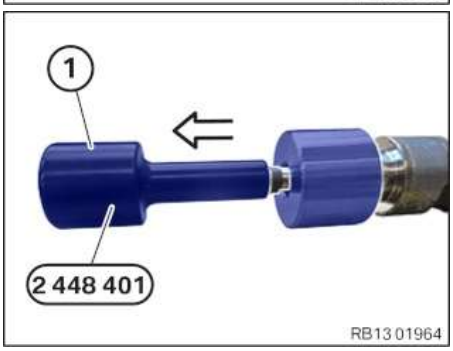
  The assembly sleeve (1) is **not** mounted correctly when the smaller diameter points to the injector tip.



- Mount the Teflon ring (2) with the installation cone (1) from the set of special tools 2 448 401 on the injector tip .

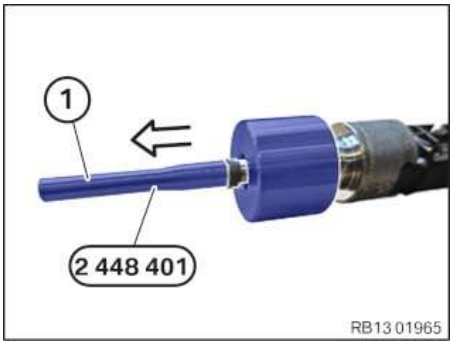


- Use the sliding sleeve (1) from the set of special tools 2 448 401 to push the Teflon ring (2) into the groove (3) on the injector in the direction of the arrow.

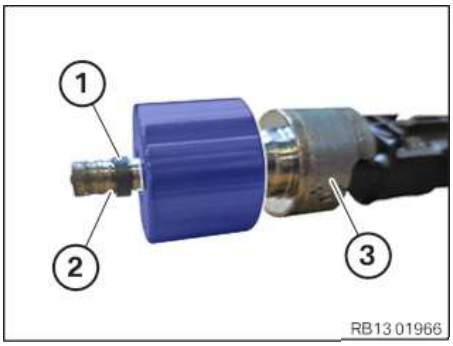


- Thread out the sliding sleeve (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

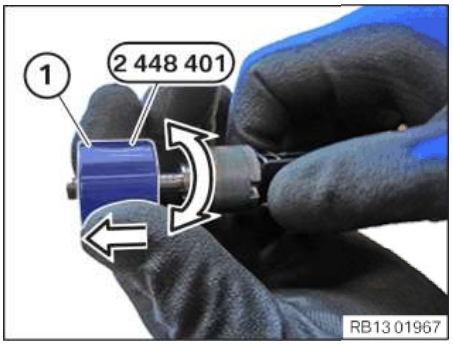
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- Thread out the installation cone (1) from the set of special tools 2 448 401 in the direction of the arrow and remove.

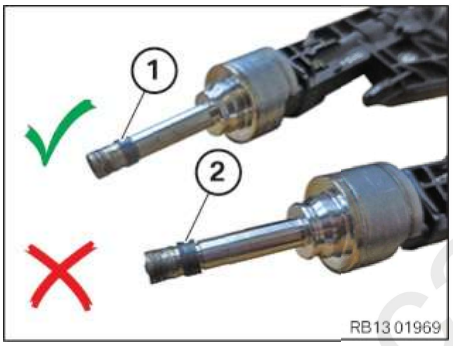


- Make sure that the expanded Teflon ring (1) is properly inserted in the groove (2) of the injector (3) and can be moved easily with your fingers.



- Calibrate the expanded Teflon ring with the assembly sleeve (1) from the set of special tools 2 448 401 to the installation dimension in the direction of the arrow.
- Perform **rotational movements** in increments of 180° synchronous to the **pull-off movement**. Perform the movements slowly and **not** jerky.

  This calibrates the Teflon ring (1) to the installation dimension.
- Thread out and remove the assembly sleeve (1).

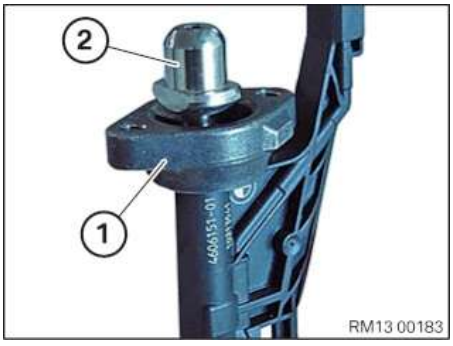


- Check the correct installation dimension of the Teflon ring (1):
  - (1) indicates a correct installation dimension of the Teflon ring.
  - (2) indicates an incorrect installation dimension of the Teflon ring.

52 – Installing the rail with injectors

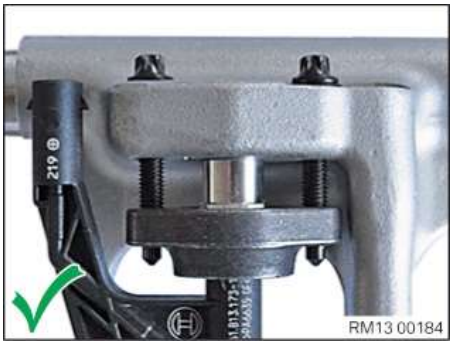
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.
Non-observance of these requirements may result in leaks and damage.



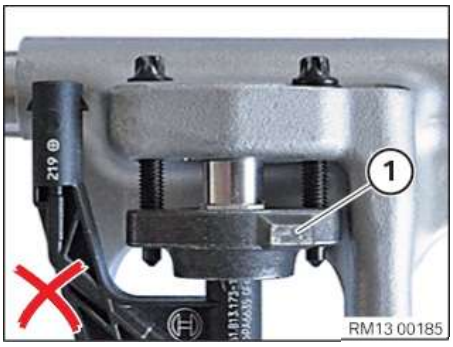
- Mount the holder (1) above the bayonet fitting (2) on the injector.
- **If the holder** (1) **has a cast lug:** Make sure that the holder is installed in the correct position.

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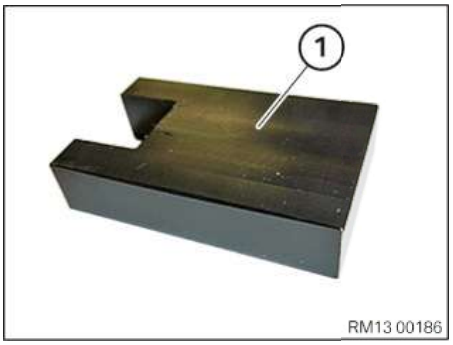
- If applicable, note the position of the cast lug:

  The holder is mounted **correctly** when the cast lug is located at the rear.



- If applicable, note the position of the cast lug:

  The holder is mounted **incorrectly** when the cast lug (1) is in front.



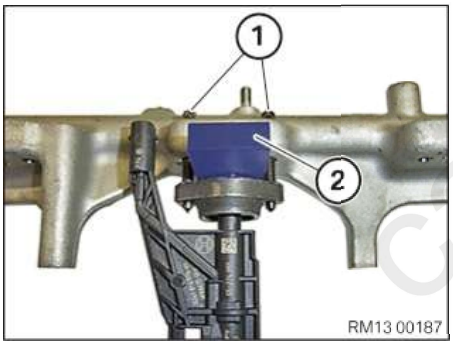
RISK OF DAMAGE

Damage to injectors.

Weld seams on the injector may tear due to incorrect distances between the rail and injector so that the injector must be renewed.

- Insertion of the distance gauge is compulsory.
- Replace distance gauge, if a thickness of 8.5 mm is no longer given in the distance gauge.

- Use the special tool (distance gauge) 2 358 022 (1).



- Mount the injectors with holders and the **new** screws (M5x30) to the rail.

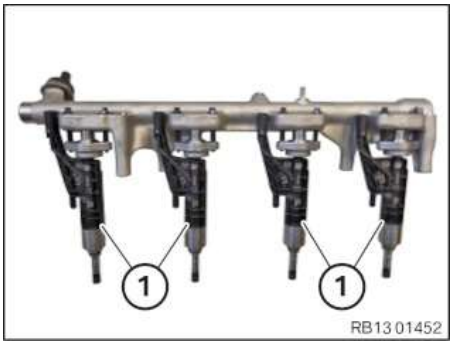
  Parts: Screws (M5x30)
- Keep the rail on a clean table in such a way that the openings on the rail for the injectors point upwards.

  The electrical injector connections must point to the fuel pressure sensor.
- Slide the special tool (distance gauge) 2 358 022 (2) between the holders and the rail onto the injector head.
- Make sure that the special tool (distance gauge) 2 358 022 (2) rests flat on the retaining bridge.
- Hand-tighten both screws (M5x30) (1) uniformly until the special tool (distance gauge) 2 358 022 (2) rests flat against the rail and the holder.



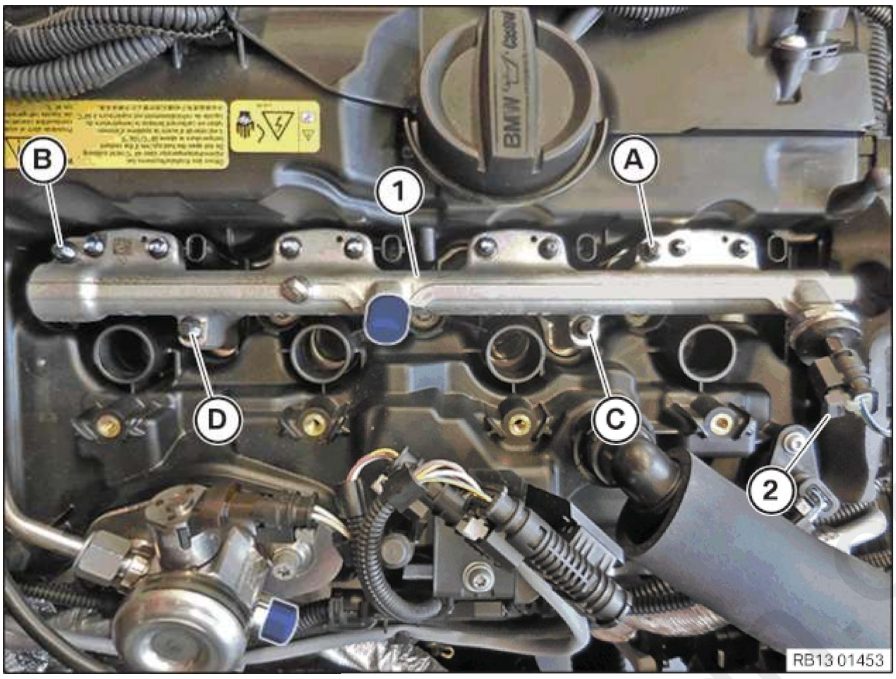
- Remove the special tool (distance gauge) 2 358 022 (1).
- Repeat this operation for all injectors.

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- Check injectors (1) for loose fit at the rail.
- Align the electrical injector connections parallel to the rail.

  The injectors (1) must move freely.



- Attach the rail (1) with the injectors to the cylinder head from the top.
- Make sure the injector tips catch the corresponding holes for the injectors in the cylinder head.
- Make sure the guides on the injector are properly inserted into the guide bores in the cylinder head.
- As soon as resistance can be felt when pressing down, position and hand-tighten the screws (M6x70) (A) and (B).
- Set the torque wrench to 2 Nm.
- Tighten the screws (A) and (B) in alternating order by **180°** each with the torque wrench until the rail is positioned flush on the cylinder head.
- If the tightening torque (2 Nm) is reached before the rail is positioned on the cylinder head: Disassemble the rail and restart the installation procedure.
- Renew the injectors after 3 failed attempts.
- Insert bolts (C) and (D).

TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

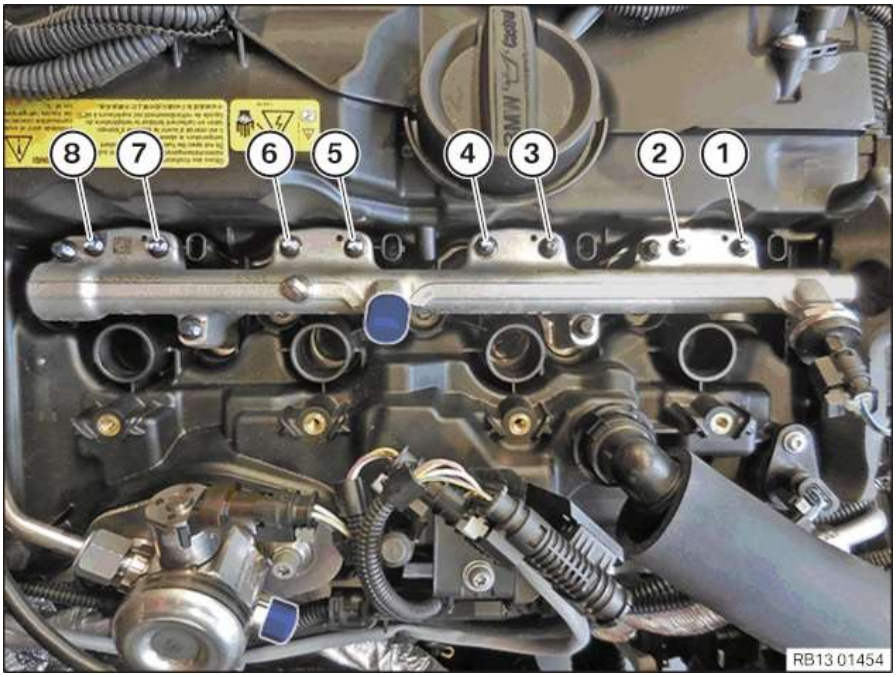
- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.



- Make sure that the rail (1) rests flat against the cylinder head.

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- Attach a socket to an extension.

  Do not use a reversible ratchet or torque wrench.
- Apply the screws (M5x30) in pairs (1) with (2), (3) with (4), (5) with (6),(7) with (8) in alternating order to **90° hand-tight**.
- Set the torque wrench to 5 Nm.

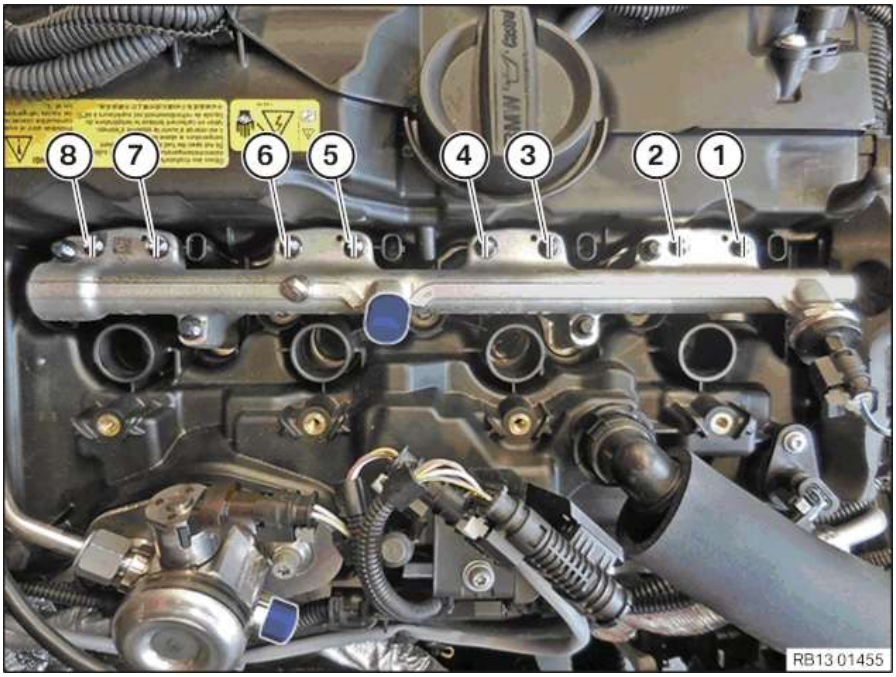
TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

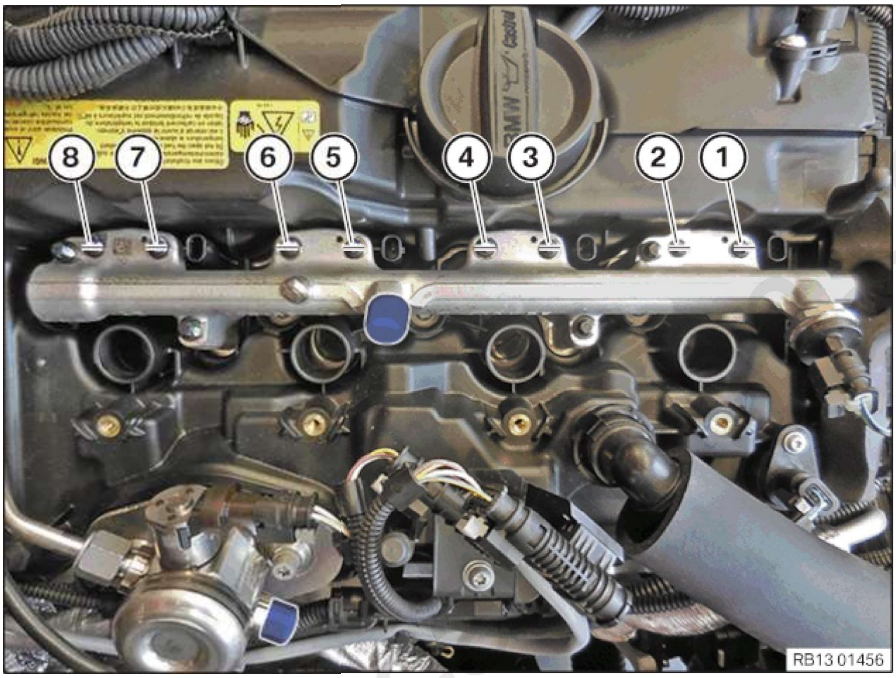
Non-observance of these requirements may result in leaks and damage.

- **Screw the M5x30 screws according to the following plan:**
  - **Fuel injector 1:**
  - Tighten the bolt (1) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (2) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (1) and (2) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 2:**
  - Tighten the bolt (3) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (4) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (3) and (4) until both bolts reach a torque of 5 Nm.
  - **Fuel injector 3:**
  - Tighten the bolt (5) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (6) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (5) and (6) until both bolts have reached a torque of 5 Nm.
  - **Fuel injector 4:**
  - Tighten the bolt (7) at an angle of rotation of 90° with the torque wrench.
  - Tighten the bolt (8) at an angle of rotation of 90° with the torque wrench.
  - Repeat the operations for bolts (7) and (8) until both bolts reach a torque of 5 Nm.

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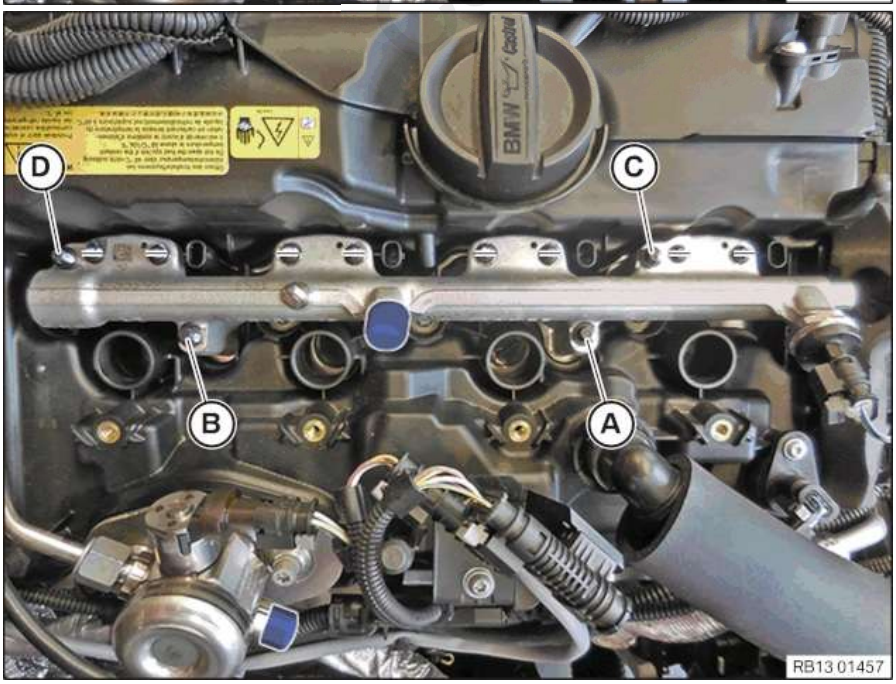


- Mark all bolts (1) to (8) with a vertical line (see figure).
- **Tighten screws using an angle of rotation.**
  - Tighten the bolt (1) with an angle of rotation of 90°.
  - Tighten the bolt (2) with an angle of rotation of 90°.
  - Tighten the bolt (3) with an angle of rotation of 90°.
  - Tighten the bolt (4) with an angle of rotation of 90°.
  - Tighten the bolt (5) with an angle of rotation of 90°.
  - Tighten the bolt (6) with an angle of rotation of 90°.
  - Tighten the bolt (7) with an angle of rotation of 90°.
  - Tighten the bolt (8) with an angle of rotation of 90°.



- Check if all bolts (1) to (8) have been tightened with a 90° angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Unscrew the bolts (M6x70) (A) to (D).

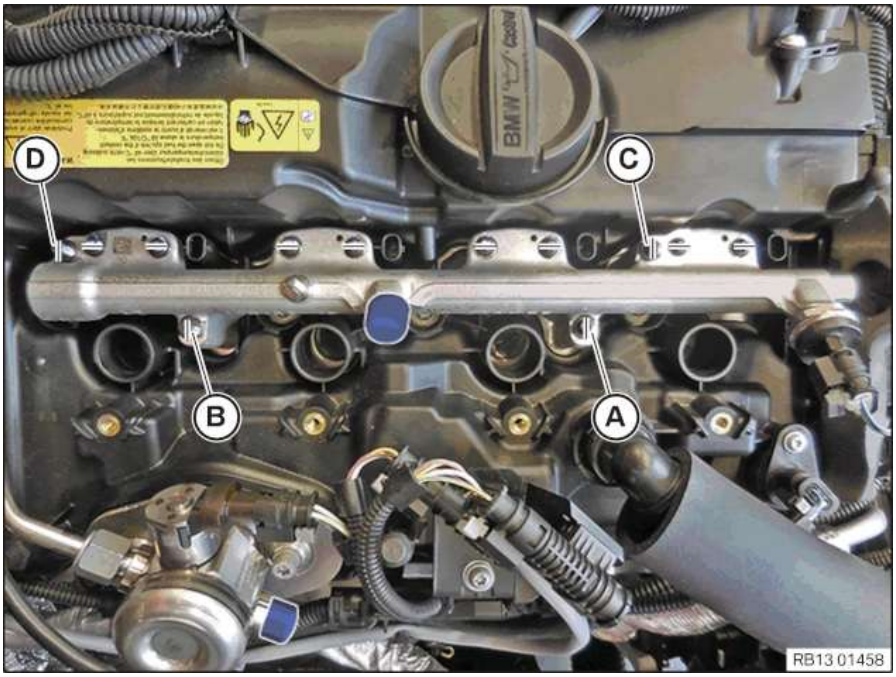
  It is imperative that the bolts are unscrewed.

TECHNICAL INFORMATION

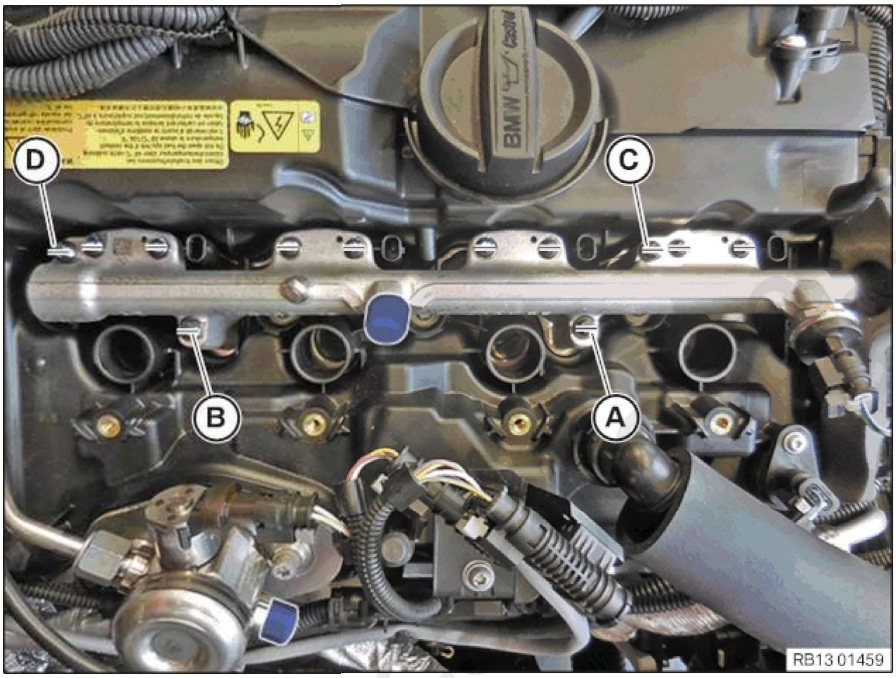
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Tighten bolt (A) to 5 Nm.
- Tighten bolt (D) to 5 Nm.
- Tighten bolt (B) to 5 Nm.
- Tighten bolt (C) to 5 Nm.

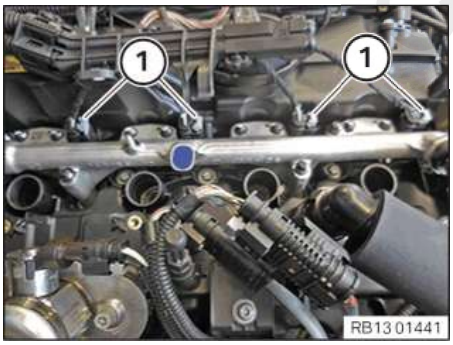


- Mark bolts (A)to (D) with a vertical line (see figure).
- Tighten the bolts (M6x70) (A) to (D) to a rotational angle **of 90°**.



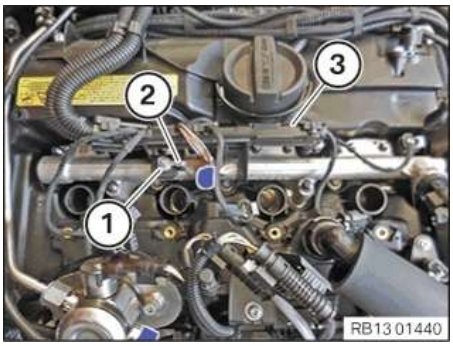
- Check if the bolts (A) to (D) have been tightened with a **90°** angle of rotation.

  The marks (lines) must be horizontal (see figure).



- Connect and lock all connectors (1) to the injectors.

  All connectors (1) must engage audibly.



- Thread in cable channel (3) and install.
- Thread in ground cable (2) and install.
- Tighten nut (1).

Ground cable to rail

M6		Tightening torque	5 Nm

RISK OF DAMAGE

Damage to the engine.

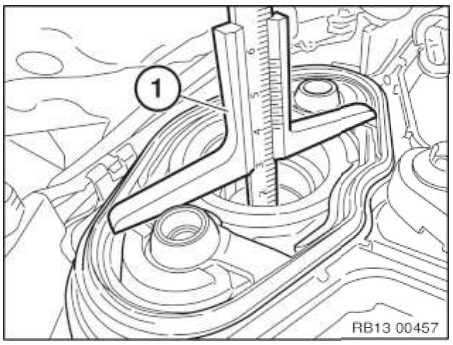
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

TECHNICAL INFORMATION

The high pressure pump can be pre-tensioned by camshaft cams. If when loosening the screws, the high pressure pump is forced out, the engine will have to be turned to bring the camshafts to a different position.

Before installing the high pressure pump, the cam of the high pressure pump drive must be turned to BDC. To do this, twist the engine if necessary in the direction of engine rotation to the central bolt of the crankshaft. Otherwise, it will not be possible to install the high-pressure pump.



- Place the depth gauge (1) flat onto the high pressure pump flange.
- Turn the engine at the central bolt in the direction of engine rotation until the BDC position of the camshaft is reached.

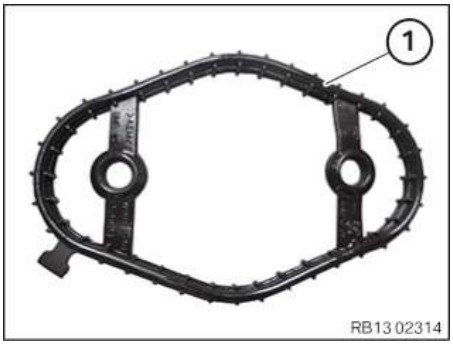
  The depth gauge (1) is in the deepest position.



- Rotate the engine with the special tool 0 493 380 (11 6 480) in the **direction of the arrow** until the cam of the high pressure pump drive is at the **BDC position** .



- Guide out and remove gasket (1).



- Renew the gasket (1).

  Parts: Gasket

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Check the threads (1) on the high pressure pump flange for sealing compound residue: Remove sealing compound residue as needed.
- Clean the thread (1) with a thread cutter **M6**.
- Make sure that no contamination enters the engine.
- Cover opening at the high pressure pump flange with suitable materials.



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).



- Insert and install the gasket (1).
- Make sure the seal (1) has been correctly positioned in the **highlighted** area.



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

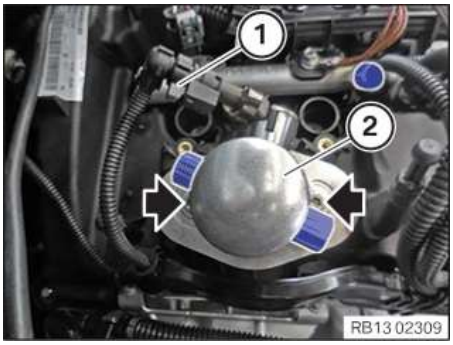
- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Clean sealing surface (1).

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- Feed in and install high pressure pump (2).
- Renew the bolts (arrows).

  Parts: Bolts
- Position screws (arrows) of the high pressure pump (2) and tighten **in alternating order** in **90°** increments.

  Compliance with this specification is imperative to make sure that the piston will not break due to twisting.

High pressure pump to high pressure pump flange

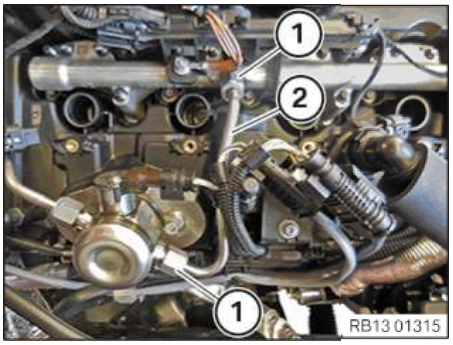
M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

54 – Installing high pressure line between rail and high pressure pump



- Guide the special tool out and remove.



- Thread in and install the high pressure line (2).
- Tighten union nut (1) hand tight.
- Tighten union nut (1).

High pressure line between high pressure pump and high pressure rail

M14		Tightening torque	33 Nm

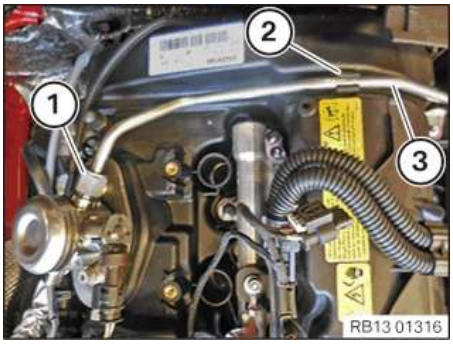
55 – Installing fuel delivery line

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

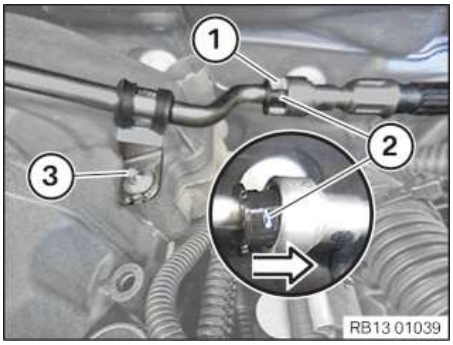


- Guide the fuel delivery line (3) in and install.
- Install rubber damper (2).
- Check the rubber damper (2) for the correct fit.
- Tighten the union nut (1) hand-tight.
- Tighten union nut (1).

Fuel delivery line to high pressure pump

M14		Tightening torque	31 Nm

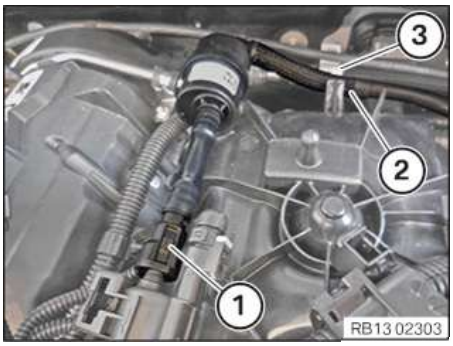
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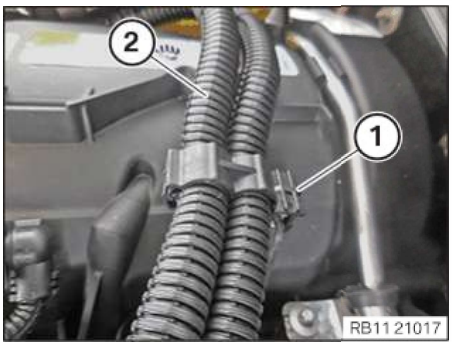
- Slide in and lock the fuel feed line in the direction of the arrow in the snap fastener (2).
  The fuel feed line must be audibly engage in the snap fastener (2).
- Secure the clamp (1).
- Tighten down screw (3).

Fuel delivery line to cylinder head cover

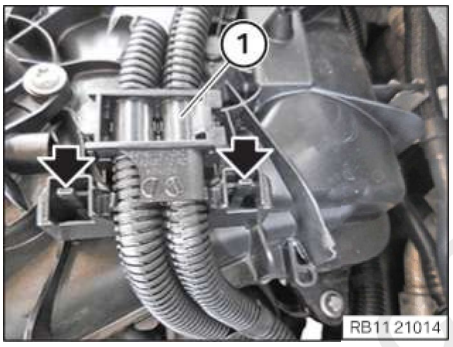
M6 screw		Tightening torque	6,5 Nm



- Insert and install the tank ventilation line (2).
- Lock (1) must engage audibly.
- Secure the tank ventilation line (2) to the clamp (3).



- Insert and install wiring harness section (2) for injectors and ignition coils.
- Secure the clamp (1).



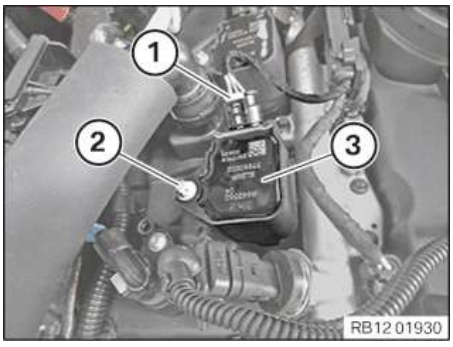
- Insert and install wiring harness section (1) for injectors and ignition coils.
- The locks (arrows) must engage audibly.

56 – Install all ignition coils

NOTICE

The description is for one component only. The procedure is identical for all further components.

▶ **Install ignition coil.**



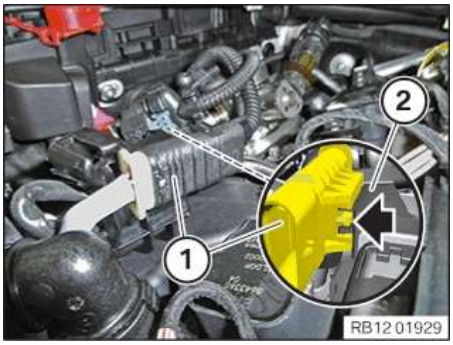
- Install ignition coil (3).
- Tighten down screw (2).

Ignition coil

Screw		Tightening torque	8 Nm

- Connect connectors (1) and lock.
  The connector (1) must engage audibly.

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- Connect and lock connector (1) with holder (2) (arrow).

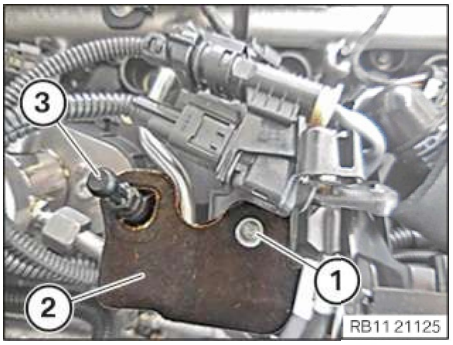
  The connector (1) must engage audibly.



- Connect connectors (1) and lock.

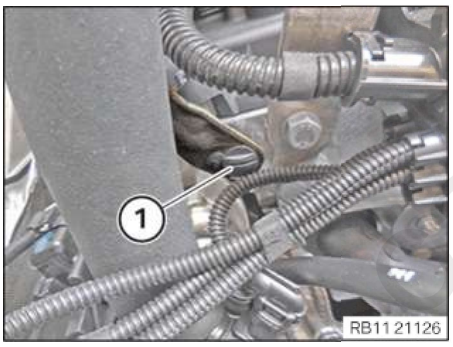
  The connector (1) must engage audibly.

57 – Install the cylinder head cover acoustic cover



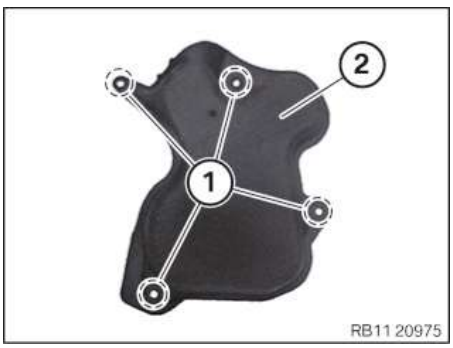
- Guide in and position the acoustic cover (2) on the ball pin (3).
- Tighten down screw (1).

Acoustic cover (side) to cylinder head cover		
TS6 x 20		8 Nm



- Secure the clip (1).

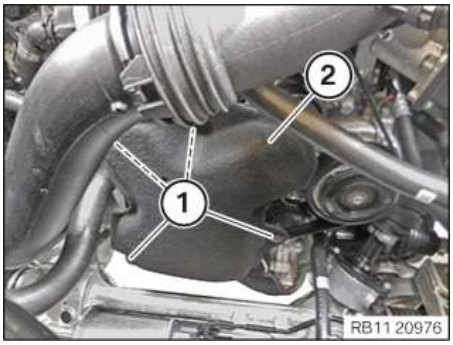
58 – Install the acoustic cover for the engine at the front



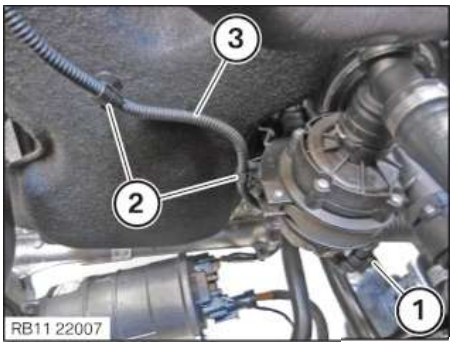
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

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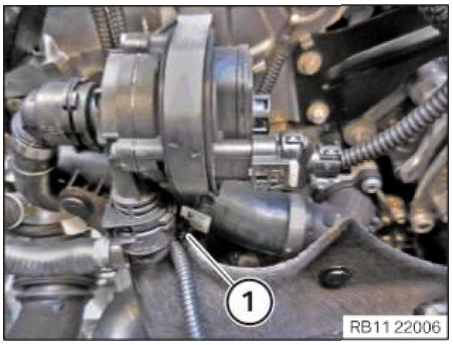


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

59 – Installing the clean air pipe with resonator

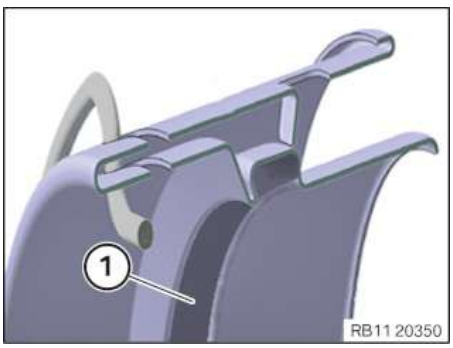


- Check the seal (1) for damages, replace if necessary.

▶ **Replace damaged gasket**

TECHNICAL INFORMATION

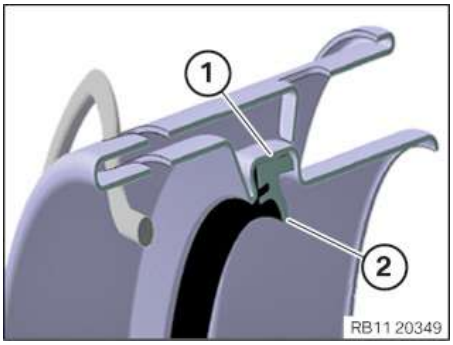
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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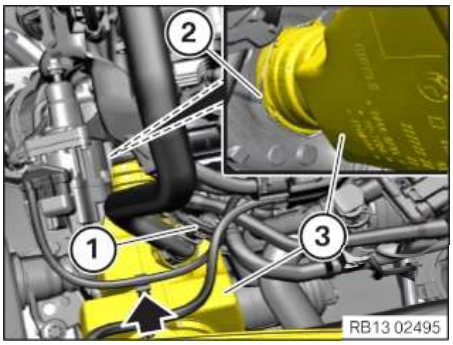
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

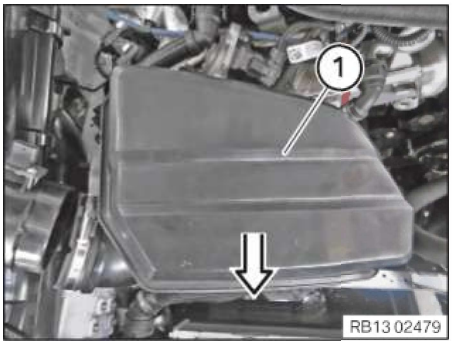
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



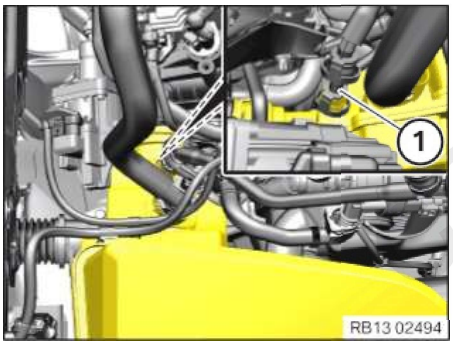
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

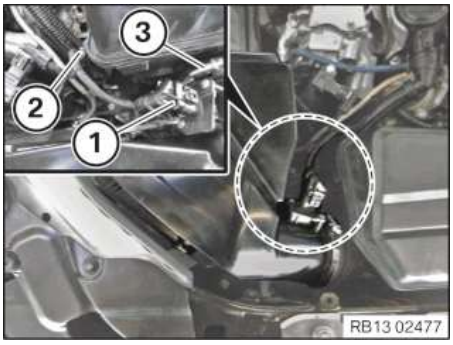
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

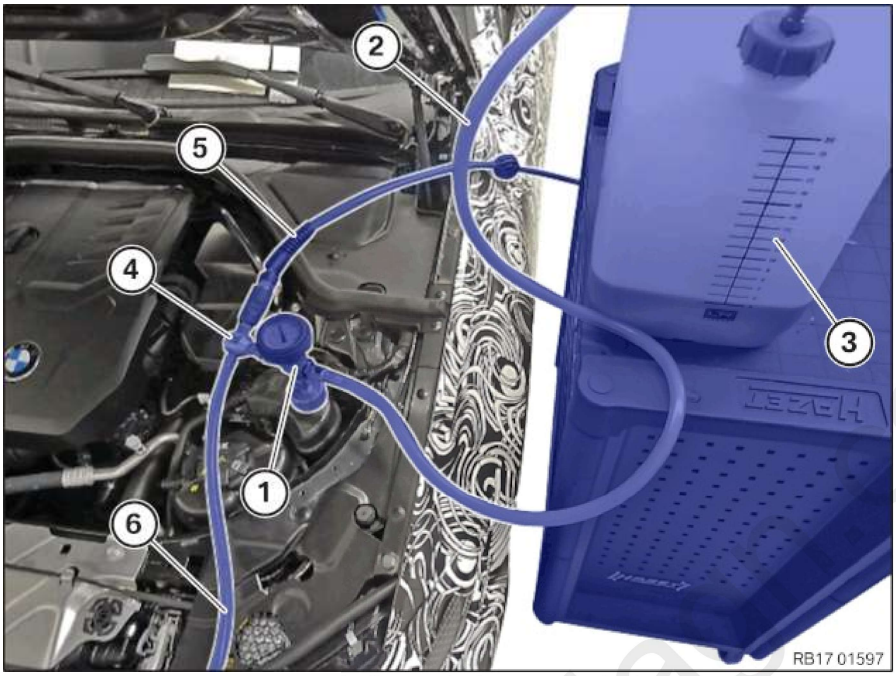
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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

60 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

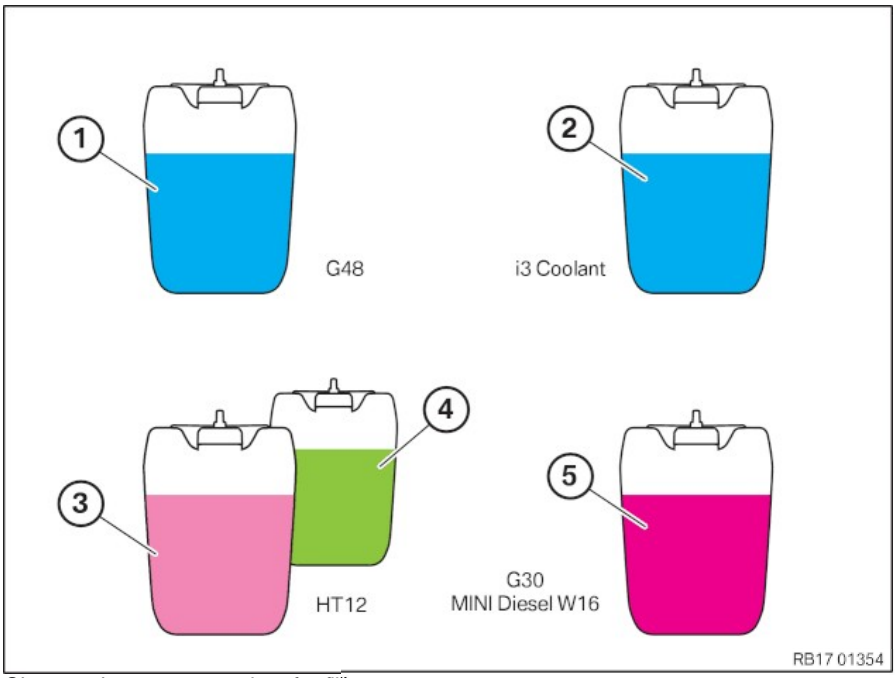
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

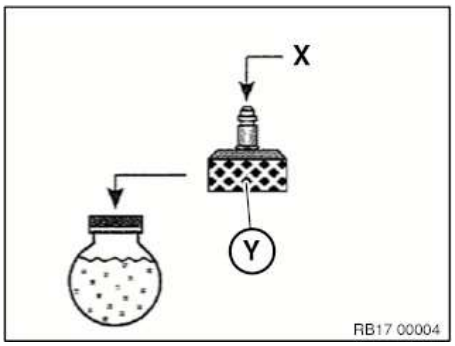
- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

Capacity of low-temperature coolant circuit G20

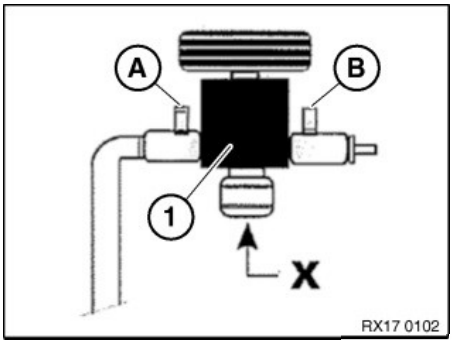
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

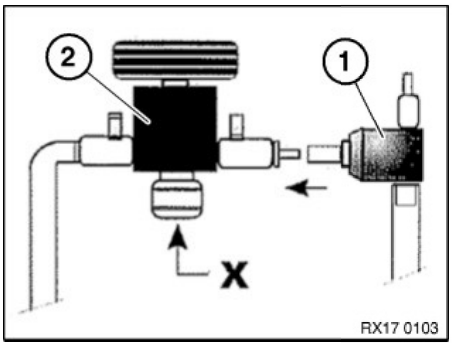
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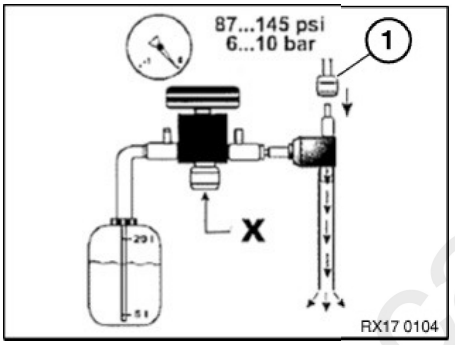
- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.



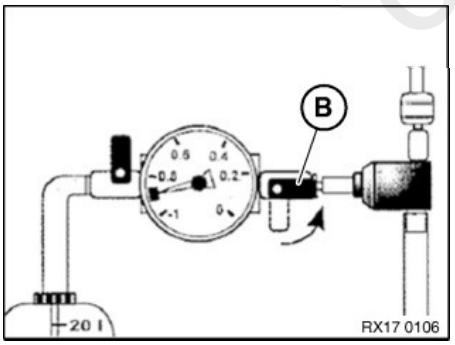
- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



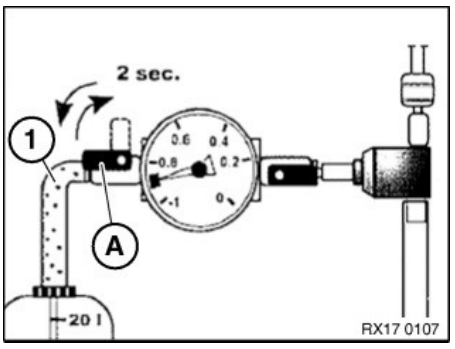
- Connect Venturi nozzle (1) to the vacuum filler device (2).
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).
  (X)is the connection on the coolant expansion tank.



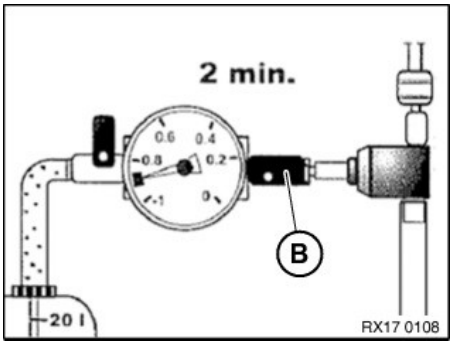
- Open shut-off valve (B).
  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

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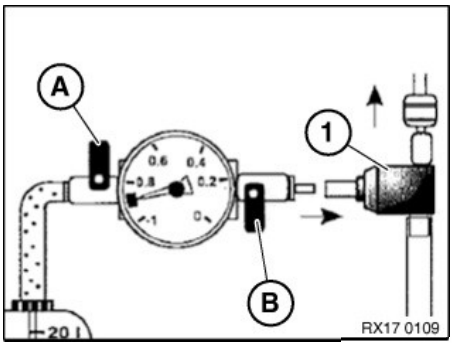


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

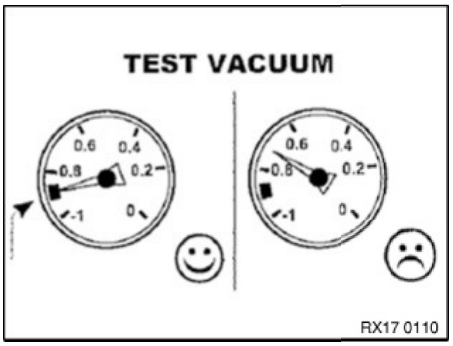
- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.



Result

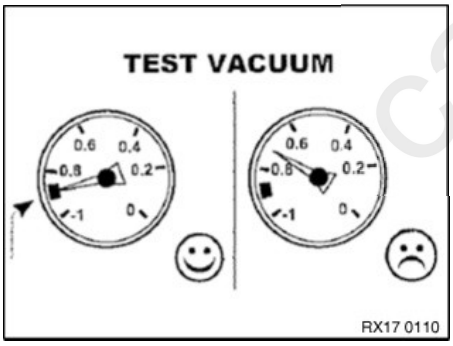
» Vacuum drops.

Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

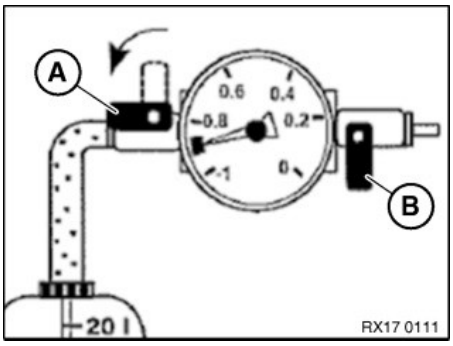


Result

» Vacuum remains constant.

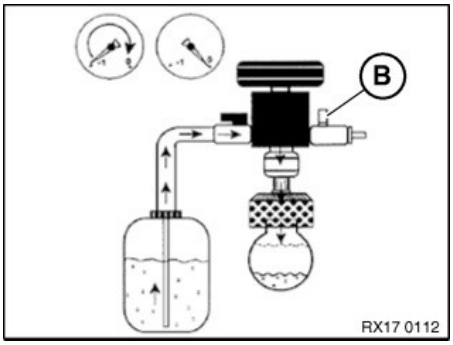
Measure

- Continue with filling.

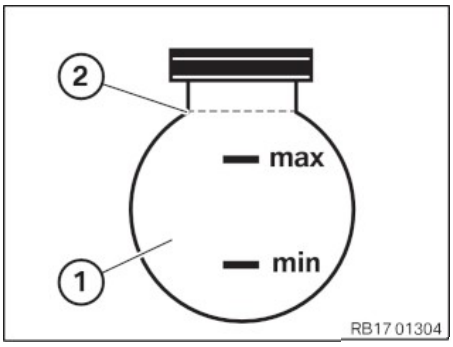


- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.

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- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

61 – Disconnecting all battery earth leads



- See additional information.

62 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

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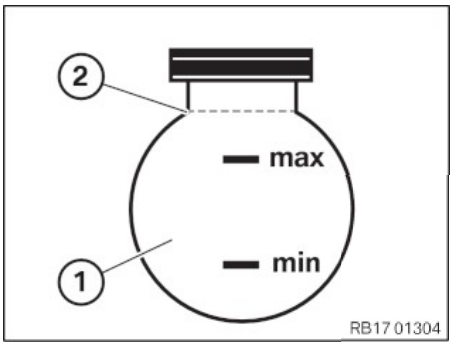
TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

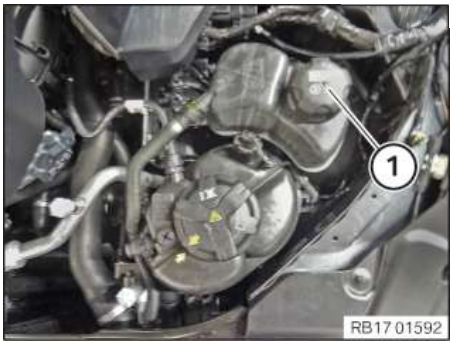
  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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TECHNICAL INFORMATION

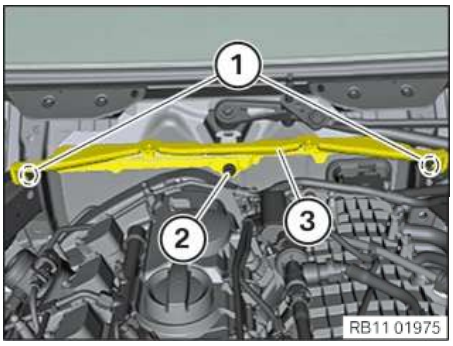
After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

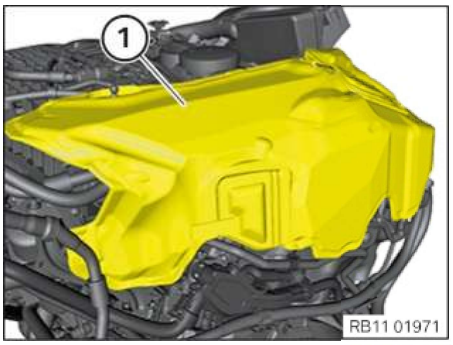
- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

63 – Installing centre bulkhead lower section



- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

64 – Installing acoustic cover at rear

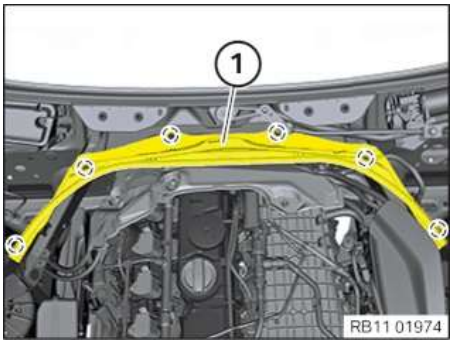


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

65 – Installing the centre bulkhead upper part

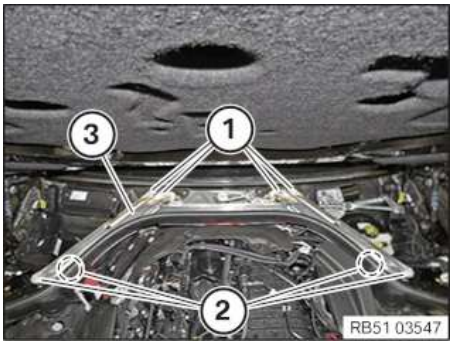


- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

	Tightening torque	3 Nm

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- **If installed:** Install tension strut on spring strut dome.
- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Bolts
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

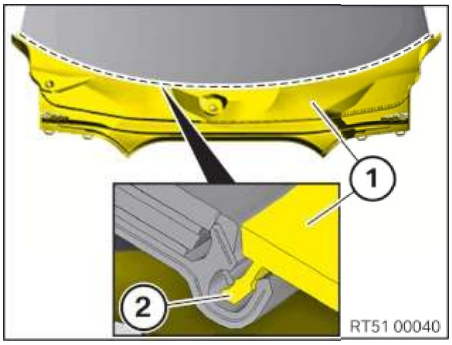
66 – Installing cowl panel cover

RISK OF DAMAGE

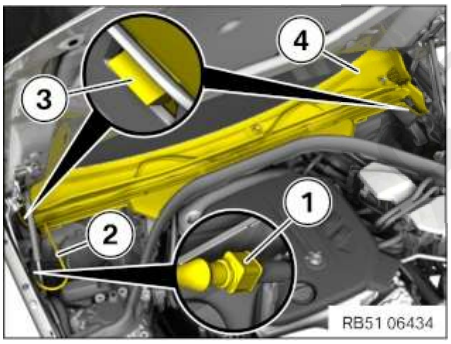
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.



- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

67 – Installing both wiper arms

NOTICE

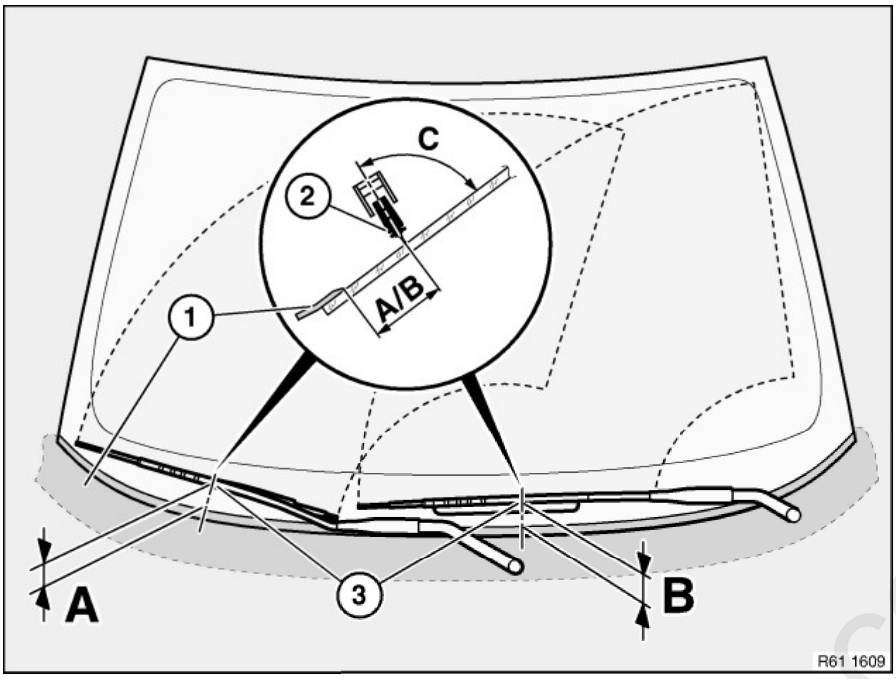
Description is for left component only. Procedure on the right side is identical.

▸ **Install the wiper arm**

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TECHNICAL INFORMATION

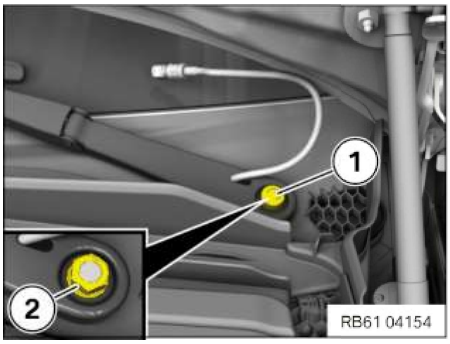
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

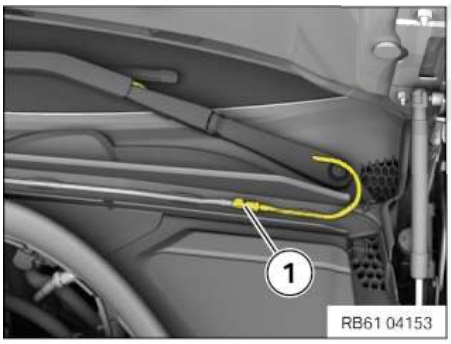


- Tighten nut (2).

Windscreen wiper arm

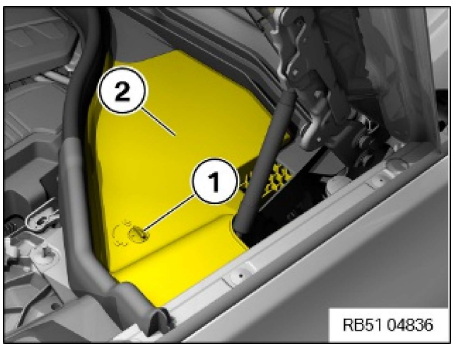
Combination hexagon nut		Tightening torque	35 Nm

- Connect the protective cap (1).



- Insert windscreen wash hose (1) into the cowl and connect at the separating point.

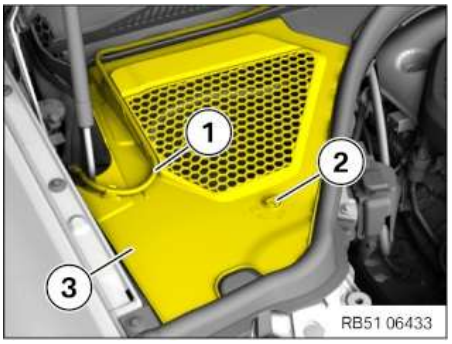
68 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

69 – Install the rear right engine compartment cover

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- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

70 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

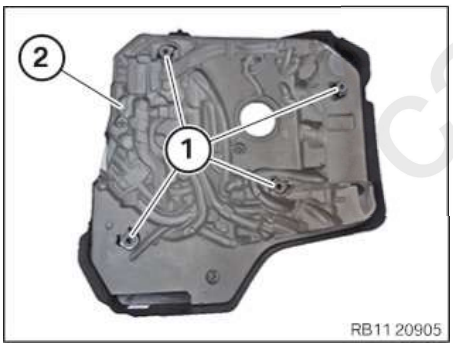
71 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

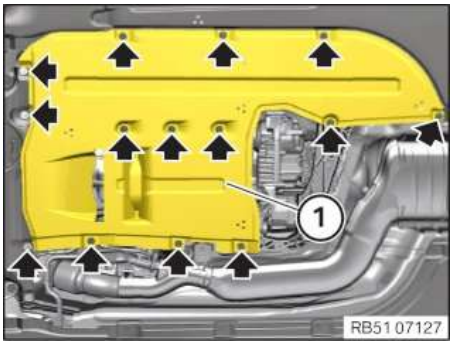


- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

72 – Installing underbody protection at rear

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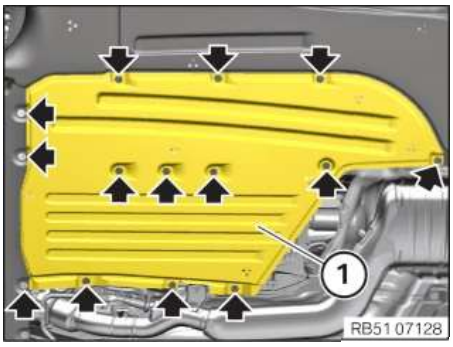
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

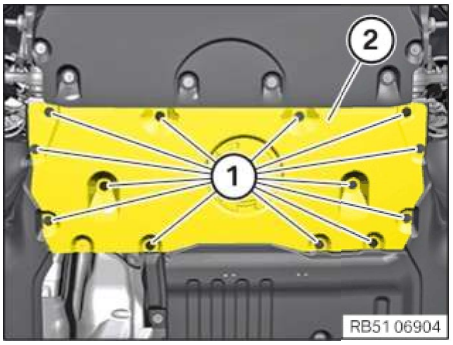
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

73 – Installing the centre underbody protection



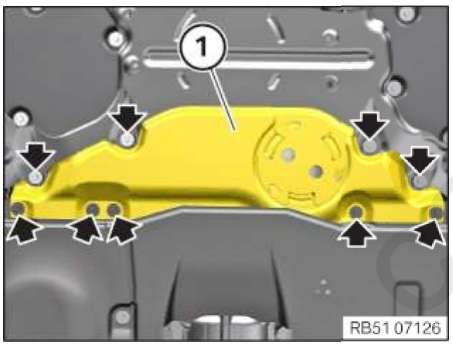
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

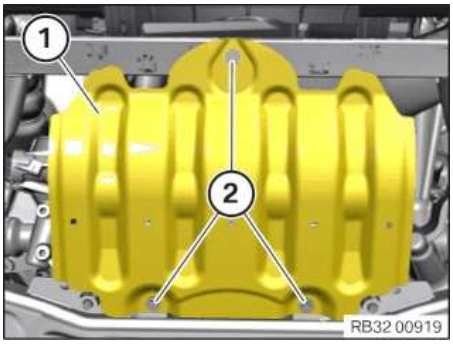
Underbody protection

Hexagon screw		Tightening torque	3 Nm

74 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



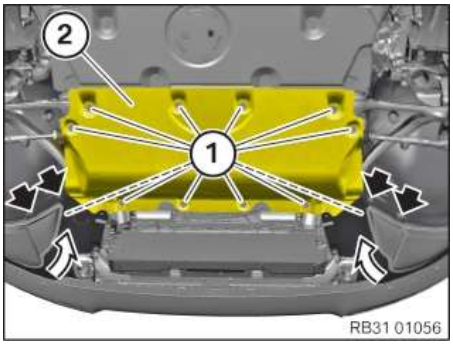
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

75 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

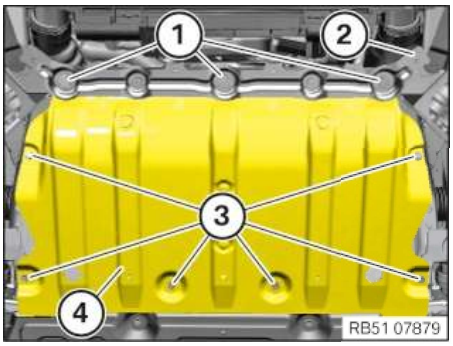
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

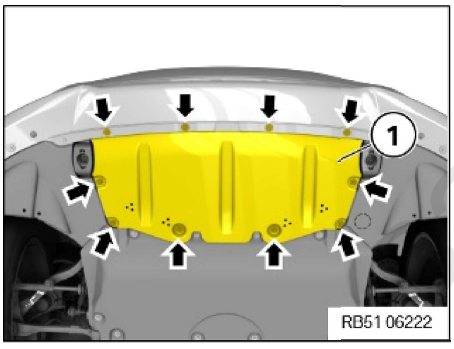
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

76 – Installing the front underbody protection



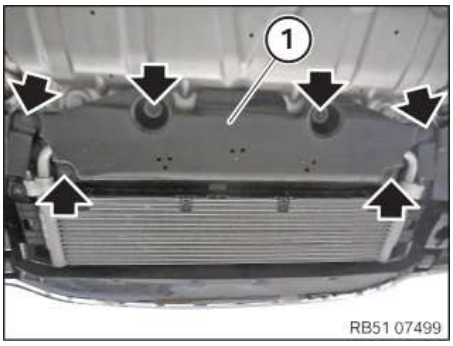
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



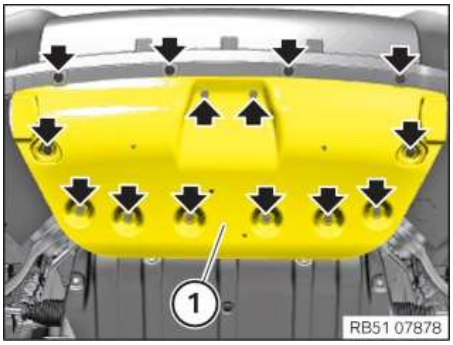
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

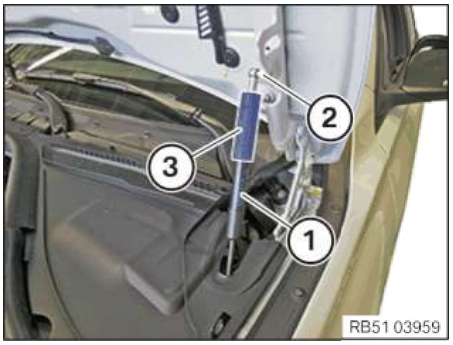
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

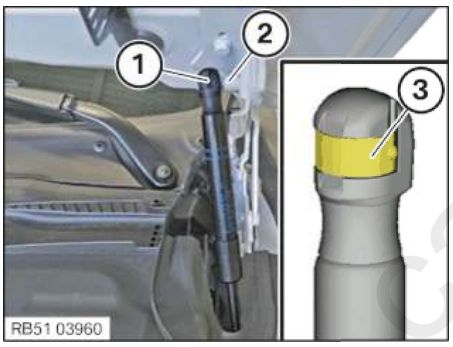
77 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

78 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 32

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Gate to bearing bracket — Used in step 42

M8			20 Nm

Intake plenum to cylinder head — Used in step 44

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 44

M6X25		Tightening torque	8 Nm

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Throttle body to holder — Used in step 44

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 44

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 44

M6		Tightening torque	8 Nm

Control unit holder on spring strut dome — Used in step 46

Hexagon screw		Tightening torque	8 Nm

Cylinder head cover to cylinder head — Used in step 49

M6x30		Jointing torque	6 Nm
		Tightening torque	11 Nm

Wiring harness section of engine to cylinder head cover — Used in step 49

M6		Tightening torque	8 Nm

Holder, positive battery cable to cylinder head cover — Used in step 49

6X18		Tightening torque	6 Nm

Ground cable to rail — Used in step 52

M6		Tightening torque	5 Nm

High pressure pump to high pressure pump flange — Used in step 53

M6x25	*Renew screws.*	Jointing torque	12 Nm
		Tightening torque	90 °

High pressure line between high pressure pump and high pressure rail — Used in step 54

M14		Tightening torque	33 Nm

Fuel delivery line to high pressure pump — Used in step 55

M14		Tightening torque	31 Nm

Fuel delivery line to cylinder head cover — Used in step 55

M6 screw		Tightening torque	6,5 Nm

Ignition coil — Used in step 56

Screw		Tightening torque	8 Nm

Acoustic cover (side) to cylinder head cover — Used in step 57

TS6 x 20			8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 59

Clamp		Tightening torque	3 Nm

Bulkhead upper part to bottom bulkhead — Used in step 65

		Tightening torque	3 Nm

Tension strut on bulkhead — Used in step 65

M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome — Used in step 65

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

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Windscreen wiper arm			Used in step 67
Combination hexagon nut		Tightening torque	35 Nm

Underbody protection			Used in step 7273
Hexagon screw		Tightening torque	3 Nm

Bumper buffer device steering on front axle support			Used in step 74
M10		Tightening torque	56 Nm

Underbody protection of the steering gear			Used in step 75
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

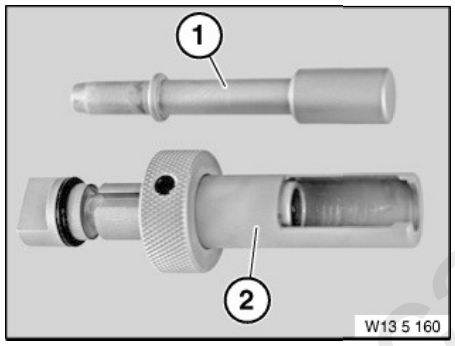
Wheel arch cover (screws)			Used in step 75
Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support			Used in step 75
M10		Tightening torque	56 Nm

Underbody protection front			Used in step 76
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

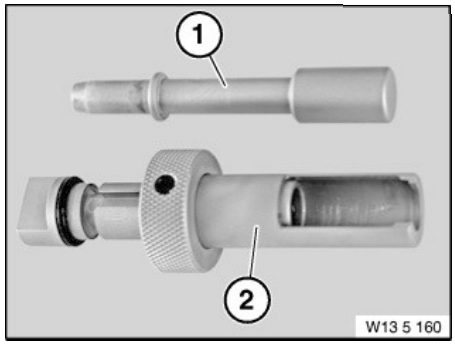
Overview of Special Tools

0 496 567 (13 5 161) Fastener



Common	Used in step 17
Usage	(Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

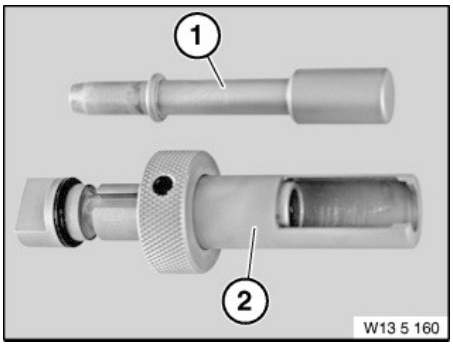
0 496 568 (13 5 162) Fastener



Common	Used in step 17
Usage	(Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool
Included in the tool or work	0 496 565
Storage location	
Replaced by	
In connection with	
SI-Number	

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0 496 565 (13 5 160) Fastener



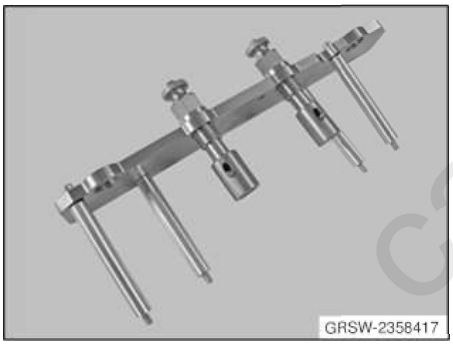
Common Used in step 17

Usage	(Caps (2x)) To close off the fuel lines when removing and installing the engine.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	
SI-Number	01 22 08 (498)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 567 (13 5 161)		**Fastener** (Cap (2 piece)) For sealing the quick connectors Deletion, only available via tool set	
2	0 496 568 (13 5 162)		**Fastener** (Cap (2 x)) To close off the fuel lines. Discontinued, can only be ordered using complete tool	

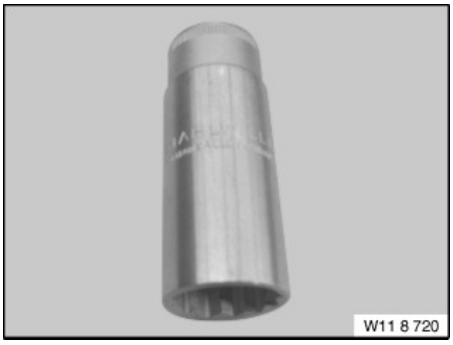
2 358 417 Device



Common Used in step 18

Usage	For removing and installing injectors. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A57
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 496 106 (11 8 720) Socket WAF 46



Common Used in step 18

Usage	(Long socket SW24) For removal and installation of oil pressure sensor. (Stahlwille or HAZET)
Included in the tool or work	
Storage location	C20
Replaced by	
In connection with	
SI-Number	01 04 07 (352)

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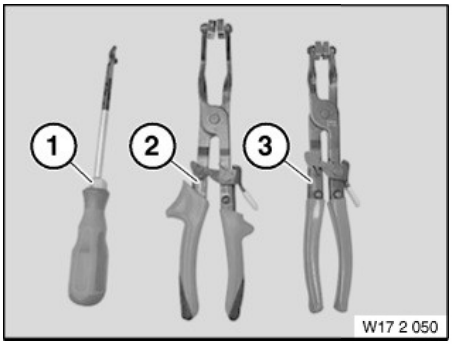
2 360 895 Pin wrench



Common Used in step 2050

Usage	For removal and installation of the magnetic actuator. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 495 794 (17 2 050) Pliers



Common Used in step 3344

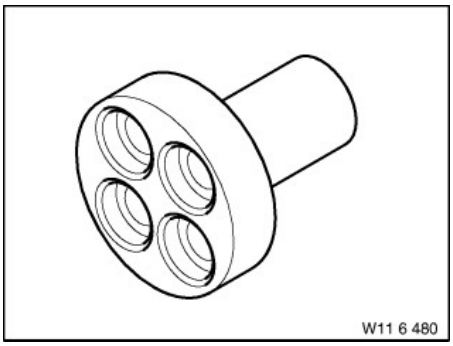
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 493 380 (11 6 480) Connector



Common	Used in step 3553
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

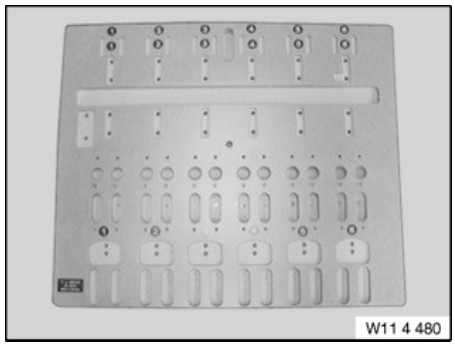
2 359 088 Device



Common	Used in step 3643
Usage	For removing and installing torsion spring of the intermediate lever.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

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0 495 105 (11 4 480) oddments tray



Common Used in step 363738

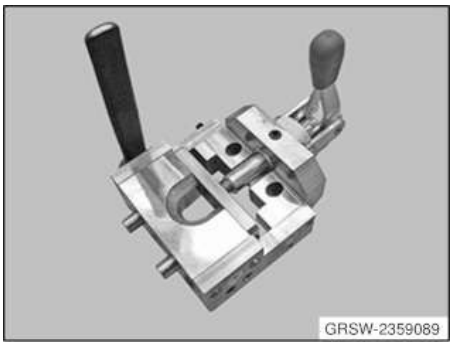
Usage	(Boards (2 pieces)) For setting down the individual components of the cylinder head.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 106 (11 4 481)		**oddments tray** (Board, intake side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	
2	0 495 107 (11 4 482)		**oddments tray** (Board, exhaust side) Discontinued, only available as part of complete special tool 11 4 480 = 83 30 0 495 105	

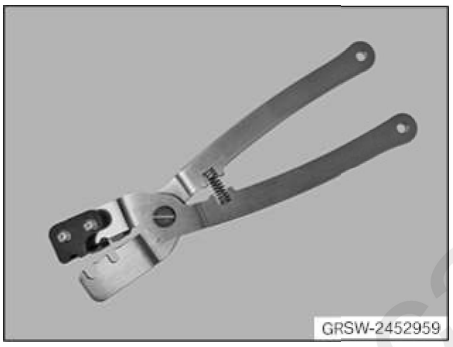
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2 359 089 Device



Common	Used in step 42
Usage	For positioning the sliding block. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

2 452 959 Pliers



Common	Used in step 51
Usage	For disassembly of the PTFE sealing rings on the injector HDEV5 & HDEV6. Replaces 0495757 (SWZ number 13 0 191). Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A5
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 448 401 Fitting aid



Common	Used in step 51
Usage	For installation of PTFE rings on injector. Contour-graphic silhouette foil is included in the delivery specification. Further information on the contour-graphic silhouette foil is included in service information 00 22 13 (969).
Included in the tool or work	
Storage location	C55
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

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2 358 022 Gauge



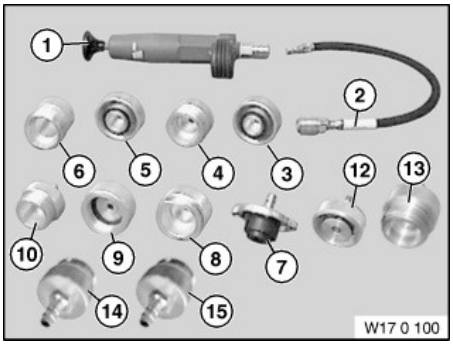
Common Used in step 52

Usage	To position the injector during installation. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	
SI-Number	01 13 14 (098)

0 494 417 (17 0 100) Tester

Used in step 60

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Common

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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Overview Technical Data

Distance from window pane edge to wiper blade Used in step 67

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

Capacity of low-temperature coolant circuit G20	Used in step 60
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	2248

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	161
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	161
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
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61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting battery earth lead	161
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	161
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Operating materials	Used in step
Main group 17	60

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11 37 020 Removing and installing/replacing servomotor for eccentric shaft

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Removing the throttle body

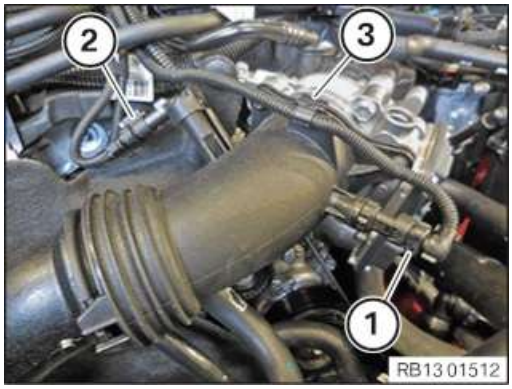
RISK OF DAMAGE

Electrostatic discharge.

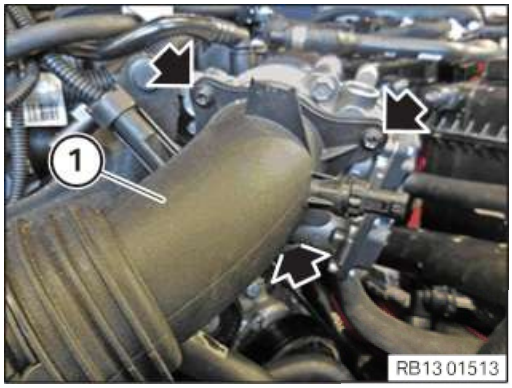
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

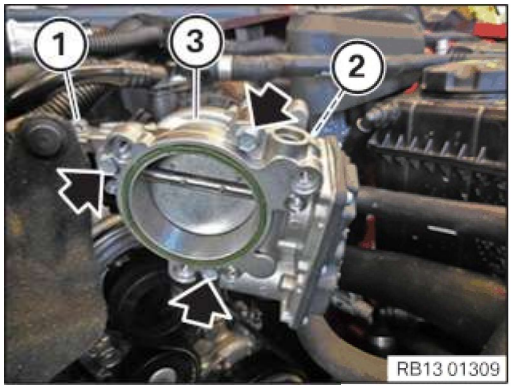
manualdiagn.com



- Unlock and loosen connector (1).
- Unlock and loosen connector (2).
- Unlock and loosen clamp (3).



- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



- Loosen screw (1).
- Remove screws (arrows).
- Unlock and loosen connector (2).
- Remove the throttle bodies (3).

MAIN WORK

3 – Removing the servomotor for the eccentric shaft

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

RISK OF DAMAGE

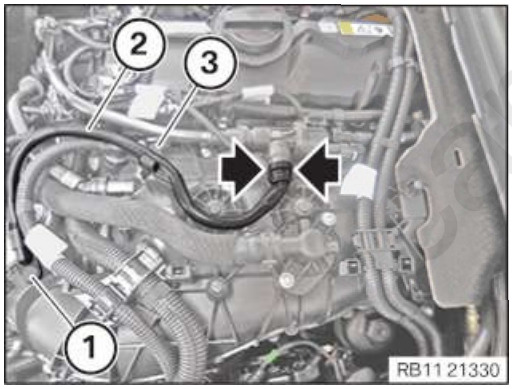
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

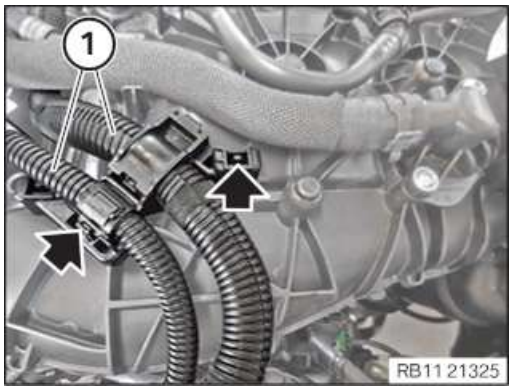
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

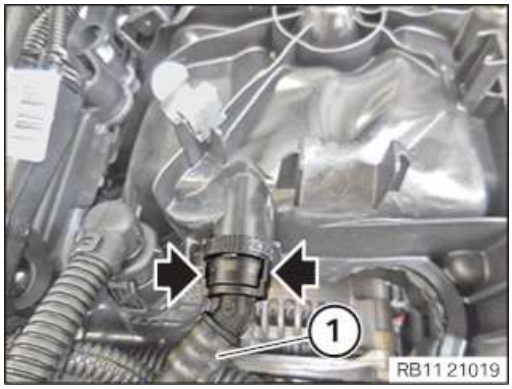
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



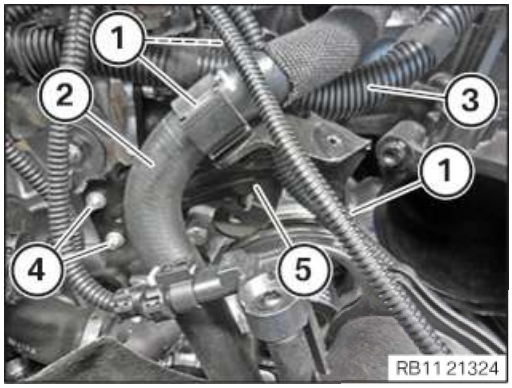
- Unlock the locks (arrows).
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



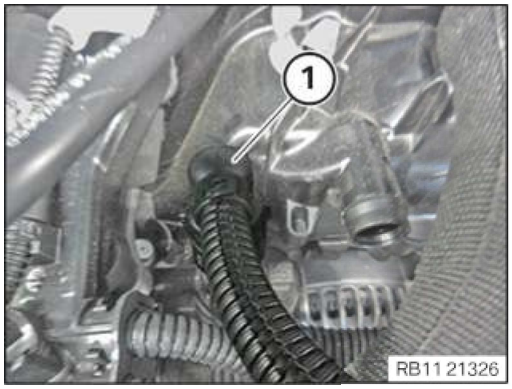
- Unlock and detach the locks (arrows).
- Guide out the wiring harness section (1) for sensor system 2 and place to one side.



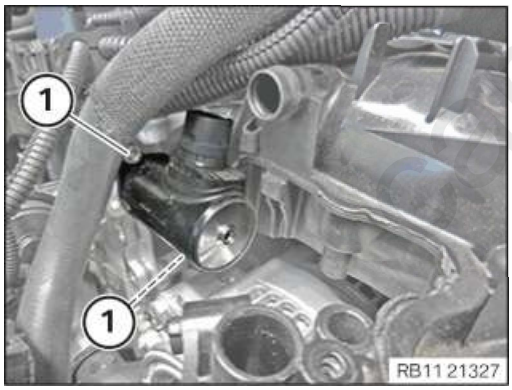
- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



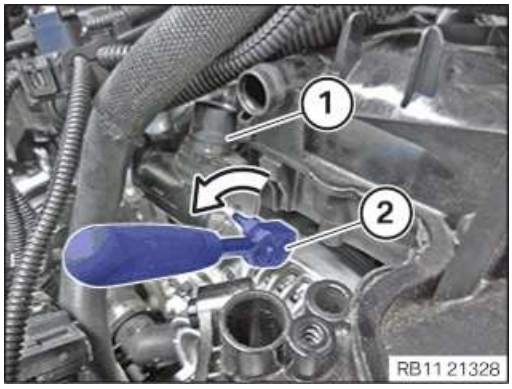
- Unlock and loosen the clamps (1).
- Feed out coolant line (2) and place to one side.
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.
- Loosen screws (4).
- Guide out and remove holder (5).



- Unlock plug connection (1) and disconnect.



- Loosen screws (1).



- Turn the drive shaft of the servomotor (1) with a standard tool (2) in the direction of the arrow.
- Make sure that the drive shaft of the servomotor (1) is not turned beyond the end stop of the eccentric shaft.
- Guide out and remove the servomotor (1).
- Catch and dispose of emerging engine oil.

4 – Installing servomotor for the eccentric shaft

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RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

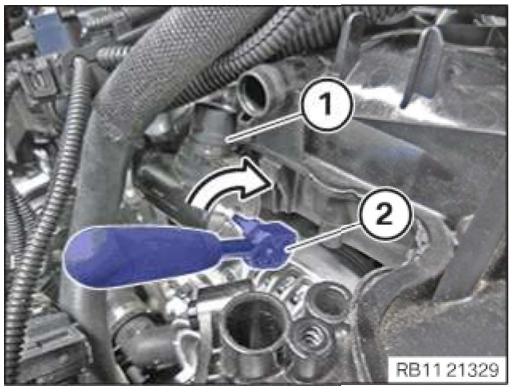
- Route all cables without abrasions, do not trap and crush.



- Renew sealing ring (1).

  Parts: Sealing ring

- Guide in and install sealing ring (1) up to the limit position on the housing.



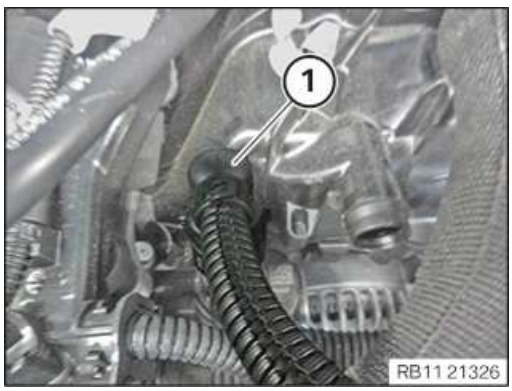
- Insert the servomotor (1) to the gearing on the cylinder head.
- Turn the drive shaft of the servomotor (1) in the direction of the arrow with a standard tool (2) until the servomotor (1) is flush with the cylinder head.



- Tighten the screws (1).

Electrical servomotor to cylinder head

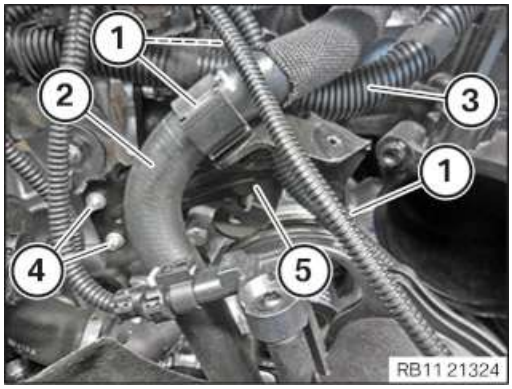
M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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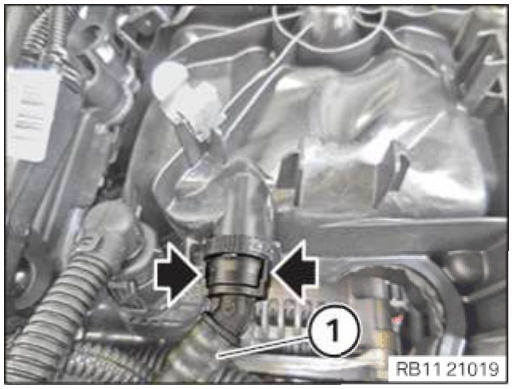


- Insert and install the holder (5).
- Tighten down screws (4).

Manifold support for intake air to cylinder head

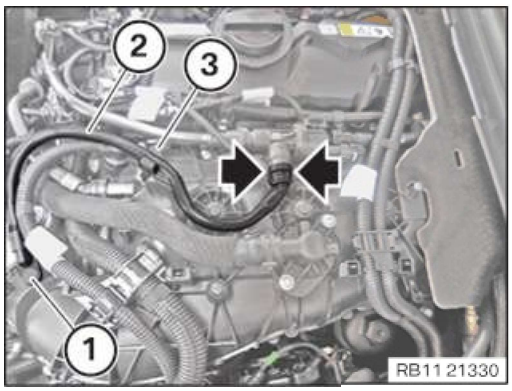
M6X16		Tightening torque	8 Nm

- Guide in and install wiring harness section (3) for sensor system 2.
- Feed in and install coolant line (2).
- Connect and lock the clamps (1).
- Make sure the clamps (1) engage audibly.



- Insert and install the tank ventilation line (1).

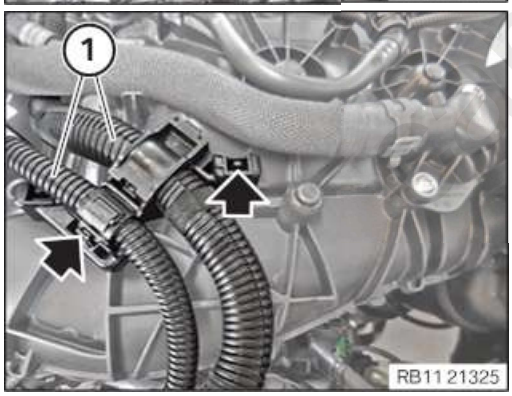
  The locks (arrows) must engage audibly.



- Insert and install the tank ventilation line (2).
- Make sure that you can hear the locks (arrows) engage.
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

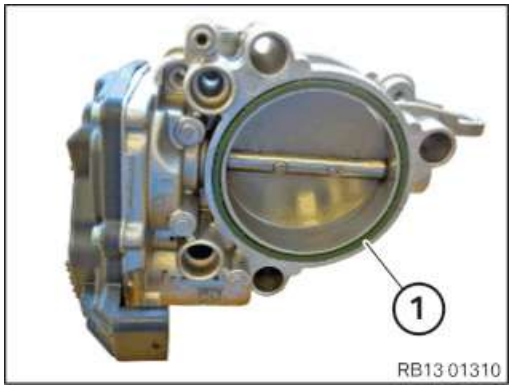
Oval-head screw		Tightening torque	3 Nm



- Guide in and install wiring harness section (1) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.

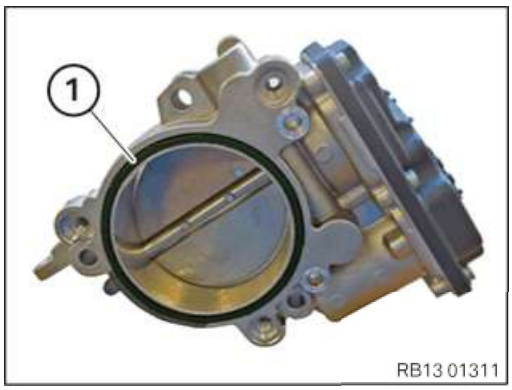
POSTPROCESSES

5 – Installing the throttle body



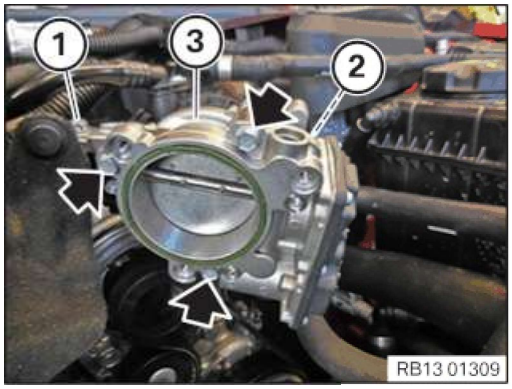
- Renew sealing ring (1).

  Parts: Sealing ring



- Renew sealing ring (1).

  Parts: Sealing ring



- Feed in and install the throttle body (3).
- Connect and lock the connector (2).
- Tighten screws (arrows).

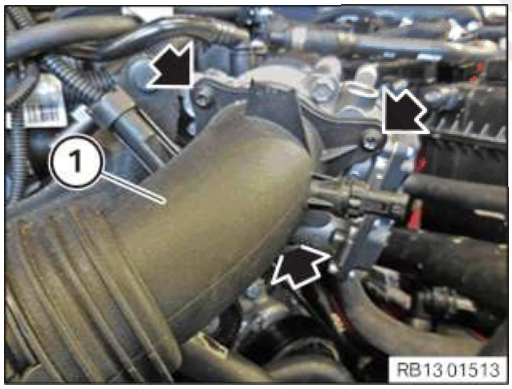
Throttle body to intake plenum

M6X50		Tightening torque	7 Nm

- Tighten down screw (1).

Throttle body to holder

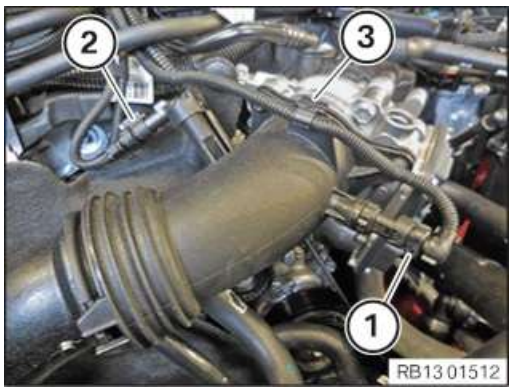
M6X25		Tightening torque	8 Nm



- Insert and install charge air line (1).
- Tighten screws (arrows).

Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect and lock the connector (1).
- Connect and lock the connector (2).
- Secure clamps (3).

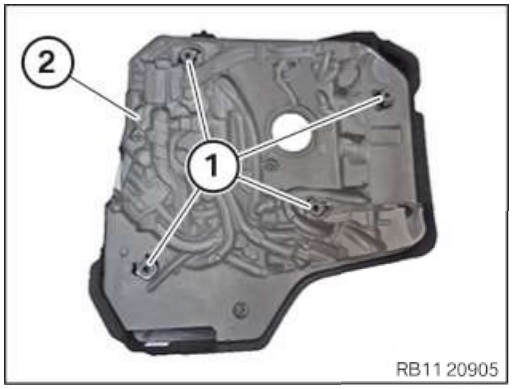
6 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

Additional Information

Overview of Tightening Torques

Electrical servomotor to cylinder head			Used in step 4
M6		Tightening torque	8 Nm

Manifold support for intake air to cylinder head			Used in step 4
M6X16		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 4
Oval-head screw		Tightening torque	3 Nm

Throttle body to intake plenum			Used in step 5
M6X50		Tightening torque	7 Nm

Throttle body to holder			Used in step 5
M6X25		Tightening torque	8 Nm

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Charge air line to throttle body			Used in step 5
M6		Tightening torque	8 Nm

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	2
61 35 ... Notes on ESD protection (Electro Static Discharge)	23

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11 40 000 Checking engine oil pressure

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

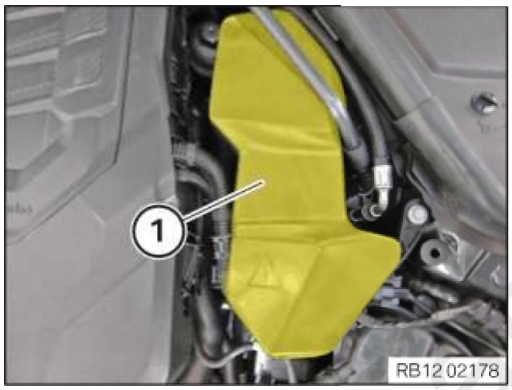
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Remove the cover of the DME control unit



- Pull the cover (1) toward the top and remove.

4 – Removing the oil filter element

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

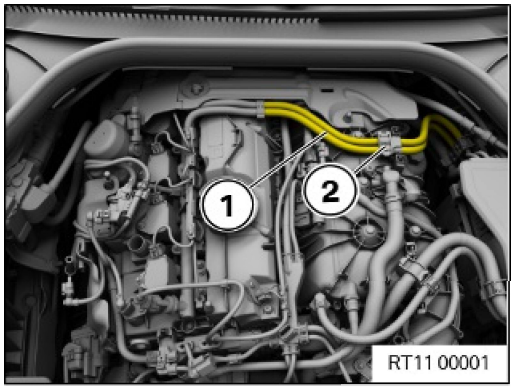
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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

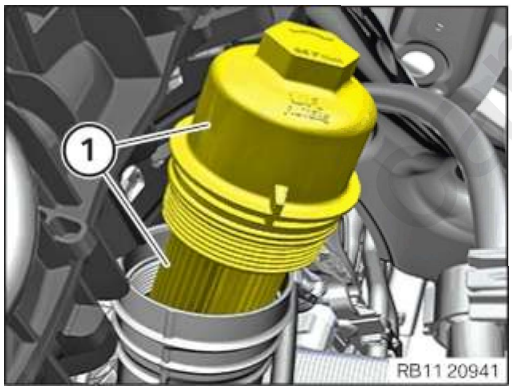
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Unclip engine wiring harness (1) from holder (2) and place it aside.



- Loosen the oil filter cover (1).

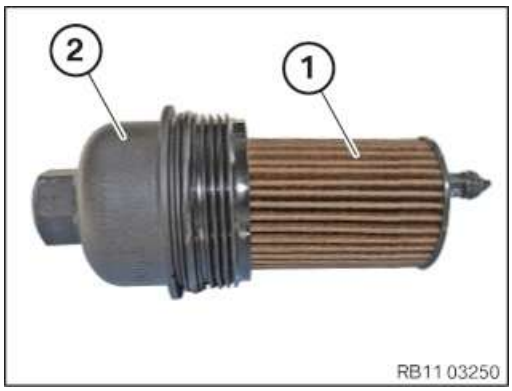


TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Guide out and remove the oil filter cover in the upward direction with oil filter element (1).

5 – Remounting oil filter element



- Loosen the oil filter element (1) from the oil filter cover (2).

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- Install oil filter element (1) in the oil filter module.

  Make sure that the guide lug of the oil filter element is installed correctly in the oil filter module.

MAIN WORK

6 – Checking the oil pressure



- Install and tighten the special tool 2 289 603.

Special tool to measure the pressure on the oil filter module

O-ring lightly oiled.	Tightening torque	25 Nm

- Connect special tool 0 496 623 (11 4 310) to special tool 2 289 603.
- Gasket on the pressure sensor **(part number: 81 31 2 357 801 and 81 38 0 431 592)**.
- Pressure sensor **(part number: 81 31 2 357 801 and 81 38 0 431 592)** in the special tool 0 496 623 (11 4 310).
- Use the connecting cable to connect the pressure sensor **(part number: 81 31 2 357 801 or 81 38 0 431 592)** with the Integrated Measurement Interface Box (IMIB) (81 38 2 295 937).



- Check oil pressure.
- Observe diagnosis instructions.



- Remove special tools 0 496 623 (11 4 310) and 2 289 603.

POSTPROCESSES

7 – Mounting oil filter element in the oil filter cover

RISK OF DAMAGE

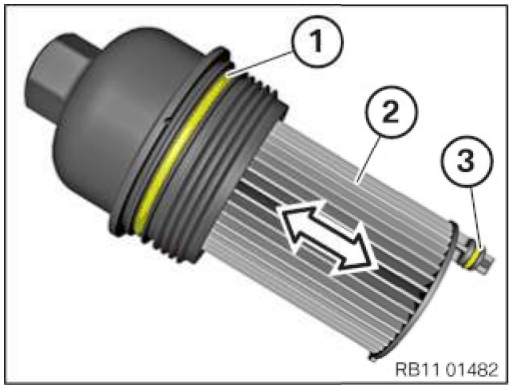
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Remove the oil filter element (1).



- Replace O-ring (1) and (3).

  Parts: O-rings
- Ensure that O-rings (1) and (3) are installed **correctly**.
- Coat the O-rings (1) and (3) with engine oil.
- Push the oil filter element (2) into the oil filter cover .

  The oil filter element (2) must engage audibly.

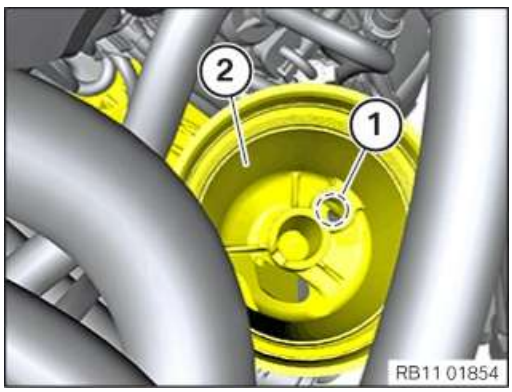
8 – Installing the oil filter element

RISK OF DAMAGE

Contaminant or foreign body.

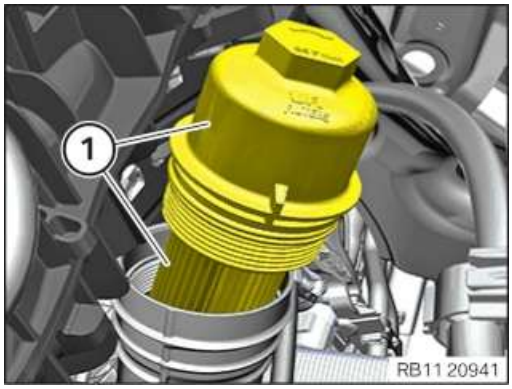
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Position the oil filter cover with the oil filter element in guide bore hole (1) in oil filter housing (2).

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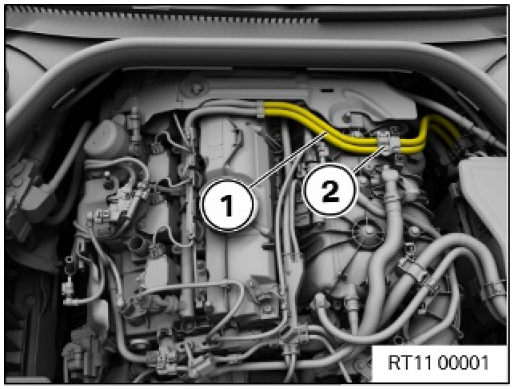
- Install the oil filter cover (1) including oil filter element.



- Tighten the oil filter cover (1).

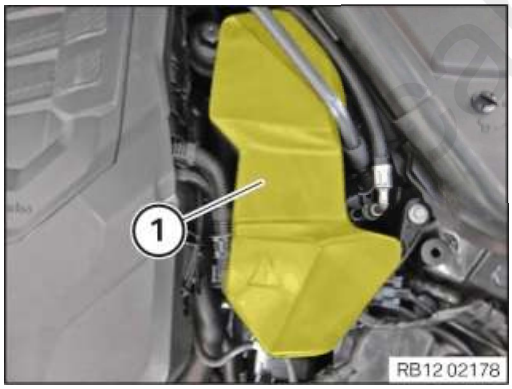
Oil filter cover to oil filter module

O-ring lightly oiled.	Tightening torque	25 Nm



- Clip in the engine wiring harness (1) in the holder (2).

9 – Installing the cover of the DME control unit



- Insert and install cover (1) into guides.

10 – Install acoustic cover

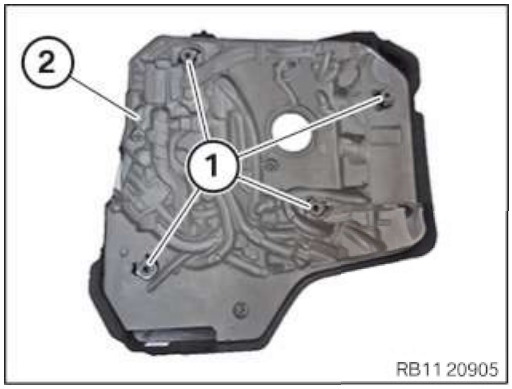
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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

11 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

Additional Information

Overview of Tightening Torques

Special tool to measure the pressure on the oil filter module — Used in step 6

O-ring lightly oiled.	Tightening torque	25 Nm

Oil filter cover to oil filter module — Used in step 8

O-ring lightly oiled.	Tightening torque	25 Nm

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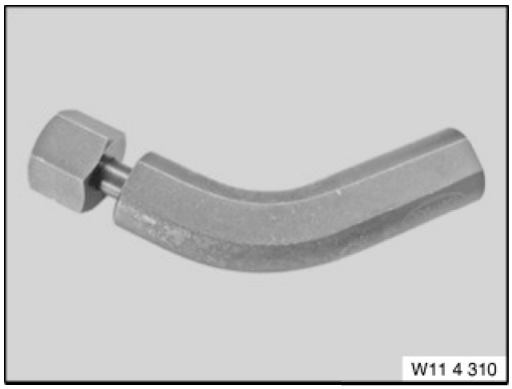
Overview of Special Tools

2 289 603 Adapter



Common	Used in step 6
Usage	For oil pressure metering on the oil filter housing. Contour-graphic silhouette foil is included in delivery specification. Further information on the contour-graphic silhouette foil can be found in service information 00 22 13 (969).
Included in the tool or work	
Storage location	A56
Replaced by	
In connection with	13 3 060 = 0491259
SI-Number	01 04 14 (071)

0 496 623 (11 4 310) Adapter



Common	Used in step 6
Usage	For fuel pressure check. For variable camshaft timing control VANOS with Integrated Measurement Interface Box IMIB (100 bar sensor in delivery specification). In combination with 11 5 360.
Included in the tool or work	
Storage location	B26
Replaced by	
In connection with	11 5 360 = 0495130
SI-Number	01 27 09 (598)

Overview Technical Data

Parts

Parts required

Designation	Used in step
Seals, oil filter element to full-flow oil filter and to oil filter cover	8
Seal, oil filter cover to full-flow oil filter	8

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11 41 115 Removing and installing/replacing hydraulic valve for oil-pressure control

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads

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- See additional information.

2 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

3 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

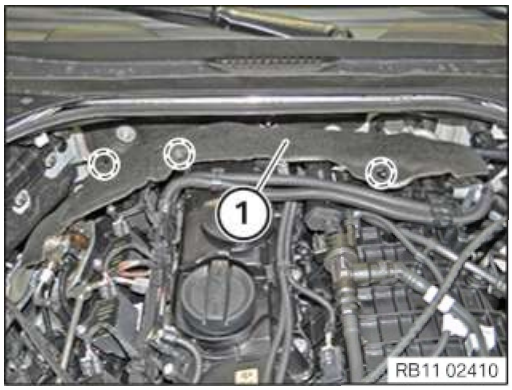
- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

4 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

5 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

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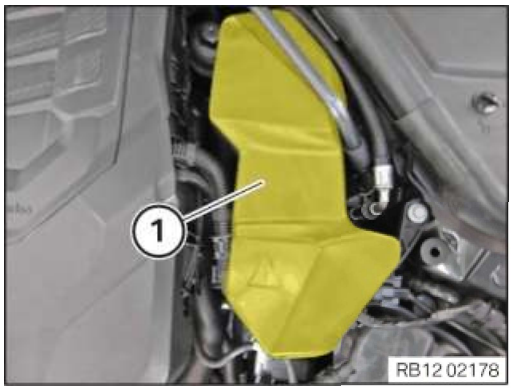
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

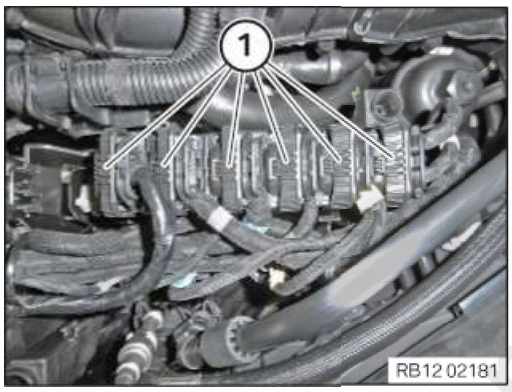
For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

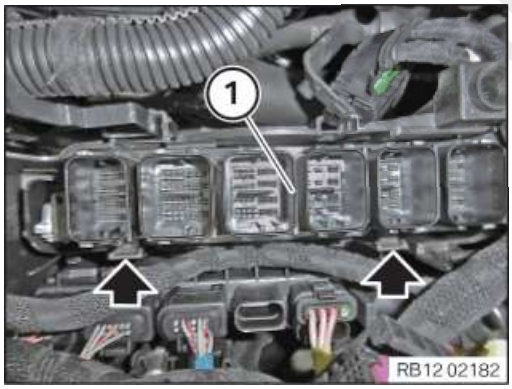
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.



- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

6 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

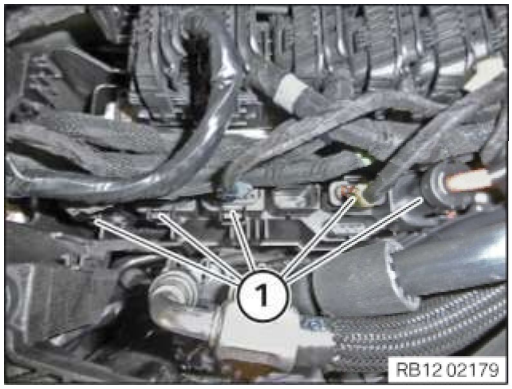
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

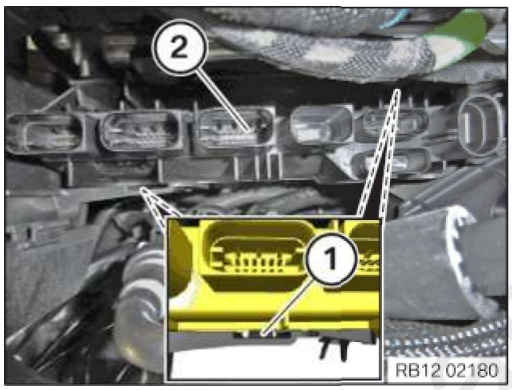
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

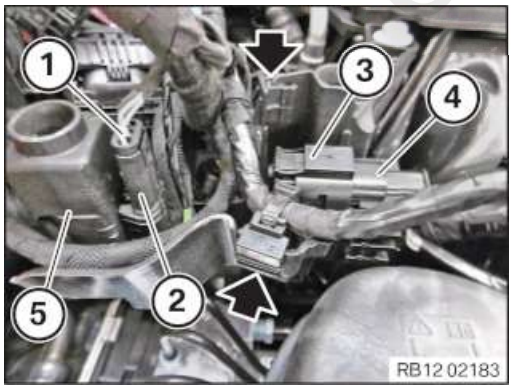


- Unlock and disconnect plug connections (1).



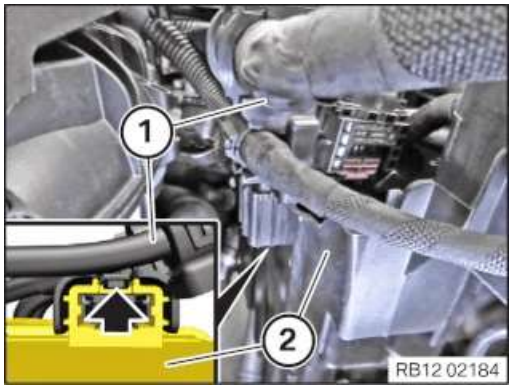
- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

7 – Removing the control unit holder

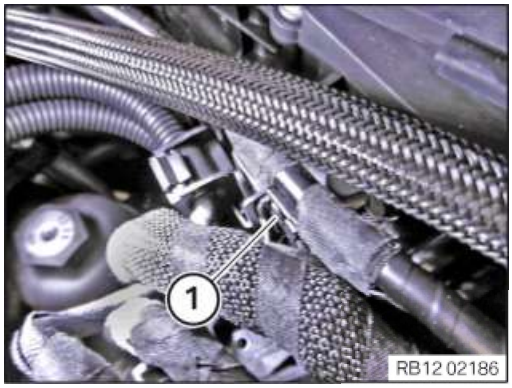


- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).

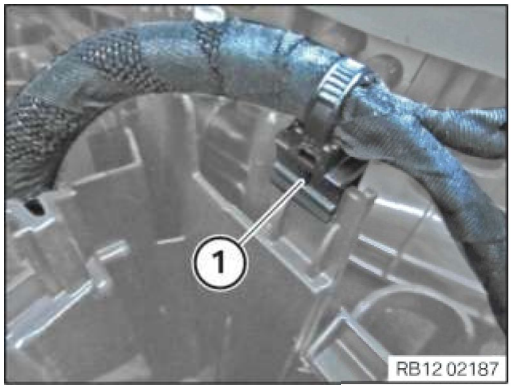
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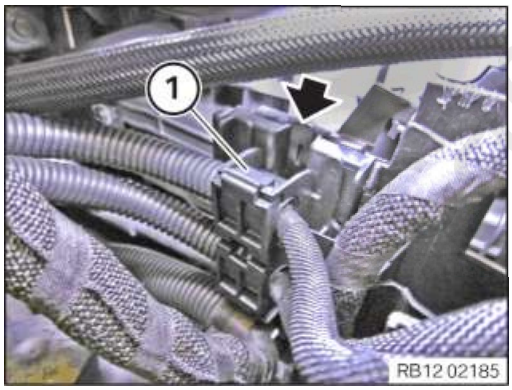
- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).



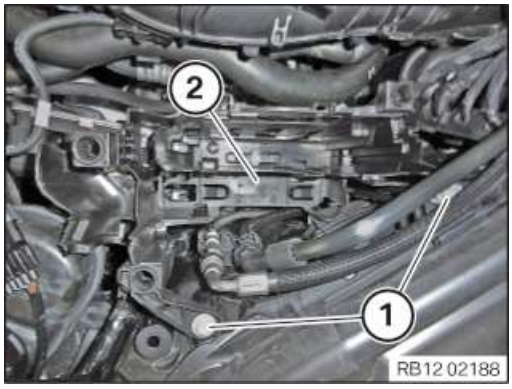
- Loosen clamp (1).



- Loosen clamp (1).



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

8 – Removing the clean air pipe with the resonator

rdiagn.com

WARNING

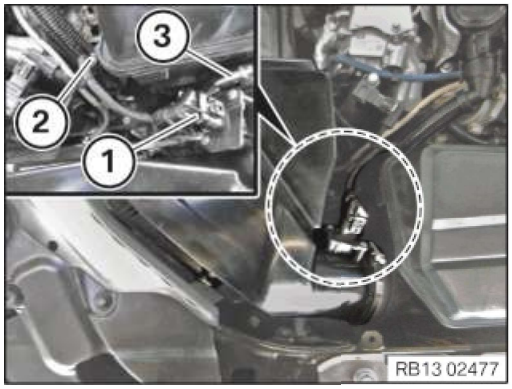
Hot surfaces.

Risk of burning!

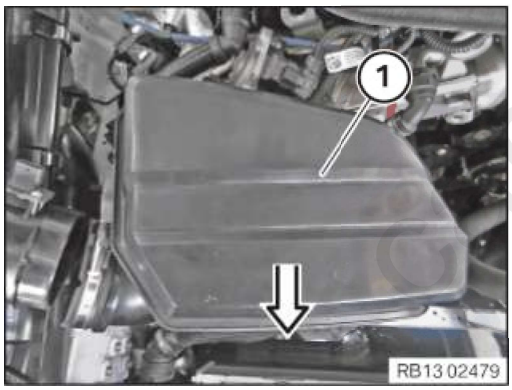
- Perform all work only on components that have cooled down.



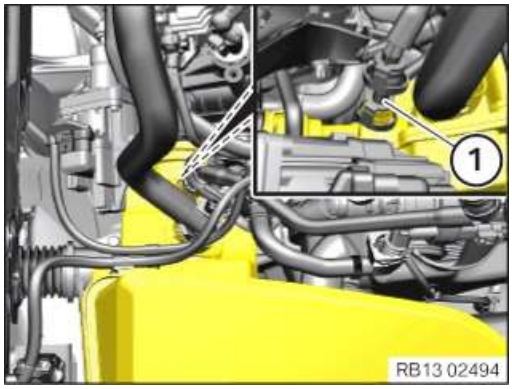
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



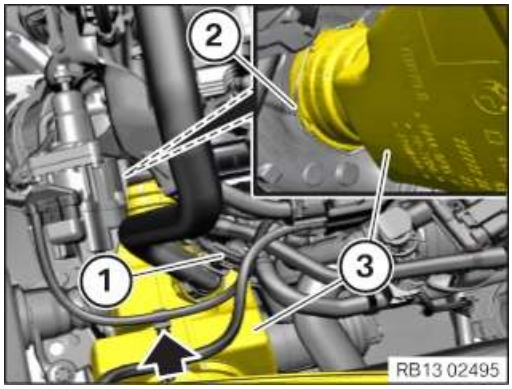
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

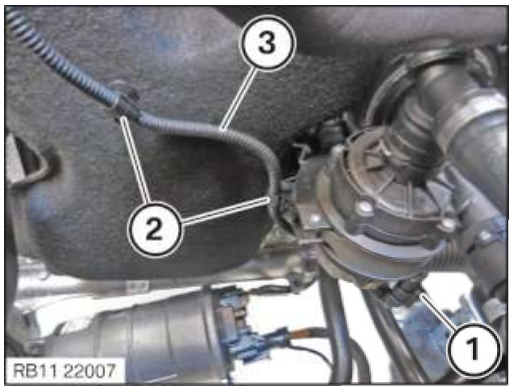


- Unlock and disconnect the tank ventilation line (1).

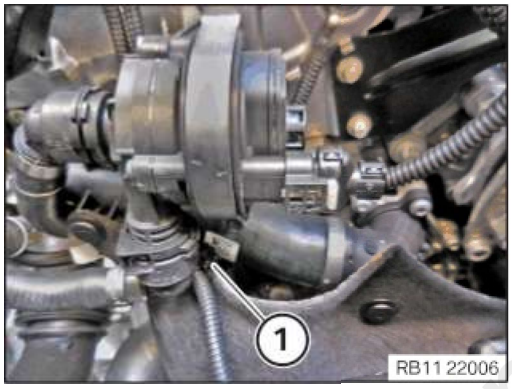


- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

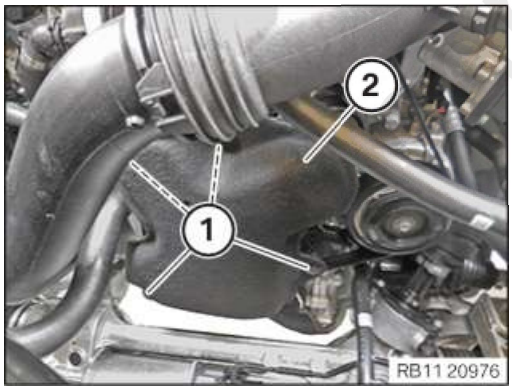
9 – Removing the acoustic cover for the engine at the front



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

10 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

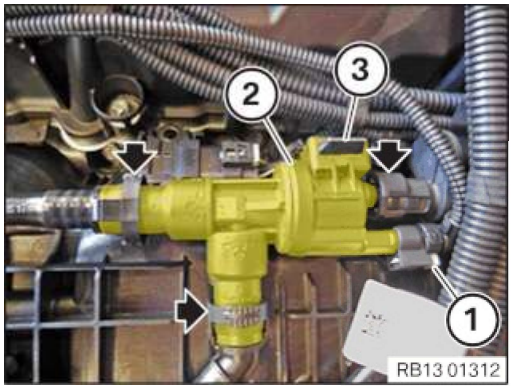
mdiagn.com

RISK OF DAMAGE

Electrostatic discharge.

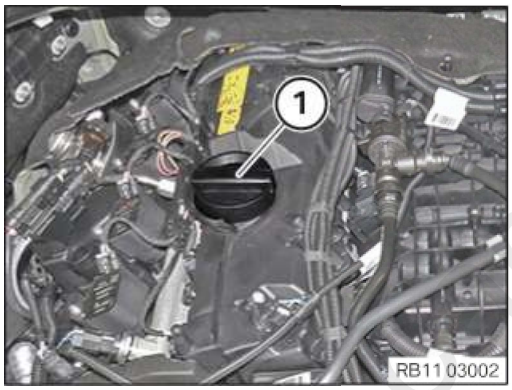
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

11 – Removing the oil filler cap



- Open oil filler cap (1).

12 – Removing the oil filter element

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

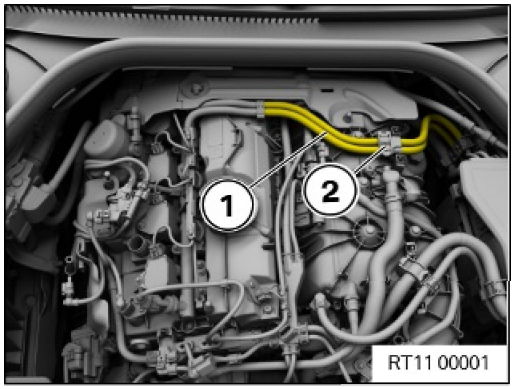
carsdiagn.com

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

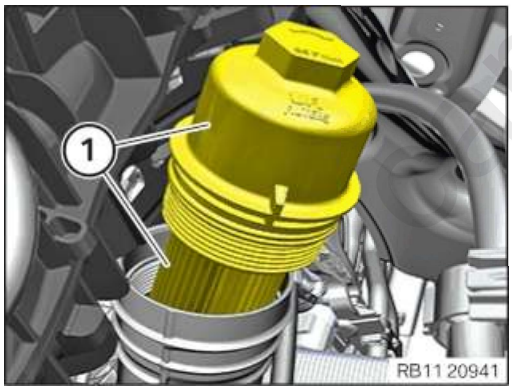
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Unclip engine wiring harness (1) from holder (2) and place it aside.



- Loosen the oil filter cover (1).



TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Guide out and remove the oil filter cover in the upward direction with oil filter element (1).

13 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

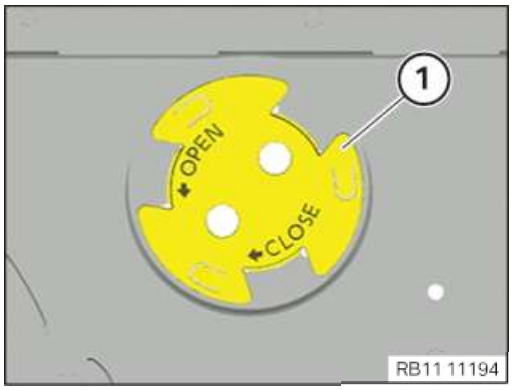
autodiagn.com

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).



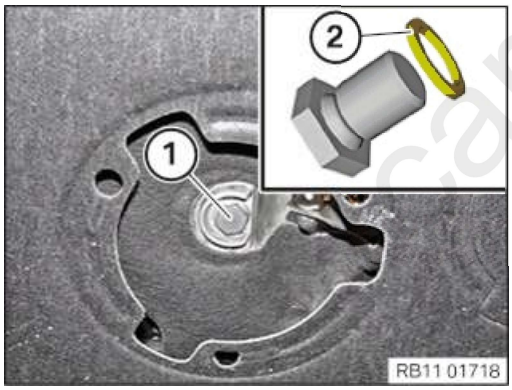
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

14 – Tightening the oil drain plug



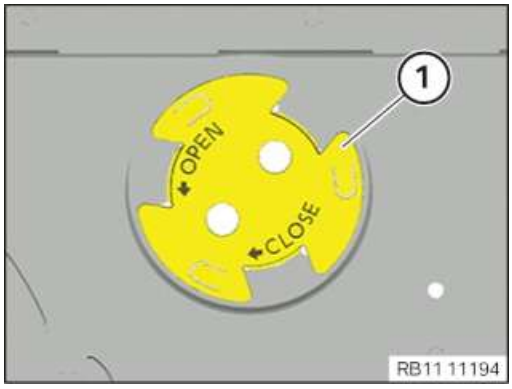
- Renew sealing ring (2).

  Parts: Sealing ring

- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

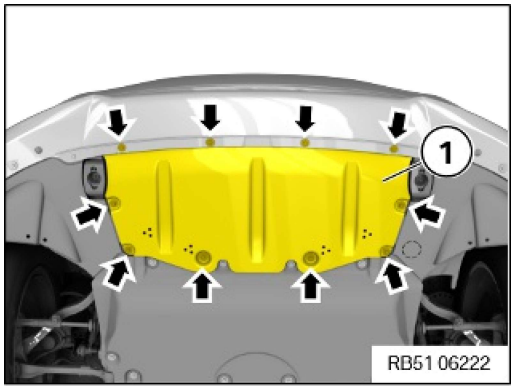
M12x16	Renew the sealing ring.	Tightening torque	25 Nm



- Install service cap (1).

15 – Removing the front underbody protection

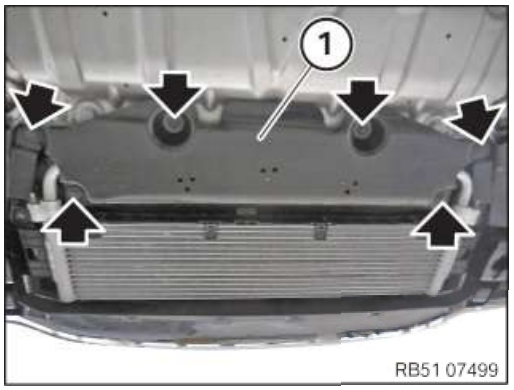
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- **Version 1:**

  Remove screws (arrows).

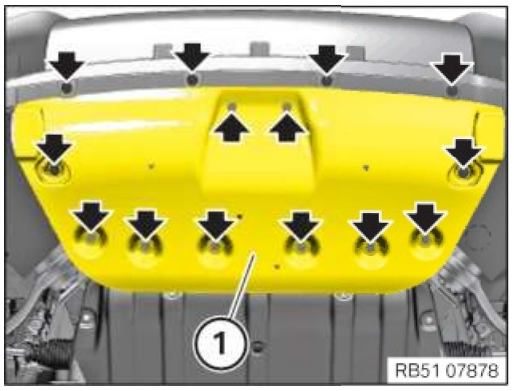
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

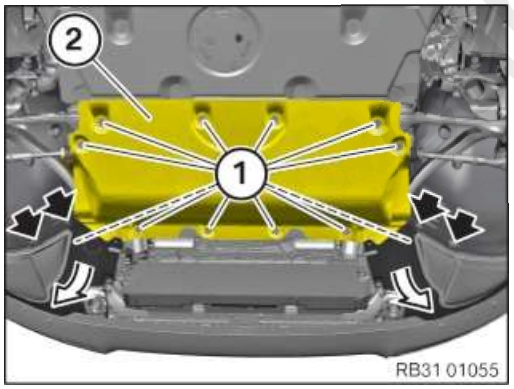


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

16 – Remove the underbody protection of the steering gear



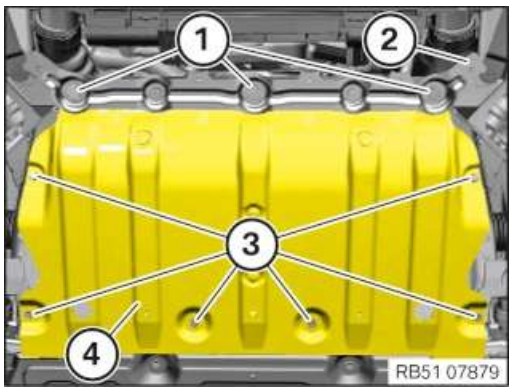
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

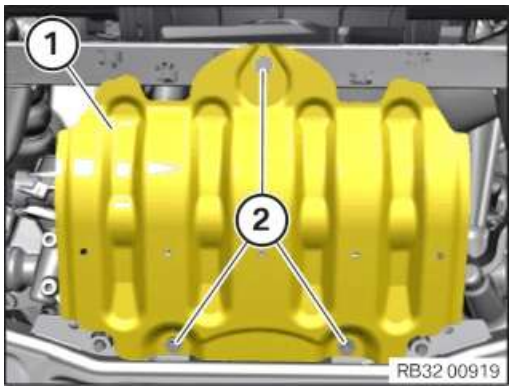
  Slide the steering gear underbody protection (4) out and remove.

17 – If installed: Removing the steering start protection

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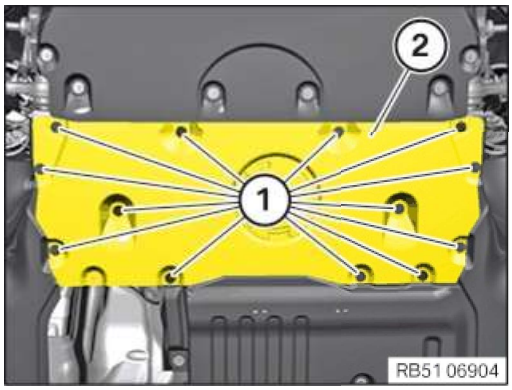
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

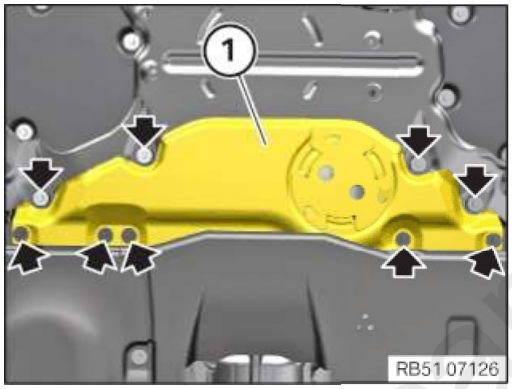
18 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

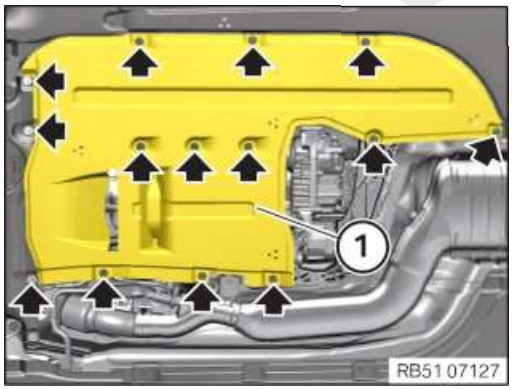


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

19 – Remove rear underbody protection

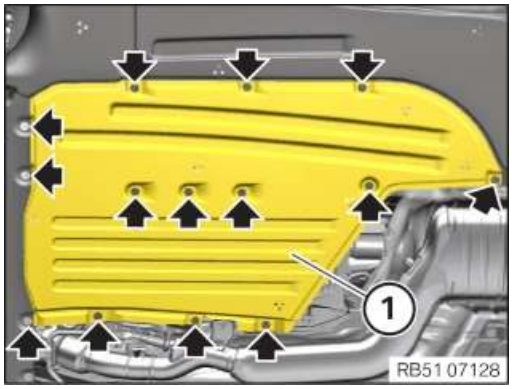


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

20 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

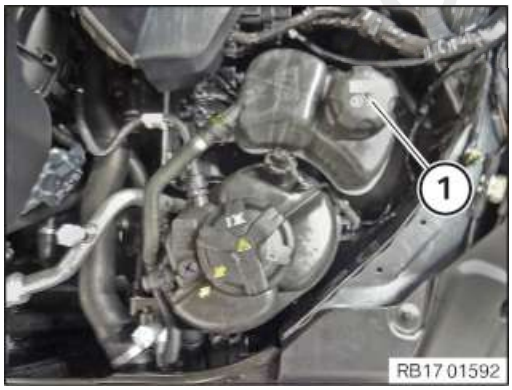
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

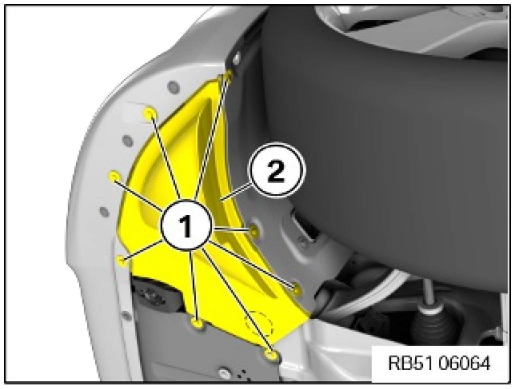
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

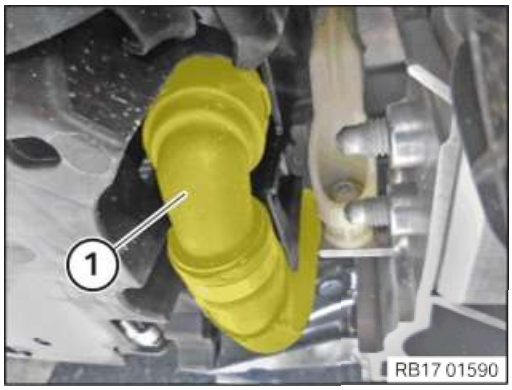


- Loosen sealing cap (1).

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- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

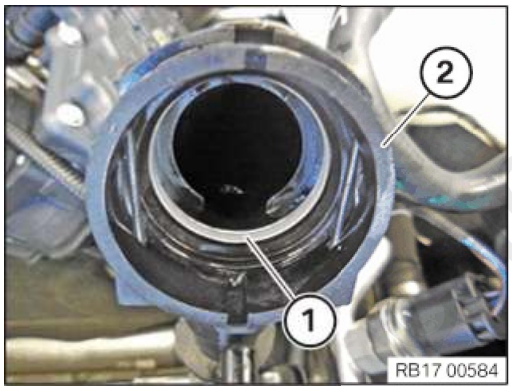


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

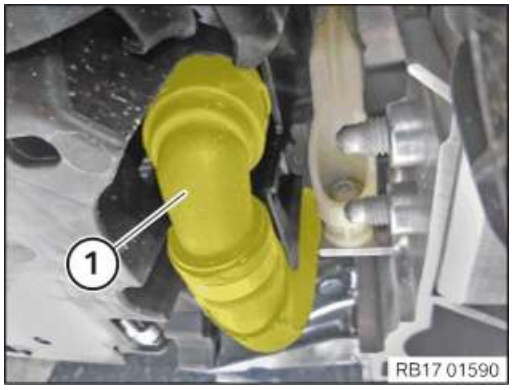
21 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



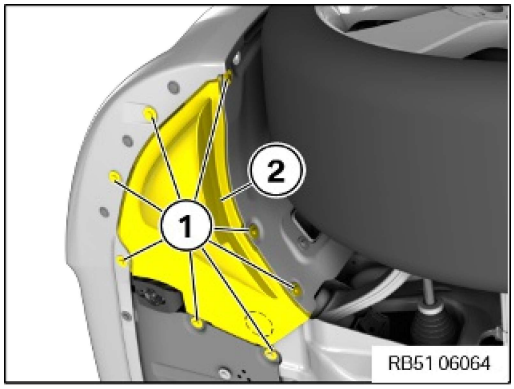
- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.

mdiag.com



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

22 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

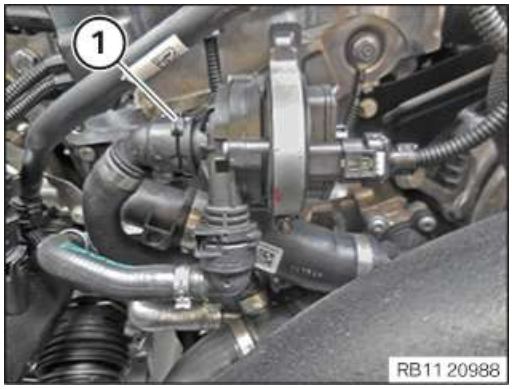
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

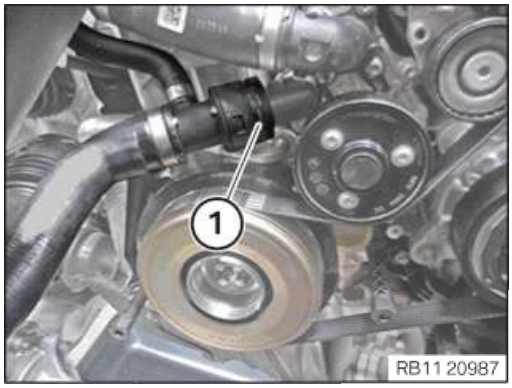


- Loosen sealing cap (1).

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- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

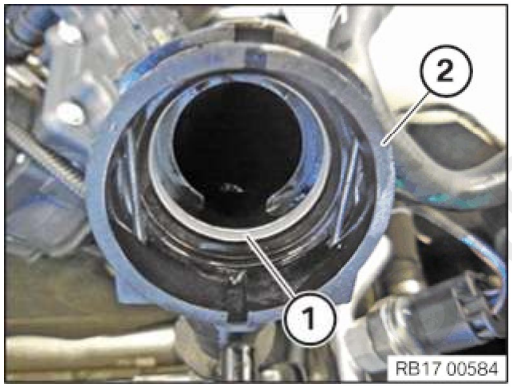


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

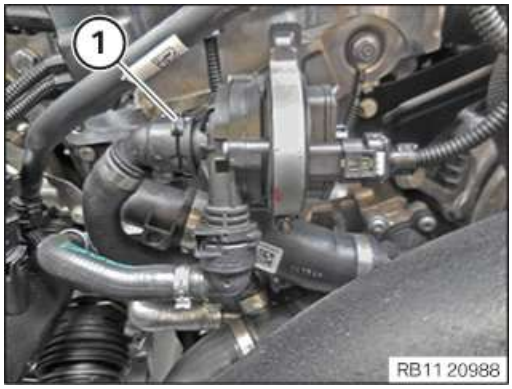
23 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

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- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

24 – Removing the intake plenum

RISK OF DAMAGE

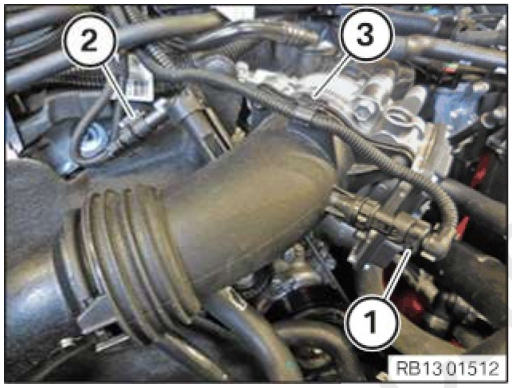
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

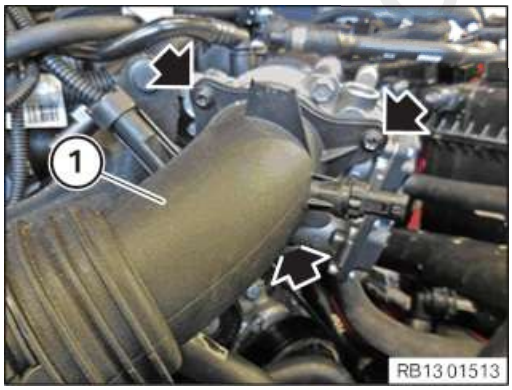
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

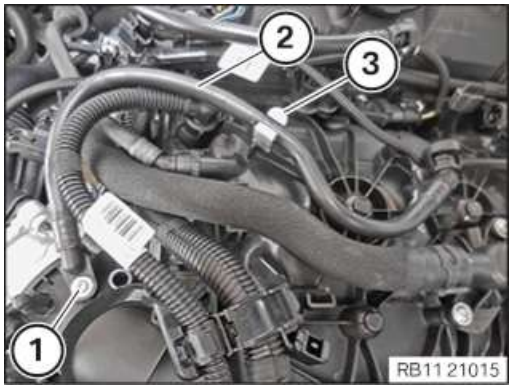
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



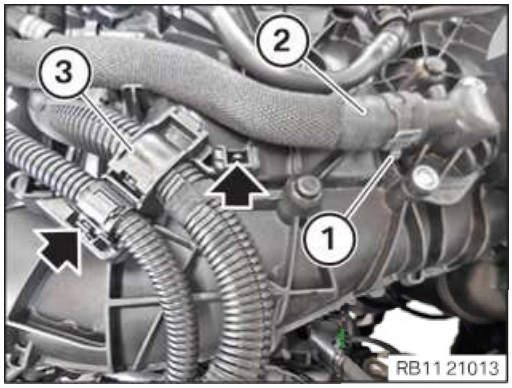
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



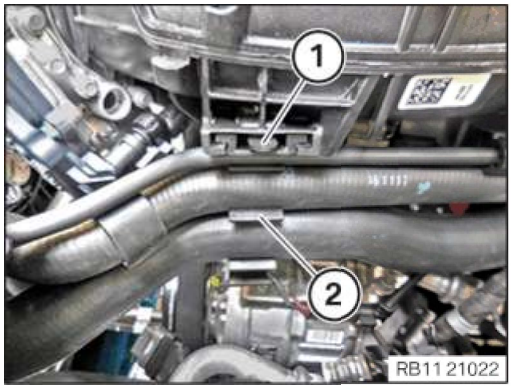
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



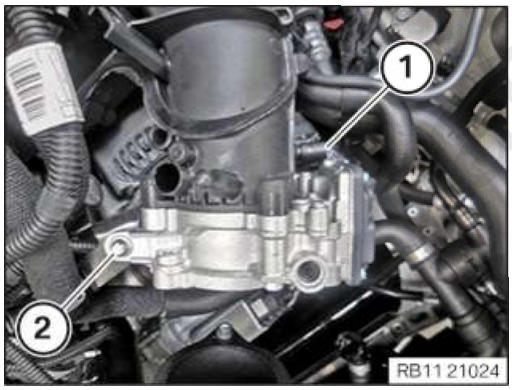
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



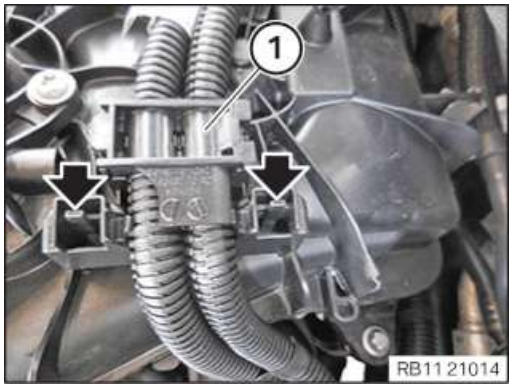
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

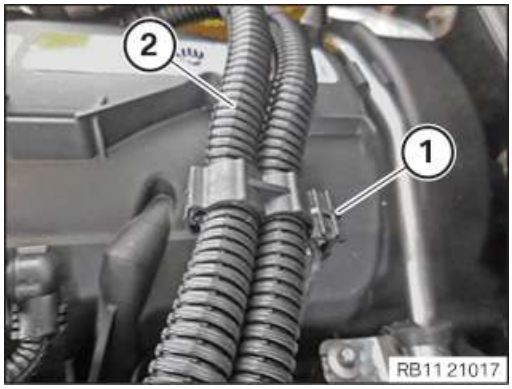


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

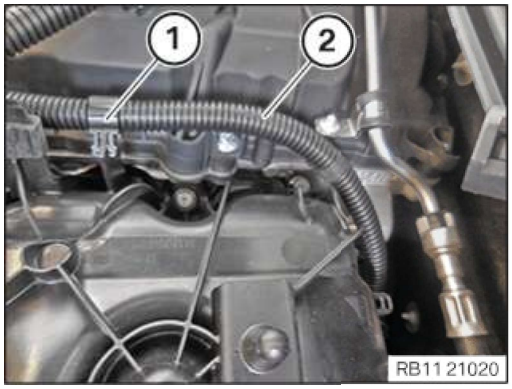
mdiagn.com



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



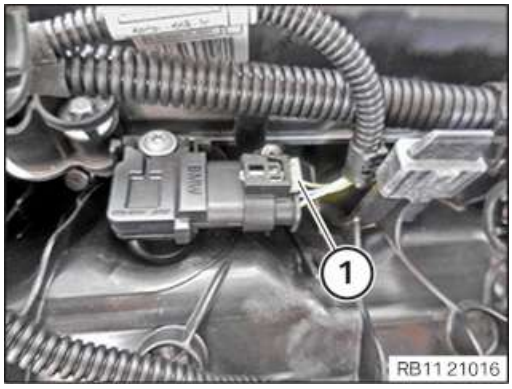
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

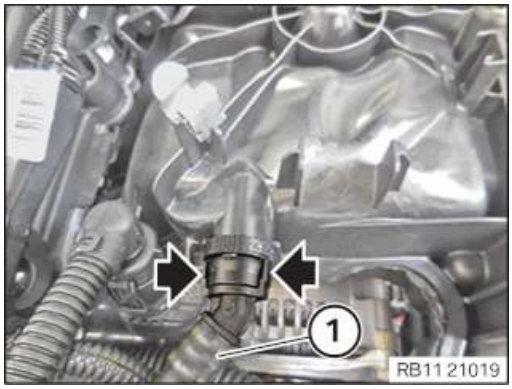


- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

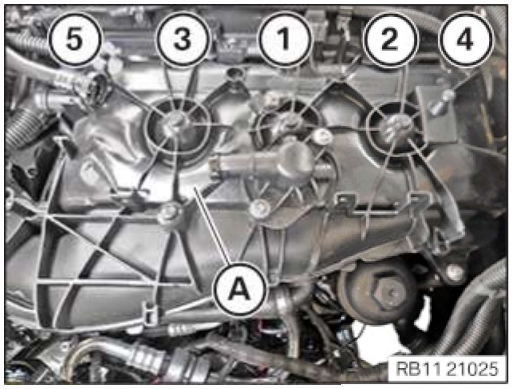
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- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

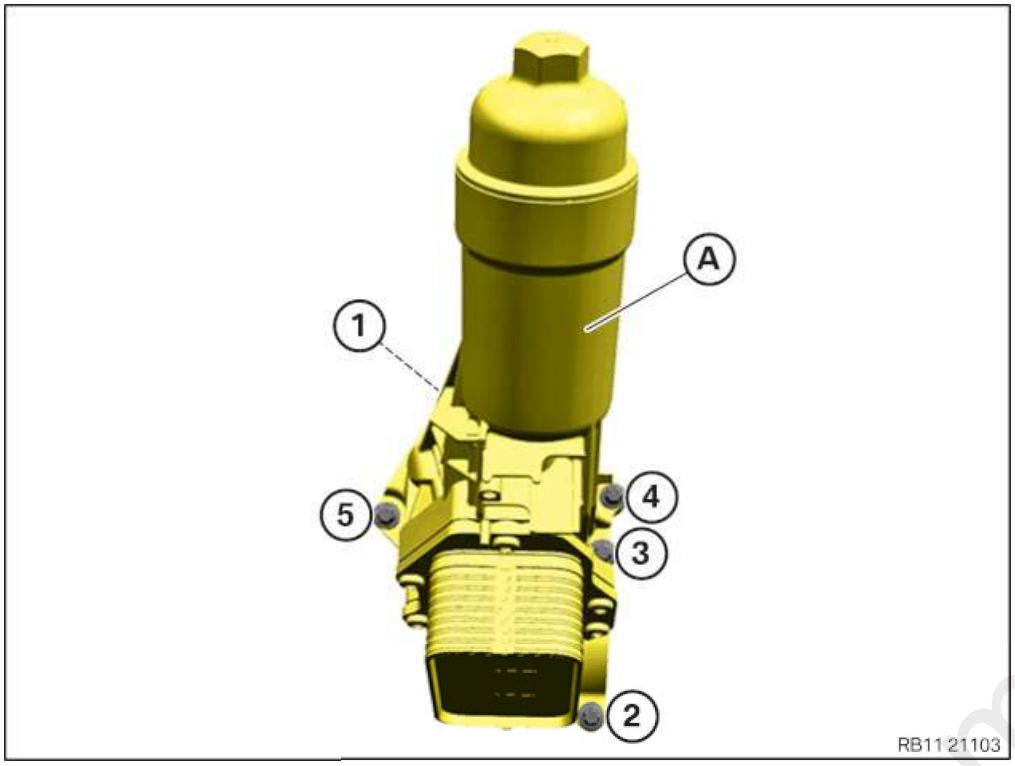
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

25 – Remove the complete full-flow oil filter

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Full-flow oil filter



A Full-flow oil filter

1 to 5 Bolts

Prerequisite

Disconnect all batteries.

RISK OF DAMAGE

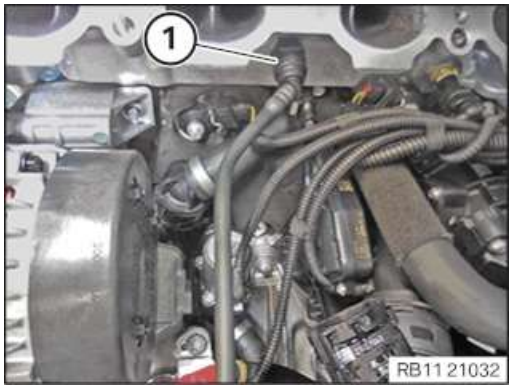
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

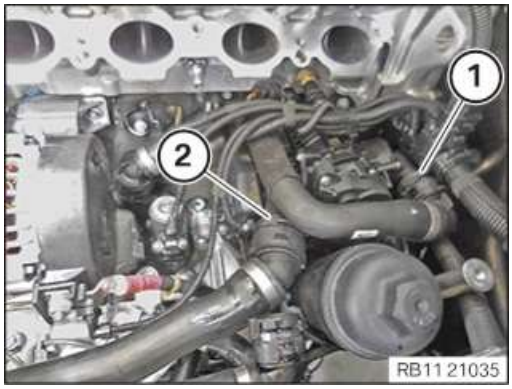
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

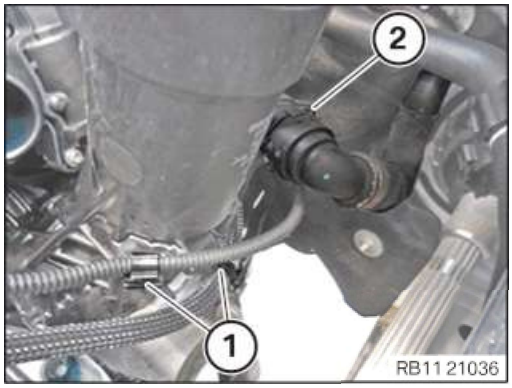


- Unlock and loosen coolant line (1).

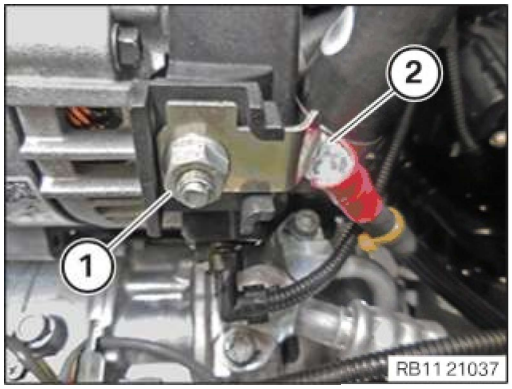
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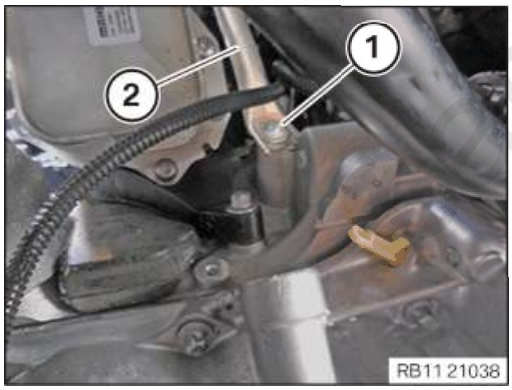
- Unlock and loosen coolant line (1).
- Unlock and loosen coolant line (2).
- Catch and dispose of escaping coolant.



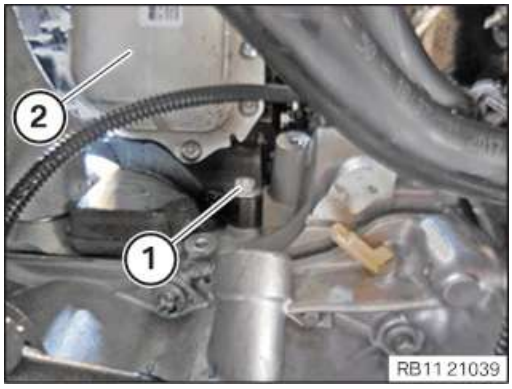
- Loosen clamps (1).
- Unlock and loosen coolant line (2).
- Catch and dispose of escaping coolant.



- Unfasten nut (1).
- Thread out positive battery cable (2) and set it aside.

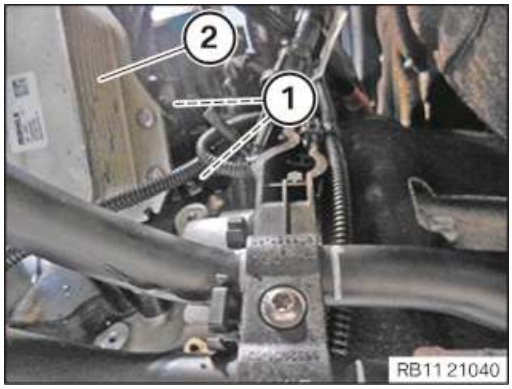


- Loosen screw (1).
- Guide out and remove manifold support (2).

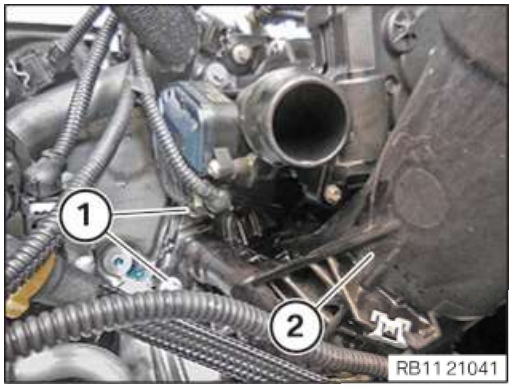


- Release screw (1) on full-flow oil filter (2).

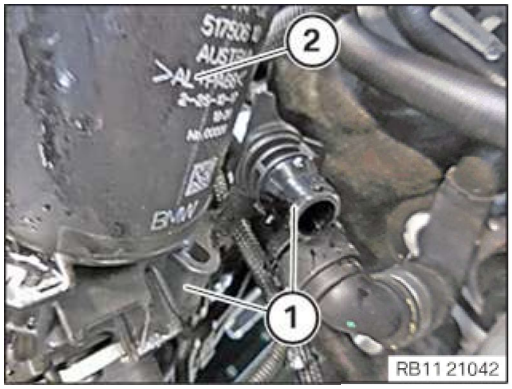
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- Loosen the screws (1) on the full-flow oil filter (2).



- Loosen the screws (1) on the full-flow oil filter (2).



- Guide out coolant line (1) on full-flow oil filter (2) and place it aside.
- Guide out and remove the full-flow oil filter (2).

MAIN WORK

26 – Removing the hydraulic valve for the oil pressure control

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

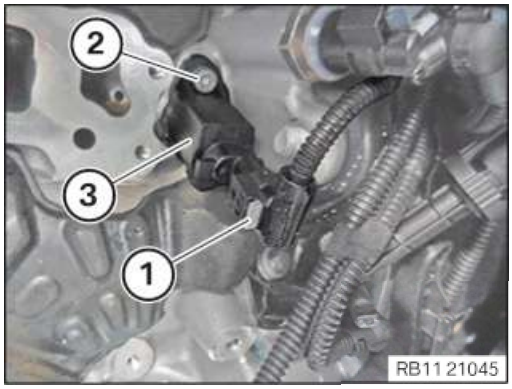
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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Unlock and loosen connector (1).
- Loosen screw (2).
- Guide out and remove the hydraulic valve (2).

27 – Installing the hydraulic valve for the oil pressure control

RISK OF DAMAGE

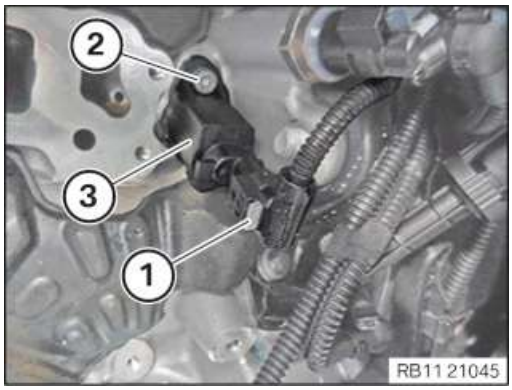
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Check the O-ring (1) for damage.
- If necessary, replace the hydraulic valve.



- Feed in and install the hydraulic valve (3).
- Tighten down screw (2).

Hydraulic valve to crankcase

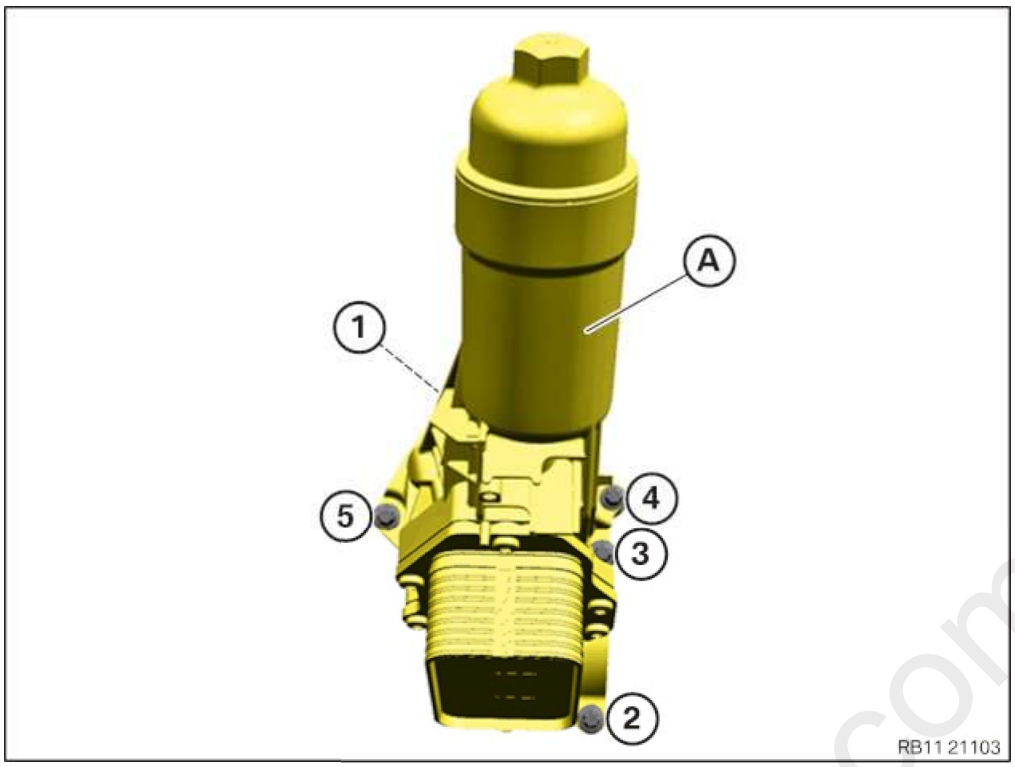
M6 x 18		Tightening torque	8 Nm

- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

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28 – Install the complete full-flow oil filter

Full-flow oil filter

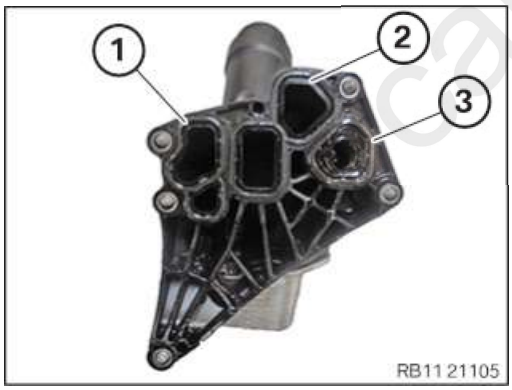


A Full-flow oil filter

1 to 5 Bolts

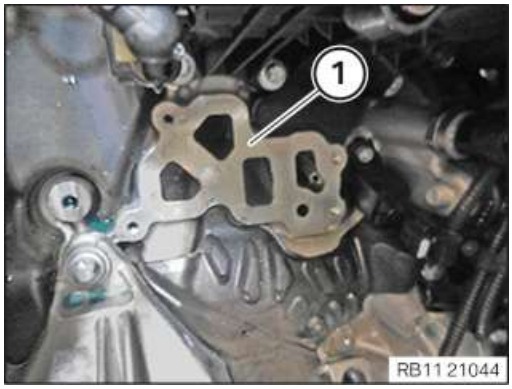
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.



- Renew the gaskets (1), (2) and (3) on the full-flow oil filter.

  Parts: Seals



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean any sealing residue on sealing surface (1) on the crankcase with the special tool 0 495 102 (11 4 470).

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- Have a cleaning cloth ready.

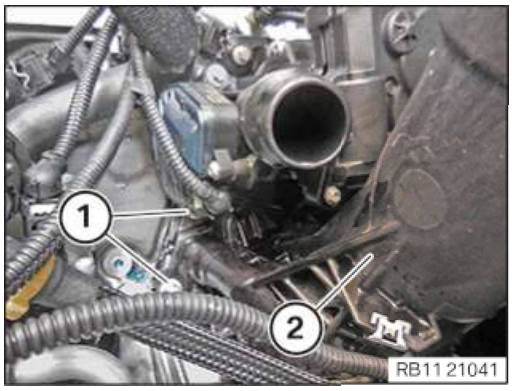
RISK OF DAMAGE

Damage to the engine.

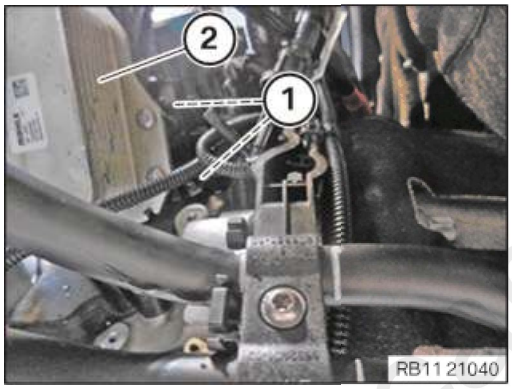
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

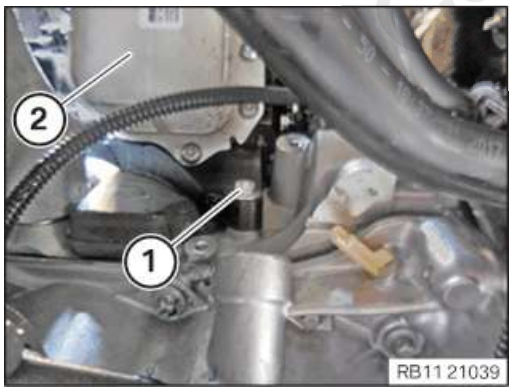
- Crank the engine with the special tool 0 493 380 (11 6 480) until the engine oil flows in the area of oil duct (1).



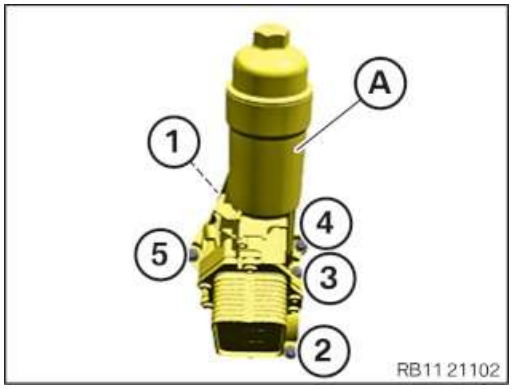
- Install full-flow oil filter (2) from the top and position it.
- Hand-tighten the bolts (1).



- Apply the screws (1) on the full-flow oil filter (2) hand-tight.



- Apply the screws (1) on the full-flow oil filter (2) hand-tight.



TECHNICAL INFORMATION

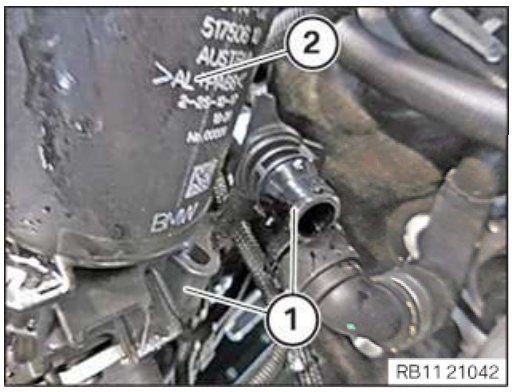
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

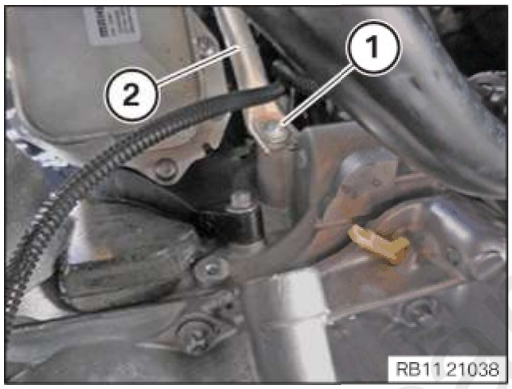
- Tighten the screw on full-flow oil filter (A) in the (1) to (5) order.

Full-flow oil filter to crankcase

M6	Observe tightening sequence.	Jointing torque Tightening torque	4 Nm 10 Nm



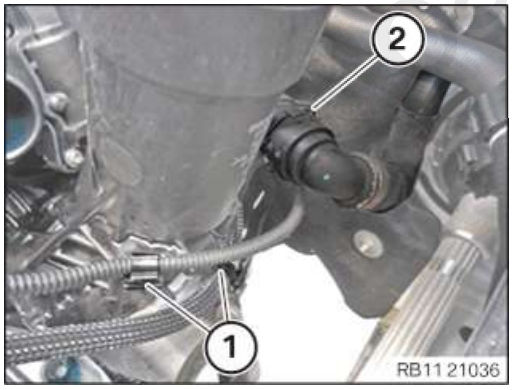
- Guide in and install coolant line (1) on full-flow oil filter (2).



- Guide in and install manifold support (2).
- Tighten down screw (1).

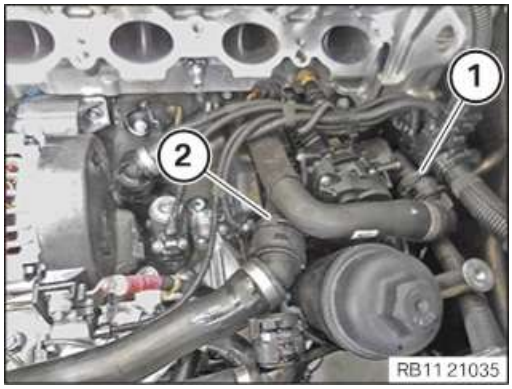
Manifold support to crankcase

M6x16		Tightening torque	8 Nm

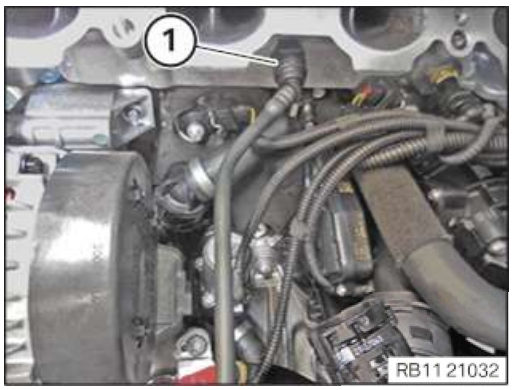


- Secure clamps (1).
- Connect and lock coolant line (2).
- Make sure that the cooling line (2) engages audibly.

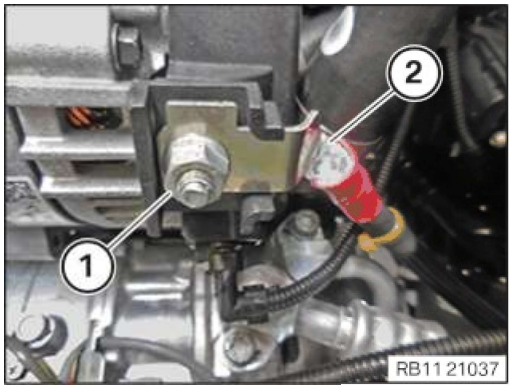
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- Connect and lock coolant line (1).
- Connect and lock coolant line (2).
- Make sure that you can hear coolant lines (1) and (2) engage.



- Feed in and install coolant line (1).
- Make sure that the cooling line (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and install the positive battery cable (2).
- Tighten nut (1).

Positive battery cable to the alternator

M8		Tightening torque	19 Nm

29 – Installing the oil filter element

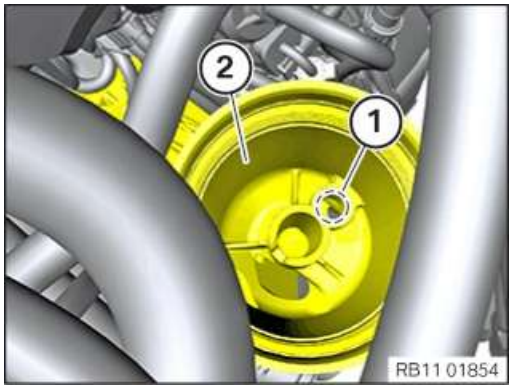
RISK OF DAMAGE

Contaminant or foreign body.

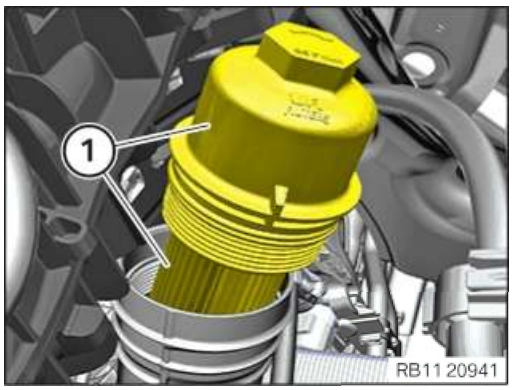
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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- Position the oil filter cover with the oil filter element in guide bore hole (1) in oil filter housing (2).



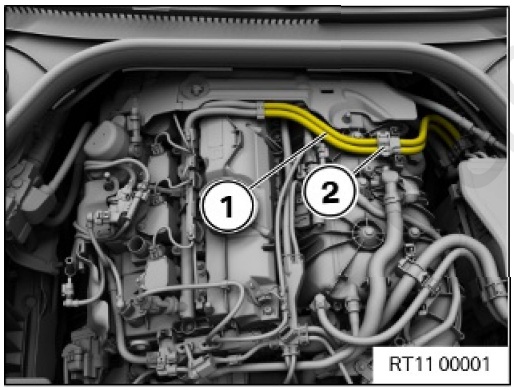
- Install the oil filter cover (1) including oil filter element.



- Tighten the oil filter cover (1).

Oil filter cover to oil filter module

O-ring lightly oiled.	Tightening torque	25 Nm



- Clip in the engine wiring harness (1) in the holder (2).

30 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

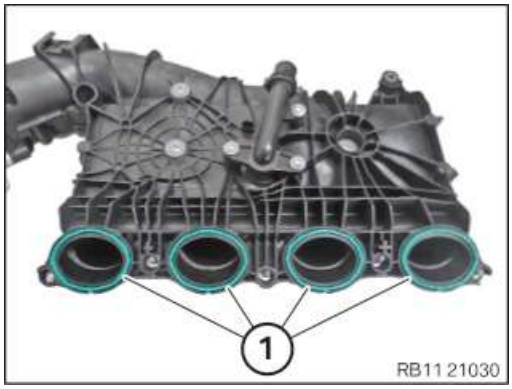
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

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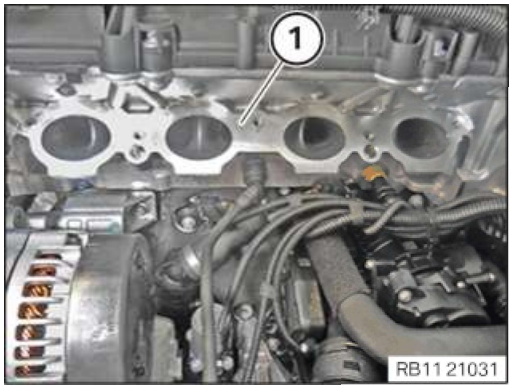
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

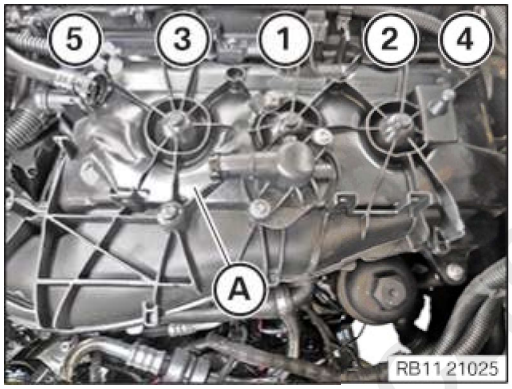


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



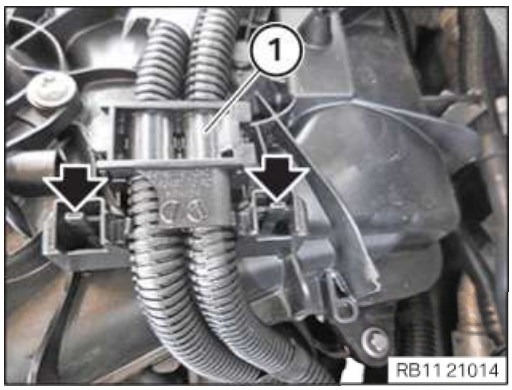
- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.



- Tighten down screw (1).

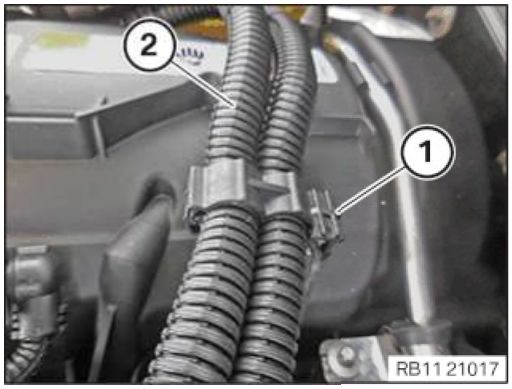
Intake plenum to support

M6X25		Tightening torque	8 Nm

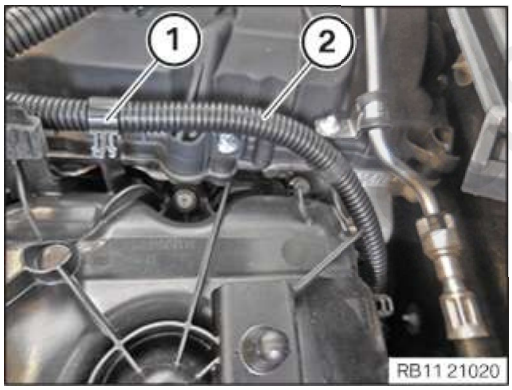


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

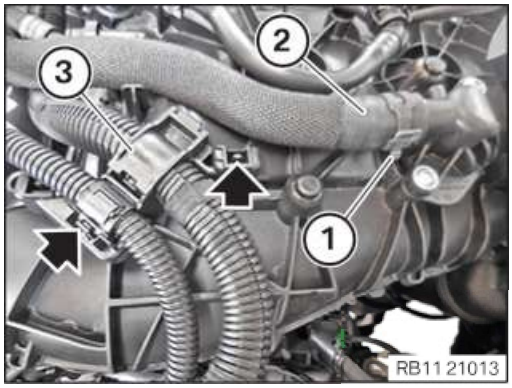
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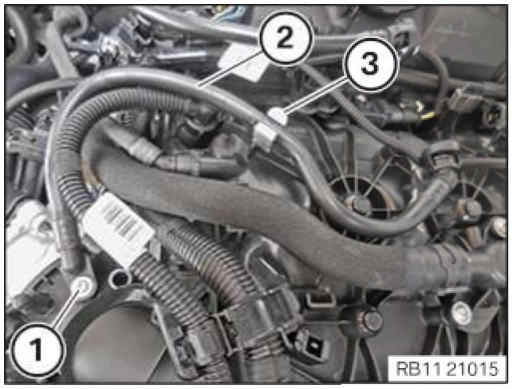
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



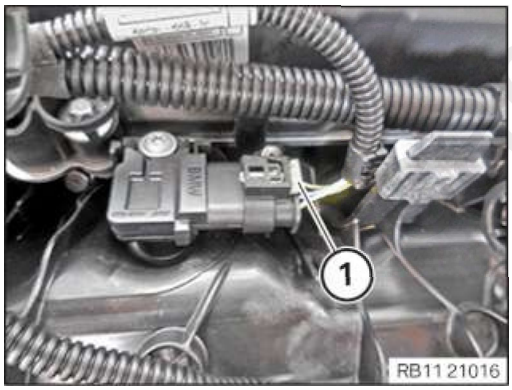
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

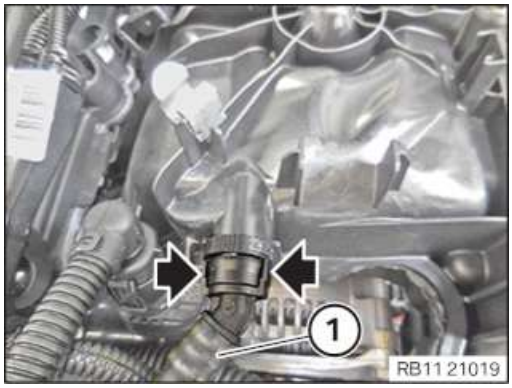
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

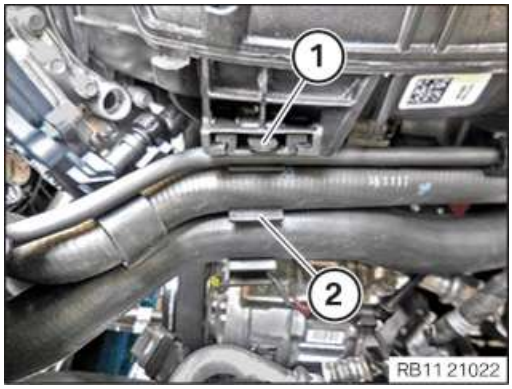
  The connector (1) must engage audibly.



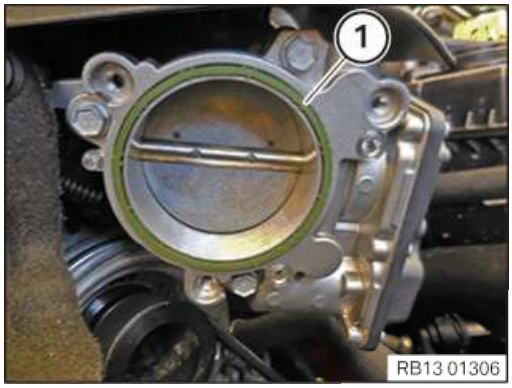
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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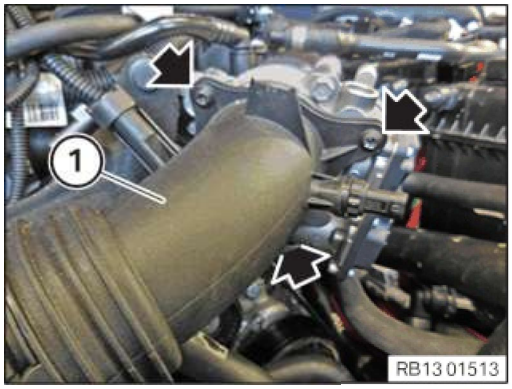


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

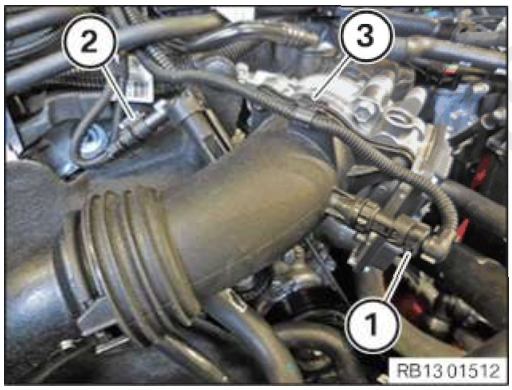
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

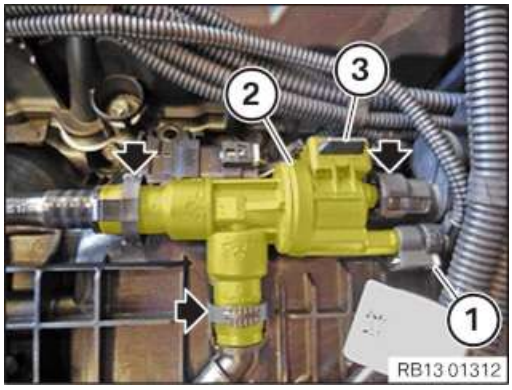
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

31 – Installing the tank vent valve



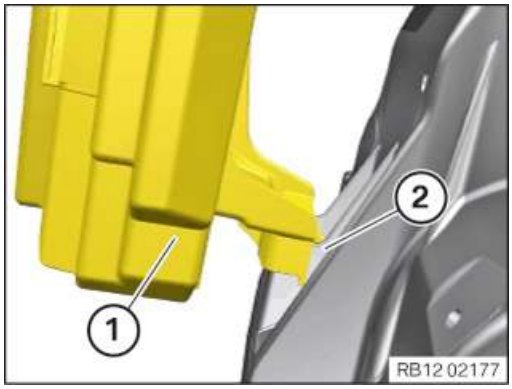
- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

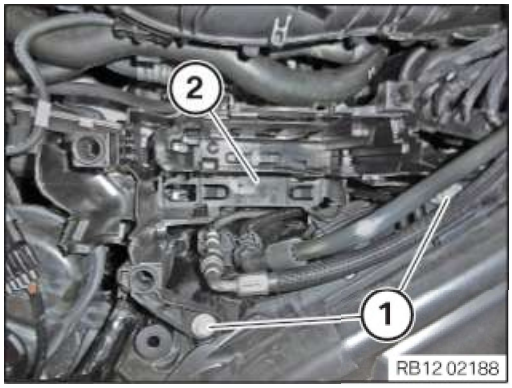
  The connector (1) must engage audibly.

32 – Installing the control unit holder

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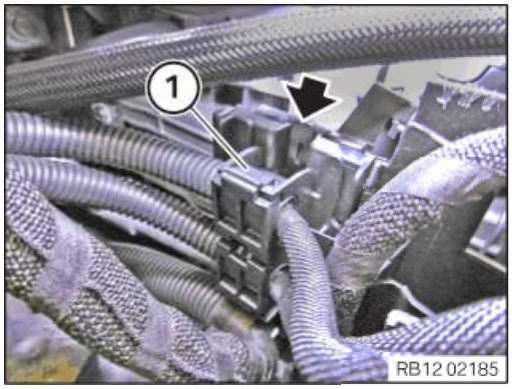
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

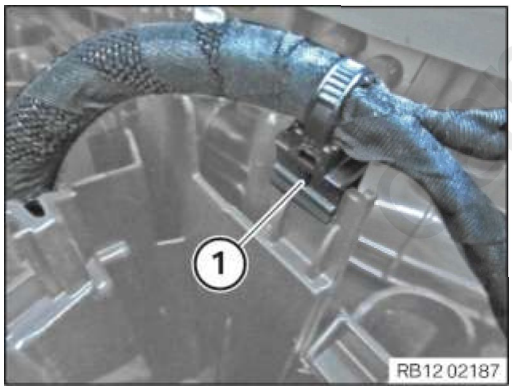
Control unit holder on spring strut dome

Hexagon screw		Tightening torque	8 Nm

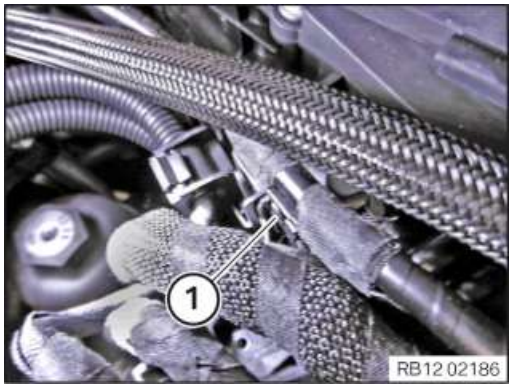


- Feed in and install the cable clip (1).

  Lock (arrow) must audibly engage.

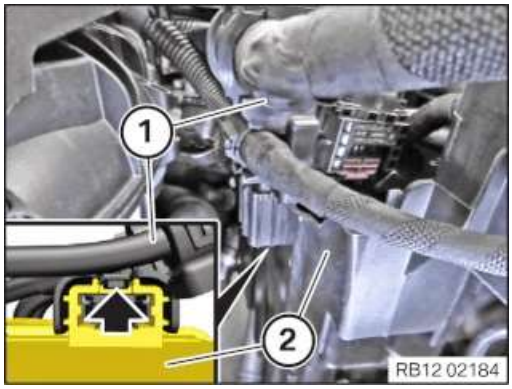


- Secure clamps (1).

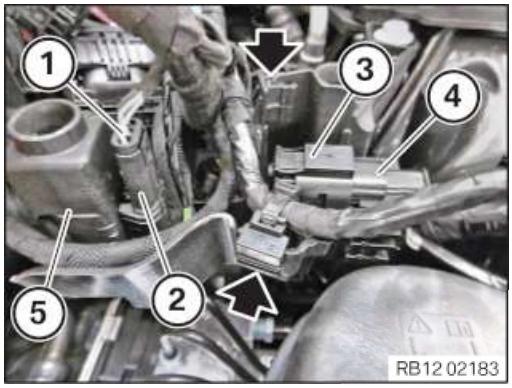


- Secure clamps (1).

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- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

33 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

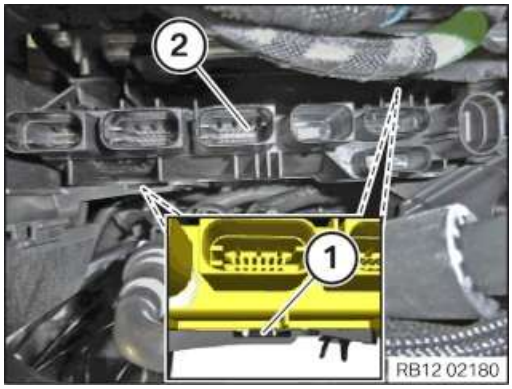
RISK OF DAMAGE

Electrostatic discharge.

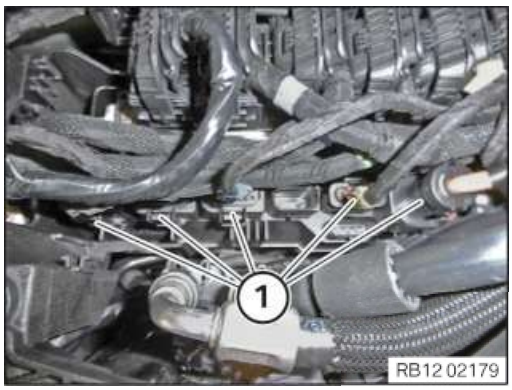
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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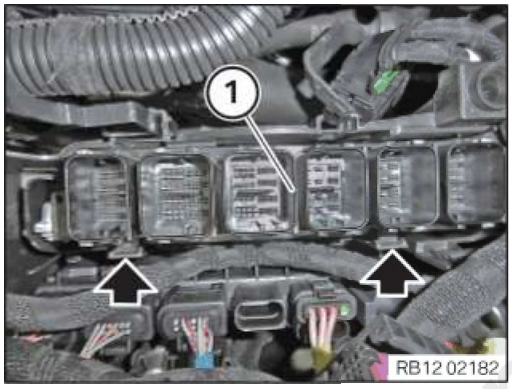


- Insert and install the integrated supply module (PDM) (2).
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).

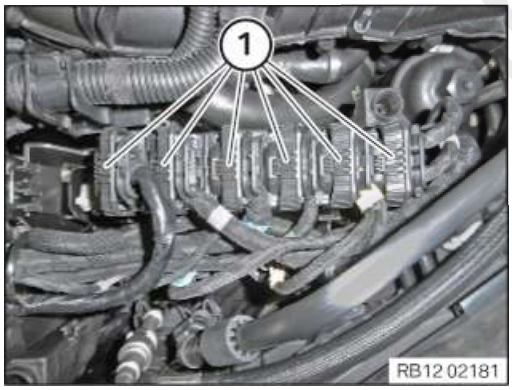


- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

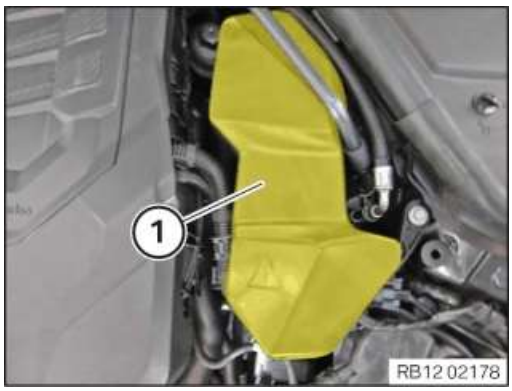
34 – Installing the DME control unit



- Feed in and install DME control unit (1).
  The locks (arrows) must engage audibly.

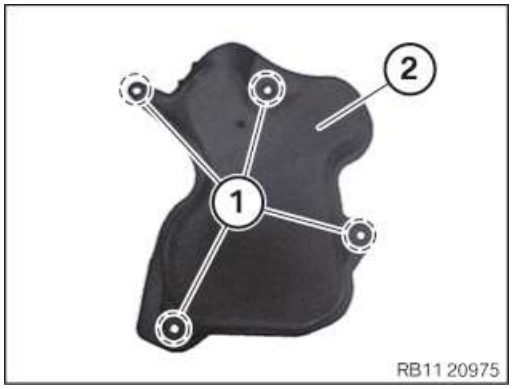


- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.



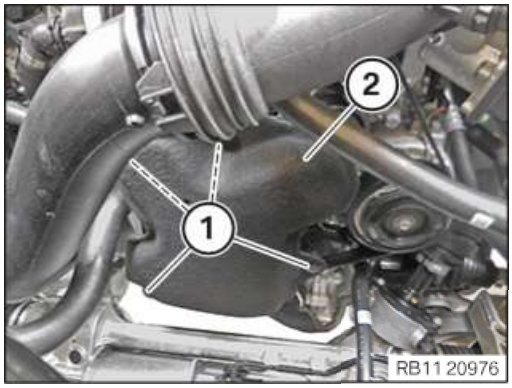
- Insert and install cover (1) into guides.

35 – Install the acoustic cover for the engine at the front

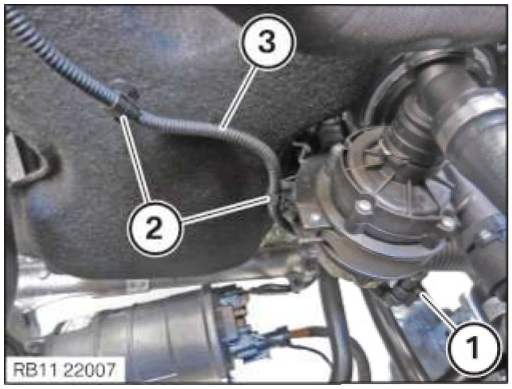


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

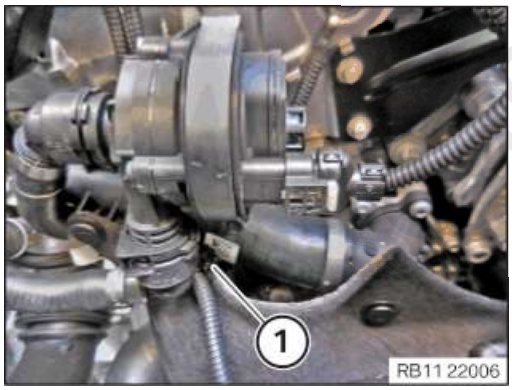


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



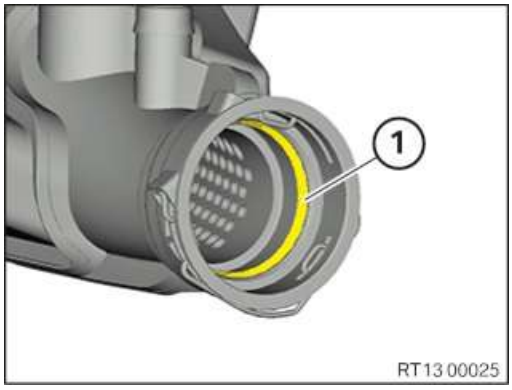
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

36 – Installing the clean air pipe with resonator



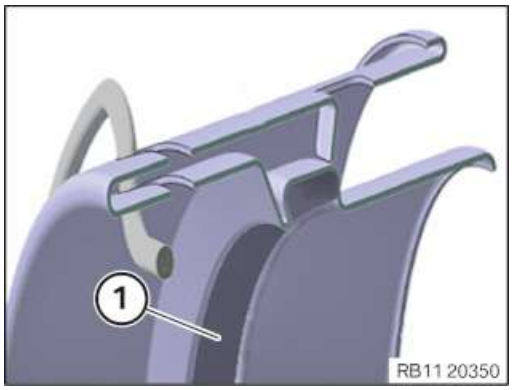
- Check the seal (1) for damages, replace if necessary.

► **Replace damaged gasket**

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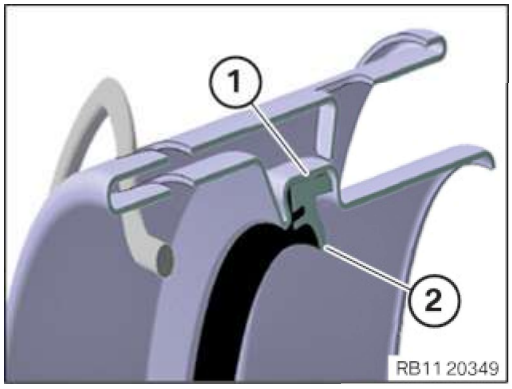
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



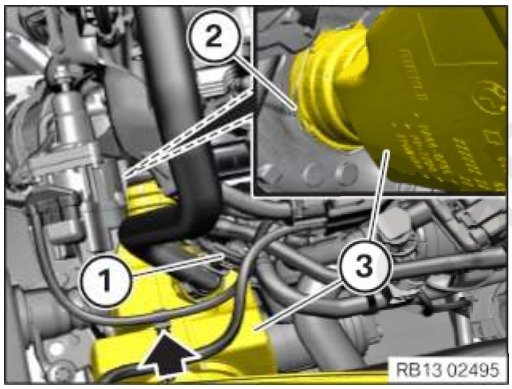
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

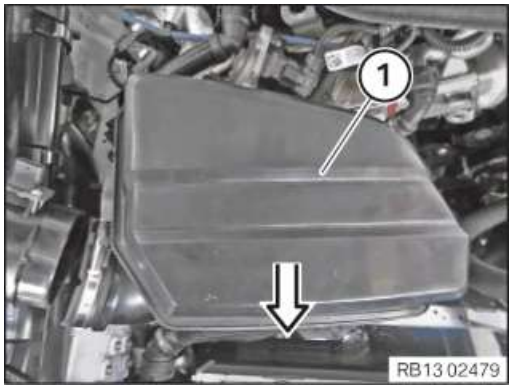
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



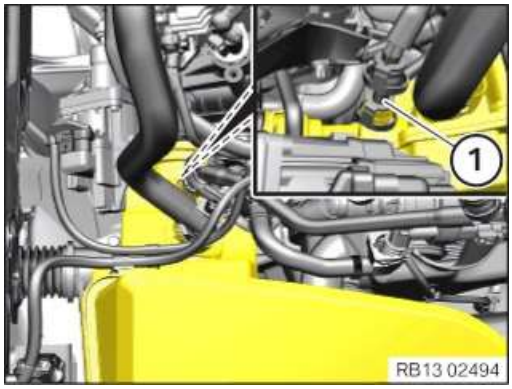
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

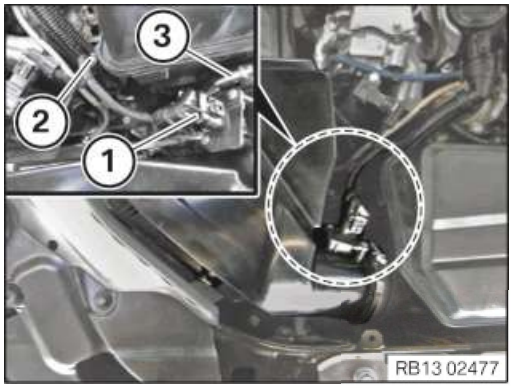
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

37 – Topping up the engine oil

RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Drain the engine oil.

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- Pour in engine oil.

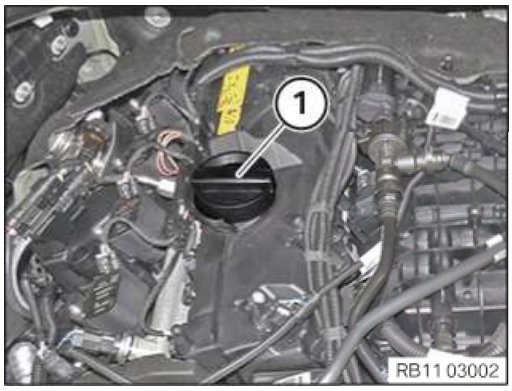
Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

38 – Installing the oil filler cap

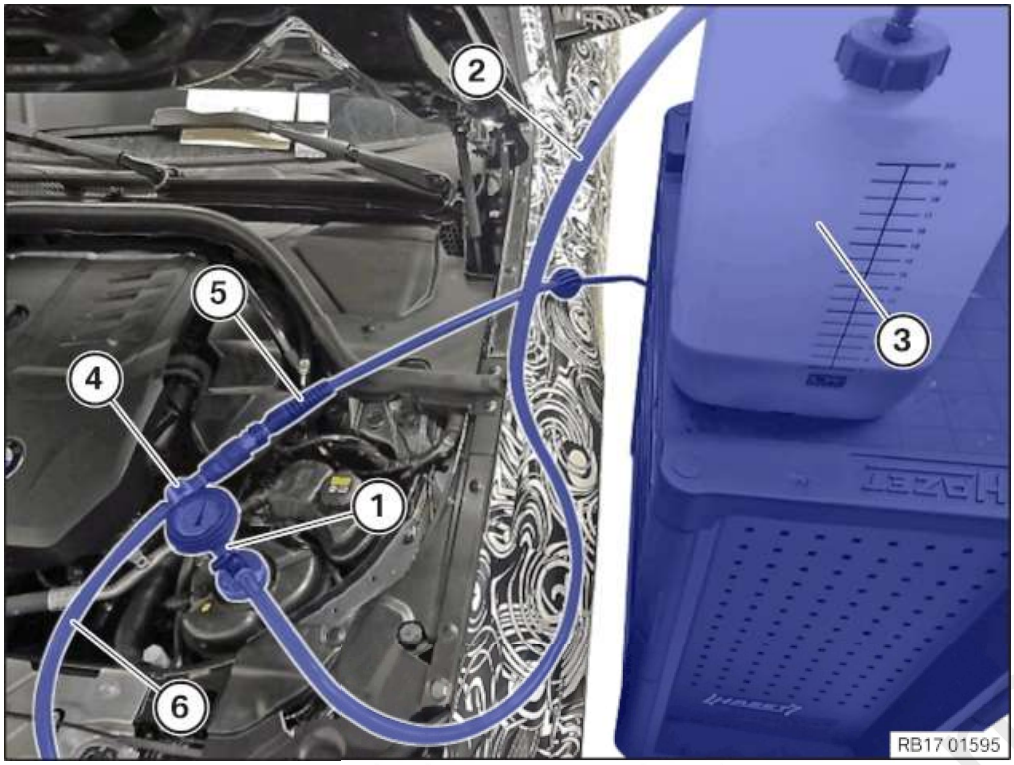


- Close oil filler cap (1).

39 – Fill the high-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

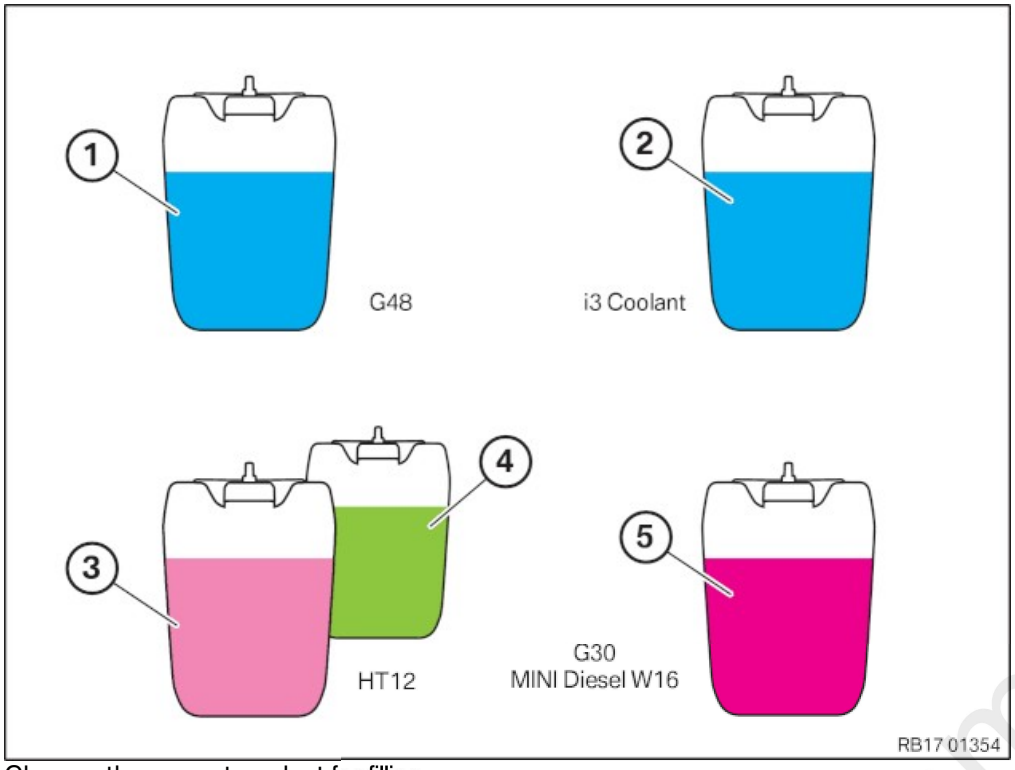
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

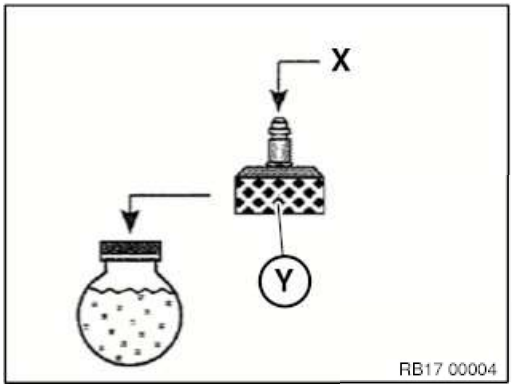
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

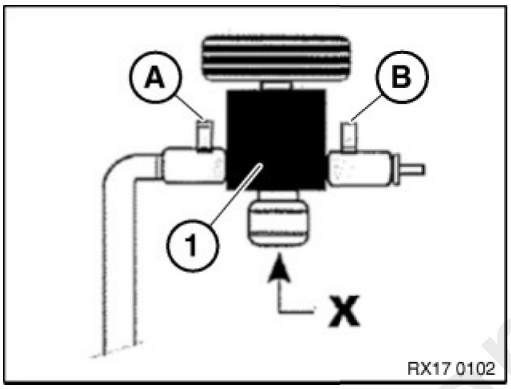
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

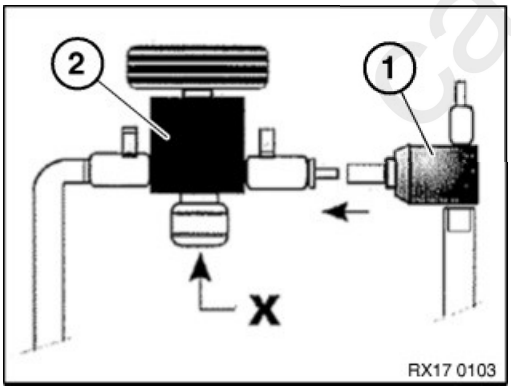
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

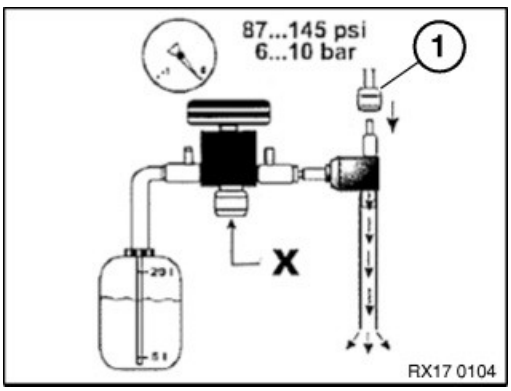


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

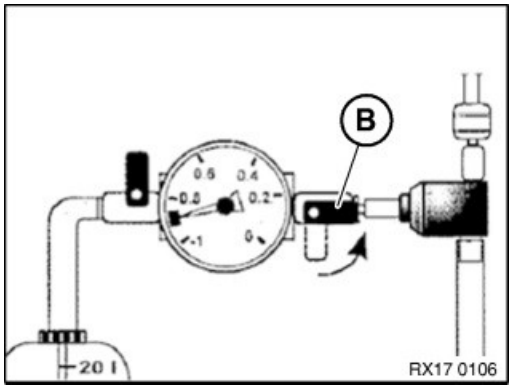
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

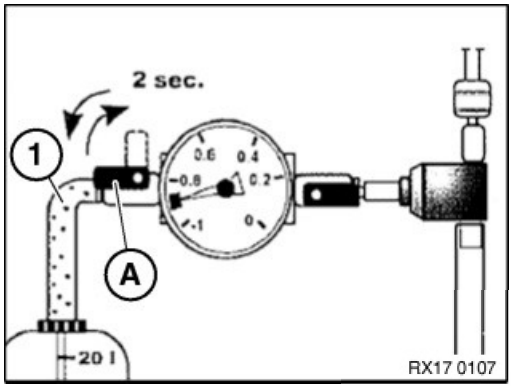
  (X)is the connection on the coolant expansion tank.

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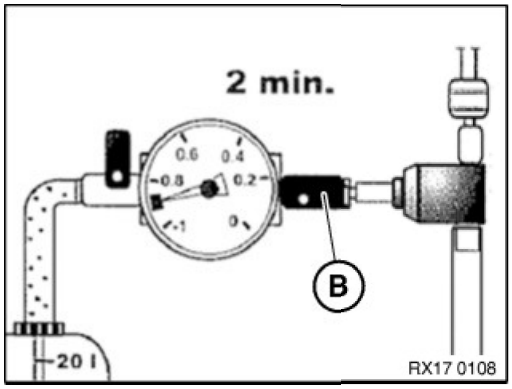
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

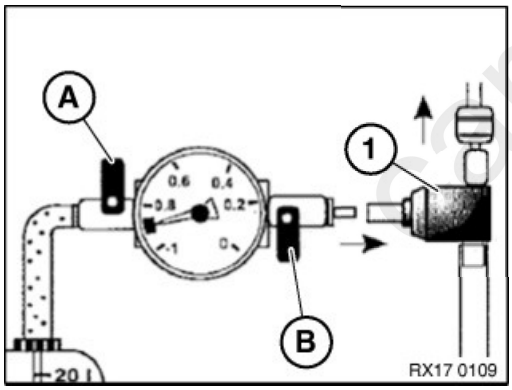


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

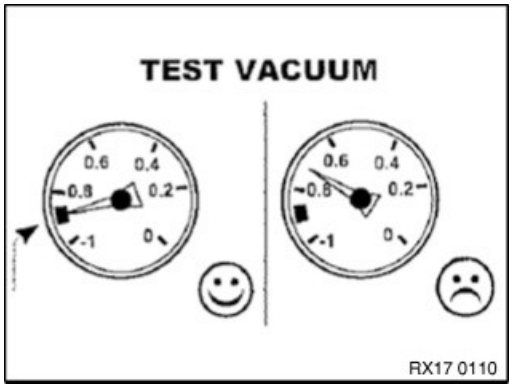
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

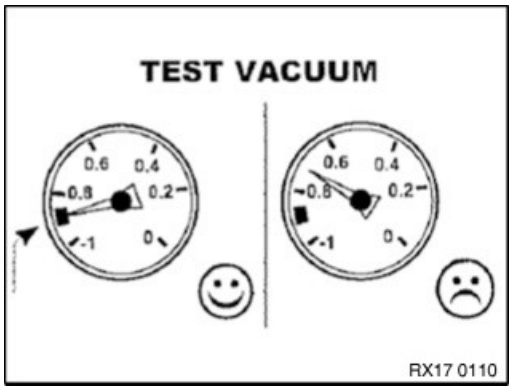
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



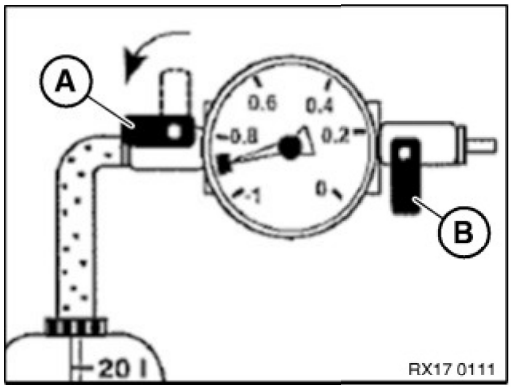
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

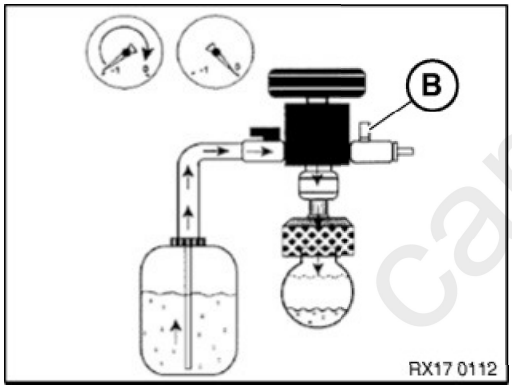
» Vacuum remains constant.

Measure

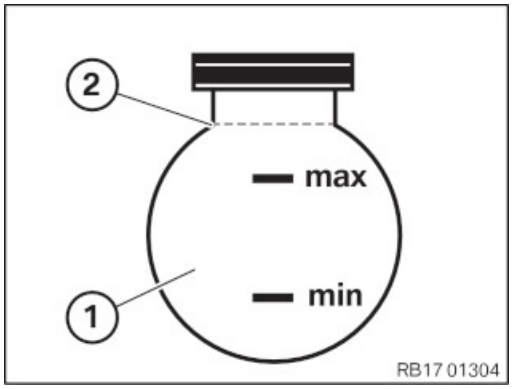
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).

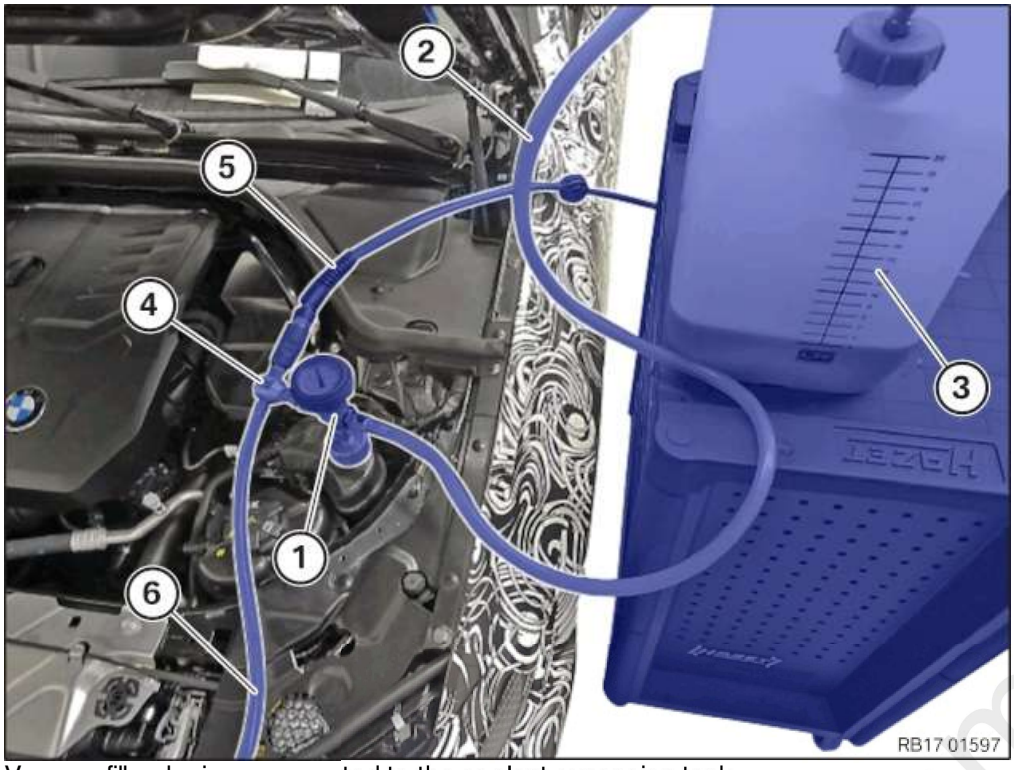


- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

40 – Filling the low-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

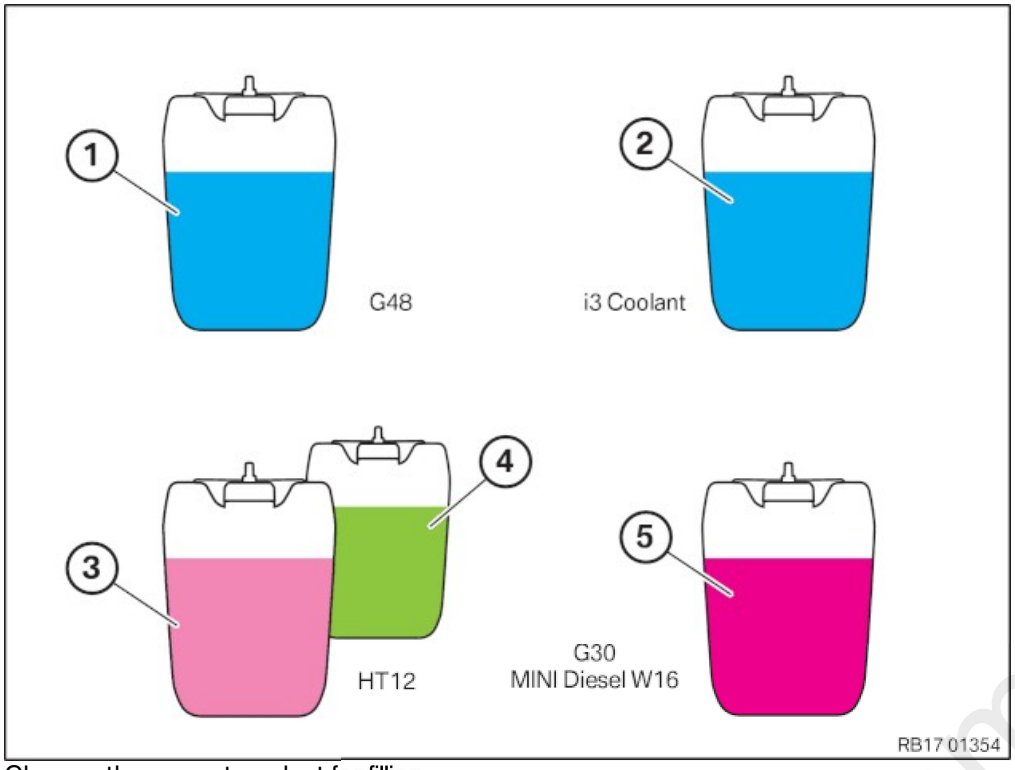
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

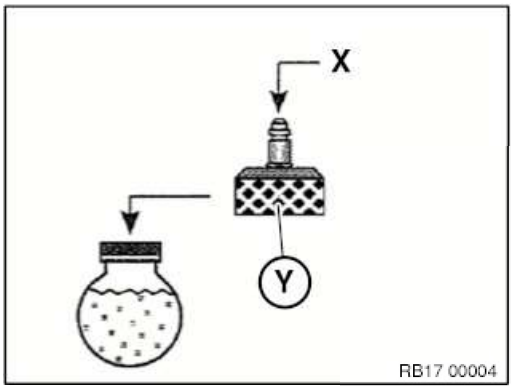
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

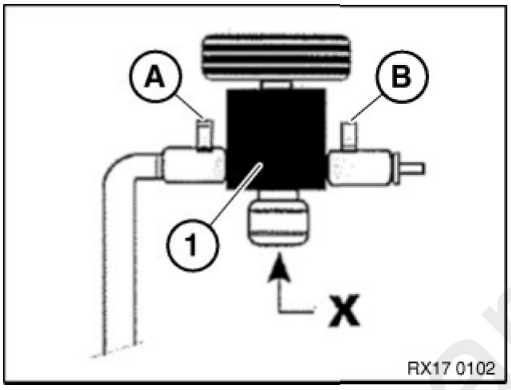
Capacity of low-temperature coolant circuit G20

B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

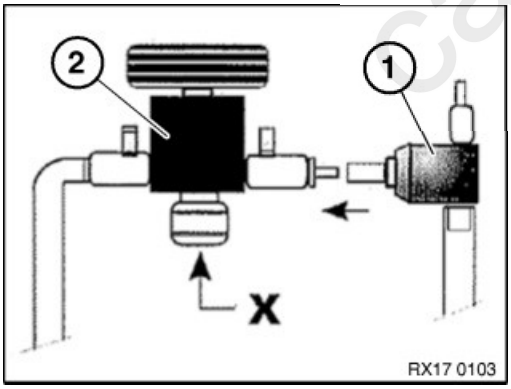
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

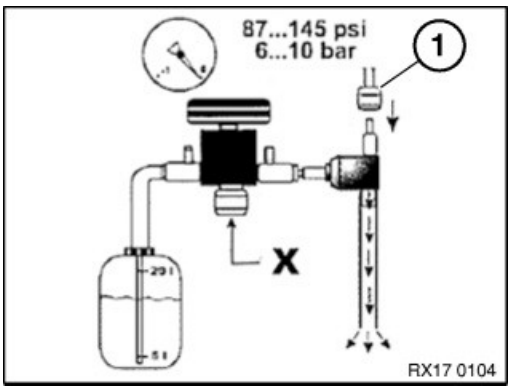


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

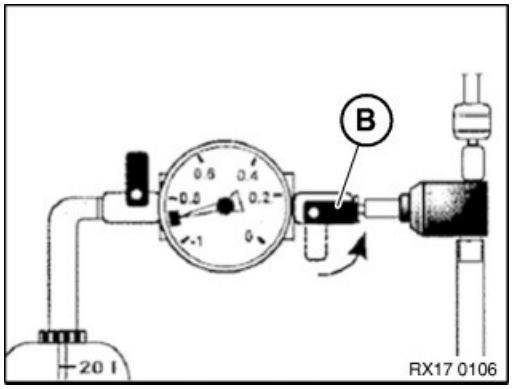
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

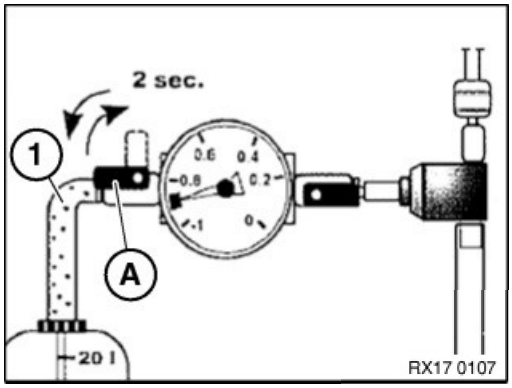
  (X)is the connection on the coolant expansion tank.

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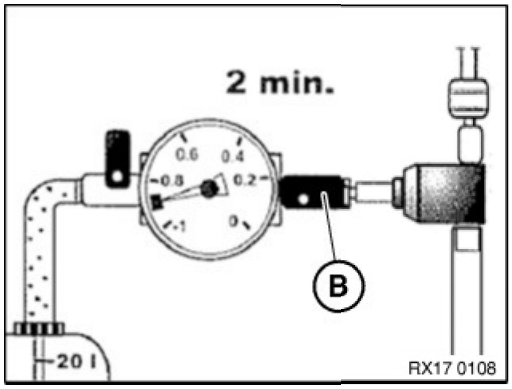
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

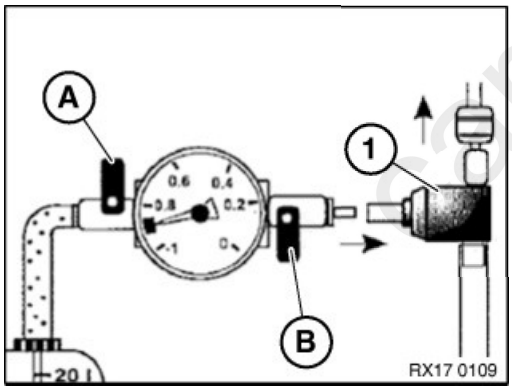


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

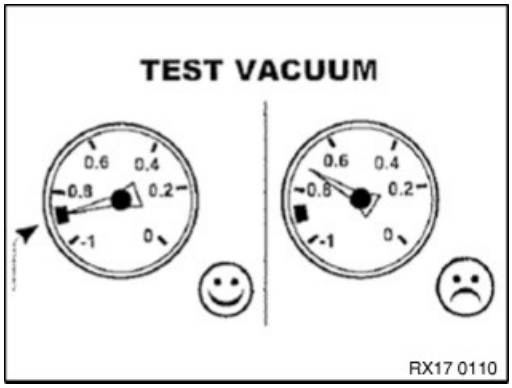
TECHNICAL INFORMATION

The coolant hoses contract during vacuum build-up.

- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).



Check

- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

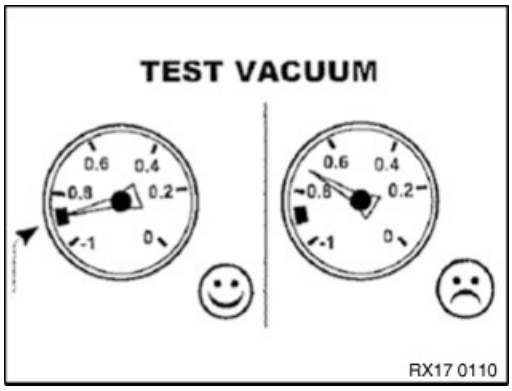
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



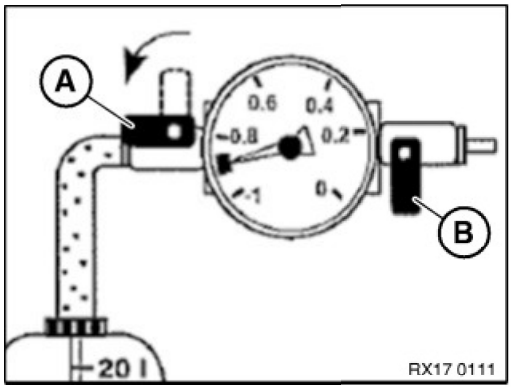
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

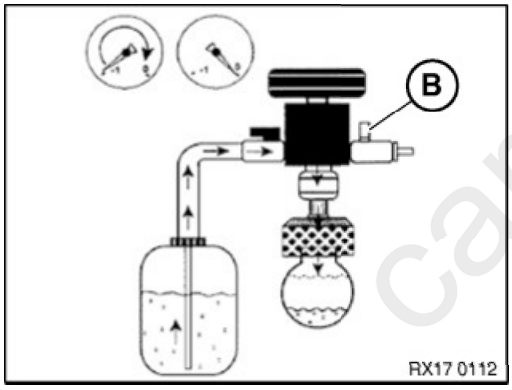
» Vacuum remains constant.

Measure

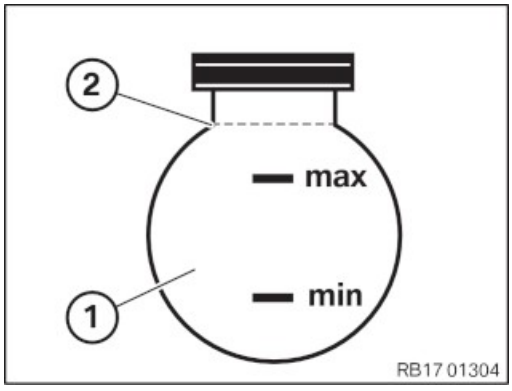
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

41 – Disconnecting all battery earth leads

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- See additional information.

42 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

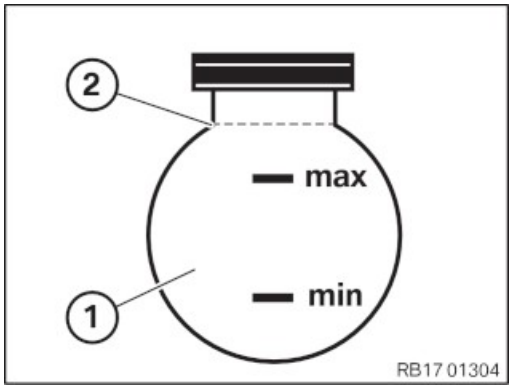
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

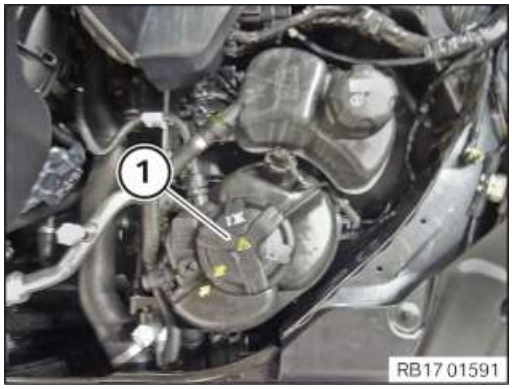
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

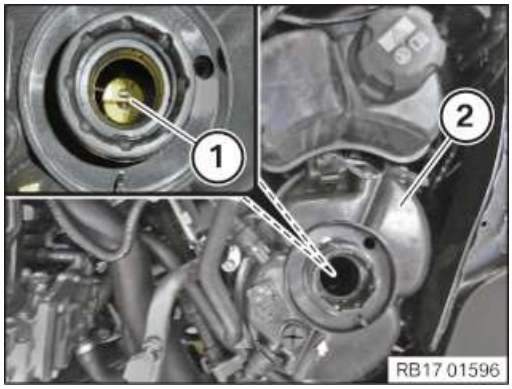
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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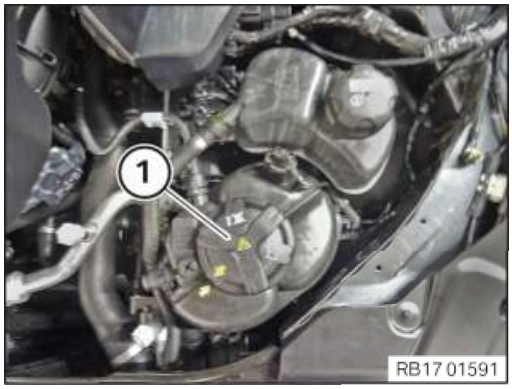
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

43 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

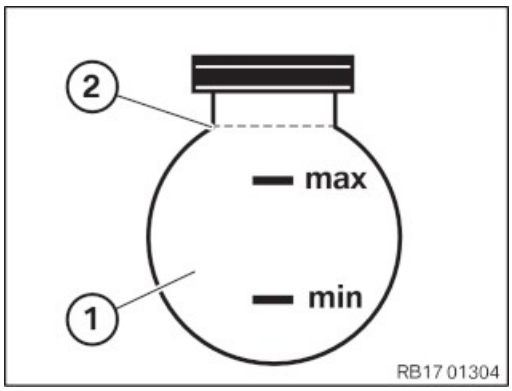
Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

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TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

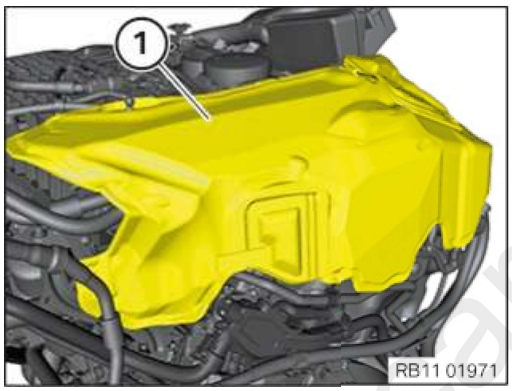
The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

44 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

45 – Installing acoustic cover at rear



- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

46 – Install acoustic cover

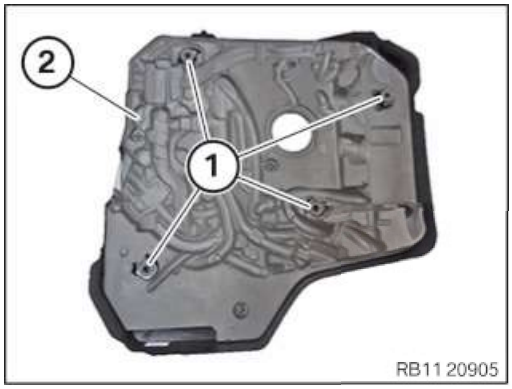
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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



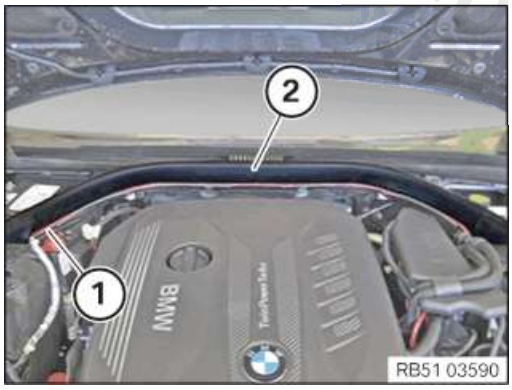
- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

47 – Install the seal for the bonnet



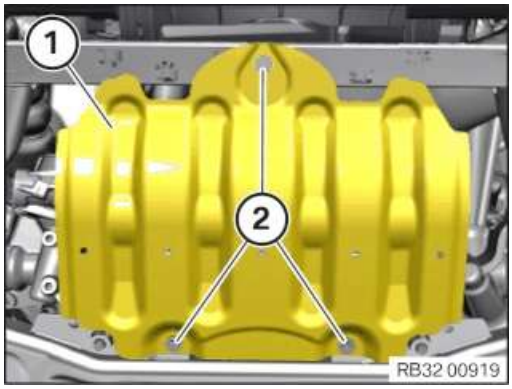
- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

48 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

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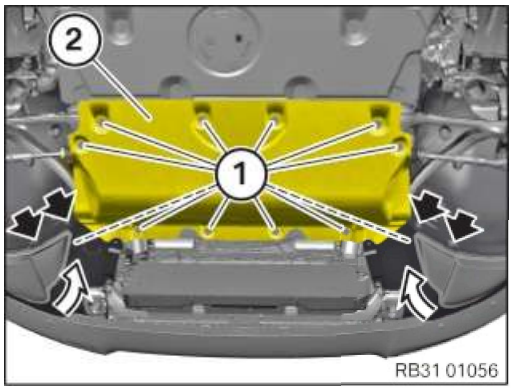


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

49 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

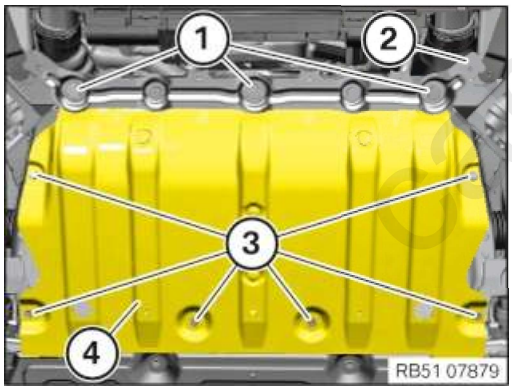
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

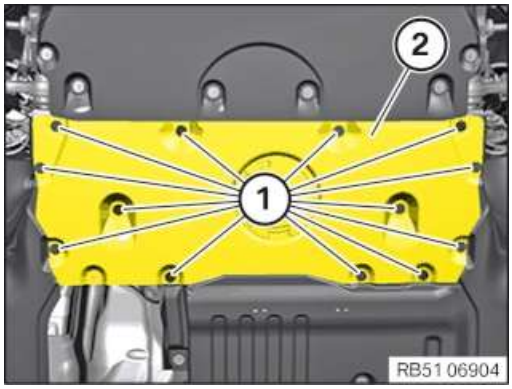
- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

50 – Installing the centre underbody protection

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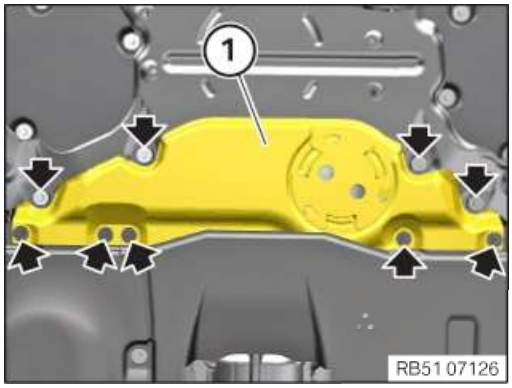
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

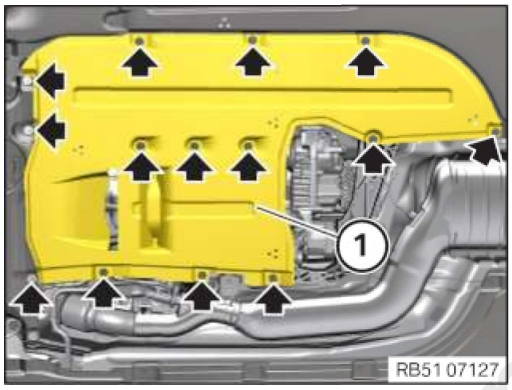
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

51 – Installing underbody protection at rear



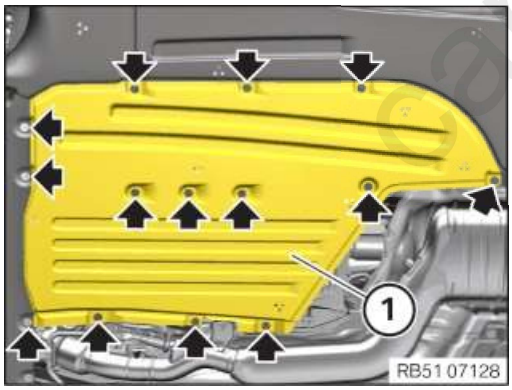
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

  Insert and install the rear underbody protection (1).

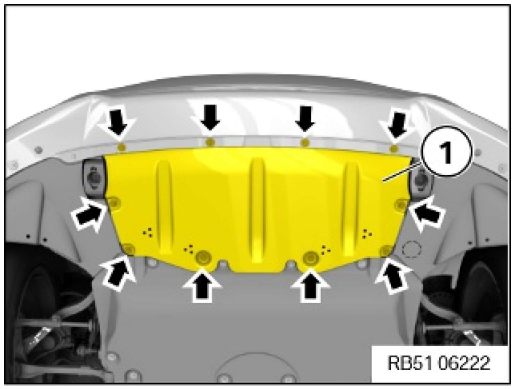
  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

52 – Installing the front underbody protection

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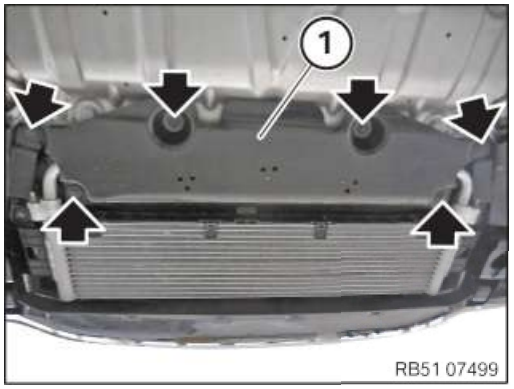
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



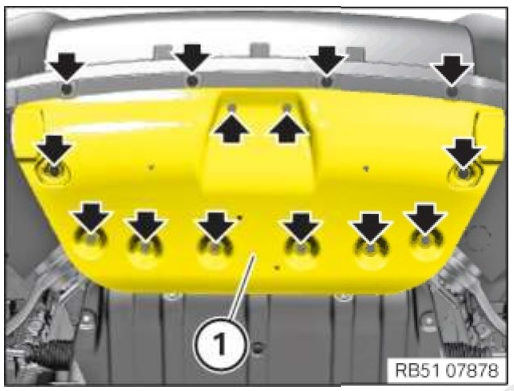
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Oil drain plug — Used in step 14

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Cover, front bottom on side — Used in step 21

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Hydraulic valve to crankcase — Used in step 27

M6 x 18		Tightening torque	8 Nm

Full-flow oil filter to crankcase — Used in step 28

M6	Observe tightening sequence.	Jointing torque	4 Nm
		Tightening torque	10 Nm

Manifold support to crankcase — Used in step 28

M6x16		Tightening torque	8 Nm

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Positive battery cable to the alternator			Used in step 28
M8		Tightening torque	19 Nm

Oil filter cover to oil filter module			Used in step 29
O-ring lightly oiled.		Tightening torque	25 Nm

Intake plenum to cylinder head			Used in step 30
M6		Tightening torque	10 Nm

Intake plenum to support			Used in step 30
M6X25		Tightening torque	8 Nm

Throttle body to holder			Used in step 30
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 30
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body			Used in step 30
M6		Tightening torque	8 Nm

Control unit holder on spring strut dome			Used in step 32
Hexagon screw		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 36
Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support			Used in step 48
M10		Tightening torque	56 Nm

Underbody protection of the steering gear			Used in step 49
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 49
Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support			Used in step 49
M10		Tightening torque	56 Nm

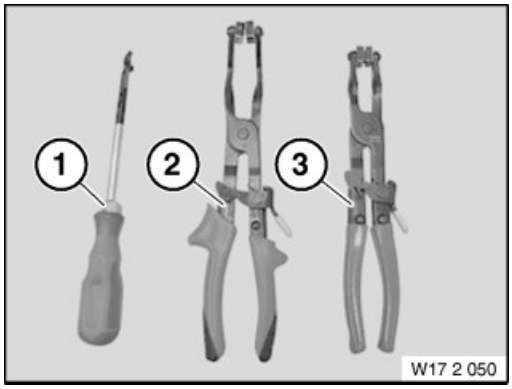
Underbody protection			Used in step 5051
Hexagon screw		Tightening torque	3 Nm

Underbody protection front			Used in step 52
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

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0 495 794 (17 2 050) Pliers



Common Used in step 2430

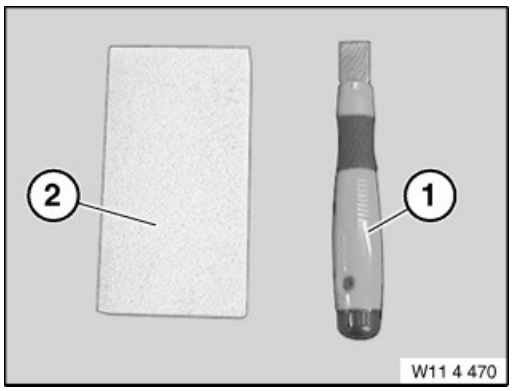
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 495 102 (11 4 470) Tool



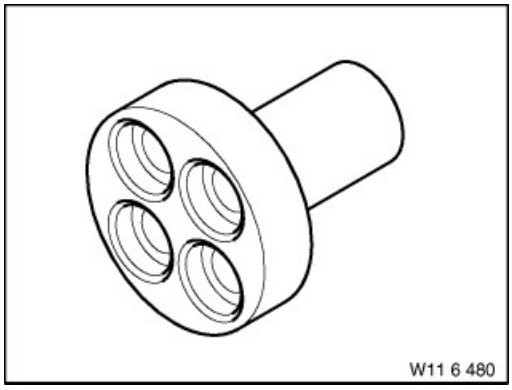
Common	Used in step 28
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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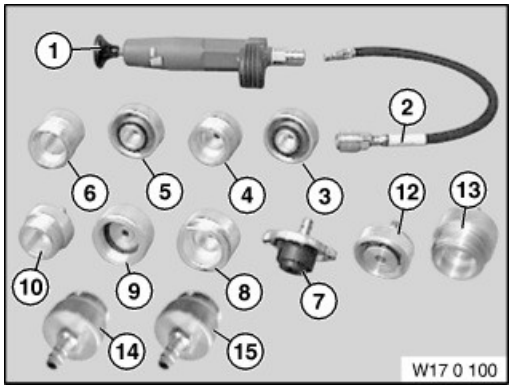
0 493 380 (11 6 480) Connector



Common	Used in step 28
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

0 494 417 (17 0 100) Tester

Common	Used in step 3940
Usage	For checking engine cooling system on watertightness. For checking radiator cap.



Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	

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14	0 495 889 (17 0 115)	**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Engine oil B48B20O1/B46B20O1	Used in step 37
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil	Used in step 37
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Capacity of high-temperature coolant circuit G20	Used in step 39
B48B20O1/B46B20O1	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Capacity of low-temperature coolant circuit G20	Used in step 40
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

General repair instructions	**Used in step**
12 00 ... Instructions for removal and replacement of control units	534

Repair instructions	**Used in step**
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	141
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	141
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141

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61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 20 900 Disconnecting and connecting battery earth lead	141
61 35 ... Notes on ESD protection (Electro Static Discharge)	56102633
61 35 ... Notes on ESD protection (Electro Static Discharge)	10
61 00 730 Encode/program control unit(s) (after vehicle test)	34
17 00 ... Notes for working on cooling system.	3940

Operating materials	Used in step
3.0 Technically appropriate engine oils for BMW Group engines	37

Operating materials	Used in step
Main group 17	3940

Parts

Parts required

Designation	Used in step
Seals, oil filter element to full-flow oil filter and to oil filter cover	29
Seal, oil filter cover to full-flow oil filter	29

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This documentation refers to special tools that were not yet available when going to press.

11 41 000 Removing and installing/replacing oil pump

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WARNING

Motor vehicle may slip off the vehicle hoist where components are supported.

Danger! Life-threatening injuries!

- Secure the vehicle hoist against lowering and lifting.

WARNING

Vehicle may slip off the vehicle hoist if the vehicle hoist is handled incorrectly.

Danger! Life-threatening injuries!

- Observe safety information on raising the vehicle using a vehicle hoist.
- For additional information see: 00 ... Raising the vehicle using a vehicle hoist.

WARNING

Motor vehicle may slip off the vehicle hoist if the weight is distributed unevenly.

Danger! Life-threatening injuries!

- Ensure there is a specific weight compensation on the motor vehicle.

WARNING

Falling or tipping of a heavy component.

Danger! Life-threatening injuries!

- Before lowering or removing the front axle: Secure the engine in mounting orientation.
- For additional information see: 11 00 670 Securing engine in installation position.

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

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1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

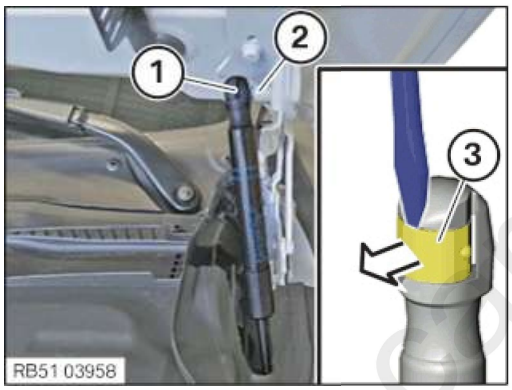
Engine compartment lid is open.

CAUTION

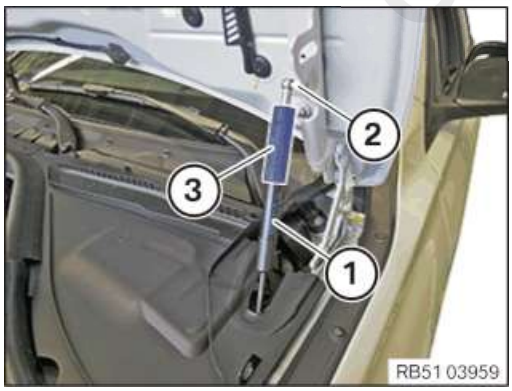
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



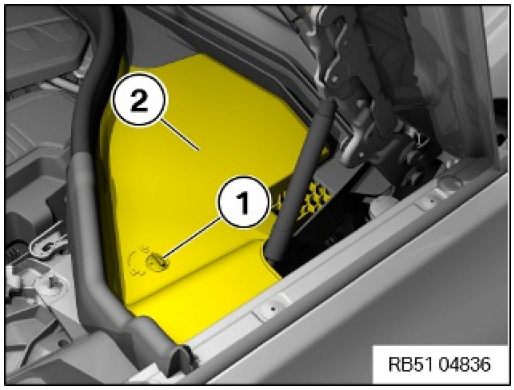
TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

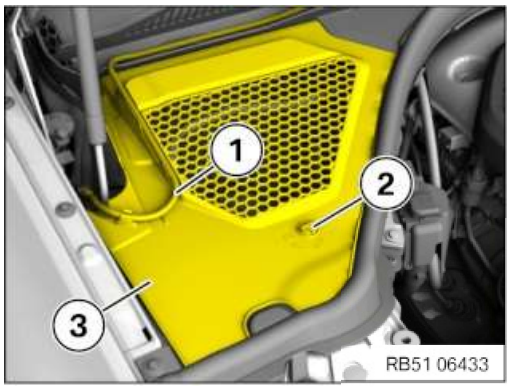
3 – Remove the cover of the engine compartment at the rear left

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- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

4 – Remove the cover of the rear right engine compartment

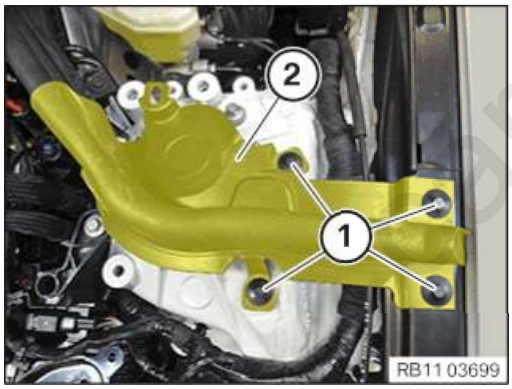


- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

5 – Removing side bonnet gaskets

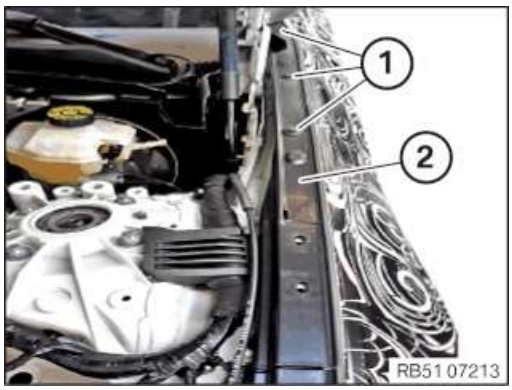
NOTICE

Perform the operations on the left and right side.



- Loosen the rivet (1).
- Remove side bonnet seal (2) from spring strut dome.

6 – Remove sealing of the side panel



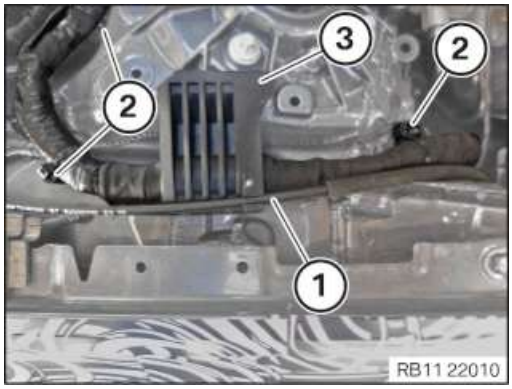
NOTICE

Description is for left component only. Procedure on the right side is identical.

- Loosen the expanding rivet (1).
- Guide out seal (2) and remove.

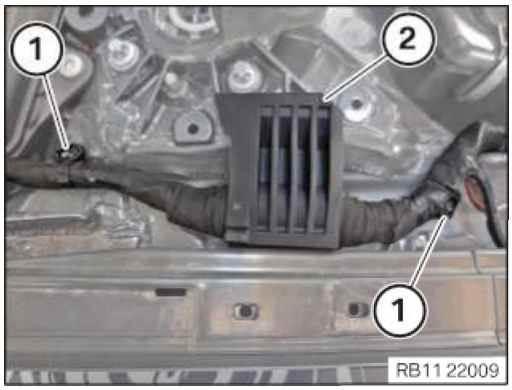
7 – Partially loosen the wiring harness section on the spring strut dome

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- Feed out the cable (1) of the front flap and set it aside.
- Loosen clamps (2).
- Feed out wiring harness section (3) on the spring strut dome on left and set it aside.

8 – Releasing the wiring harness section on the right spring strut dome



- Loosen clamps (1).
- Guide out wiring harness section (2) on the right spring strut dome and set it aside.

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing the clean air pipe with the resonator

WARNING

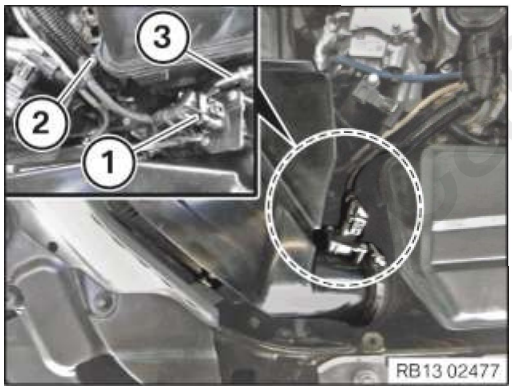
Hot surfaces.

Risk of burning!

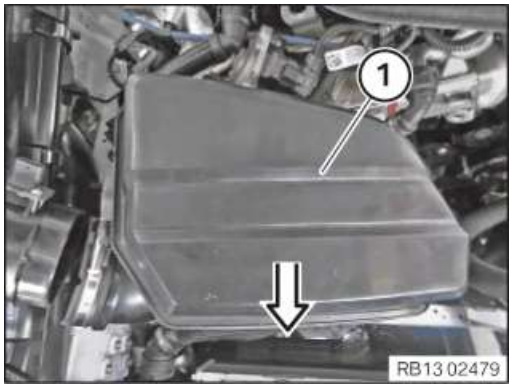
- Perform all work only on components that have cooled down.



- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

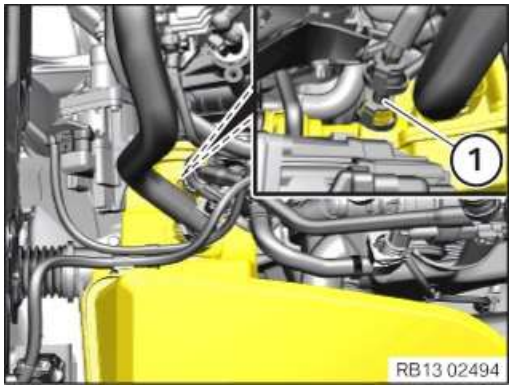


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

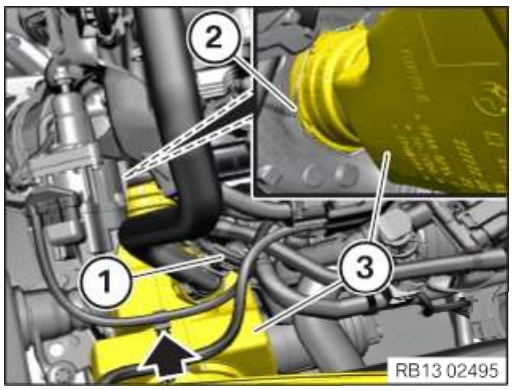


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

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- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

11 – Removing both front wheels

▸ **Removing the wheel**



- In vehicles with M Carbon ceramic brake: The wheel assembly jack must be used to remove the wheel (see workshop equipment).

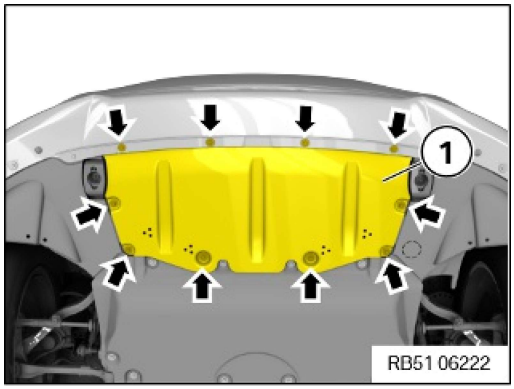
  This process is intended to prevent damage to the brake disc.



- If several wheels are removed simultaneously: Use a piece of chalk to mark on each tyre the axle and side on which the corresponding wheel is fitted.
- Release the wheel bolts (arrows) crosswise and remove the wheel.
- To release and tighten wheel bolts with a security code: Use a suitable adapter from the tool set .

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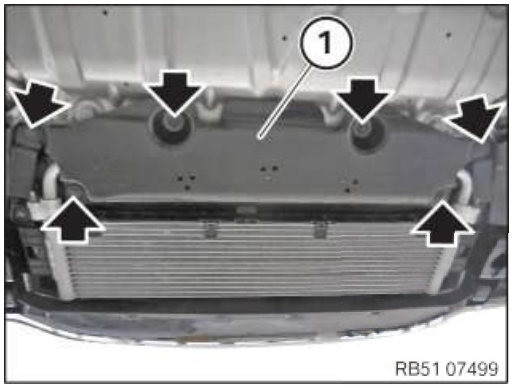
12 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

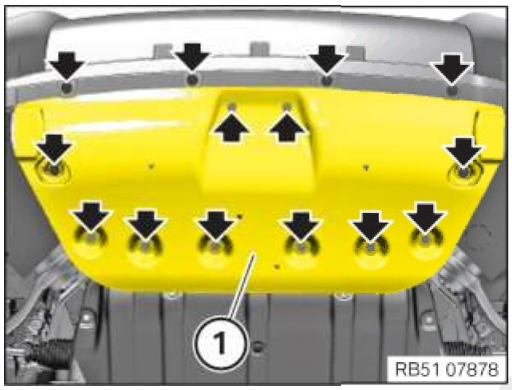
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

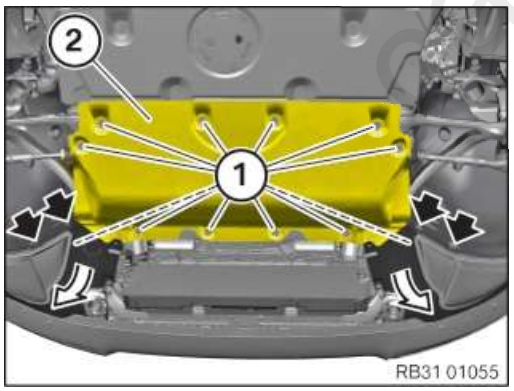


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

13 – Remove the underbody protection of the steering gear



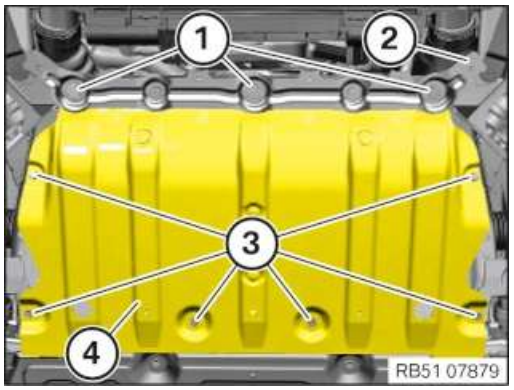
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

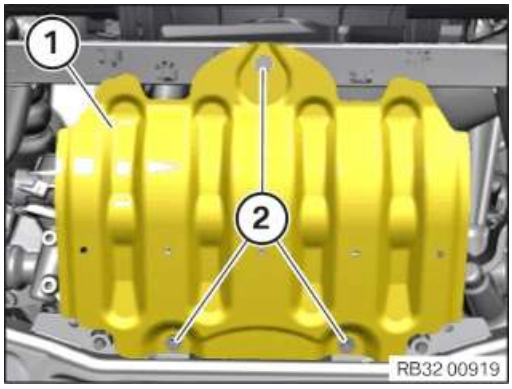
  Slide the steering gear underbody protection (4) out and remove.

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14 – If installed: Removing the steering start protection

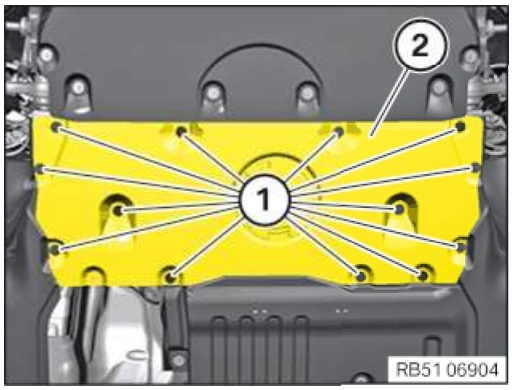
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

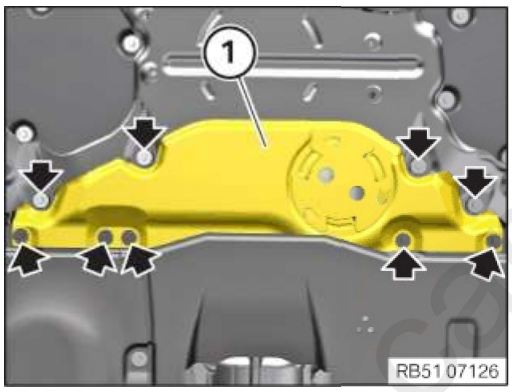
15 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

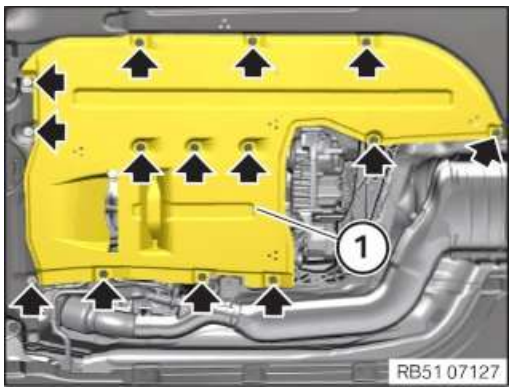


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

16 – Remove rear underbody protection

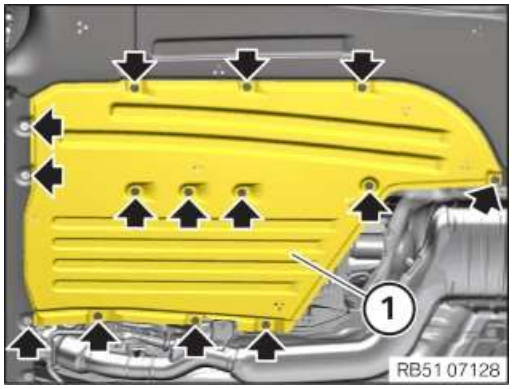


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

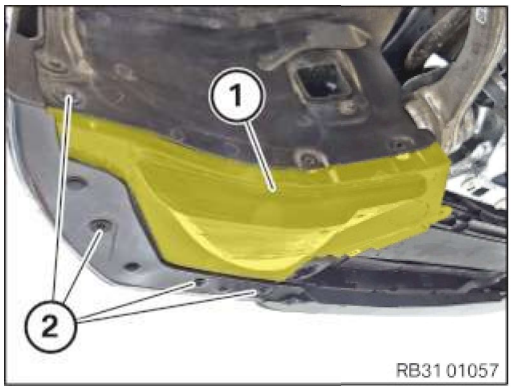
  Guide out rear underbody protection (1) and remove it.

17 – Removing the bottom left and right wheel arch cover

NOTICE

Description is for left component only. Procedure on the right side is identical.

▶ **Remove bottom wheel arch cover**

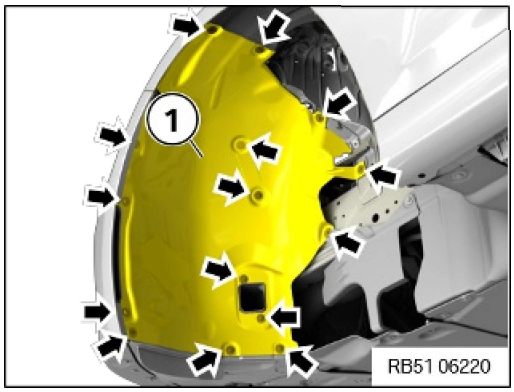


- Loosen screws (2).
- Remove bottom wheel arch cover (1)

18 – Removing the front section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.



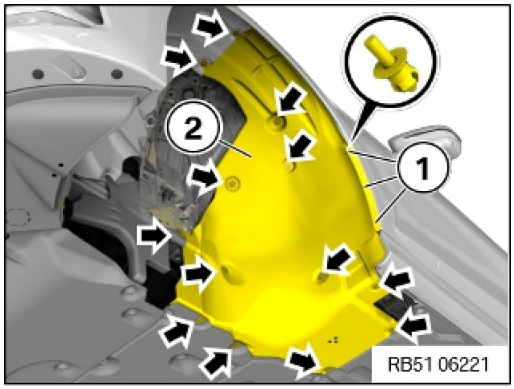
- Remove screws (arrows).
- Remove front section of the front wheel arch cover (1).

19 – Removing the rear section of the front wheel arch cover front

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.

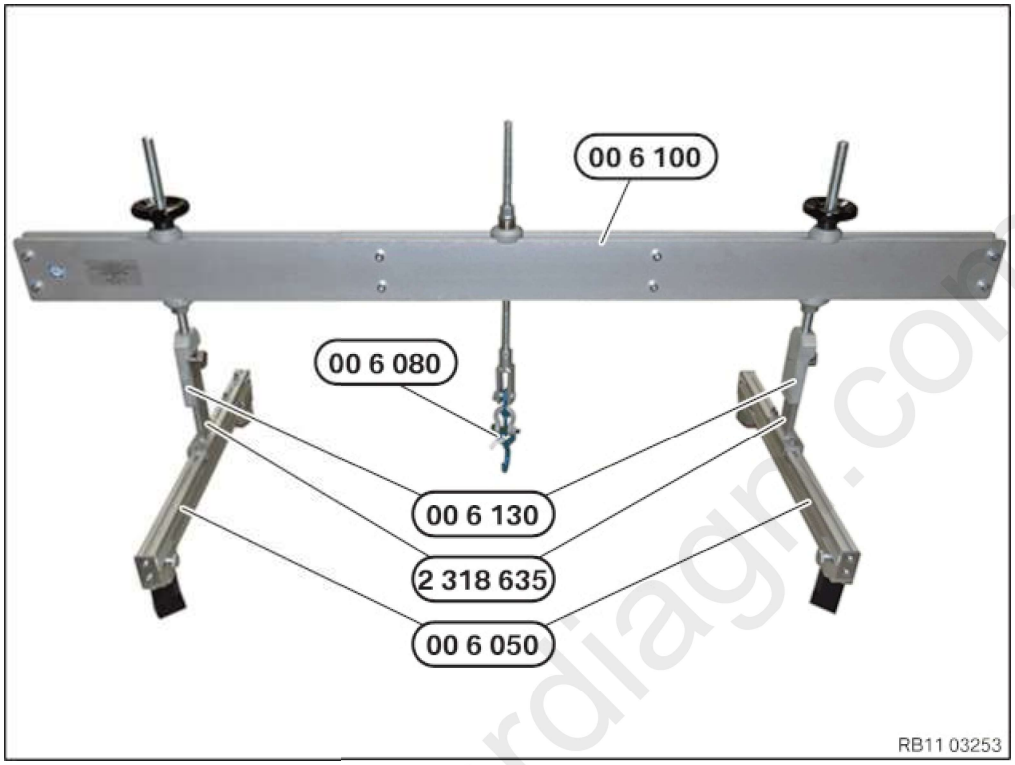
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- Loosen the expanding rivet (1).
- Remove screws (arrows).
- Remove the rear section of the front wheel arch cover (2).

20 – Securing engine in installation position

Overview: Prepared engine bridge



CAUTION

Components connected to the engine joint or cross member.

Danger of injury!

- Check lifting eyes and engine mounting brackets for damage, e.g. cracks.
- Attach the component to correctly mounted engine joints or cross members only.
- Exclusively lift the component, do not move it forwards, backwards or in transverse direction.



- Guide in and position special tool 2 459 012 on cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm

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- **Carefully** position engine bridge (1) with help from an auxiliary person.



- Make sure that special tool on the left is correctly positioned on the lock support.
- Make sure that special tool from the set of special tools , left, rests correctly on the spring strut dome.



- Make sure that special tool on the right is correctly positioned on the lock support.
- Make sure that special tool from the set of special tools , right, rests correctly on the spring strut dome.



- Align the engine bridge by moving it on the profile strips of the special tool above the engine mounting bracket (1) and screw it down.
- Align the hook above the engine mounting bracket (1).
- Connect the hook to the engine mounting bracket (1).



- Check whether the special tool on the right is correctly positioned on the lock support.

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- Check whether the special tool from the special tool kit , right, rests correctly on the spring strut dome.



- Check whether the special tool on the left is correctly positioned on the lock support.



- Check whether the special tool from the special tool kit , left, rests correctly on the spring strut dome.



- Release screw (1) on the left engine mount from the top with a commercially available tool.



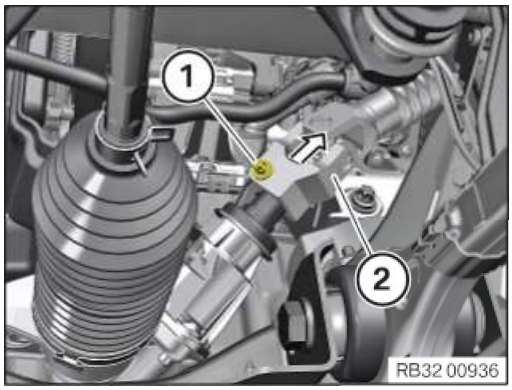
- Release screw (1) on the right engine mount from the top with a commercially available tool.

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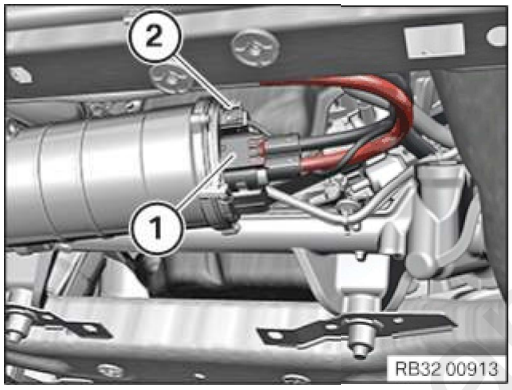
- Raise the engine by turning the special tool 2 361 506 (00 6 103) (spindle) by 10 mm.

21 – Releasing lower steering shaft from steering gear

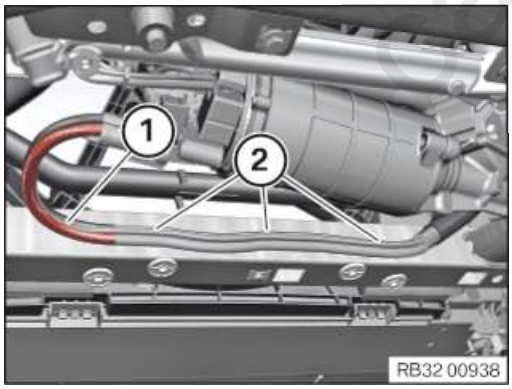


- Loosen screw (1).
- Pull off lower steering shaft (2) from steering gear in direction of arrow.

22 – Detach the wiring harness of the EPS from the front axle support

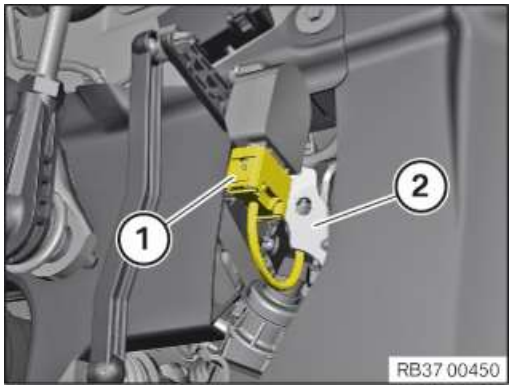


- Unlock and disconnect the plug connections (1) and (2).



- Loosen the holder (2).
- Place wiring harness (1) to one side.

23 – Detach the line connection of the ride height sensor



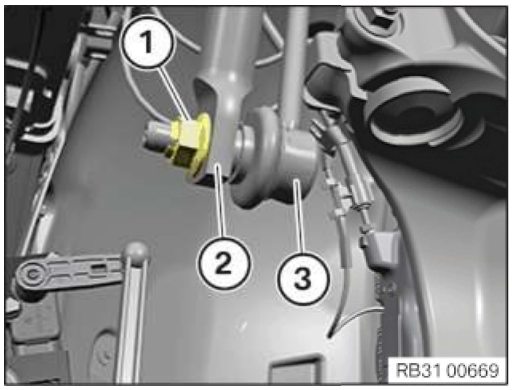
- Unlock plug connection (1) and disconnect.
- Unclip the line from holder (2).

24 – Release the left and right anti-roll bar link from the anti-roll bar

NOTICE

Perform the operations on the left and right side.

▸ **Loosening the anti-roll bar link from the anti-roll bar**



- Loosen nut (1).

Note: Use the Torx socket for counter support.

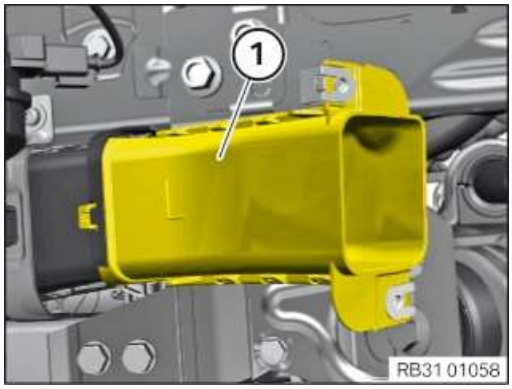
- Loosen the anti-roll bar link (3) from the anti-roll bar (2).

25 – Removing the left and right brake air duct partially

NOTICE

Perform the operations on the left and right side.

▸ **Removing brake air duct partially**



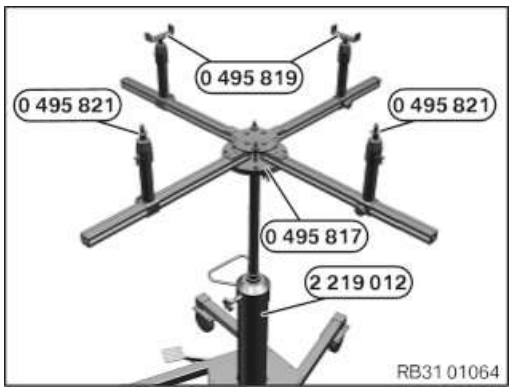
- Unclip and remove air duct (1).

26 – Preparing the special tool

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TECHNICAL INFORMATION

In a profile rail pair, two profile rails are connected to one another by gearing.



- Fit the special tool completely on the universal jack 2 219 012 with the help of an auxiliary person.
- Insert special tools in telescopic supports of a profile rail pair.
- Insert special tools in telescopic supports of other profile rail pair.

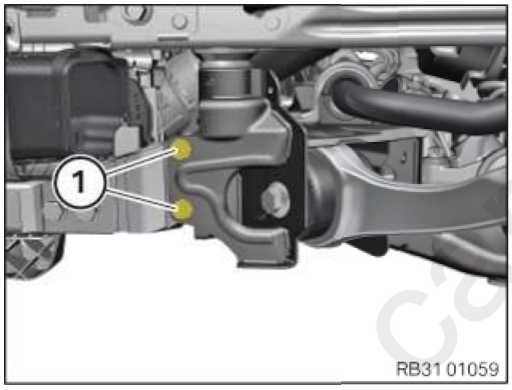
27 – Lower front axle support

WARNING

Falling or tipping of a heavy component.

Danger! Life-threatening injuries!

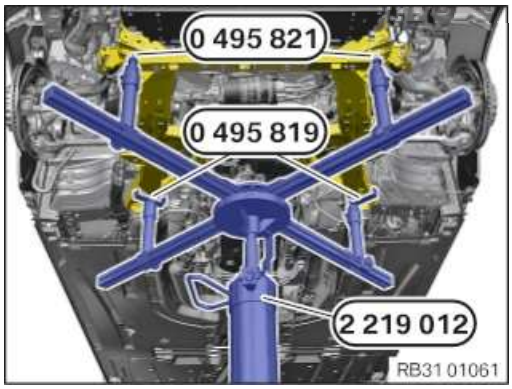
- Before lowering or removing the front axle: Secure the engine in mounting orientation.
- For additional information see: 11 00 670 Securing engine in installation position.



NOTICE

Perform the operations on the left and right side.

- Loosen screws (1).

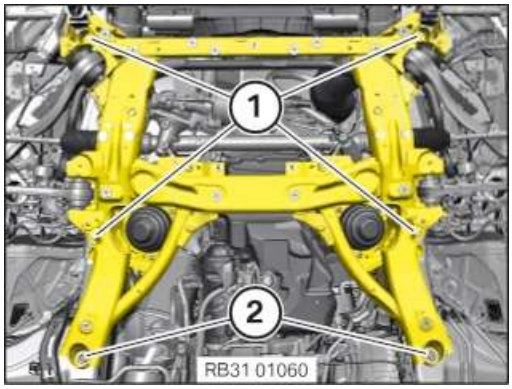


- Position the universal jack 2 219 012 with the special tools and on the front axle support.

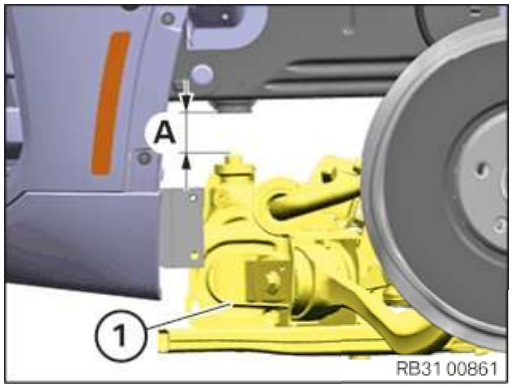
  The centre of gravity of the front axle must be centred over the universal jack 2 219 012 !

- Support the front axle support with the universal jack 2 219 012.

carflash.com



- Loosen screws (1) and (2).



- Lower the front axle support (1) with the universal jack by dimension (A).

  Dimensions (A) = maximum 15 cm

28 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

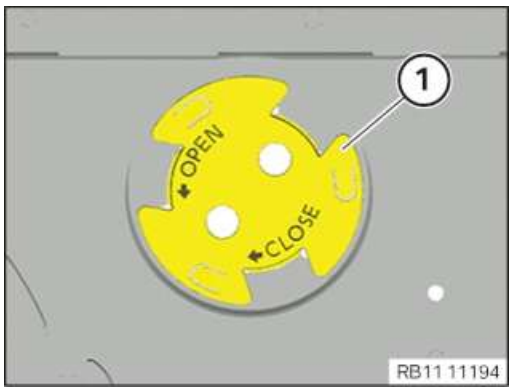
- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

WARNING

Hot surfaces.

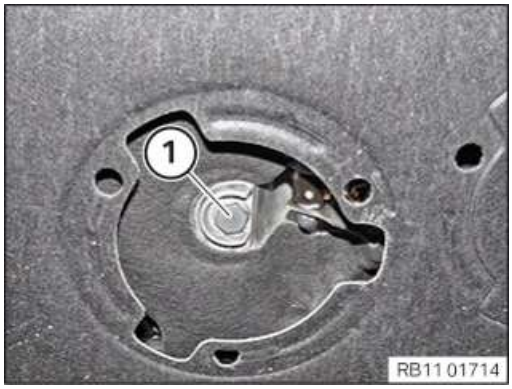
Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).

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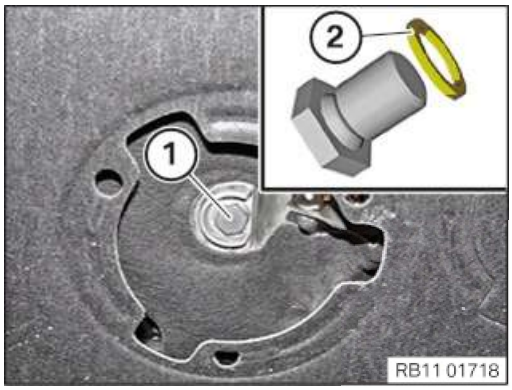
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

29 – Tightening the oil drain plug



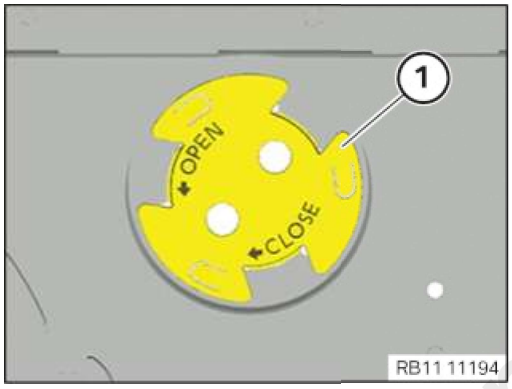
- Renew sealing ring (2).

  Parts: Sealing ring

- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

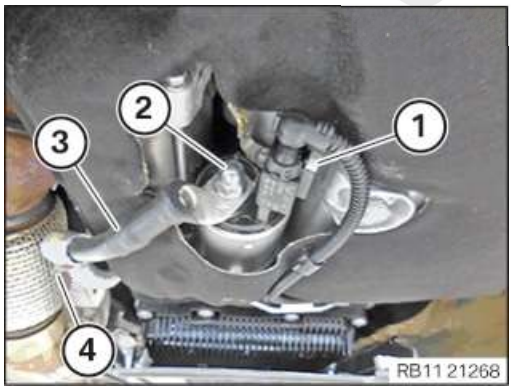


- Install service cap (1).

30 – Removing the acoustic cover of the oil sump

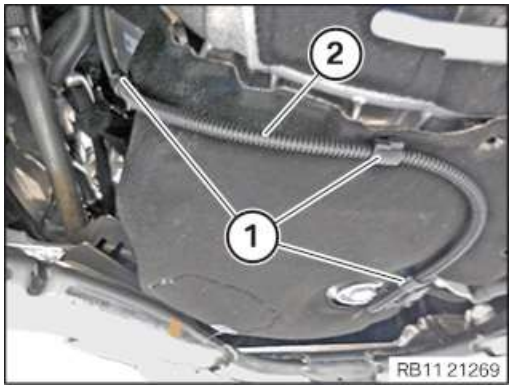
Prerequisite

Disconnect all negative battery cables.

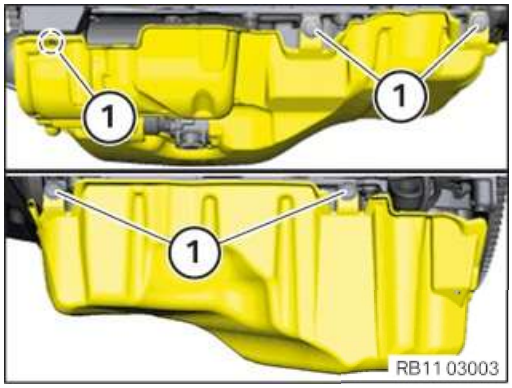


- Unlock and loosen connector (1).
- Loosen nut (2).
- Guide the positive battery cable (3) out of the clamp (4) and lay to one side.

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- Unlock and loosen the clamps (1).
- Guide out the wiring harness section of automatic transmission (2) and set it aside.



- Detach all expanding rivets (1).



- Guide out acoustic cover (1) downwards to the rear and remove it.

31 – Removing starter motor

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

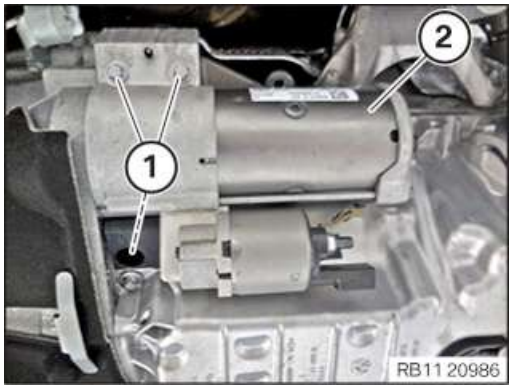
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Loosen screws (1).
- Guide out and remove starter (2).

32 – Remove oil sump

RISK OF DAMAGE

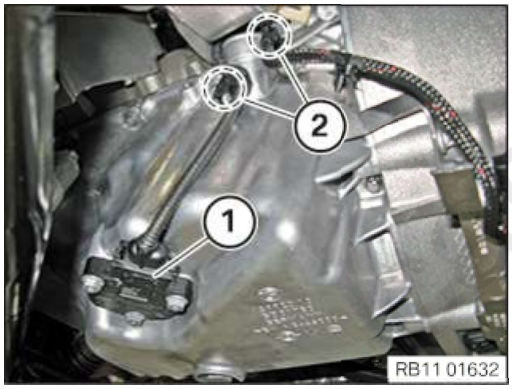
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

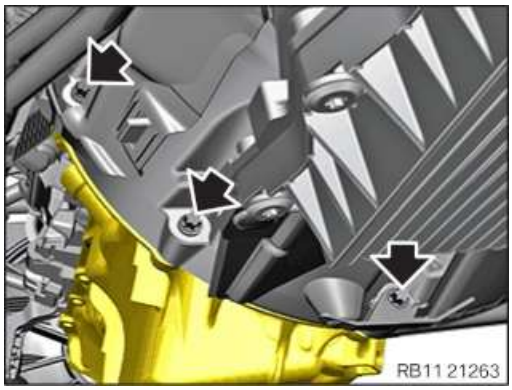
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

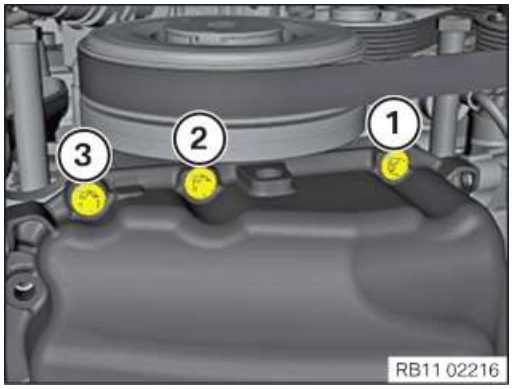
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



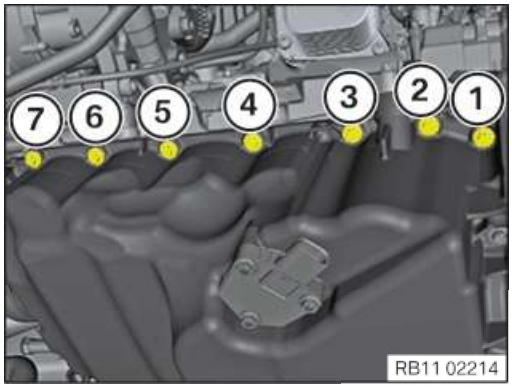
- Unlock and loosen connector (1).
- Release the cable from the clips (2) of the oil sump.



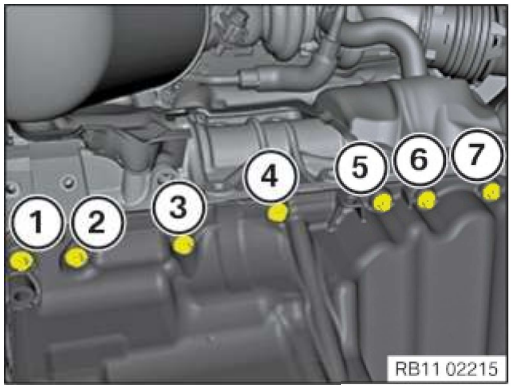
- Unscrew the transmission bolts (arrows).



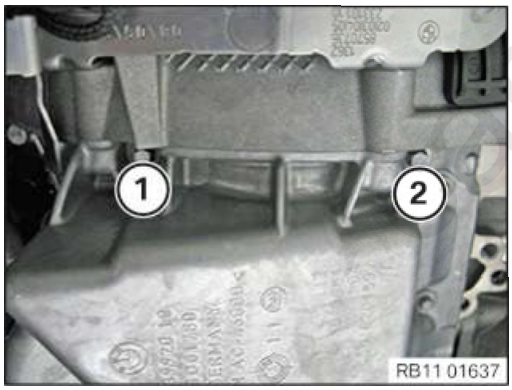
- Loosen screws (1), (2) and (3).



- Loosen screws (1) to (7).



- Loosen screws (1) to (7).



- Loosen screws (1) and (2).



TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump in the **marked** areas using suitable tools (1).

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- Guide out the oil sump (1) downwards to the rear and remove.

MAIN WORK

33 – Remove the oil vacuum pump

RISK OF DAMAGE

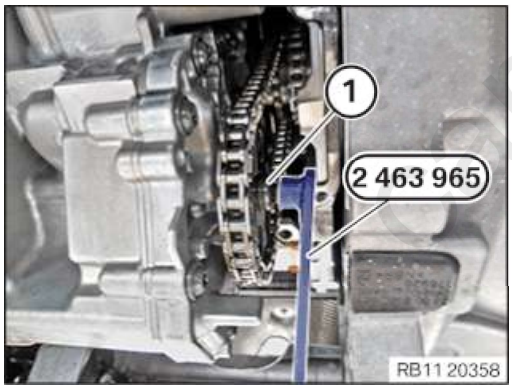
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

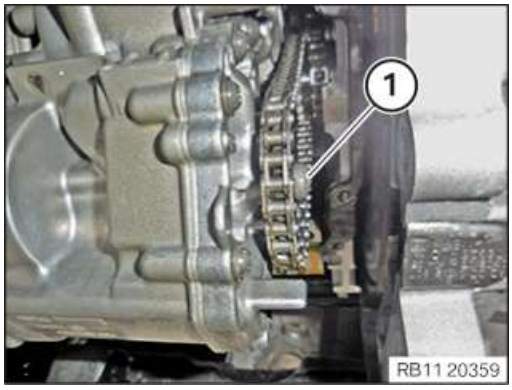
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

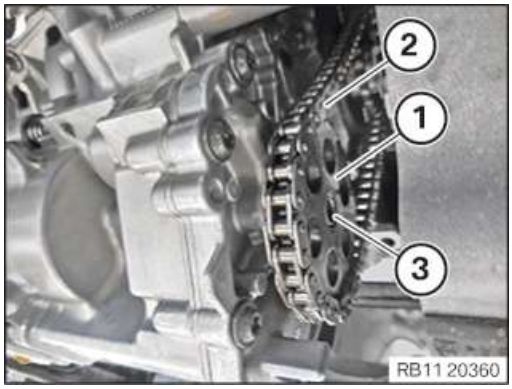
The thread is a left-hand thread.



- Release bolt (1) with the special tool 2 463 965.



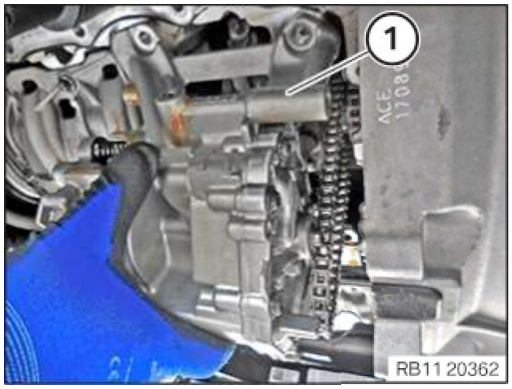
- Thread out the bolt (1) and remove it.



- Detach the camshaft sprocket (1) from the oil vacuum pump (3).
- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.



- Loosen screws (1).



- Feed out the oil vacuum pump (1) and remove it.

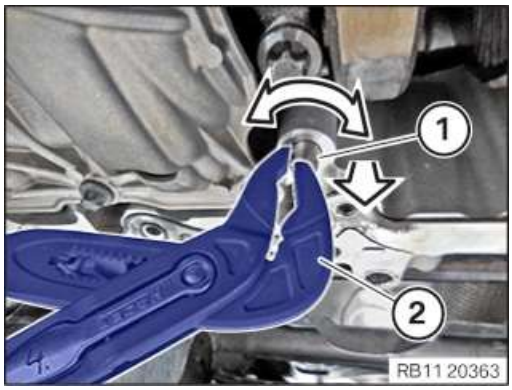
34 – Oil vacuum pump preparation

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



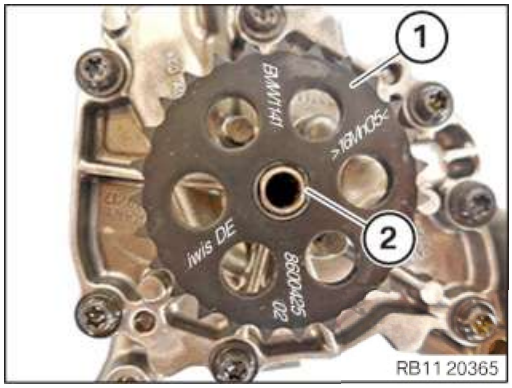
- Remove the centring sleeves (1) in direction of arrow using conventional tools (2).
- Renew the centring sleeves (1).

  Parts: Centring sleeves

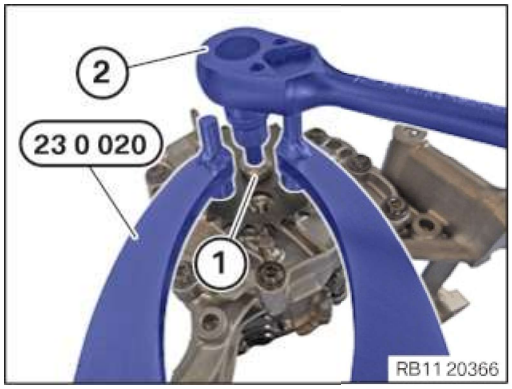
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- Insert and install new centring sleeves (1) on the oil vacuum pump (2).



- Insert and install the camshaft sprocket (1) on the oil vacuum pump (2).
- Make sure the **labelling** on the camshaft sprocket points to the **front**.



TECHNICAL INFORMATION

The thread is a left-hand thread.

- Insert and install the new screw (1).
- Hold camshaft sprocket with special tool 0 491 440 (23 0 020) and tighten screw (1) with conventional tools (2).

Note: Carry out work with a second person assisting.

Camshaft sprocket to oil vacuum pump

M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °

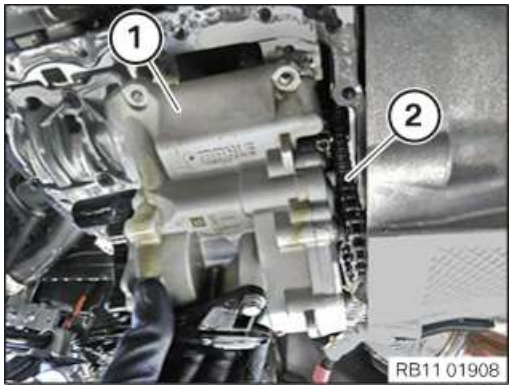


- Make sure the sealing ring (1) is installed correctly.

  The sealing ring (1) must not be damaged or missing.

35 – Install the oil vacuum pump

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- Feed the oil vacuum pump (1) into the drive chain (2) and position it.



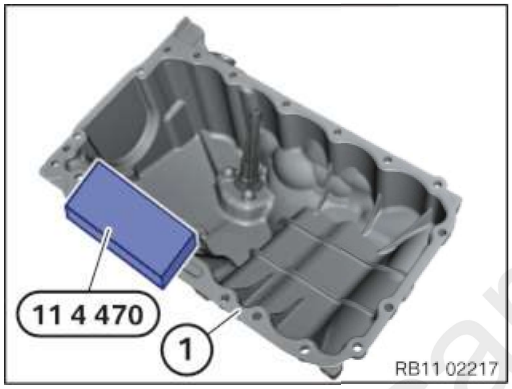
- Tighten the new bolts (1).

Oil vacuum pump to crankcase

M8	Renew screw.	1. Tightening torque 2. Angle of rotation	15 Nm 45 °

POSTPROCESSES

36 – Refitting sump



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the rough seal remains on the sealing surface (1) of the crankcase with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



- Have the special tool ready.



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

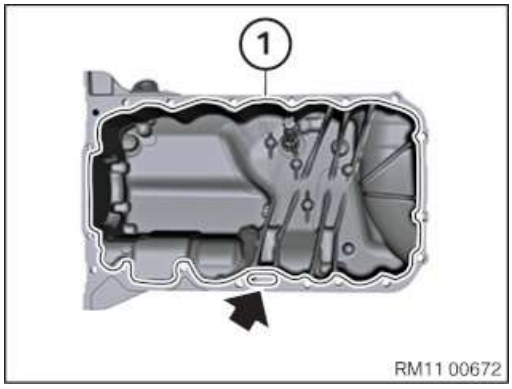
- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)



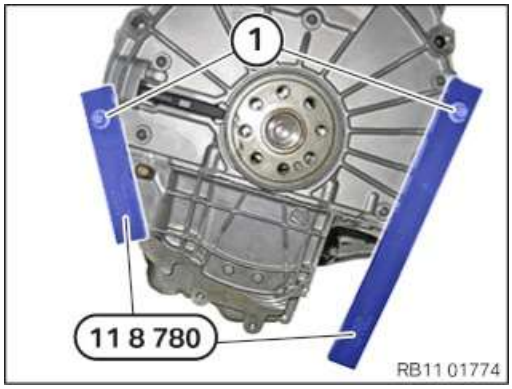
TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound along the line (1) with a thickness of 2 mm to 2.5 mm.

  Apply the sealing compound along the inner edge.
- Completely encircle the oil return orifice (arrow) with the sealing compound.

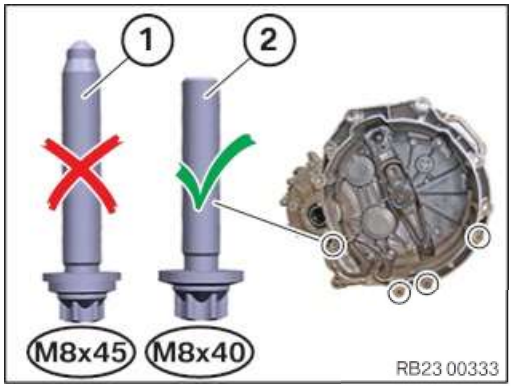
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TECHNICAL INFORMATION

The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with engine block.
- If necessary, renew fitting sleeves.



RISK OF DAMAGE

Component damage caused by incorrect screw length.

The use of screws with the incorrect screw length can damage the component.

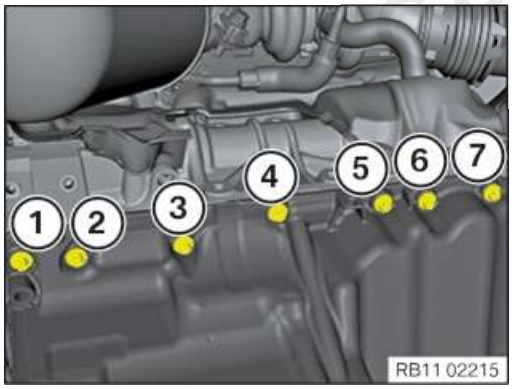
- Check for correct screw length.
- Re-install screws that correspond to the original screw length.

- Ensure that the **correct** screw (2) (M8x40) is used for mounting the oil sump on the transmission.

  The screw (1) (mounting bolt of the starter motor) may **never** be used for mounting the oil sump.



- Install oil sump (1) to top front.
- **Hand-tighten** all oil sump screws but do not tighten completely.

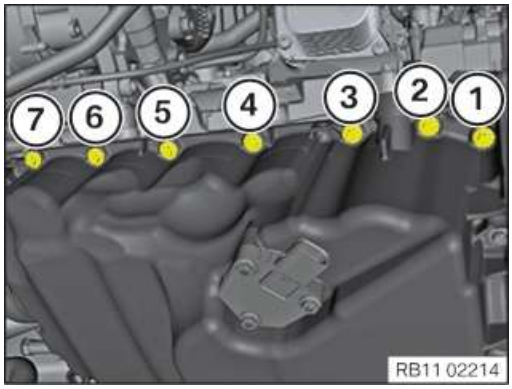


- Tighten the screws (1) to (7).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

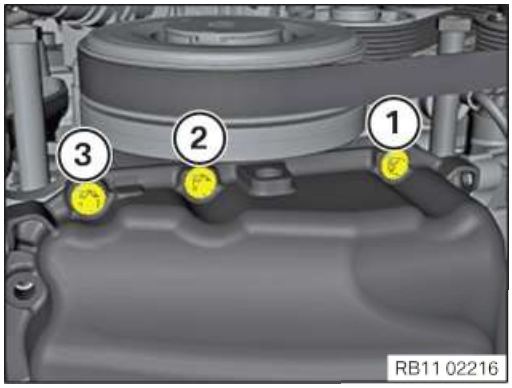
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- Tighten the screws (1) to (7).

Oil sump to crankcase

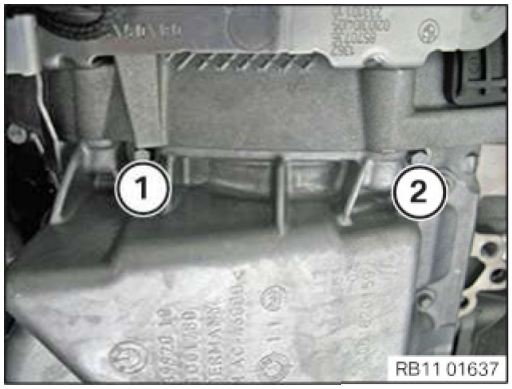
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1), (2) and (3).

Oil sump to crankcase

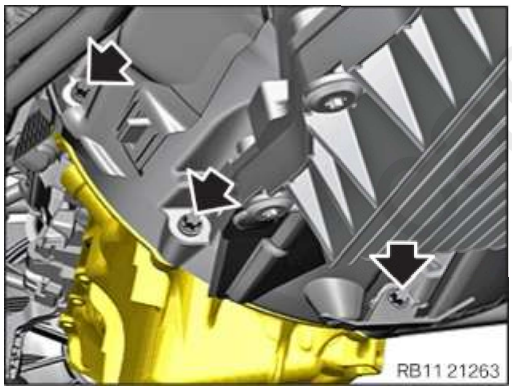
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten down screws (1) and (2).

Oil sump to crankcase

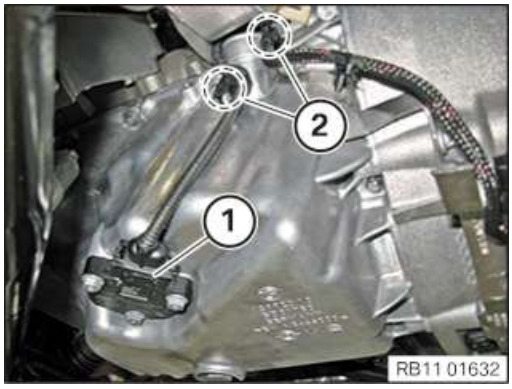
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten transmission screws (1).

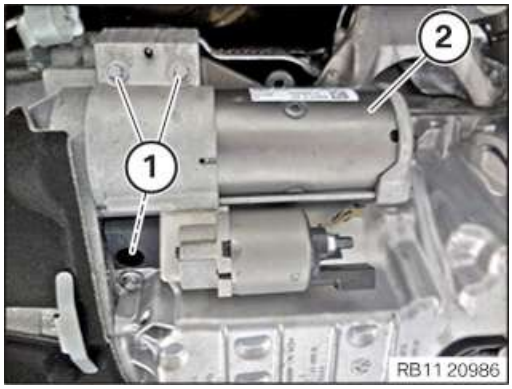
Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm



- Fasten cable on the clips (2) from the oil sump.
- Connect and lock the connector (1).
- Make sure the connector 1 engages audibly.

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- Insert and install the starter motor (2).
- Tighten the screws (1).

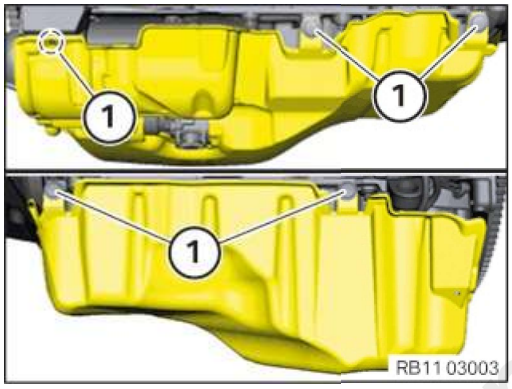
Starter motor to engine

M8X60		Tightening torque	19 Nm

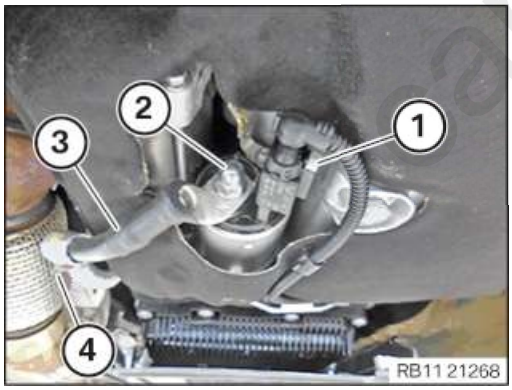
38 – Installing the acoustic cover for the oil sump



- Install acoustic cover (1) to the top front.

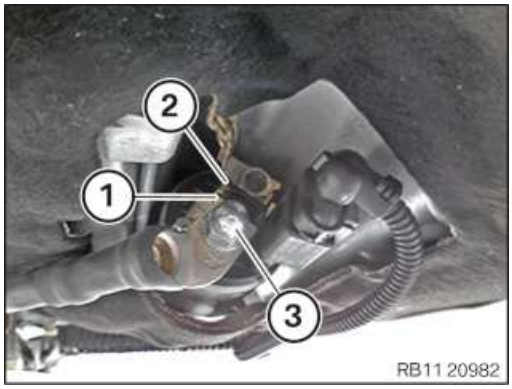


- Secure all expanding rivets (1).



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.
- Insert and install the positive battery cable (3).
- Secure positive battery cable (3) at the clamp (4).
- Tighten the nut (2) hand-tight.

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CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

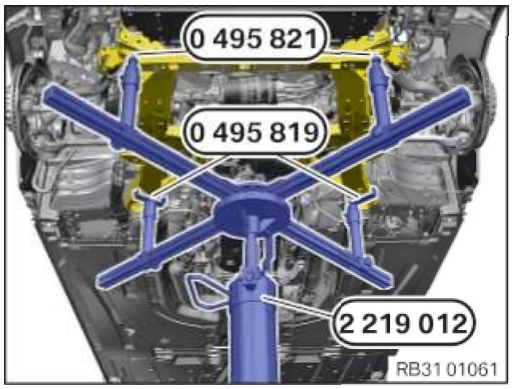
- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

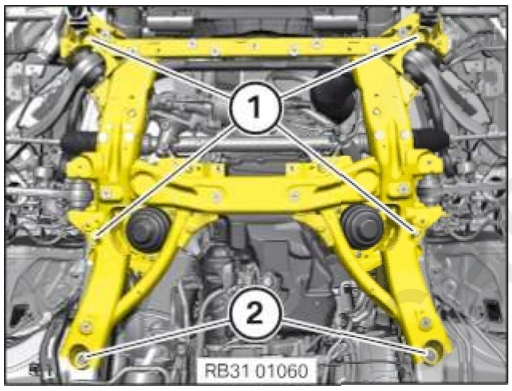
Battery positive lead to starter

M8		Tightening torque	13,5 Nm

39 – Lift front axle support and fasten.



- Carefully lift the front axle support with the universal jack 2 219 012 and position on the body.



- Replace the screws (1).

  Parts: Bolts
- Tighten the screws (1).

Front axle support to front/centre of body

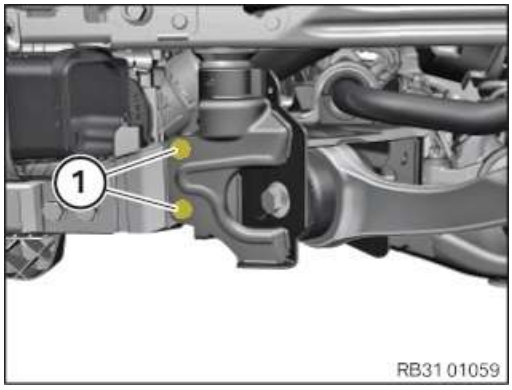
M12	Renew screws.	Jointing torque	108 Nm

- Replace the screws (2).

  Parts: Bolts
- Tighten the screws (2).

Front axle carrier to body, rear

M14	Renew screws.	Tightening torque	175 Nm

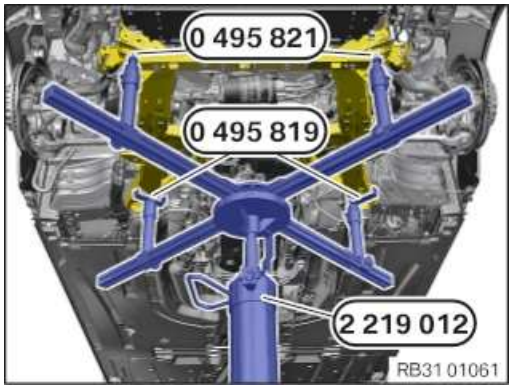


- Position the adapter for the front axle support on the front axle support .
- Tighten the screws (1).

Adapter, front axle support to front axle support

M8x70		Tightening torque	19 Nm

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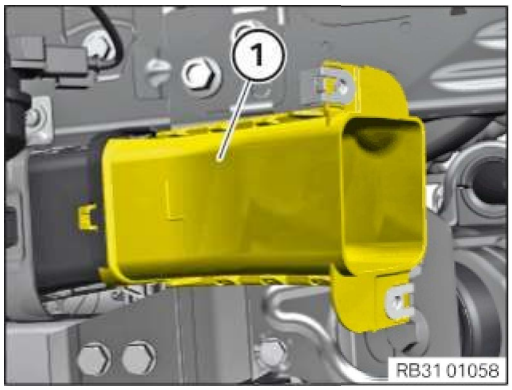
- Lower the universal jack 2 219 012 and place to one side.

40 – Partially installing the left and right brake air duct

NOTICE

Perform the operations on the left and right side.

▸ **Installing the brake air duct partially**



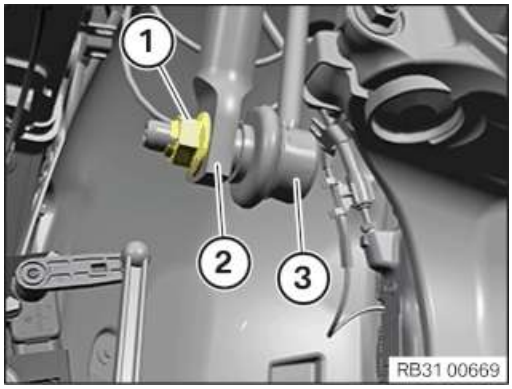
- Position and clip in air duct (1).

41 – Securing the anti-roll bar link to the left and right anti-roll bar

NOTICE

Perform the operations on the left and right side.

▸ **Securing the anti-roll bar link to the anti-roll bar**



- Position the anti-roll bar link (3) on the anti-roll bar (2).
- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

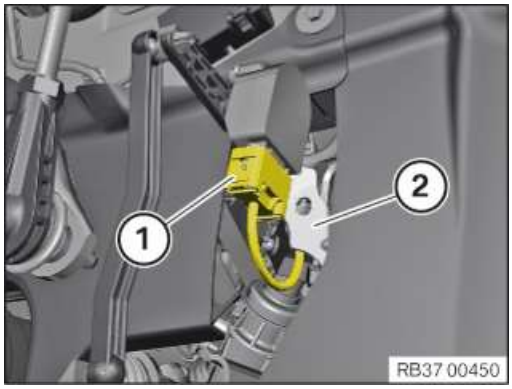
Note: Use the Torx socket for counter support.

Front anti-roll bar link to anti-roll bar/spring strut

M10	Renew nut.	Tightening torque	56 Nm

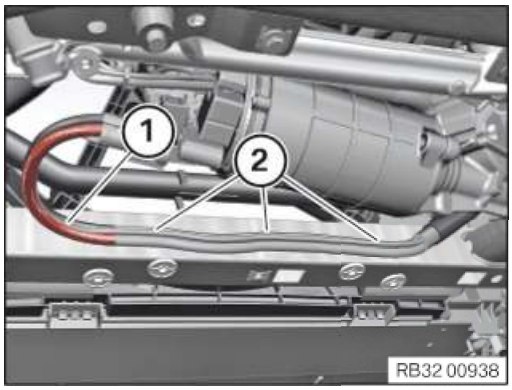
42 – Attach the line connection of the ride height sensor

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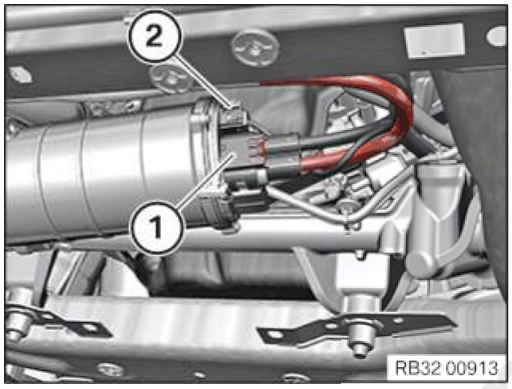


- Position the line .
- Clip in line on holder (2) .
- Connect connectors (1) and lock.

43 – Secure the wiring harness for the EPS on the front axle support



- Position the EPS wiring harness (1) from the front axle support.
- Secure the holder (2).

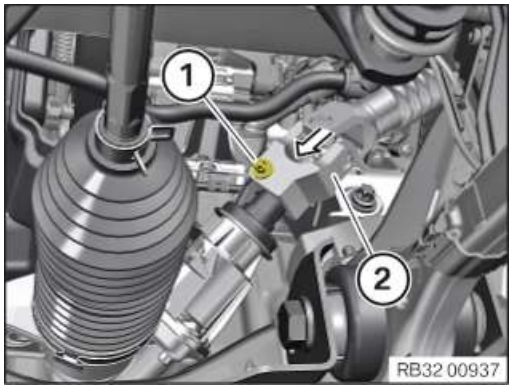


- Connect connectors (1) and (2) lock.

44 – Securing the steering shaft at the bottom on the steering gear

TECHNICAL INFORMATION

The universal joint can only be installed in one position.
The universal joint and the bottom steering gear and/or steering shaft are encoded with each other.
The clamping bolt must e positioned in the groove of the steering gear groove or the steering shaft.



- Clean the screw threads to remove all remnants of screw locking adhesive.
- Slide the lower steering shaft (2) onto the steering gear in the direction of the arrow.
- Renew the clamping bolt (1).

  Parts: Clamping bolt
- Tighten the clamping bolt (1).

Universal joint to steering box

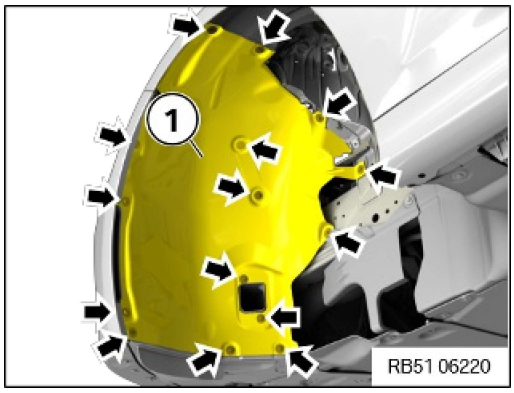
M8	Recut screw thread. Renew clamping bolt. No retorquing permitted!	Tightening torque	28 Nm

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45 – Install the front section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.



- Install the front section of the front wheel arch cover (1).
- Tighten screws (arrows).

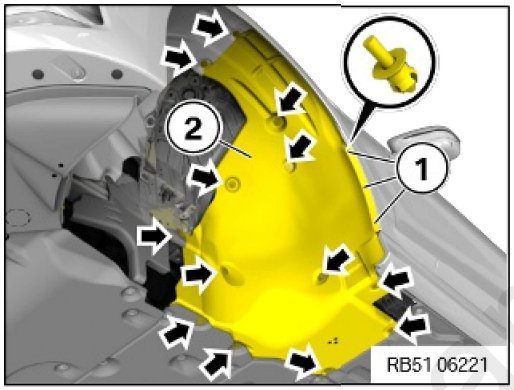
Wheel arch trim panel, front

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

46 – Install the rear section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.



- Install the rear section of the front wheel arch cover(2) .
- Tighten screws (arrows).

Wheel arch trim panel, front

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

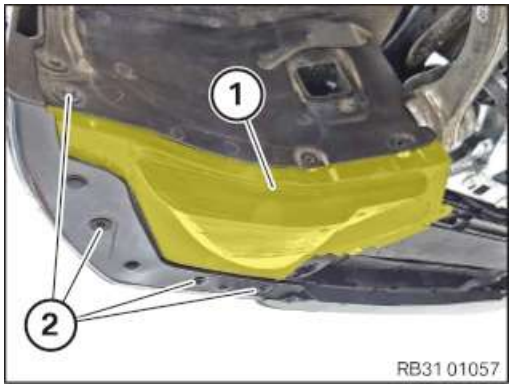
- Secure expanding rivet (1).

47 – Installing the bottom left and right wheel arch cover

NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Installing the bottom wheel arch cover**



- Position the bottom wheel arch cover (1).
- Tighten the screws (2).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

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▶ **Mounting the wheel**



TECHNICAL INFORMATION

The contact surface between the brake disc and the wheel rim must be clean and free from oil and grease. There is otherwise a risk of the wheel becoming loose at a later time.

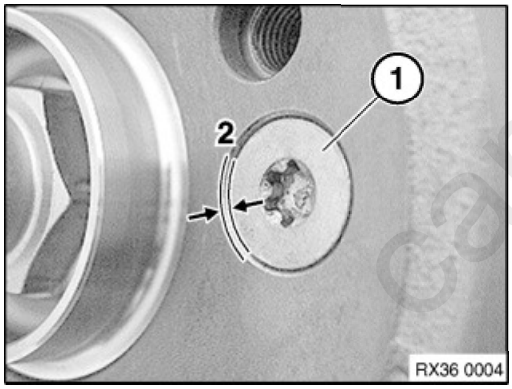
- Remove dirt, grease residues and corrosion from the contact surface with a drill and the special tool 2 344 011.

  Do not operate special tool 2 344 011 with an impact screwdriver.
- Degrease the contact surfaces with the universal cleaner (see BMW Group Parts).
- In the event of grease residue in the area of the wheel bolt holes, remove and clean the brake disc.



- Remove dirt, grease residues and corrosion from the contact surface with a drill and the special tool 2 344 011.

  Do not operate special tool 2 344 011 with an impact screwdriver.
- Degrease the contact surfaces with the universal cleaner (see BMW Group Parts).



- Check that the mounting bolt (1) for the brake disc is securely seated.

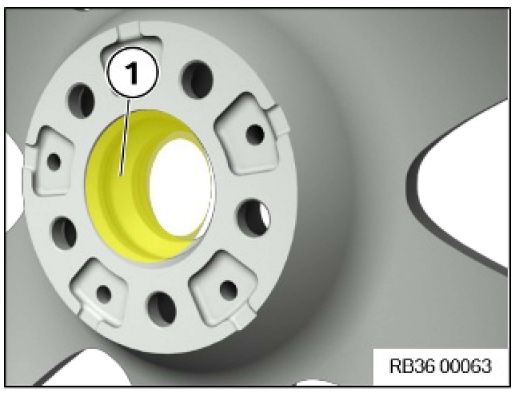
  The mounting bolt (1) for the brake disc may not protrude under any circumstances on the contact surface (2) between the brake disc and the wheel rim.

Brake disc to front wheel hub

M8	Renew screw.	Tightening torque	16 Nm

Brake disc to rear wheel hub

M8	Renew screw.	Tightening torque	16 Nm



- Thinly grease the wheel centring (1) in the wheel rim.

Expendable materials

Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233

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- Lightly grease the front and rear wheel hubs in this area (1) to protect from corrosion.

Expendable materials

Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233



- In vehicles with M Carbon ceramic brake: The wheel assembly jack must be used to install the wheel (see workshop equipment).

  This process is intended to prevent damage to the brake disc.

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TECHNICAL INFORMATION

Never use impact screwdrivers or electric screwdrivers to screw in and tighten the wheel bolts.

The wheel rim must rest uniformly against the brake disc.

In the case of non-original BMW wheel bolts/wheel rims, it may be necessary to retighten the wheel bolts on account of setting properties (refer to the documentation from the manufacturer).

Do not apply oil to new wheel bolts.

- Renew corroded wheel bolts.

  Parts: Wheel bolts
- Clean the wheel bolts.
- Check wheel bolts and threads for damage, renew the wheel bolts if necessary.
- Join and tighten the wheel bolts (arrows).

Wheel bolts

M14 / SW17	Screw in wheel bolts and evenly tighten crosswise by hand in order to centre the wheel rim. Tighten wheel bolts to the prescribed tightening torque with a calibrated torque wrench in a crosswise sequence. Check all the wheel bolts in the same order or retighten to the prescribed tightening torque again.	Tightening torque Check	140 Nm 140 Nm

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49 – Loosen the attachment of the engine in installation position



- Lower engine by turning the spindle 2 361 506 (00 6 103) until the engine lies completely on the engine supports.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the engine bridge (1) with an auxiliary person.



- Tighten bolt (1) of the left engine mount from the bottom using a standard tool.

Engine mount to engine mounting bracket

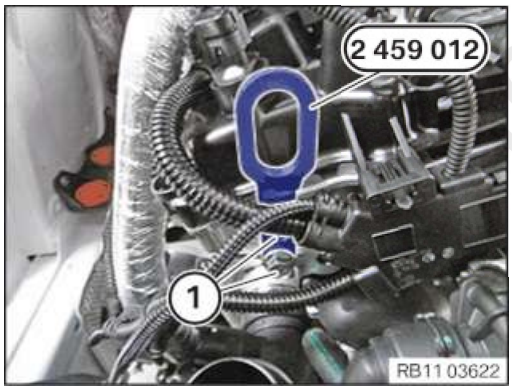
M12		Tightening torque	100 Nm



- Tighten bolt (1) of the right engine mount from the top using a standard tool.

Engine mount to engine mounting bracket

M12		Tightening torque	100 Nm



- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

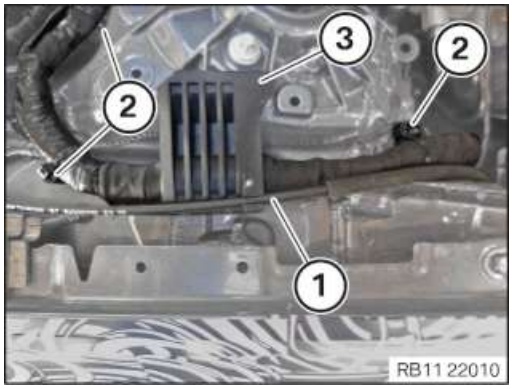
50 – Securing the wiring harness section to the left spring strut dome

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in and position wiring harness section (3) on the left spring strut dome.
- Secure clamps (2).
- Guide in and install cable (1) of the front flap.

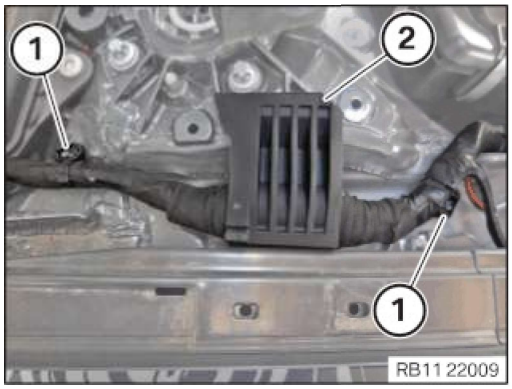
51 – Secure wiring harness section on right spring strut dome

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

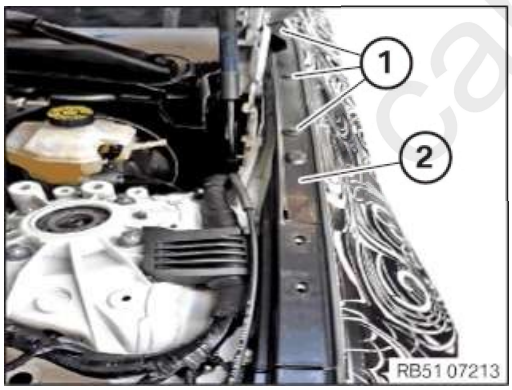
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in and position the wiring harness section (2) of right spring strut dome.
- Secure clamps (1).

52 – Installation of side panel sealing.



NOTICE

Description is for left component only. Procedure on the right side is identical.

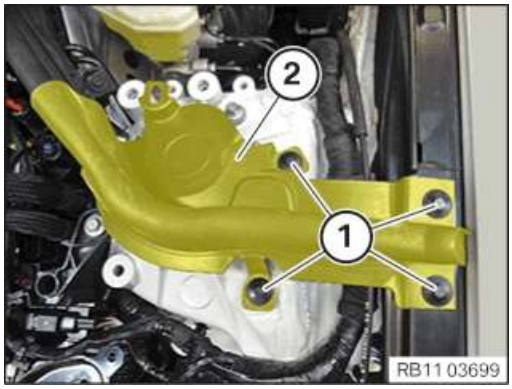
- Guide the sealing (2) in and install it.
- Mount the expanding rivets (1).

53 – Install side bonnet seals

NOTICE

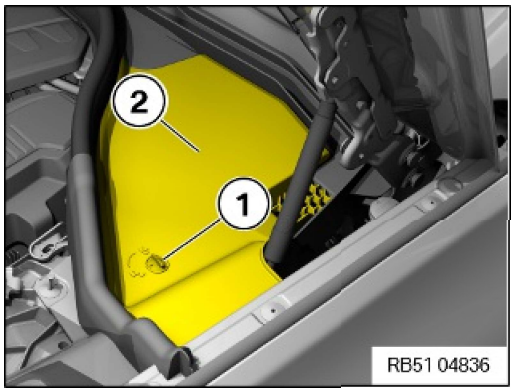
Perform the operations on the left and right side.

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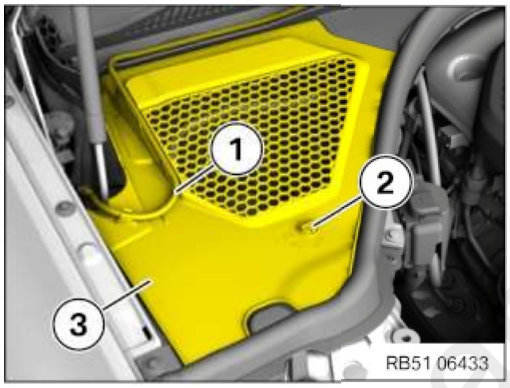
- Position the side bonnet seal (2) on the spring strut dome.
- Secure the rivet (1).

54 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

55 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

56 – Installing the clean air pipe with resonator



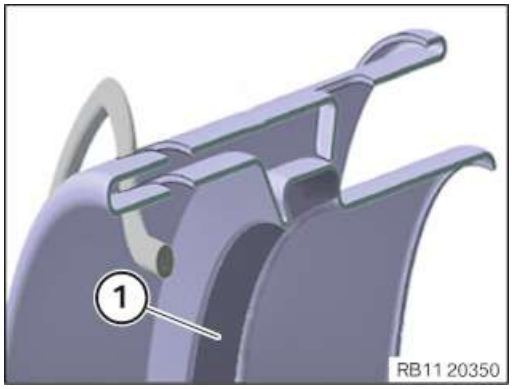
- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

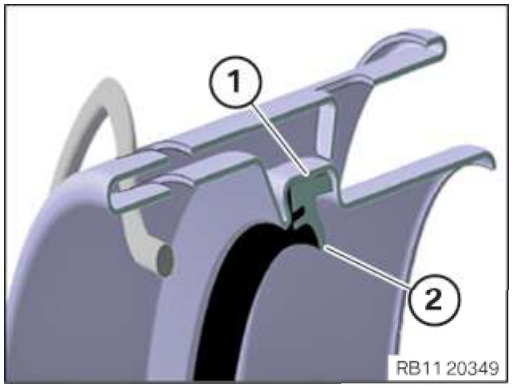
Do not use pointed or sharp-edged tools for the installation and/or removal.

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- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



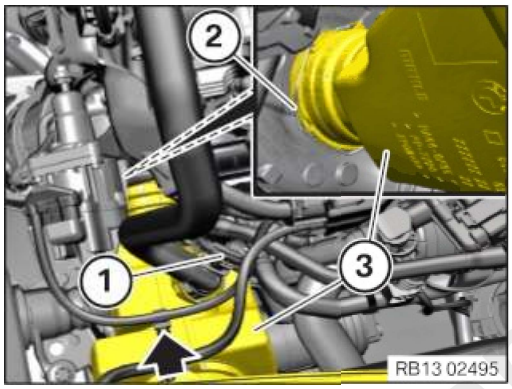
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

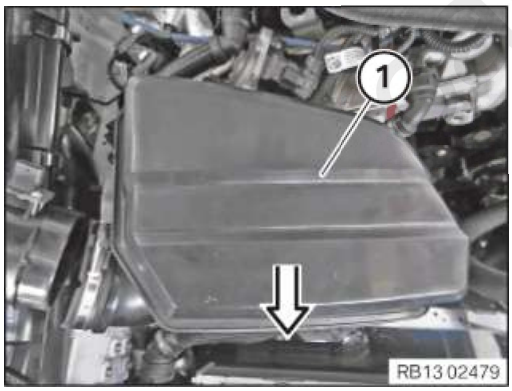
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



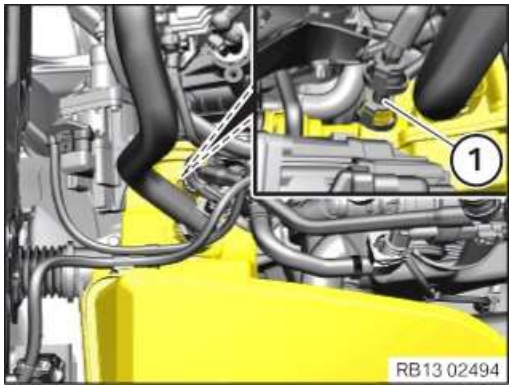
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

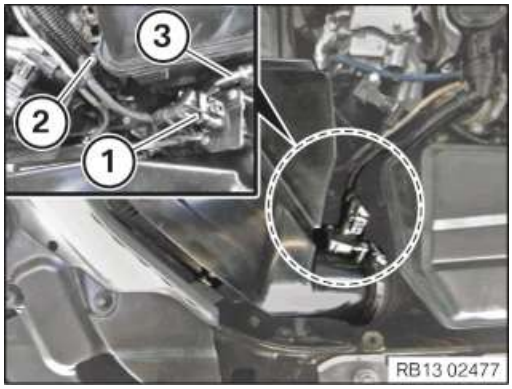
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

57 – Topping up the engine oil

RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Drain the engine oil.

- Pour in engine oil.

Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

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58 – Disconnecting all battery earth leads



- See additional information.

59 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

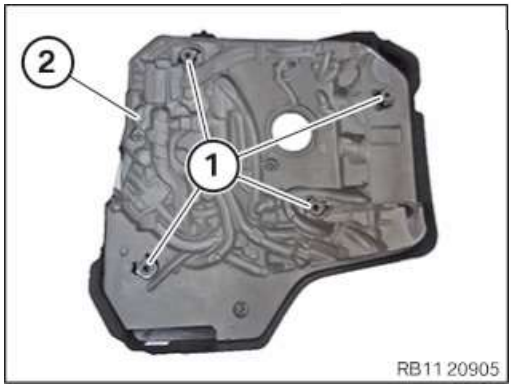
60 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

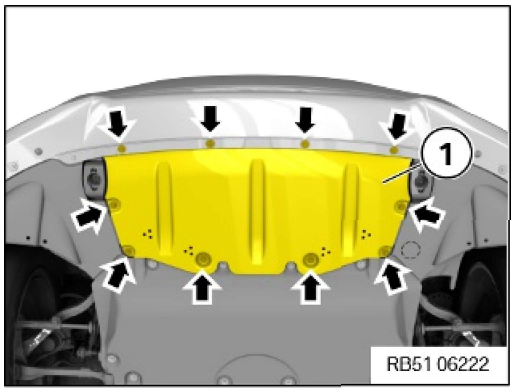
obdiagn.com



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

61 – Installing the front underbody protection



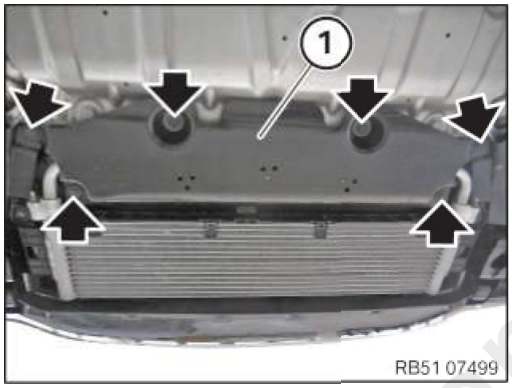
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



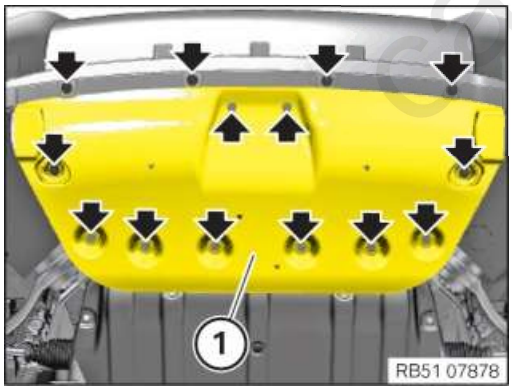
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

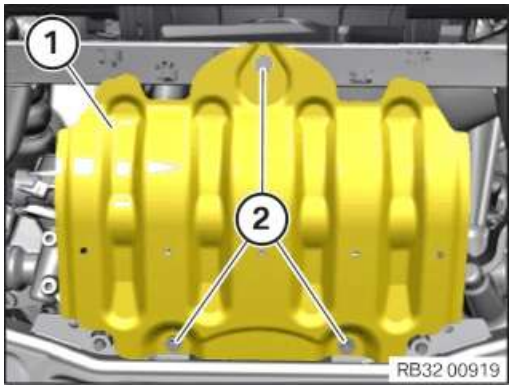
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

62 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

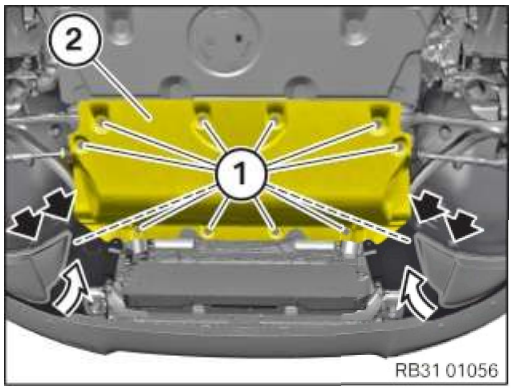


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

63 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

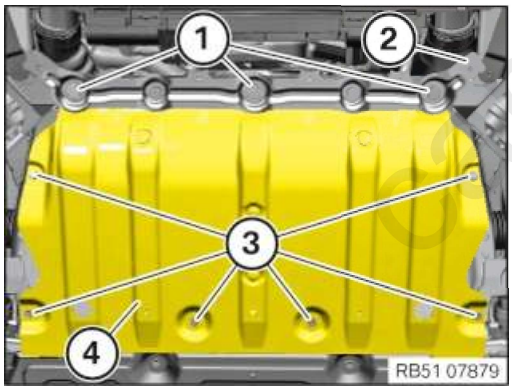
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

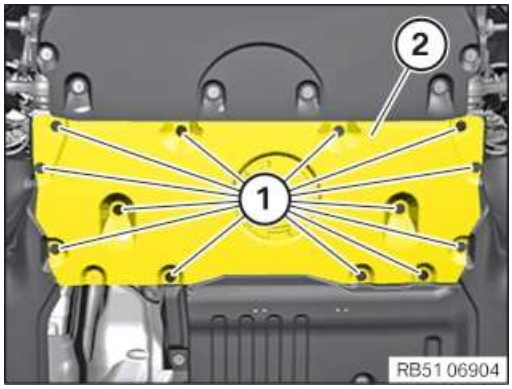
- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

64 – Installing the centre underbody protection

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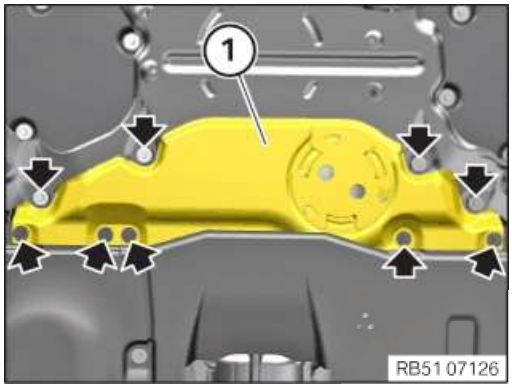
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

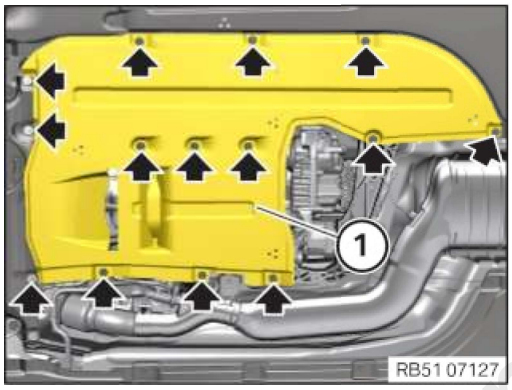
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

65 – Installing underbody protection at rear



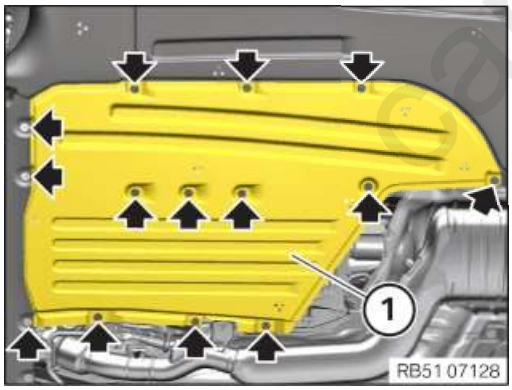
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

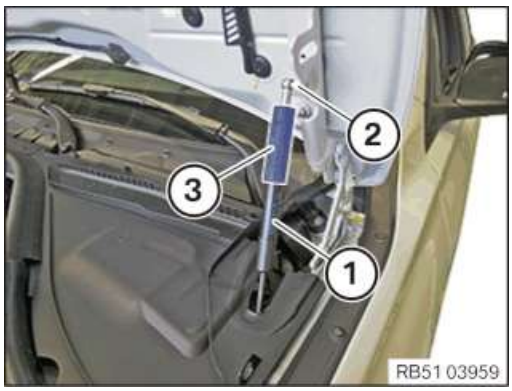
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

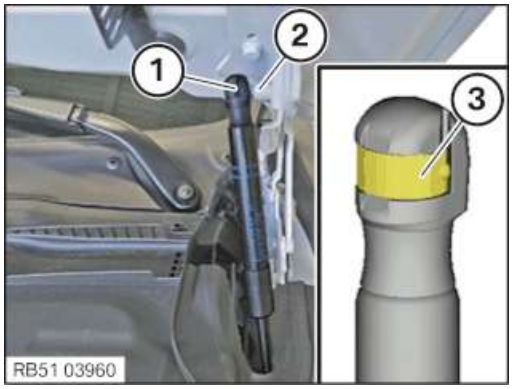
Hexagon screw		Tightening torque	3 Nm

66 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Special tool to cylinder head — Used in step 20

M8		Tightening torque	21,5 Nm

Oil drain plug — Used in step 29

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Camshaft sprocket to oil vacuum pump — Used in step 34

M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °

Oil vacuum pump to crankcase — Used in step 35

M8	Renew screw.	1. Tightening torque 2. Angle of rotation	15 Nm 45 °

Oil sump to crankcase — Used in step 36

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 36

M8 x 50		Tightening torque	19 Nm

Starter motor to engine — Used in step 37

M8X60		Tightening torque	19 Nm

Battery positive lead to starter — Used in step 38

M8		Tightening torque	13,5 Nm

Front axle support to front/centre of body — Used in step 39

M12	Renew screws.	Jointing torque	108 Nm

Front axle carrier to body, rear — Used in step 39

M14	Renew screws.	Tightening torque	175 Nm

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Adapter, front axle support to front axle support — Used in step 39

M8x70		Tightening torque	19 Nm

Front anti-roll bar link to anti-roll bar/spring strut — Used in step 41

M10	Renew nut.	Tightening torque	56 Nm

Universal joint to steering box — Used in step 44

M8	Recut screw thread. Renew clamping bolt. No retorquing permitted!	Tightening torque	28 Nm

Wheel arch trim panel, front — Used in step 4546

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

Cover, front bottom on side — Used in step 47

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Brake disc to front wheel hub — Used in step 48

M8	Renew screw.	Tightening torque	16 Nm

Brake disc to rear wheel hub — Used in step 48

M8	Renew screw.	Tightening torque	16 Nm

Wheel bolts — Used in step 48

M14 / SW17	Screw in wheel bolts and evenly tighten crosswise by hand in order to centre the wheel rim. Tighten wheel bolts to the prescribed tightening torque with a calibrated torque wrench in a crosswise sequence. Check all the wheel bolts in the same order or retighten to the prescribed tightening torque again.	Tightening torque Check	140 Nm 140 Nm

Engine mount to engine mounting bracket — Used in step 49

M12		Tightening torque	100 Nm

Clean air pipe to upper section of intake filter housing — Used in step 56

Clamp		Tightening torque	3 Nm

Underbody protection front — Used in step 61

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Bumper buffer device steering on front axle support — Used in step 62

M10		Tightening torque	56 Nm

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Underbody protection of the steering gear			Used in step 63
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 63
Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support			Used in step 63
M10		Tightening torque	56 Nm

Underbody protection			Used in step 6465
Hexagon screw		Tightening torque	3 Nm

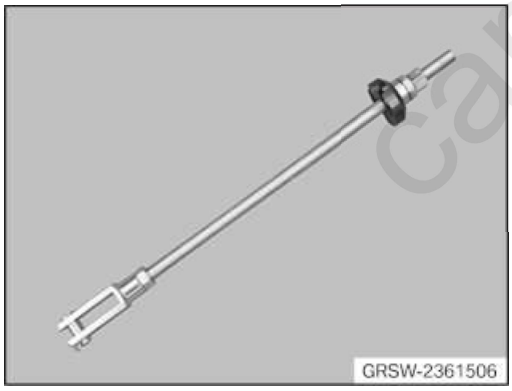
Overview of Special Tools

2 459 012 Holder



Common	Used in step 2049
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 361 506 (00 6 103) Spindle



Common	Used in step 2049
Usage	Spindle (central spindle) for Traverse 00 6 100.
Included in the tool or work	0 496 852
Storage location	
Replaced by	
In connection with	
SI-Number	01 17 10 (659)

2 219 012 Hydraulic lifter



Common	Used in step 262739
Usage	For raising and lowering various vehicle components.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 90 (207)

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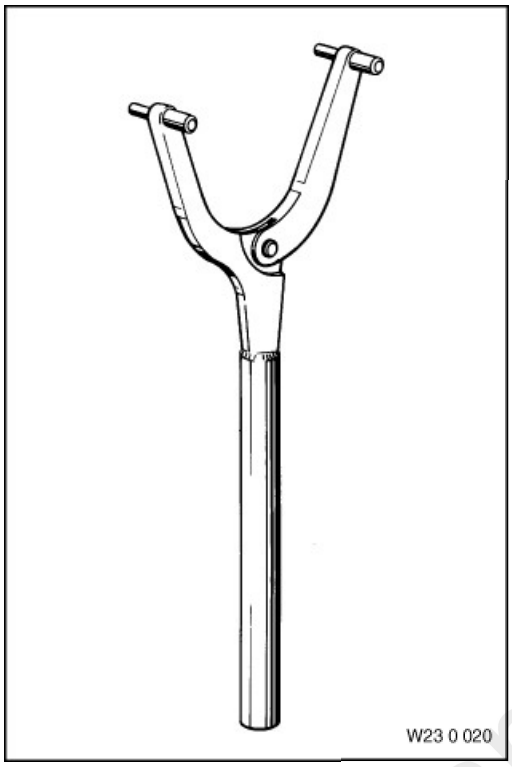
2 463 965 Socket wrench



Common Used in step 33

Usage	with T30, T40 and torx 45
Included in the tool or work	
Storage location	B6
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

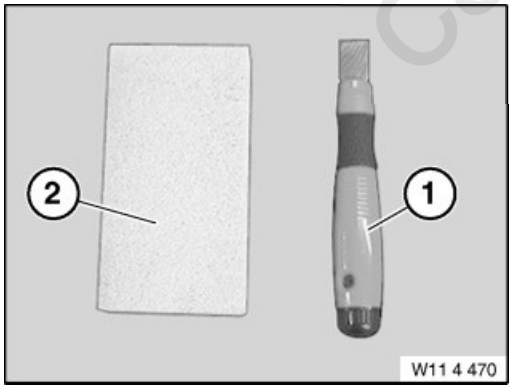
0 491 440 (23 0 020) Holder



Common Used in step 34

Usage	(counter support) For all three- and four-hole flanges when releasing and tightening down
Included in the tool or work	
Storage location	B4
Replaced by	
In connection with	
SI-Number	

0 495 102 (11 4 470) Tool



Common Used in step 36

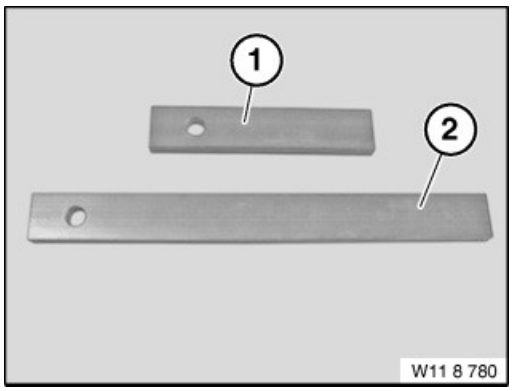
Usage	(cleaning kit) For cleaning sealing surfaces on *magnesium crankcase/cy*linder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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0 496 120 (11 8 780) Plate



Common Used in step 36

Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

2 344 011 Tool

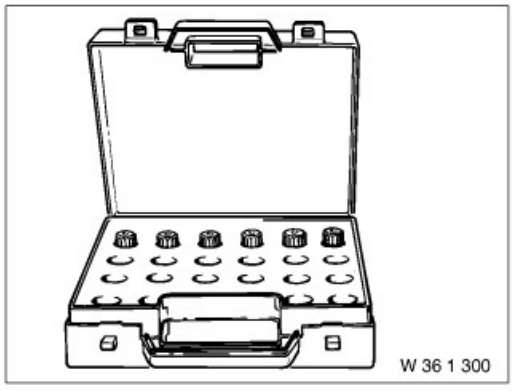


Common Used in step 48

Usage	Tool (wheel hub grinder) for cleaning the connection of the wheel rim (wheel contact face) to the wheel hub.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	08 08 12 (872)

Replacement tools:

0 495 221 (36 1 323) Wheel stud



Common Used in step 11

Usage	(Code 30) Code 39 available separately, (see EPC) under 36 13 1 181 259
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

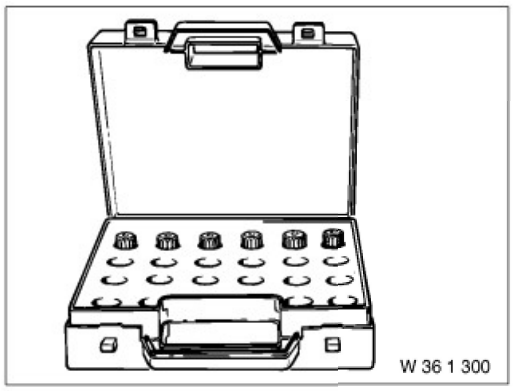
bardiag.com

0 495 224 (36 1 326) Wheel stud



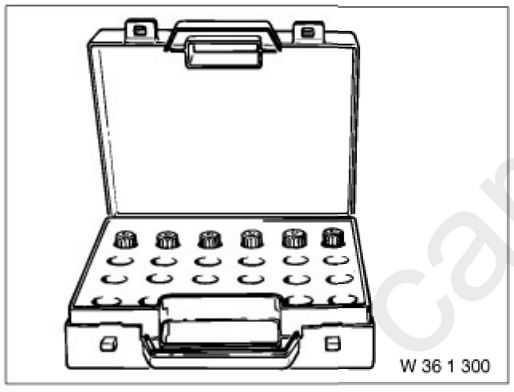
Common	Used in step 11
Usage	(Code 33) With centring bore available separately, (see EPC) under 36 13 6 765 546
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 225 (36 1 327) Wheel stud



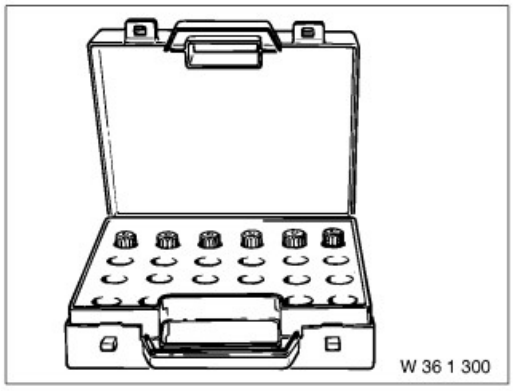
Common	Used in step 11
Usage	(Code 34) With centring bore available separately (see EPC) under 36 13 6 765 547
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 226 (36 1 328) Wheel stud



Common	Used in step 11
Usage	(Code 35) With centring bore available separately, (see EPC) under 36 13 6 762 340
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 227 (36 1 329) Wheel stud



Common	Used in step 11
Usage	(Code 36) With centring bore available separately (see EPC) under 36 13 6 762 341
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

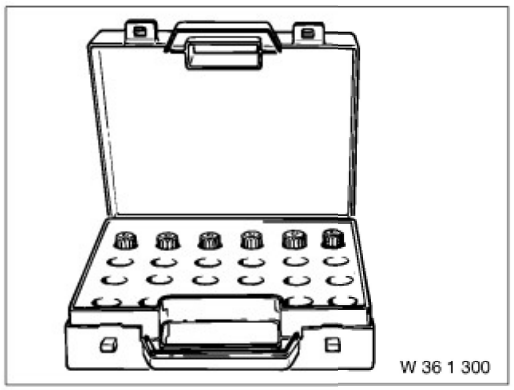
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0 495 228 (36 1 331) Wheel stud



Common	Used in step 11
Usage	(Code 37) With centring bore available separately (see EPC) under 36 13 6 762 342
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 229 (36 1 332) Wheel stud



Common	Used in step 11
Usage	(Code 38) With centring bore available separately (see EPC) under 36 13 6 762 343
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 230 (36 1 333) Wheel stud



Common	Used in step 11
Usage	(Code 40) With centring bore available separately (see EPC) under 36 13 6 762 344
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

Overview Technical Data

Engine oil B48B20O1/B46B20O1	Used in step 57
Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Engine oil	Used in step 57
Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Links

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11 42 020 Removing and installing/replacing full-flow oil filter completely

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads

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- See additional information.

2 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

3 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

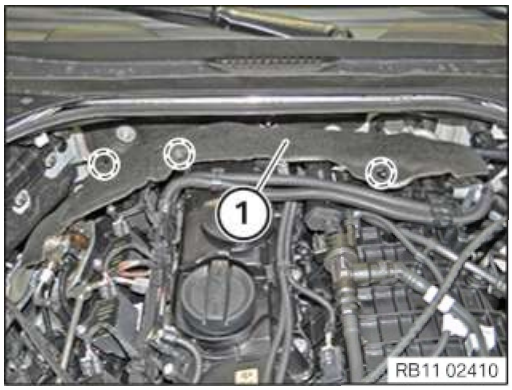
- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

4 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

5 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

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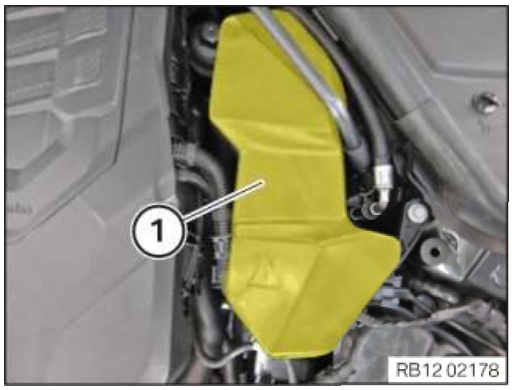
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

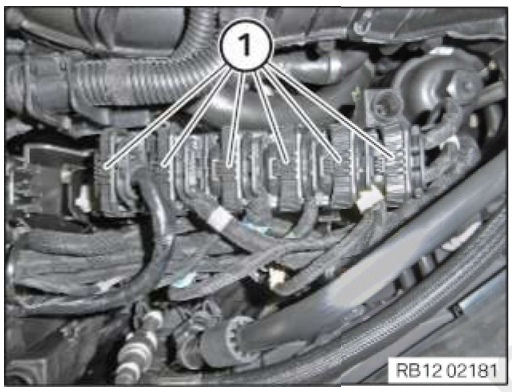
For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

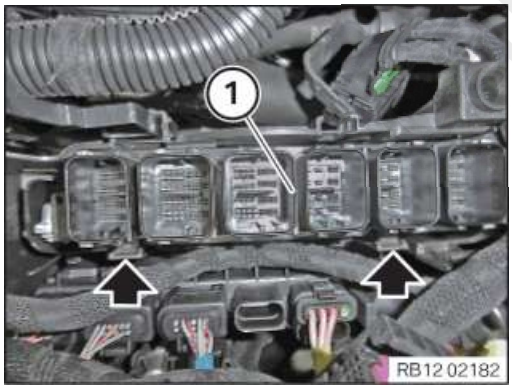
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.



- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

6 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

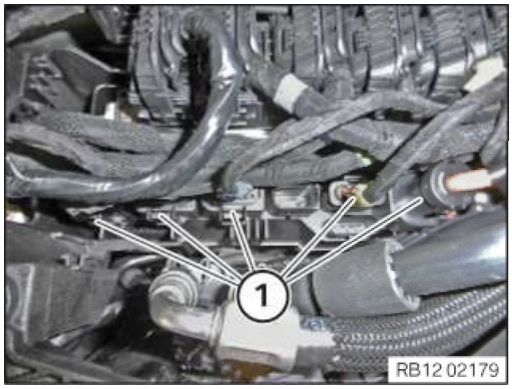
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

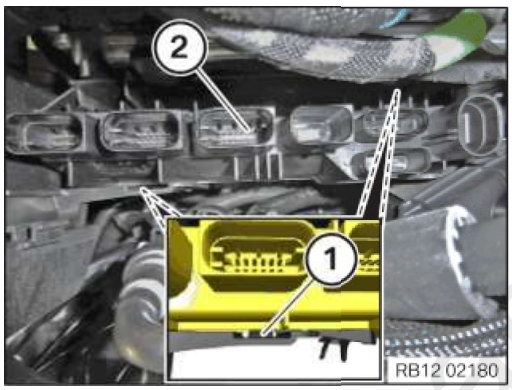
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

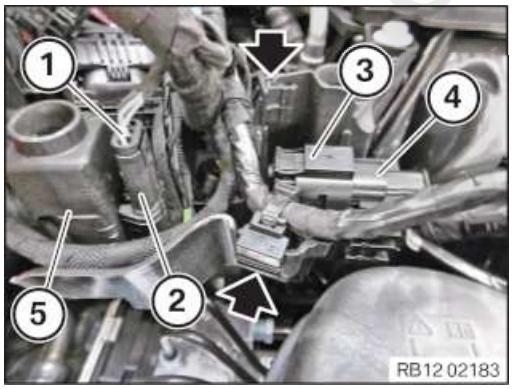


- Unlock and disconnect plug connections (1).



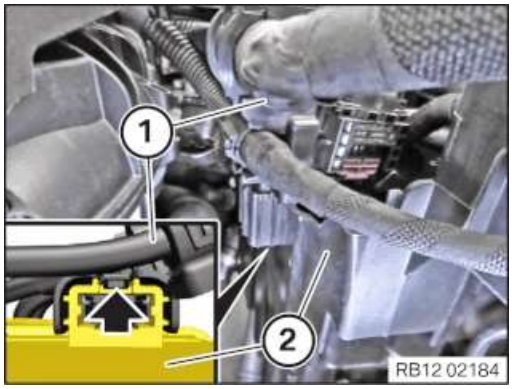
- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

7 – Removing the control unit holder

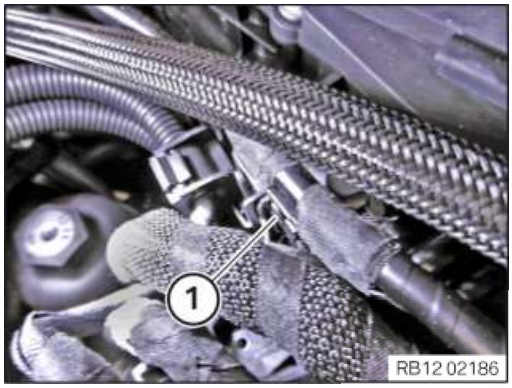


- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).

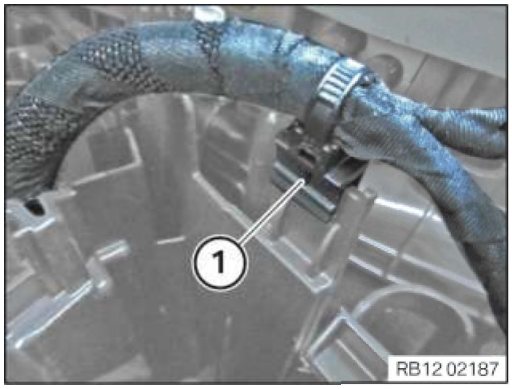
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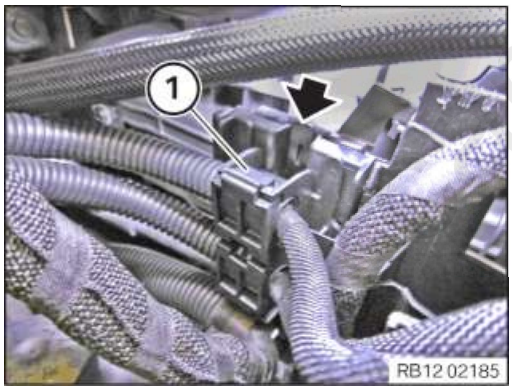
- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).



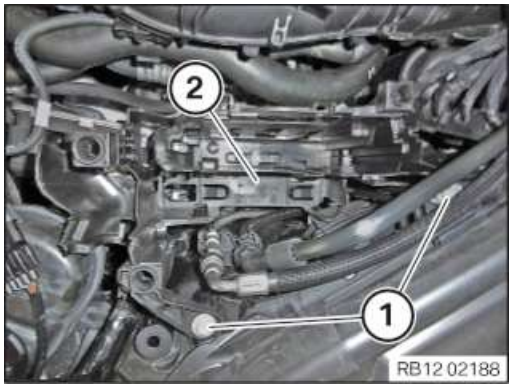
- Loosen clamp (1).



- Loosen clamp (1).



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

8 – Removing the clean air pipe with the resonator

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WARNING

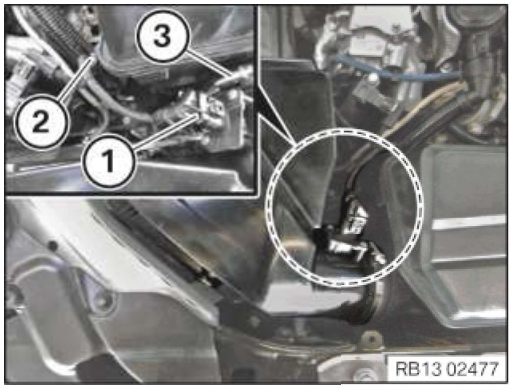
Hot surfaces.

Risk of burning!

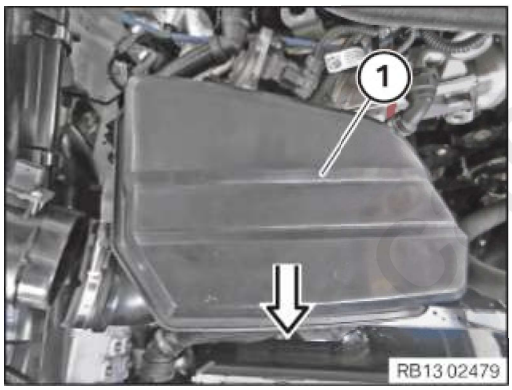
- Perform all work only on components that have cooled down.



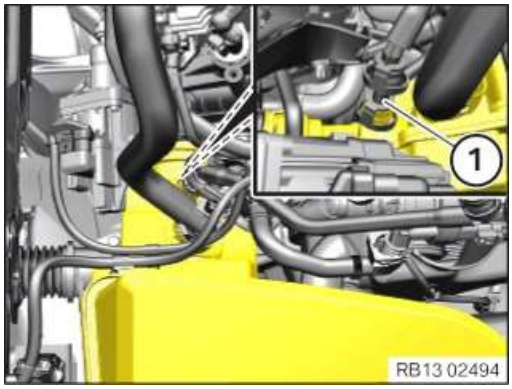
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



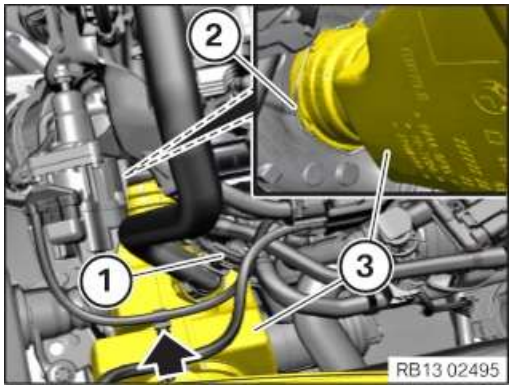
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

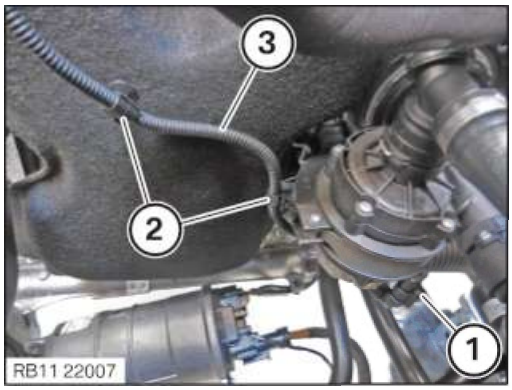


- Unlock and disconnect the tank ventilation line (1).

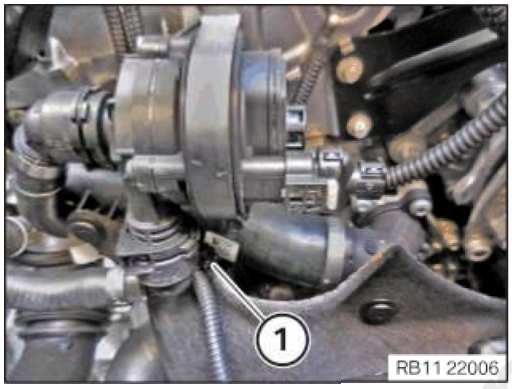


- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

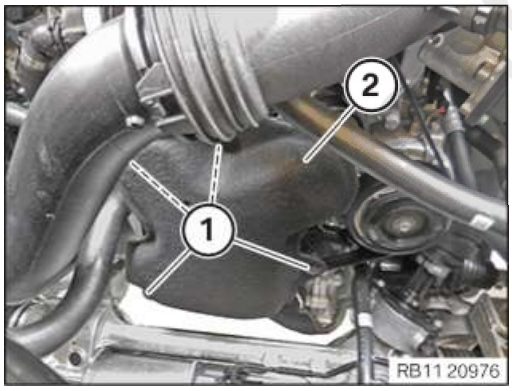
9 – Removing the acoustic cover for the engine at the front



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

10 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

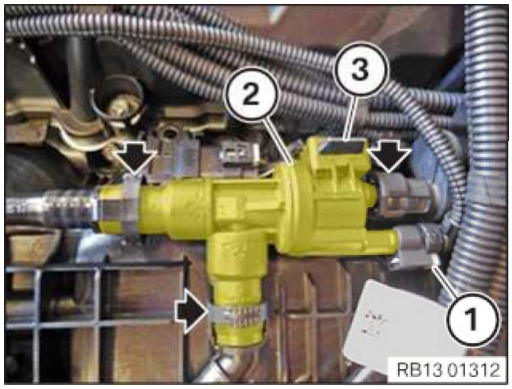
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RISK OF DAMAGE

Electrostatic discharge.

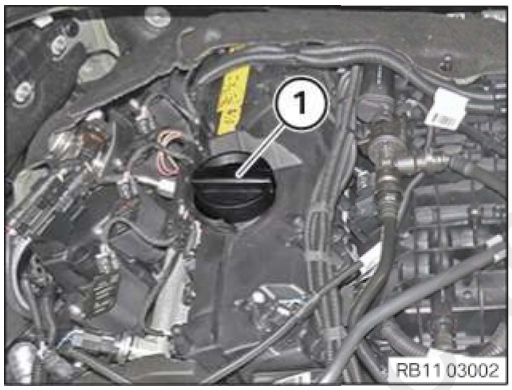
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

11 – Removing the oil filler cap



- Open oil filler cap (1).

12 – Removing the oil filter element

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

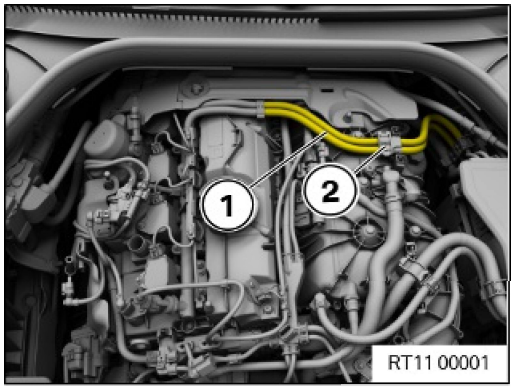
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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

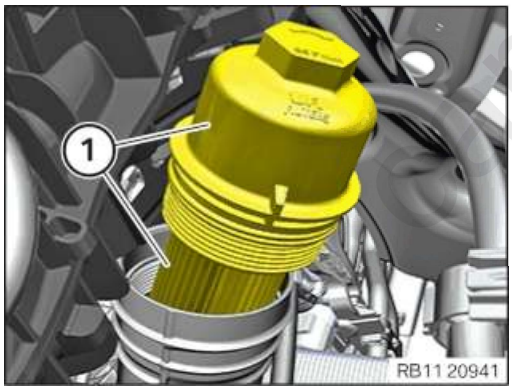
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Unclip engine wiring harness (1) from holder (2) and place it aside.



- Loosen the oil filter cover (1).



TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Guide out and remove the oil filter cover in the upward direction with oil filter element (1).

13 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

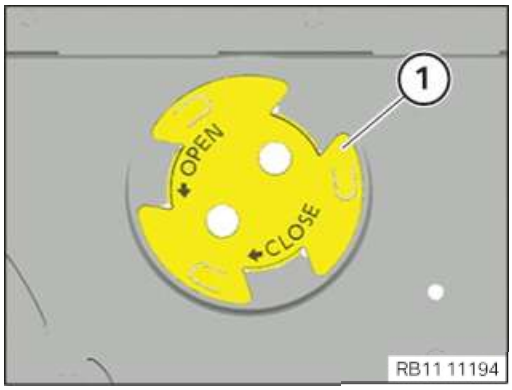
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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).



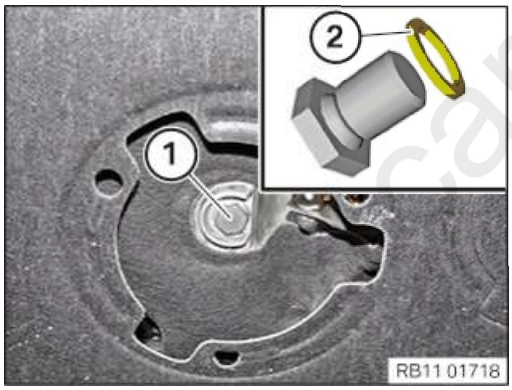
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

14 – Tightening the oil drain plug



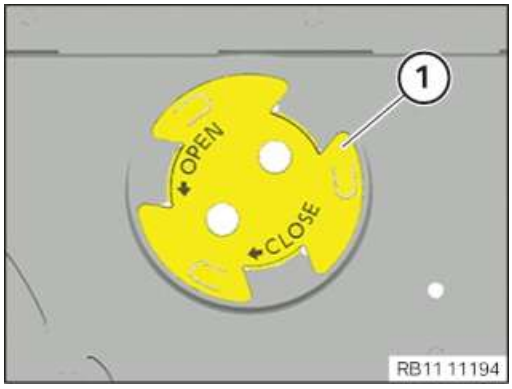
- Renew sealing ring (2).

  Parts: Sealing ring

- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

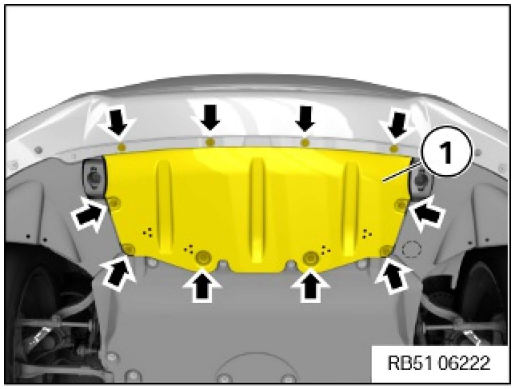
M12x16	Renew the sealing ring.	Tightening torque	25 Nm



- Install service cap (1).

15 – Removing the front underbody protection

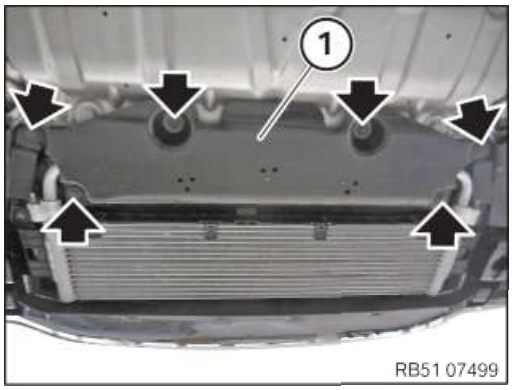
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- **Version 1:**

  Remove screws (arrows).

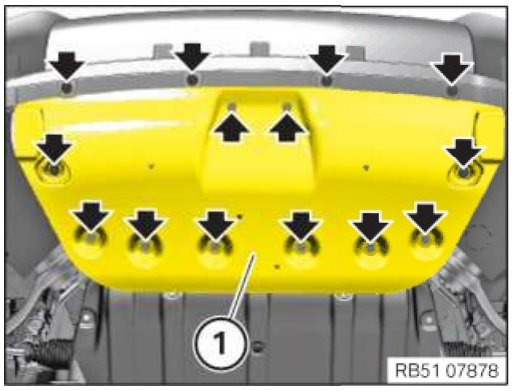
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

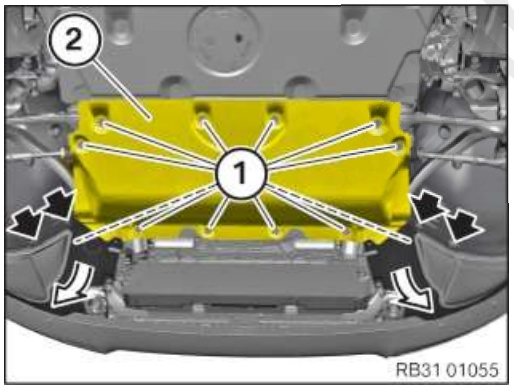


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

16 – Remove the underbody protection of the steering gear



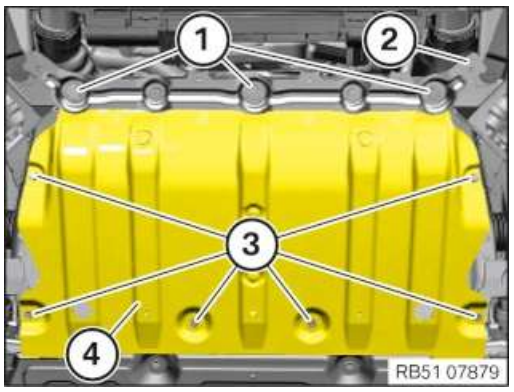
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

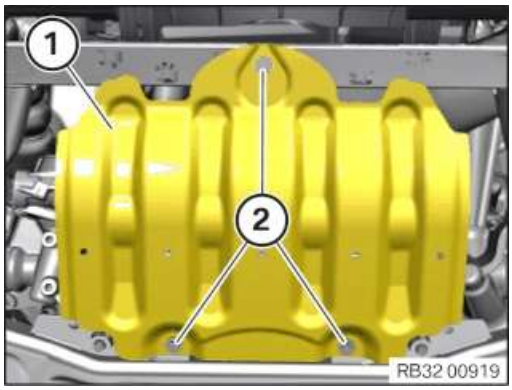
  Slide the steering gear underbody protection (4) out and remove.

17 – If installed: Removing the steering start protection

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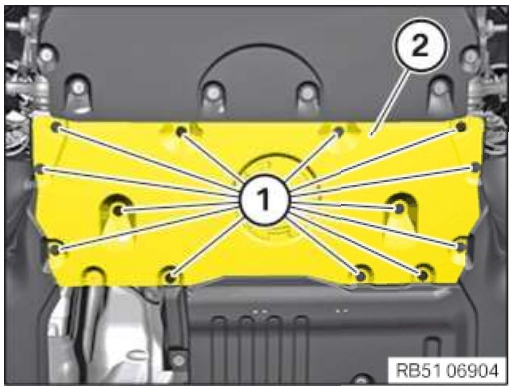
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

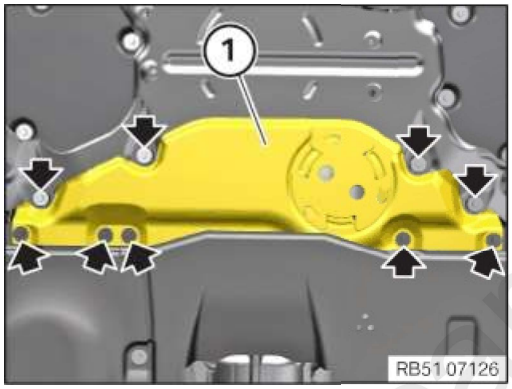
18 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

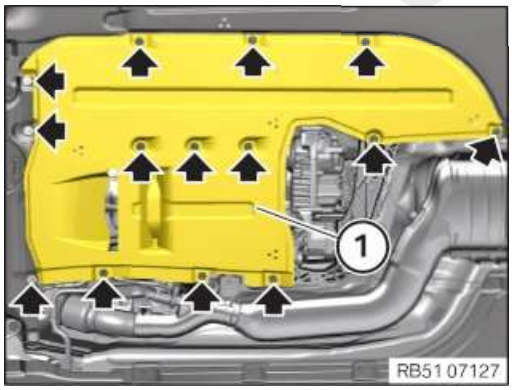


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

19 – Remove rear underbody protection

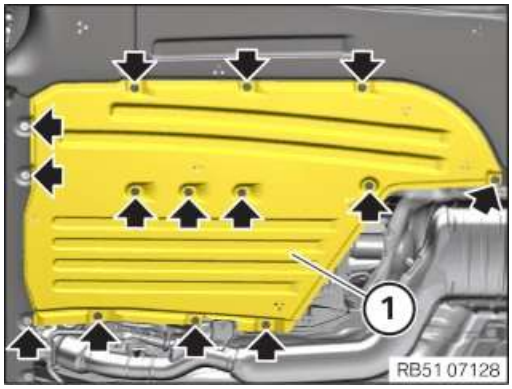


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

20 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

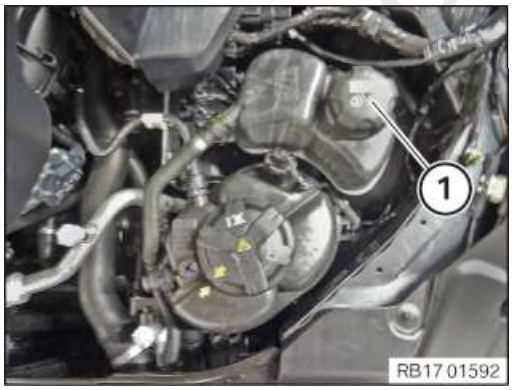
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

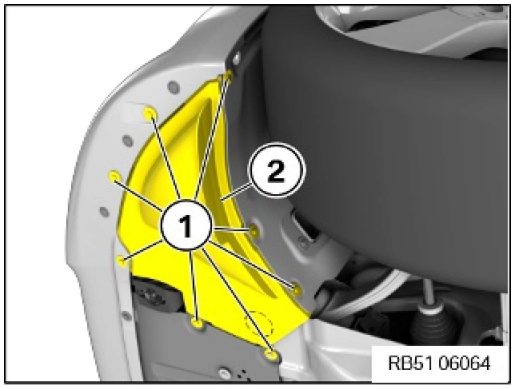
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

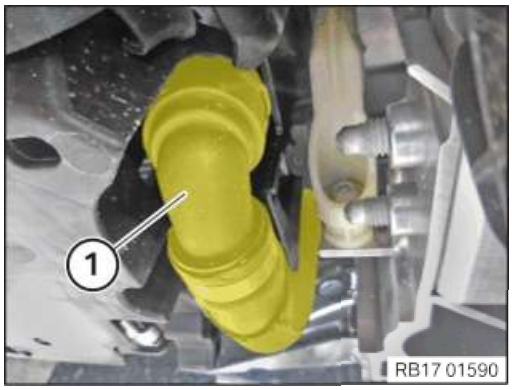


- Loosen sealing cap (1).

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- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

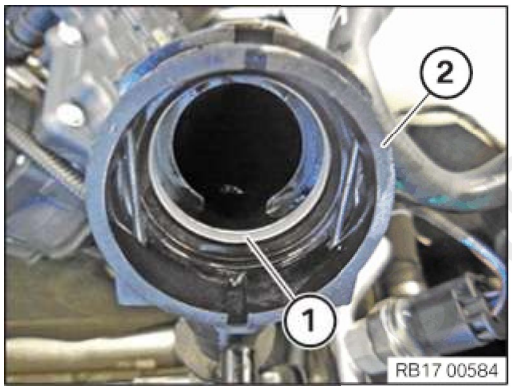


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

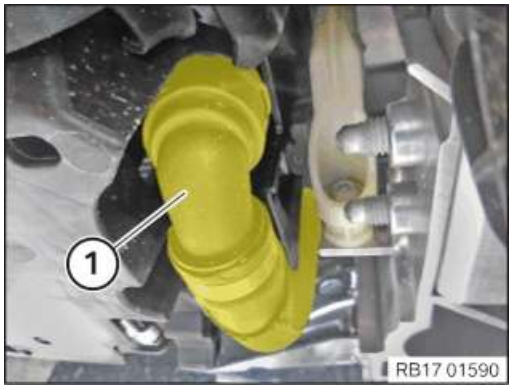
21 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



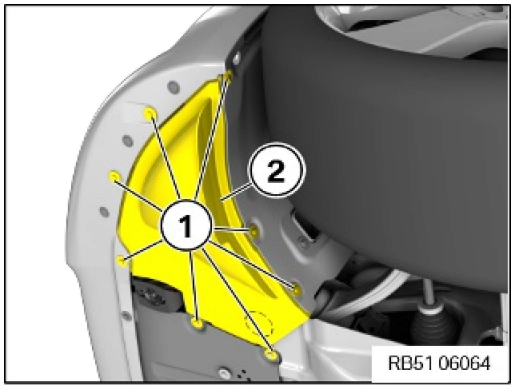
- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.

mdiag.com



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

22 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

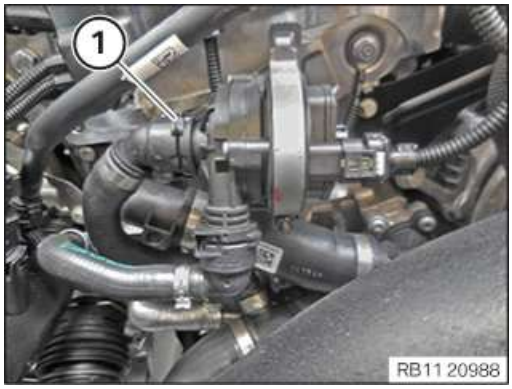
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

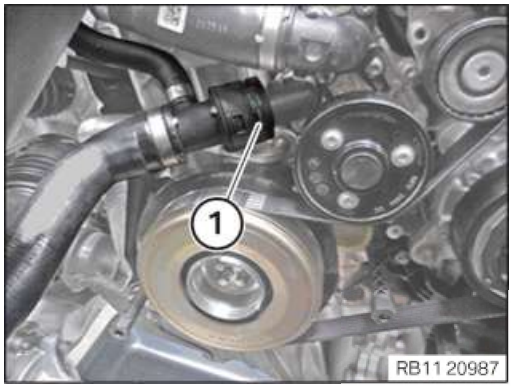


- Loosen sealing cap (1).

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- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

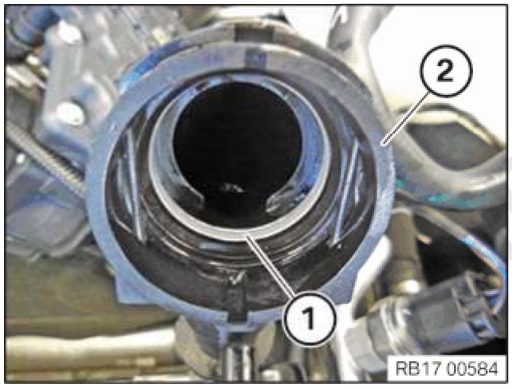


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

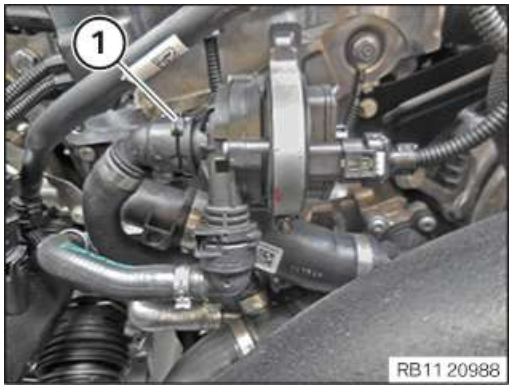
23 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

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- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

24 – Removing the intake plenum

RISK OF DAMAGE

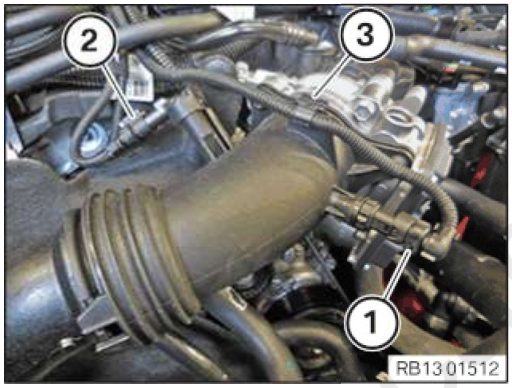
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

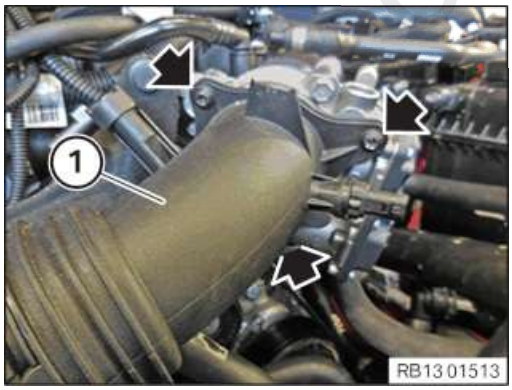
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

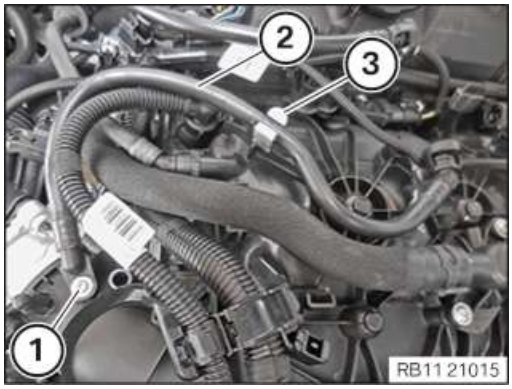
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



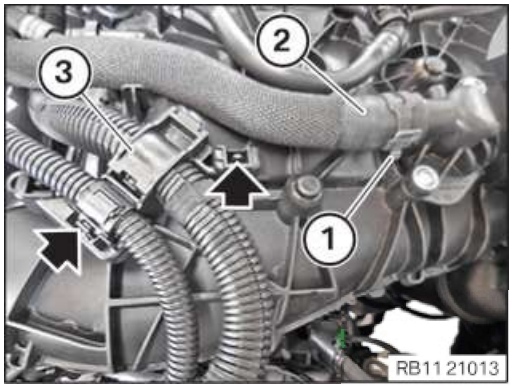
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



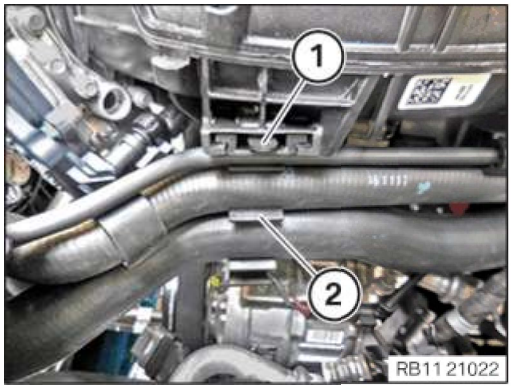
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



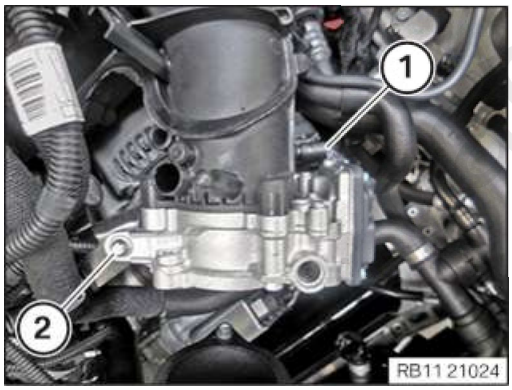
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



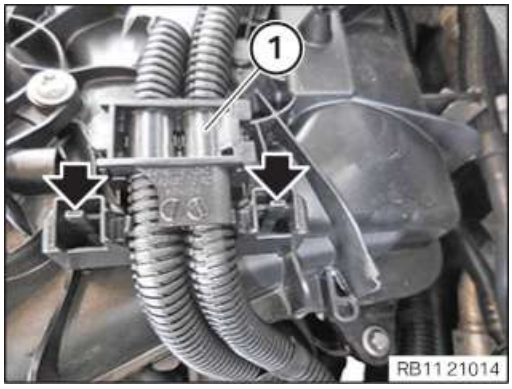
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

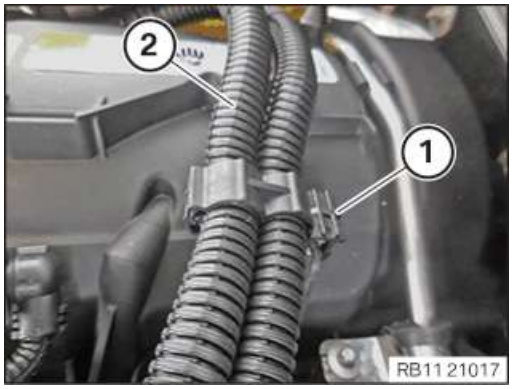


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

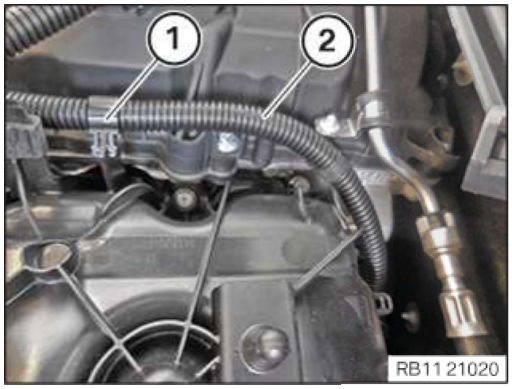
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- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



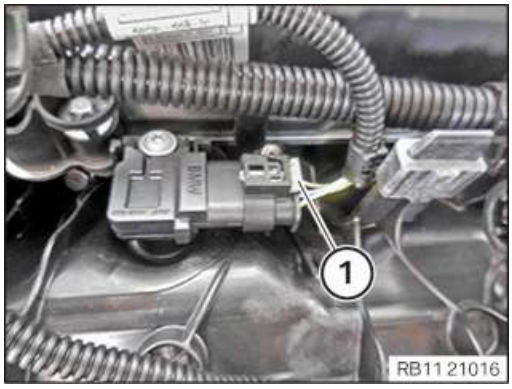
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

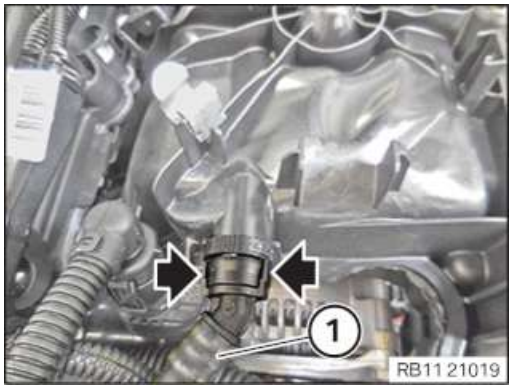


- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

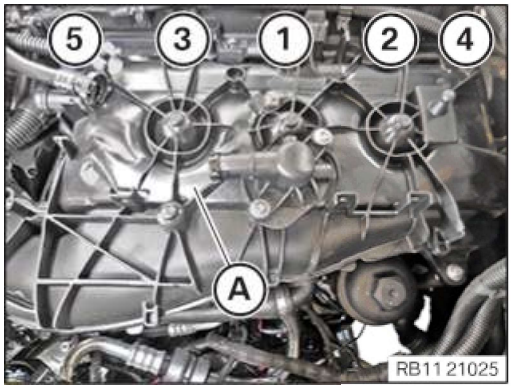
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- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

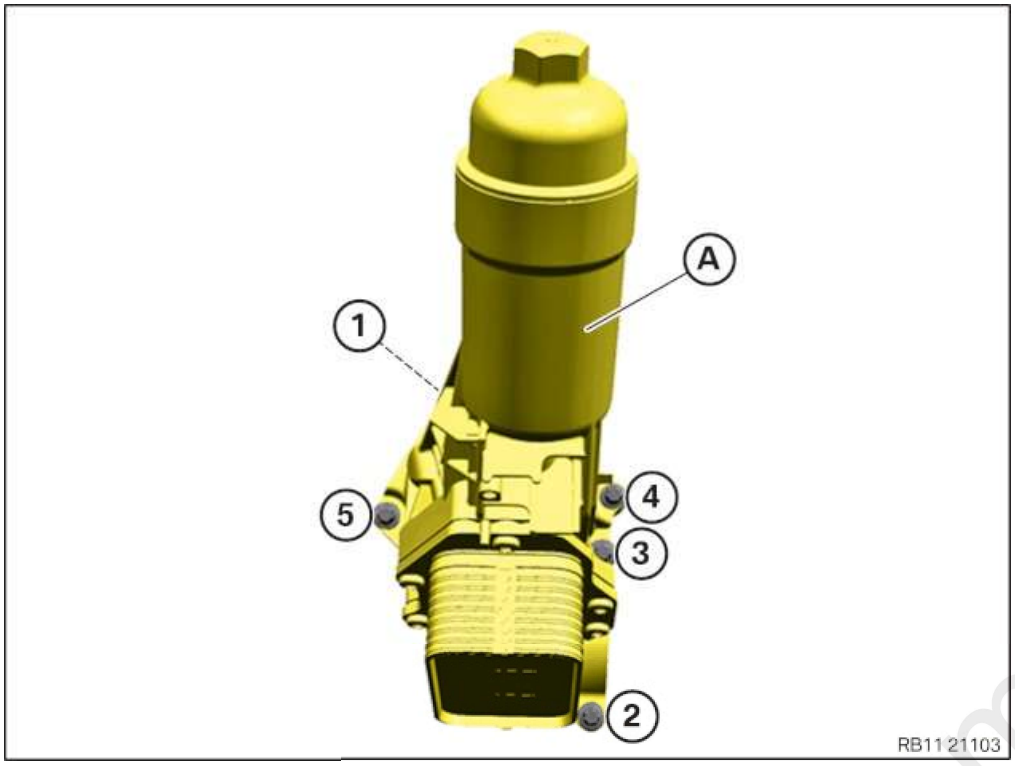
- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

MAIN WORK

25 – Remove the complete full-flow oil filter

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Full-flow oil filter



A Full-flow oil filter

1 to 5 Bolts

Prerequisite

Disconnect all batteries.

RISK OF DAMAGE

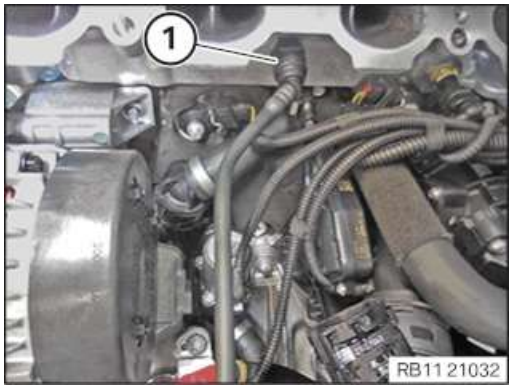
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

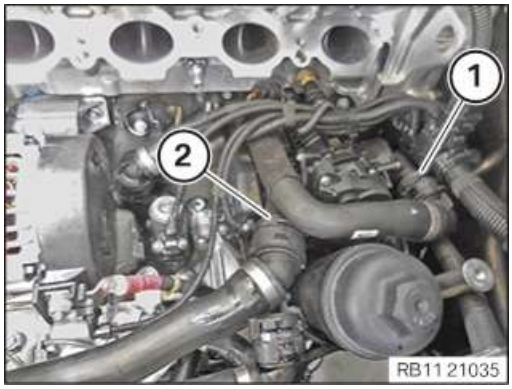
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

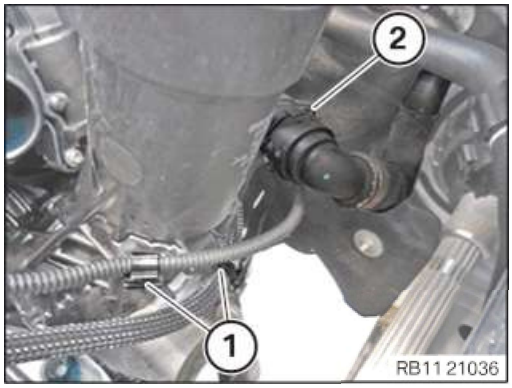


- Unlock and loosen coolant line (1).

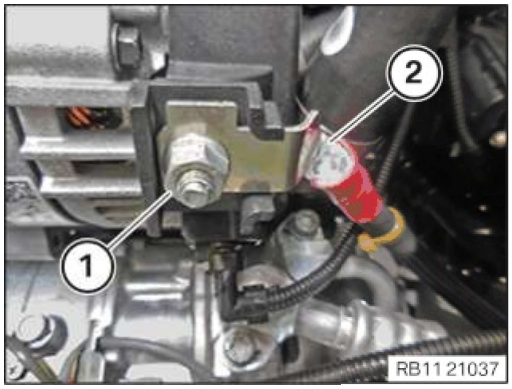
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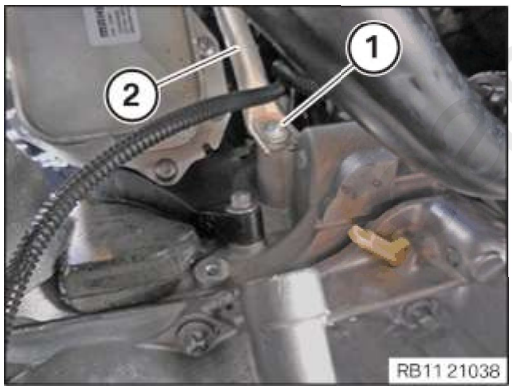
- Unlock and loosen coolant line (1).
- Unlock and loosen coolant line (2).
- Catch and dispose of escaping coolant.



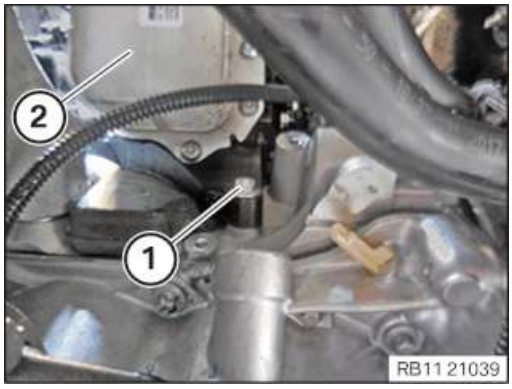
- Loosen clamps (1).
- Unlock and loosen coolant line (2).
- Catch and dispose of escaping coolant.



- Unfasten nut (1).
- Thread out positive battery cable (2) and set it aside.

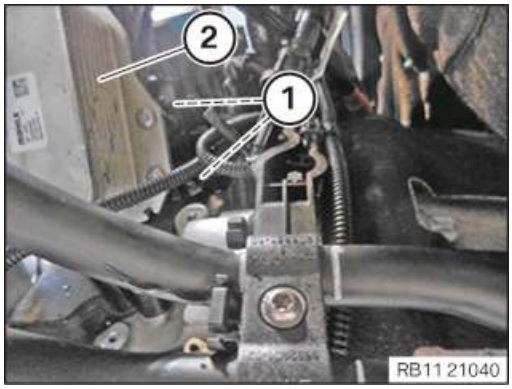


- Loosen screw (1).
- Guide out and remove manifold support (2).

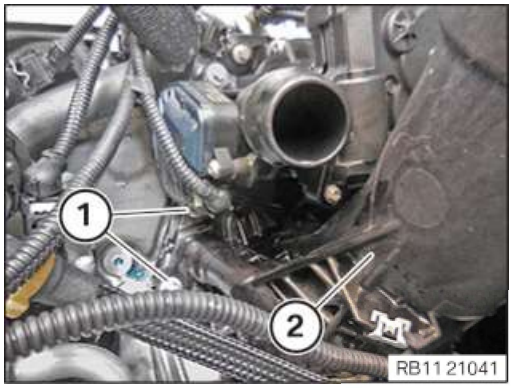


- Release screw (1) on full-flow oil filter (2).

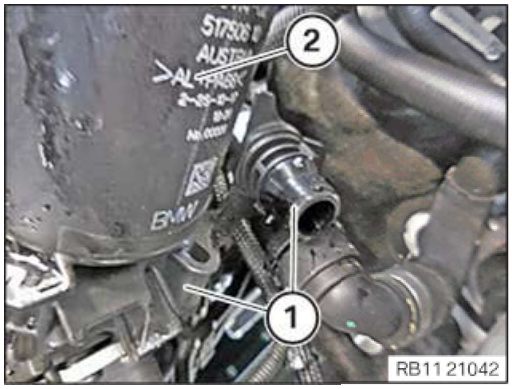
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- Loosen the screws (1) on the full-flow oil filter (2).



- Loosen the screws (1) on the full-flow oil filter (2).

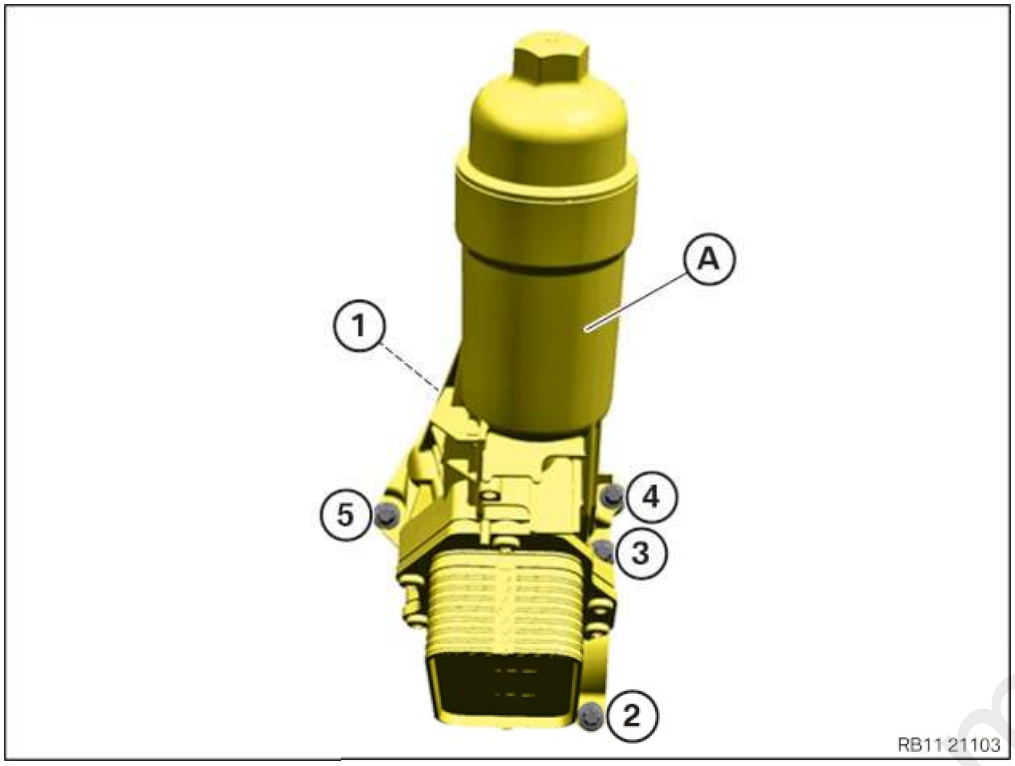


- Guide out coolant line (1) on full-flow oil filter (2) and place it aside.
- Guide out and remove the full-flow oil filter (2).

26 – Install the complete full-flow oil filter

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Full-flow oil filter

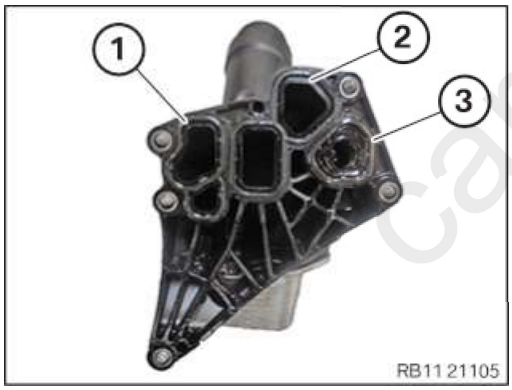


A Full-flow oil filter

1 to 5 Bolts

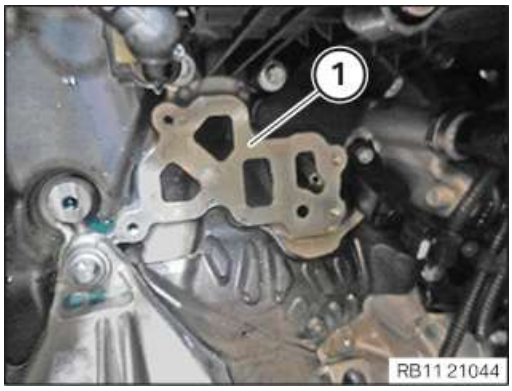
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.



- Renew the gaskets (1), (2) and (3) on the full-flow oil filter.

  Parts: Seals



RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean any sealing residue on sealing surface (1) on the crankcase with the special tool 0 495 102 (11 4 470).

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- Have a cleaning cloth ready.

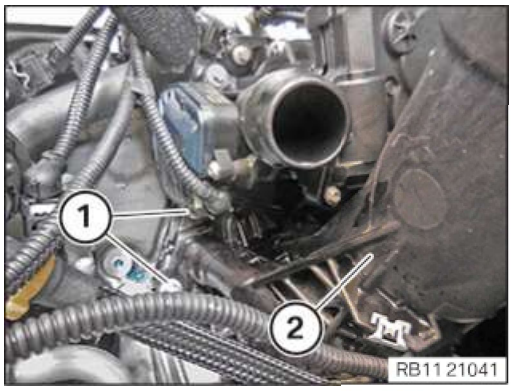
RISK OF DAMAGE

Damage to the engine.

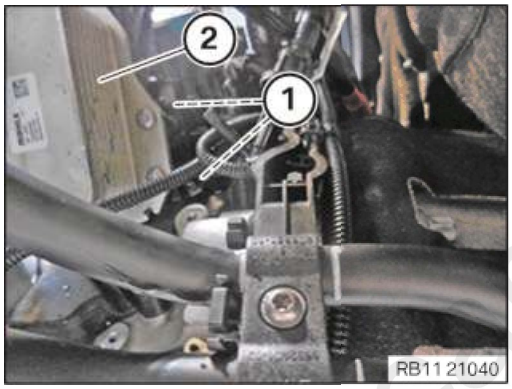
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

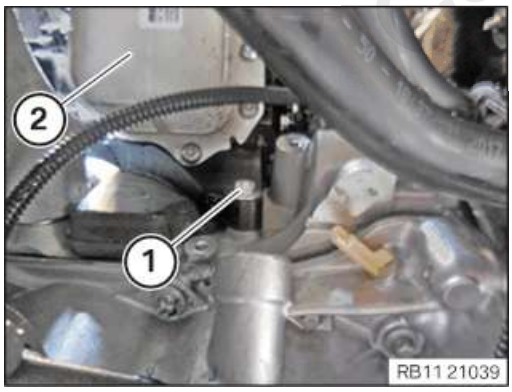
- Crank the engine with the special tool 0 493 380 (11 6 480) until the engine oil flows in the area of oil duct (1).



- Install full-flow oil filter (2) from the top and position it.
- Hand-tighten the bolts (1).

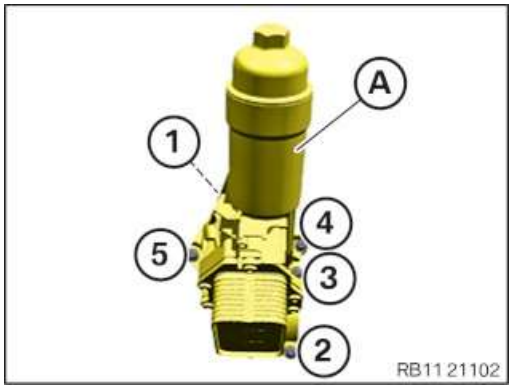


- Apply the screws (1) on the full-flow oil filter (2) hand-tight.



- Apply the screws (1) on the full-flow oil filter (2) hand-tight.

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TECHNICAL INFORMATION

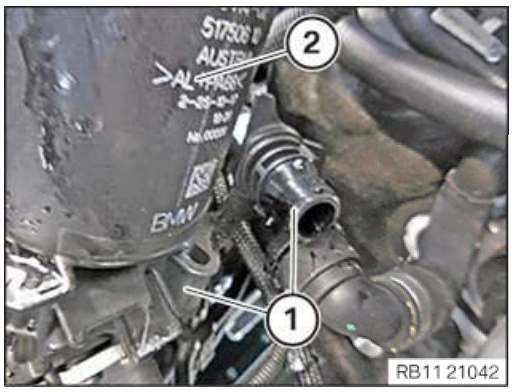
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

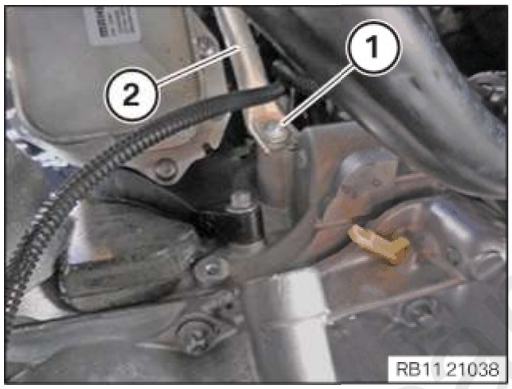
- Tighten the screw on full-flow oil filter (A) in the (1) to (5) order.

Full-flow oil filter to crankcase

M6	Observe tightening sequence.	Jointing torque Tightening torque	4 Nm 10 Nm



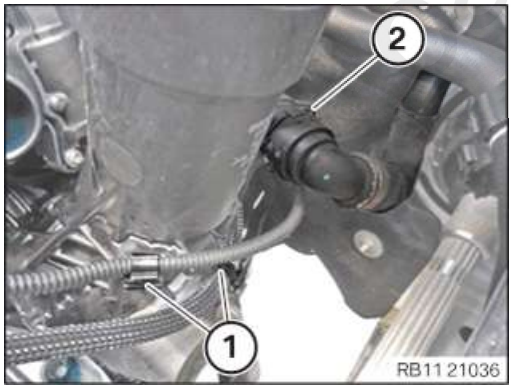
- Guide in and install coolant line (1) on full-flow oil filter (2).



- Guide in and install manifold support (2).
- Tighten down screw (1).

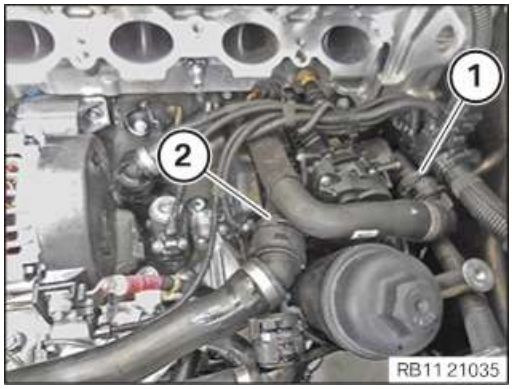
Manifold support to crankcase

M6x16		Tightening torque	8 Nm

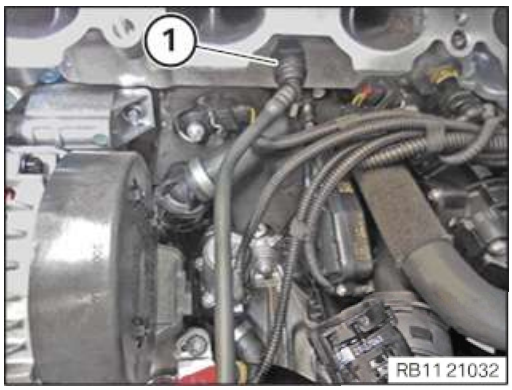


- Secure clamps (1).
- Connect and lock coolant line (2).
- Make sure that the cooling line (2) engages audibly.

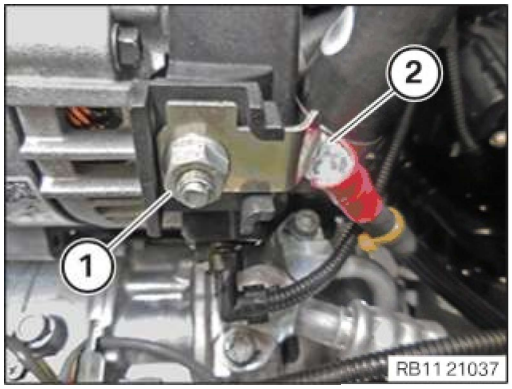
carmanualsdiagram.com



- Connect and lock coolant line (1).
- Connect and lock coolant line (2).
- Make sure that you can hear coolant lines (1) and (2) engage.



- Feed in and install coolant line (1).
- Make sure that the cooling line (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and install the positive battery cable (2).
- Tighten nut (1).

Positive battery cable to the alternator

M8		Tightening torque	19 Nm

POSTPROCESSES

27 – Installing the oil filter element

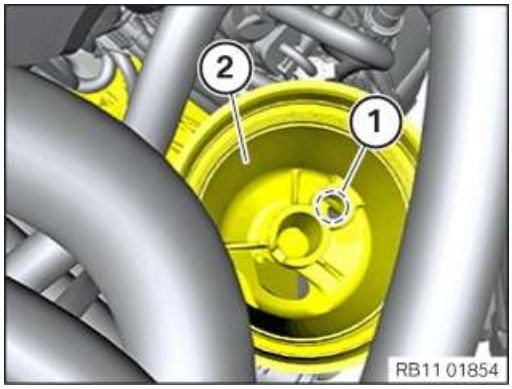
RISK OF DAMAGE

Contaminant or foreign body.

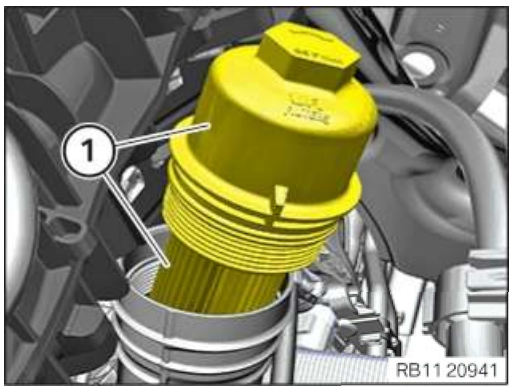
Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

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- Position the oil filter cover with the oil filter element in guide bore hole (1) in oil filter housing (2).



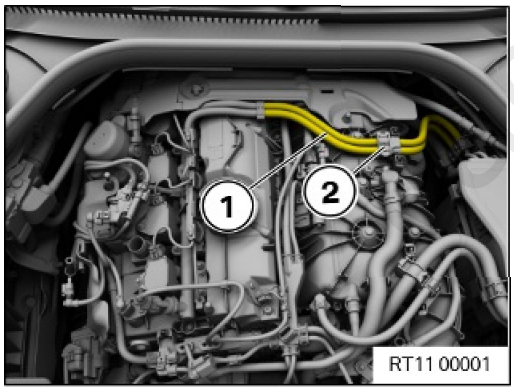
- Install the oil filter cover (1) including oil filter element.



- Tighten the oil filter cover (1).

Oil filter cover to oil filter module

O-ring lightly oiled.	Tightening torque	25 Nm



- Clip in the engine wiring harness (1) in the holder (2).

28 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

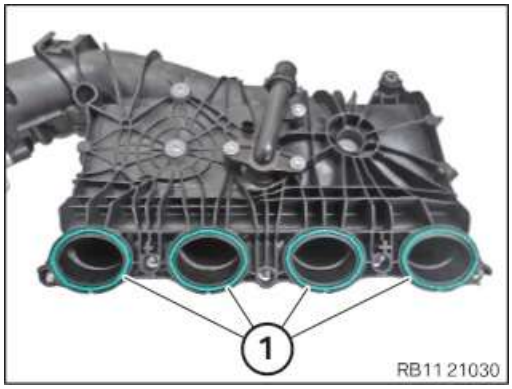
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

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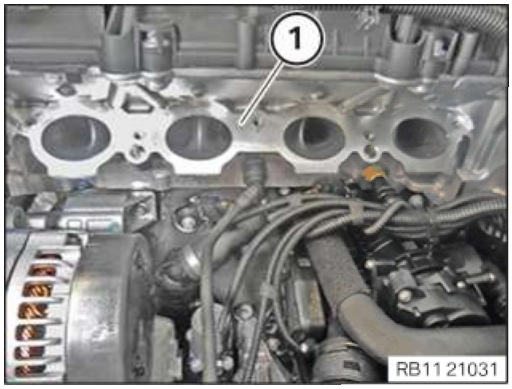
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

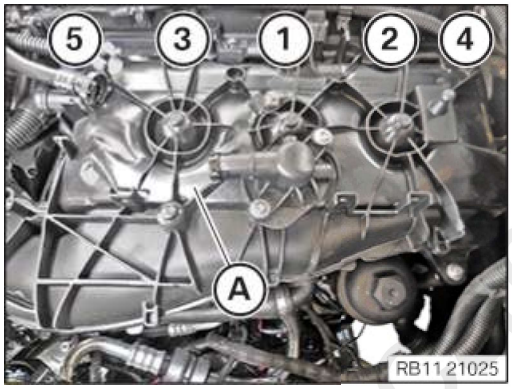


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



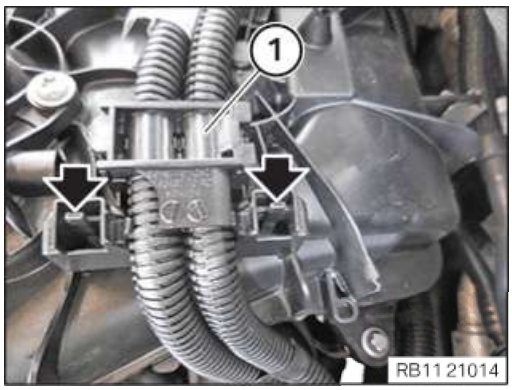
- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.



- Tighten down screw (1).

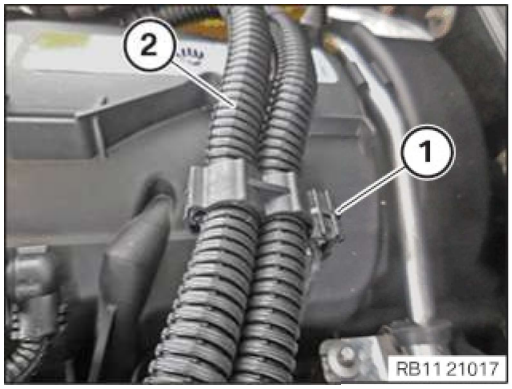
Intake plenum to support

M6X25		Tightening torque	8 Nm

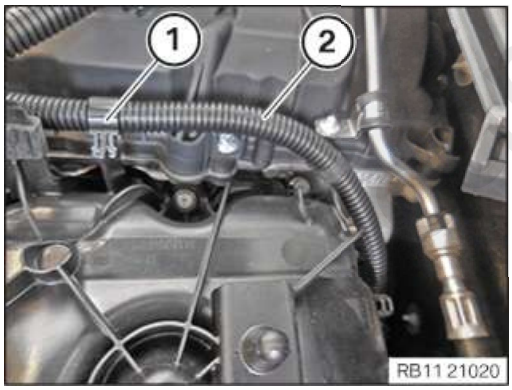


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

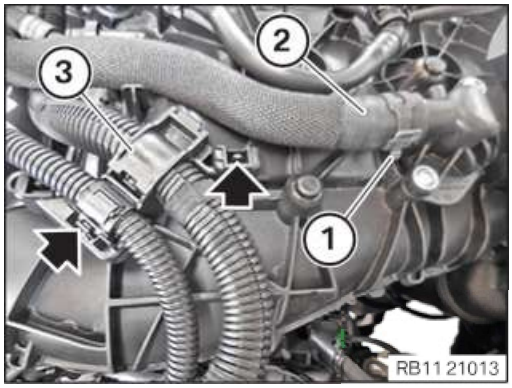
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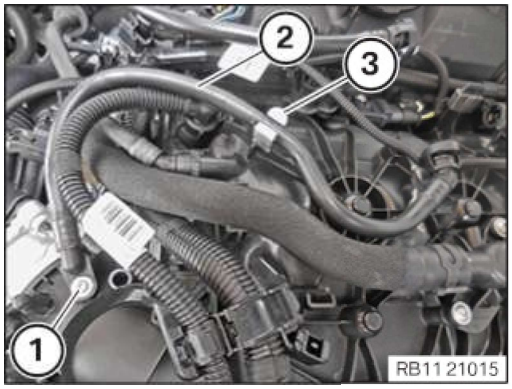
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



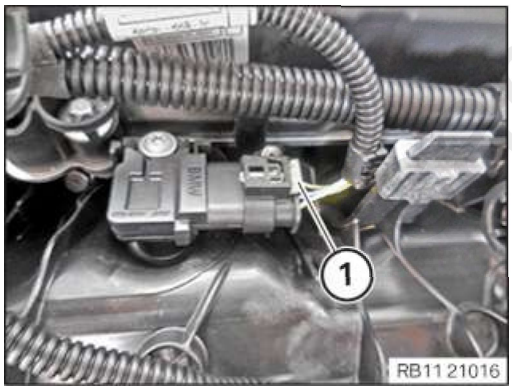
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

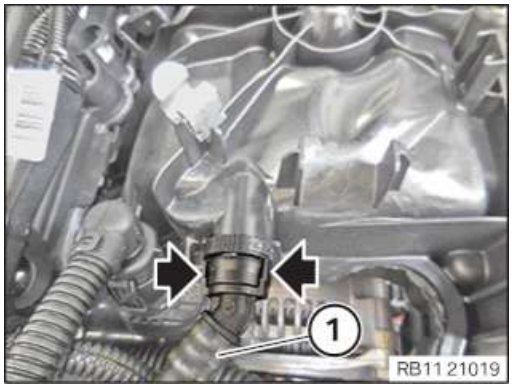
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

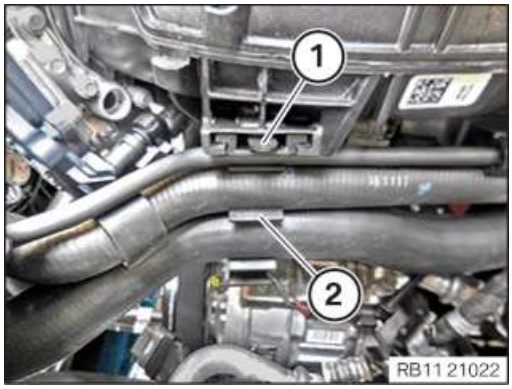
  The connector (1) must engage audibly.



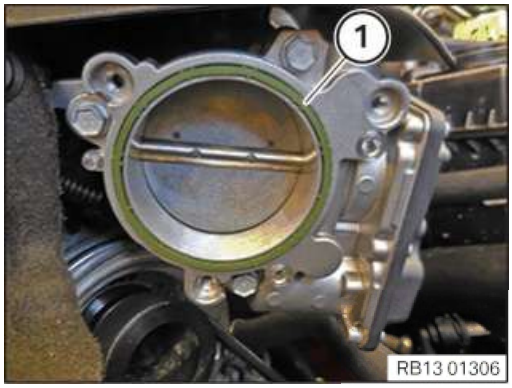
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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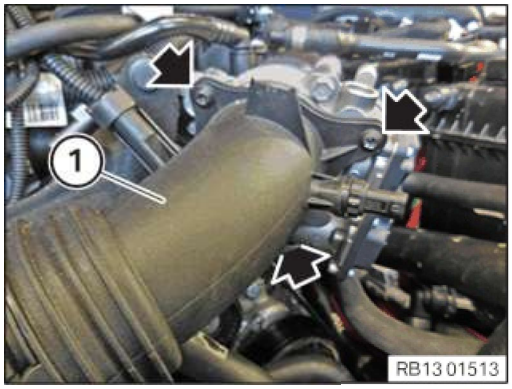


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

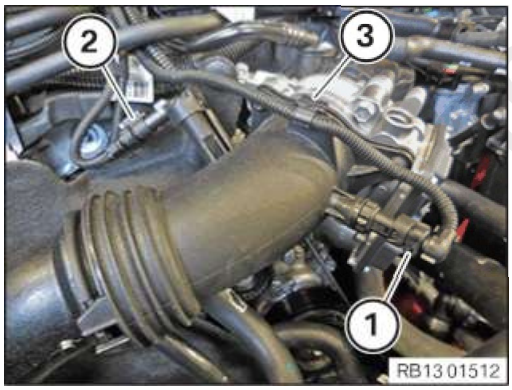
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

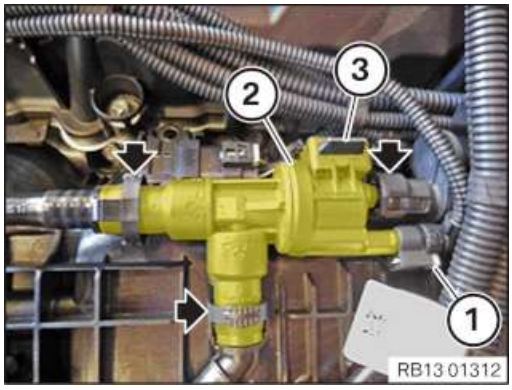
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

29 – Installing the tank vent valve



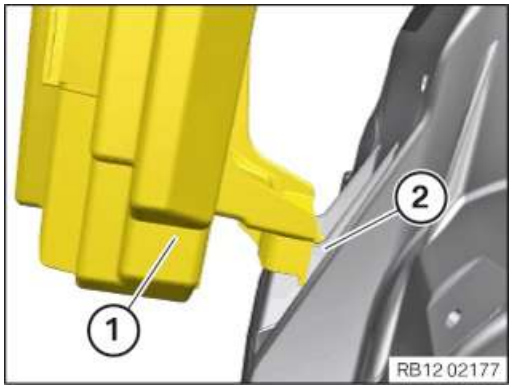
- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

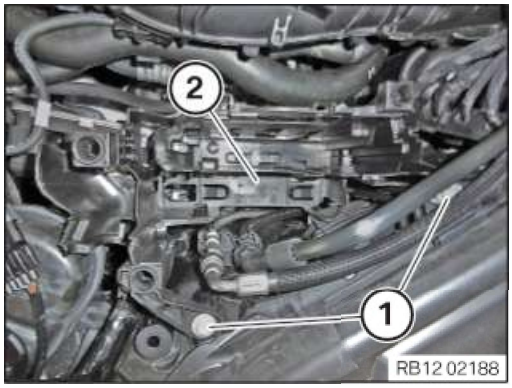
  The connector (1) must engage audibly.

30 – Installing the control unit holder

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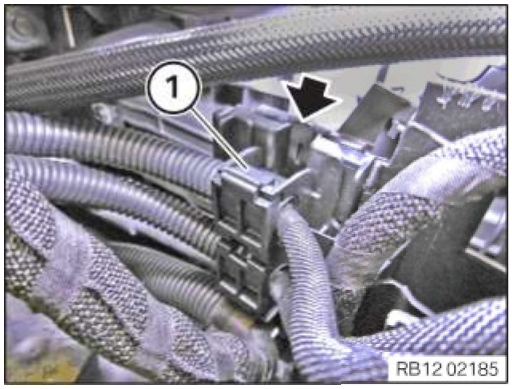
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

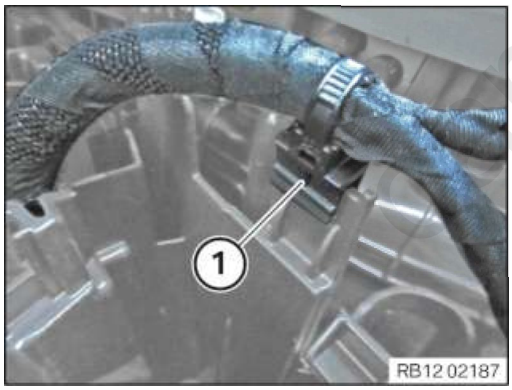
Control unit holder on spring strut dome

Hexagon screw		Tightening torque	8 Nm

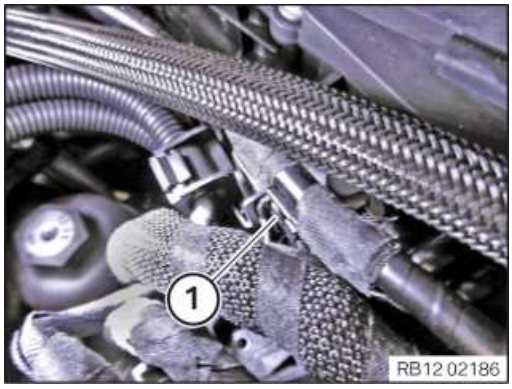


- Feed in and install the cable clip (1).

  Lock (arrow) must audibly engage.

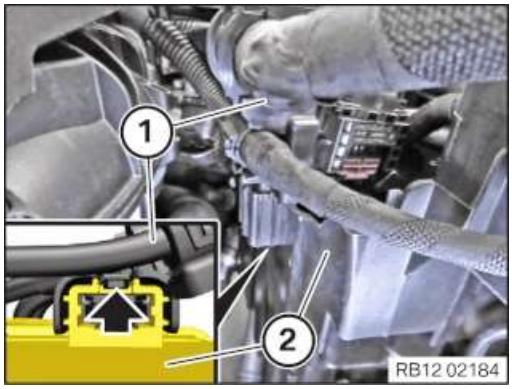


- Secure clamps (1).

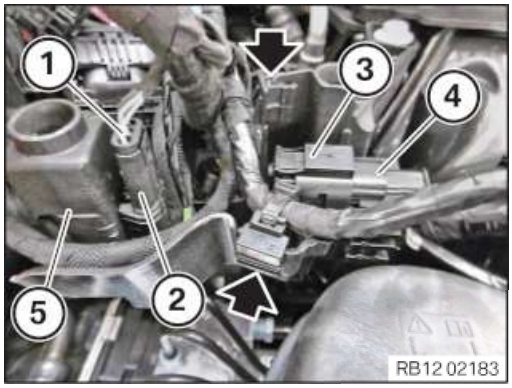


- Secure clamps (1).

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- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

31 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

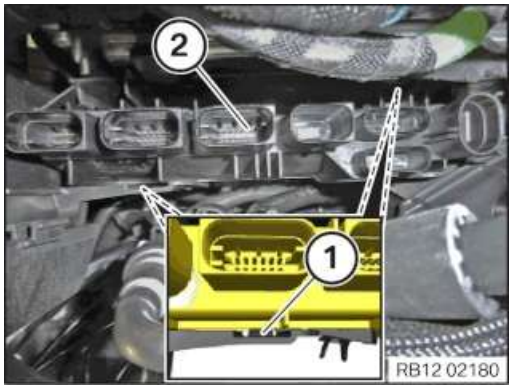
RISK OF DAMAGE

Electrostatic discharge.

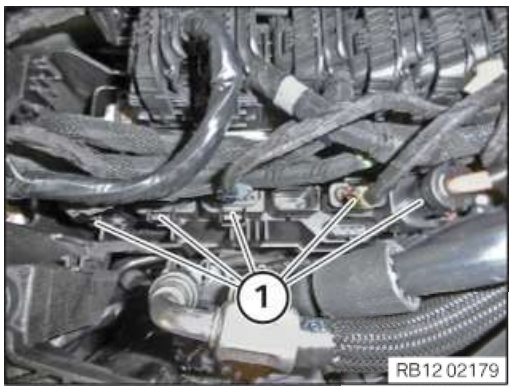
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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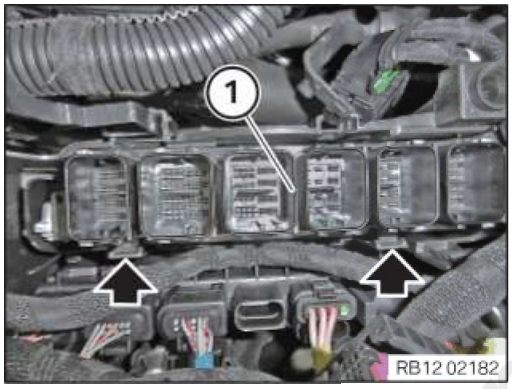


- Insert and install the integrated supply module (PDM) (2).
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).

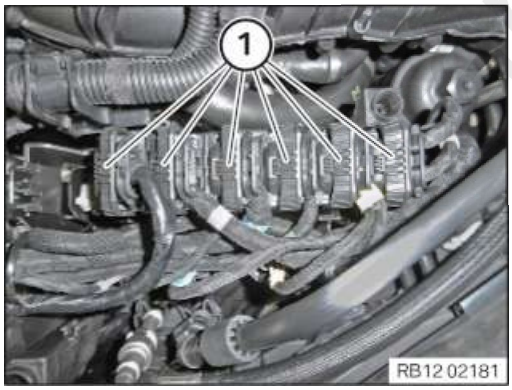


- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

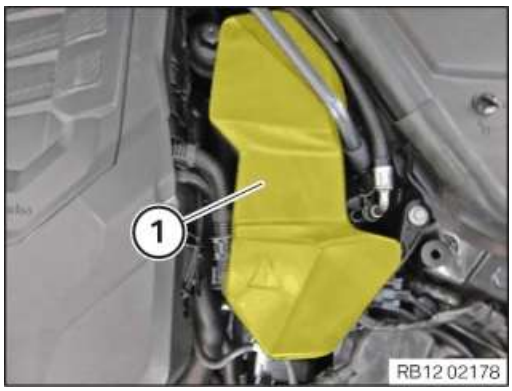
32 – Installing the DME control unit



- Feed in and install DME control unit (1).
  The locks (arrows) must engage audibly.

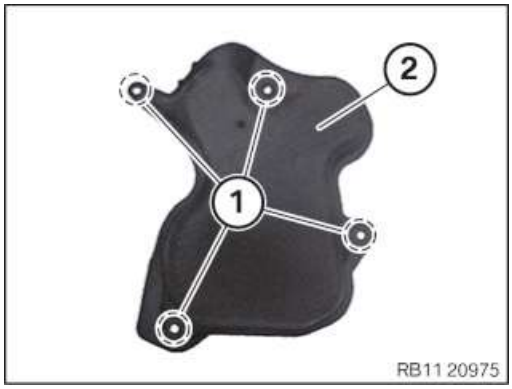


- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.



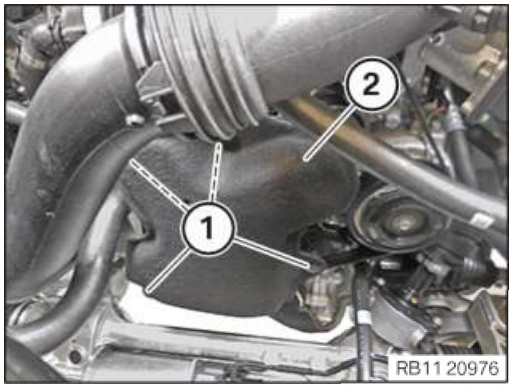
- Insert and install cover (1) into guides.

33 – Install the acoustic cover for the engine at the front

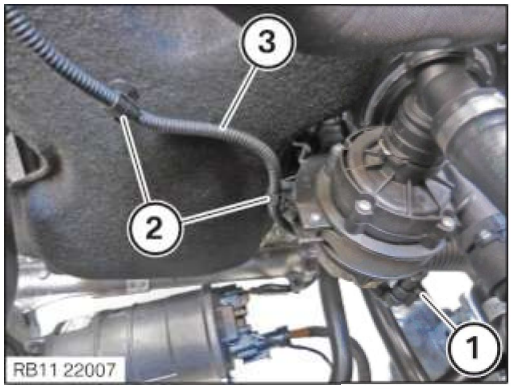


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

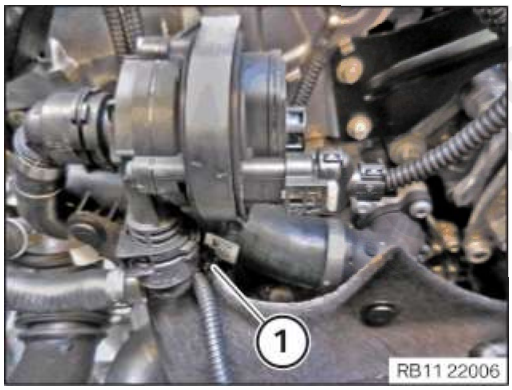


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



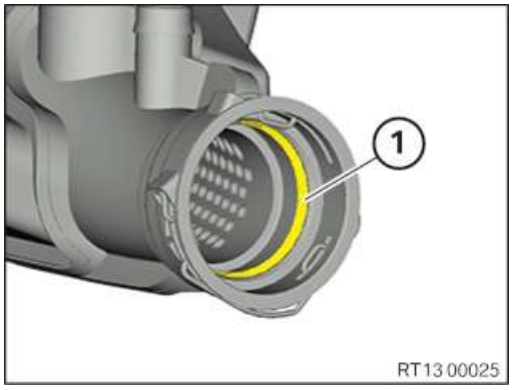
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

34 – Installing the clean air pipe with resonator



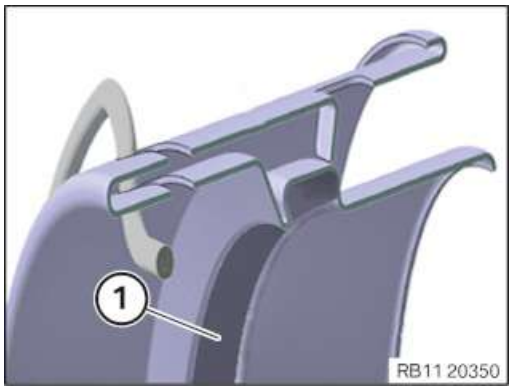
- Check the seal (1) for damages, replace if necessary.

► **Replace damaged gasket**

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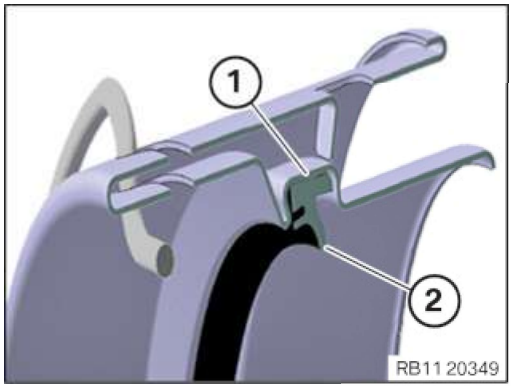
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



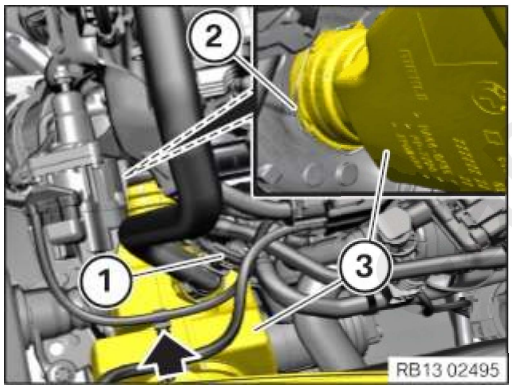
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

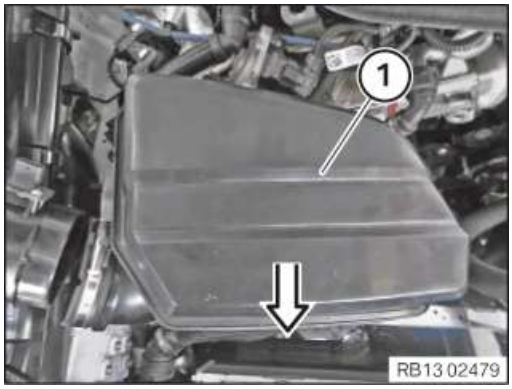
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



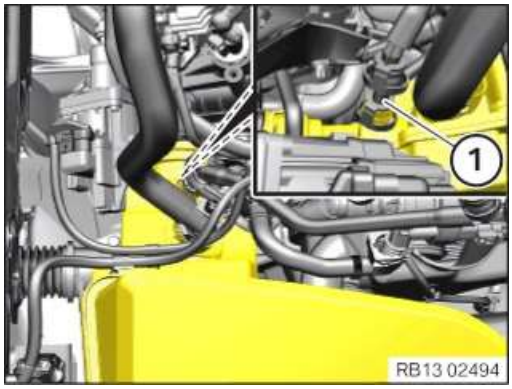
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

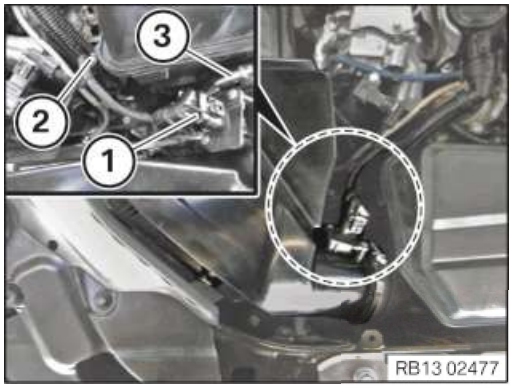
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

35 – Topping up the engine oil

RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Drain the engine oil.

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- Pour in engine oil.

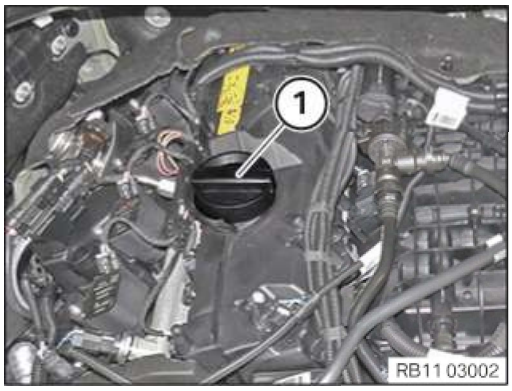
Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

36 – Installing the oil filler cap

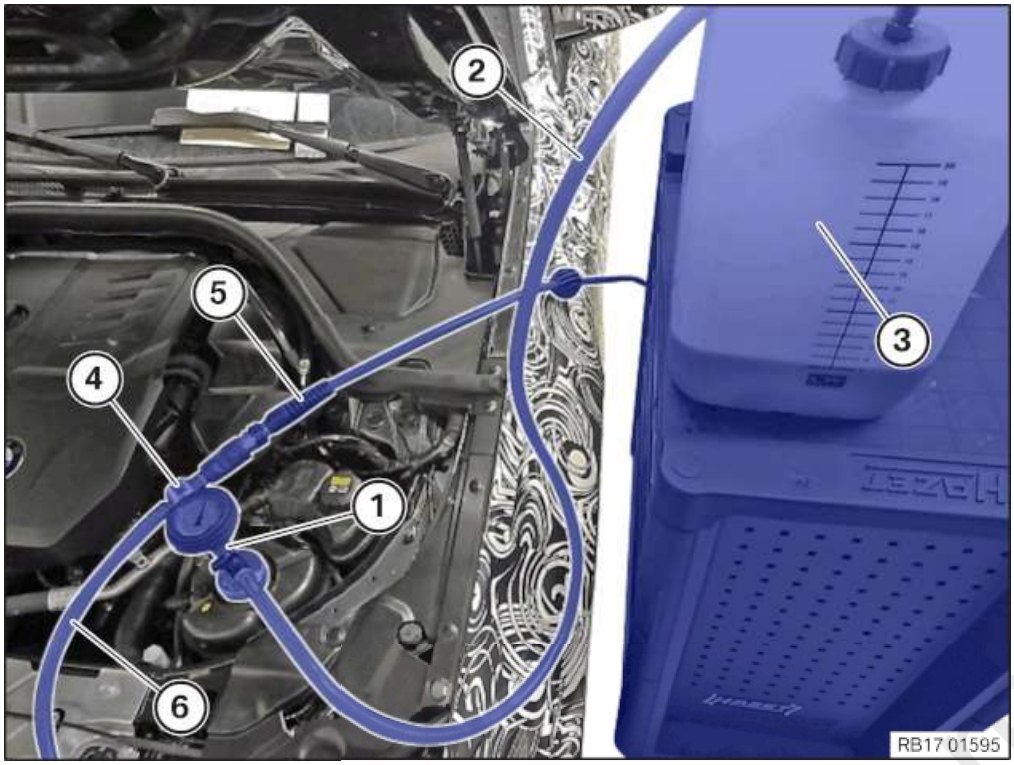


- Close oil filler cap (1).

37 – Fill the high-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

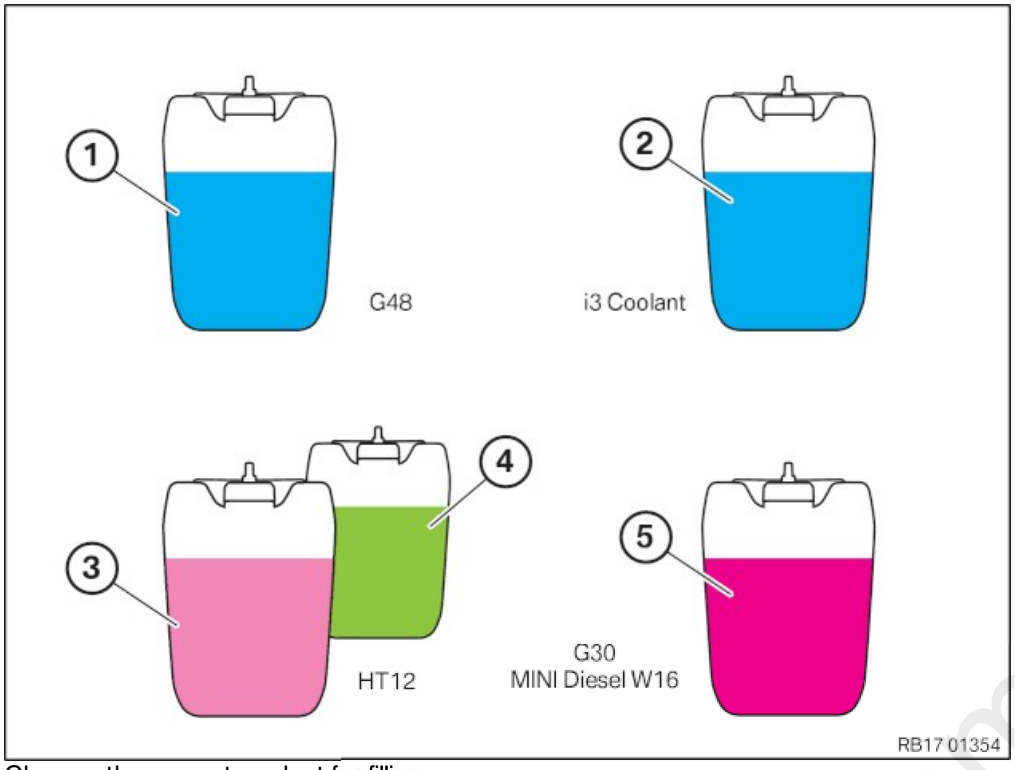
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

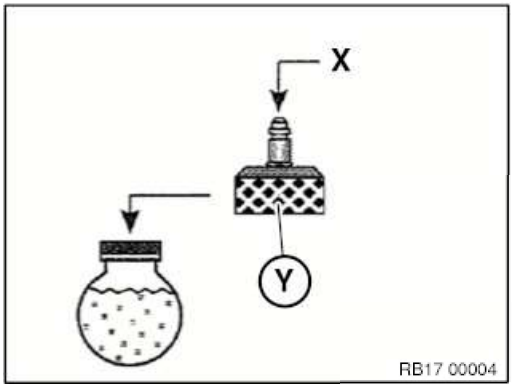
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

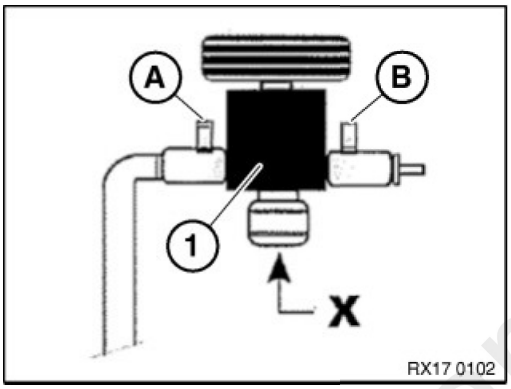
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

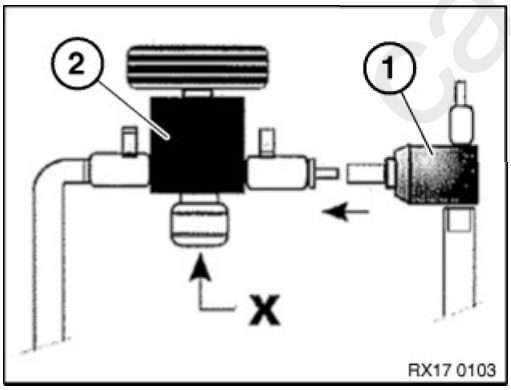
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

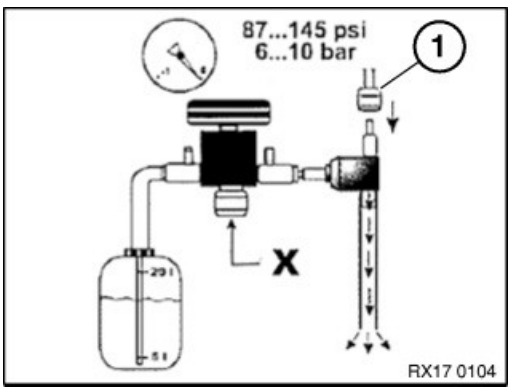


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

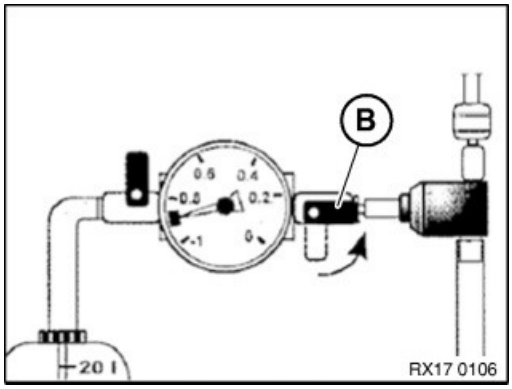
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

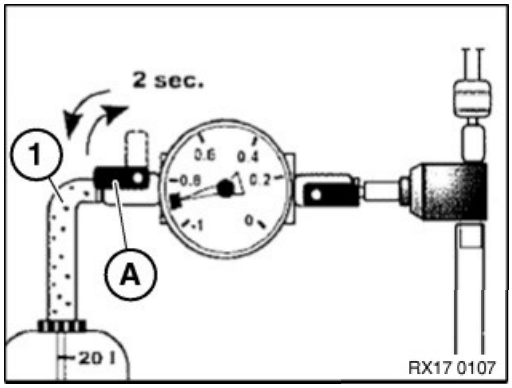
  (X)is the connection on the coolant expansion tank.

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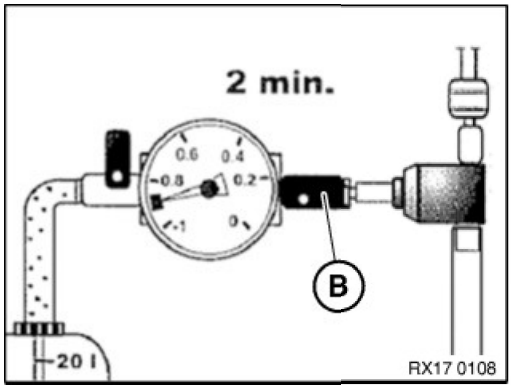
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

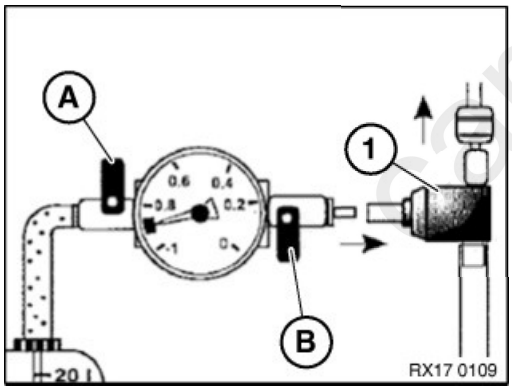


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

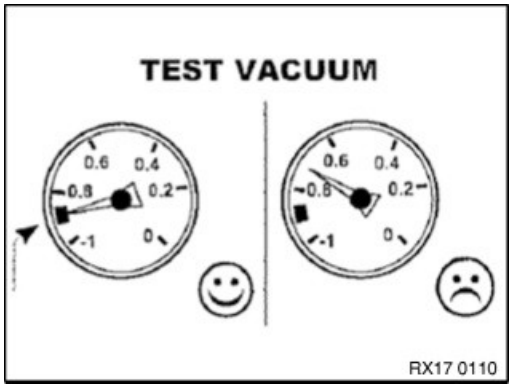
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

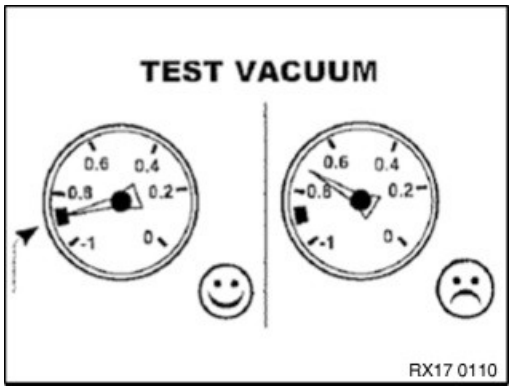
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



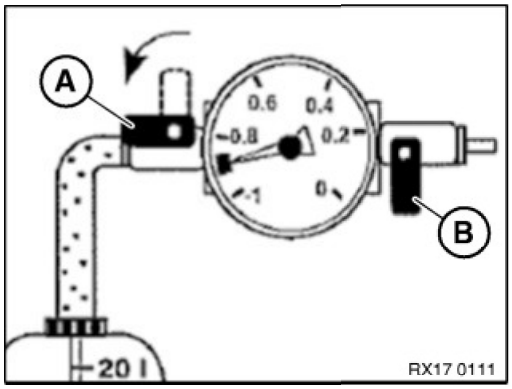
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

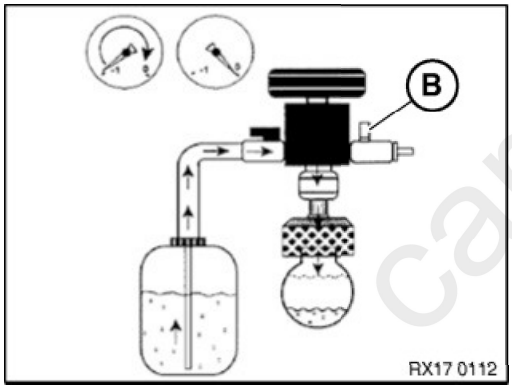
» Vacuum remains constant.

Measure

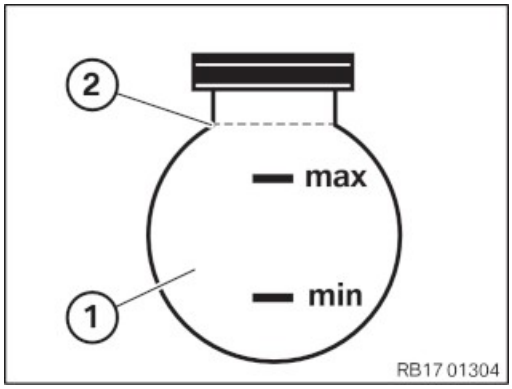
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).

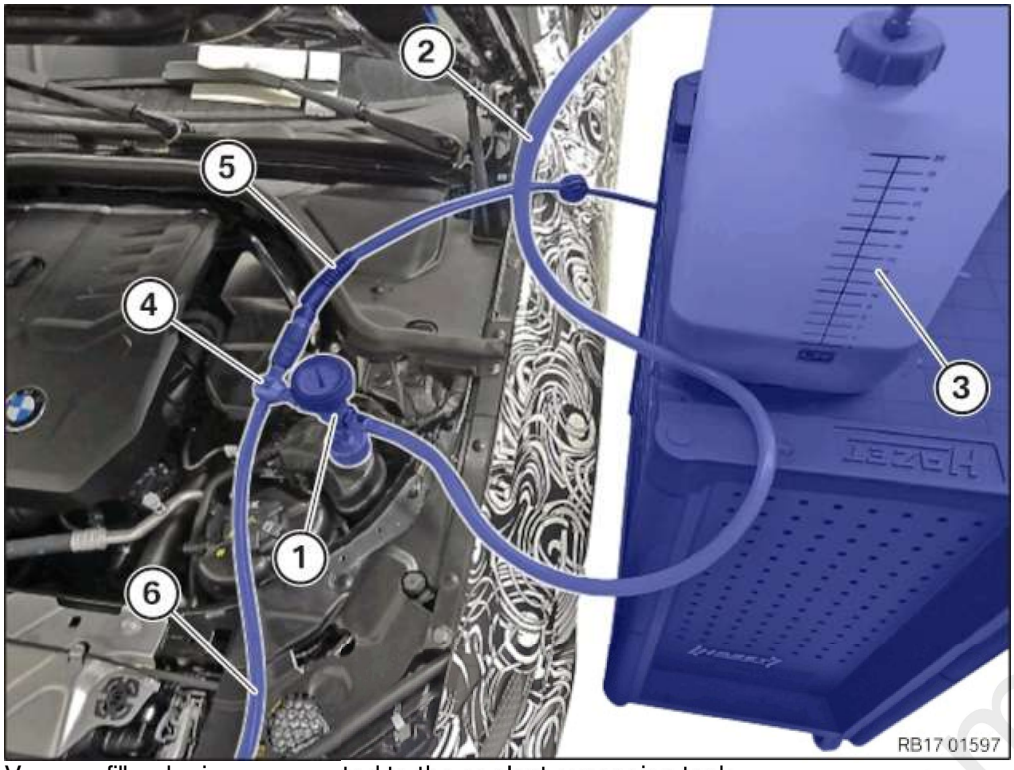


- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

38 – Filling the low-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

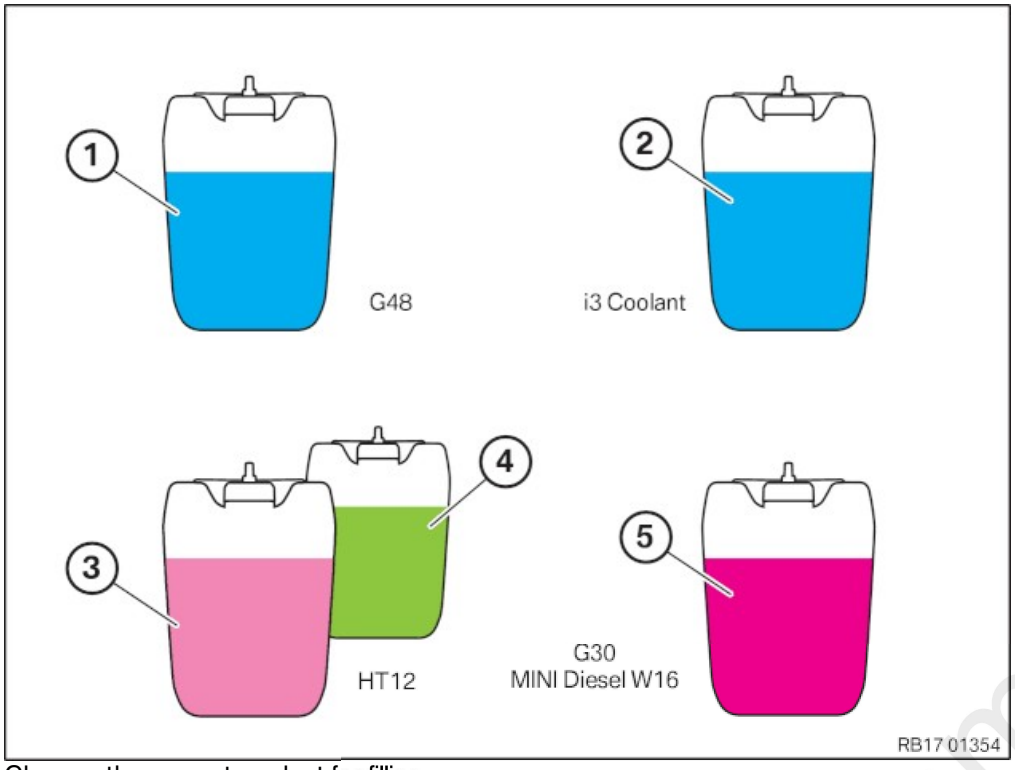
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

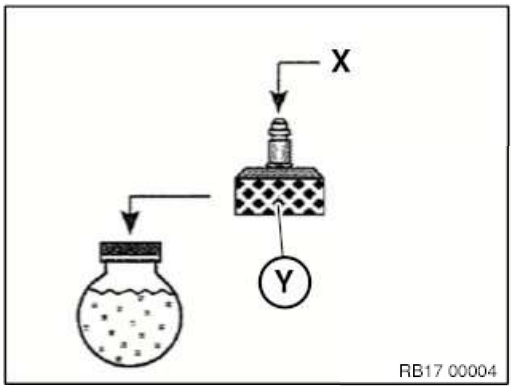
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

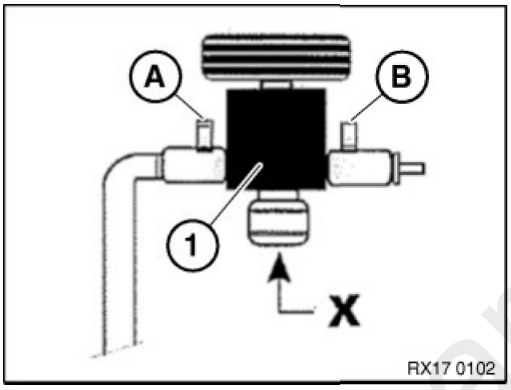
Capacity of low-temperature coolant circuit G20

B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

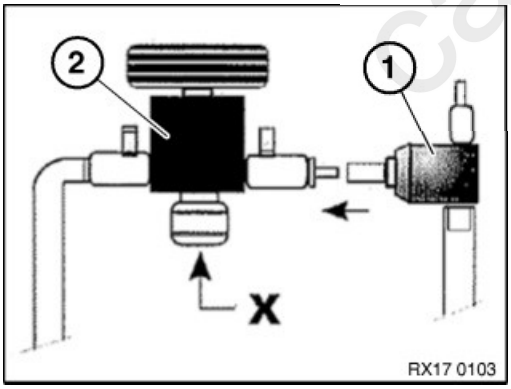
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

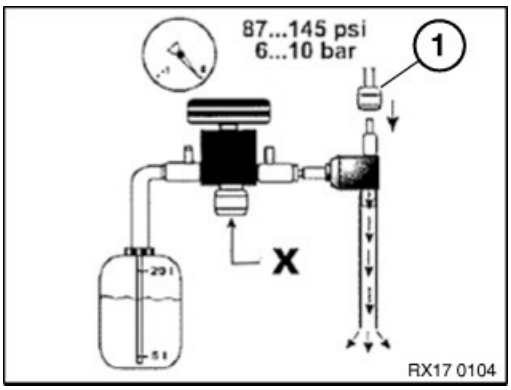


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

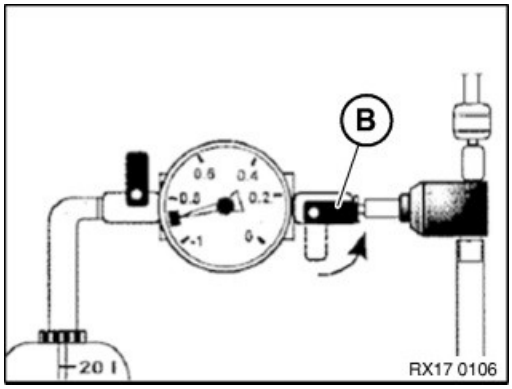
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

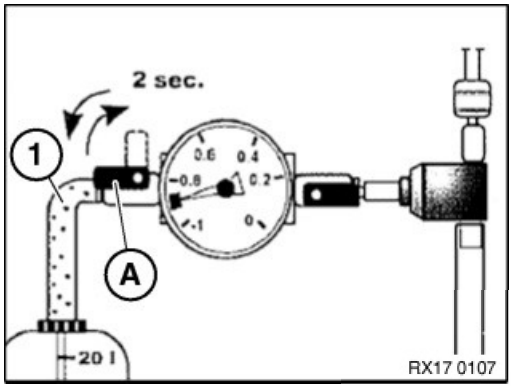
  (X)is the connection on the coolant expansion tank.

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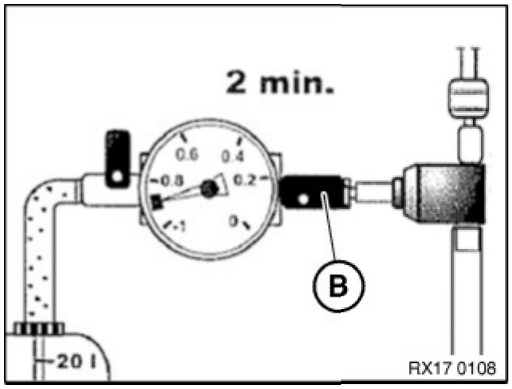
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

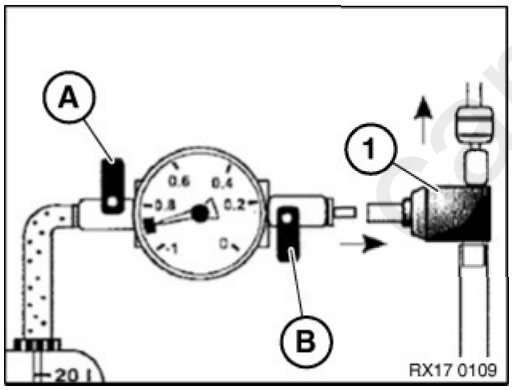


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

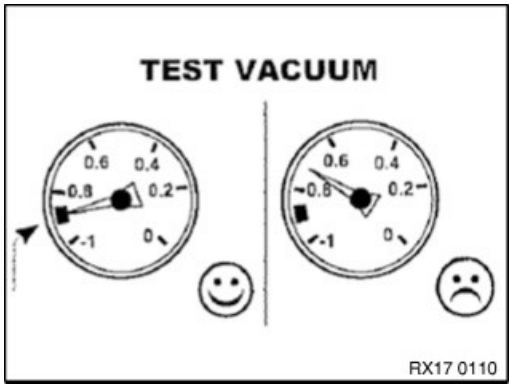
The coolant hoses contract during vacuum build-up.

- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

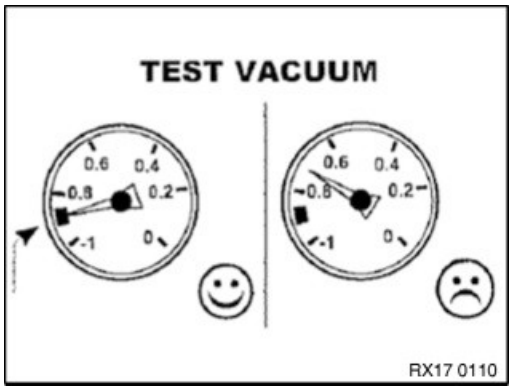
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



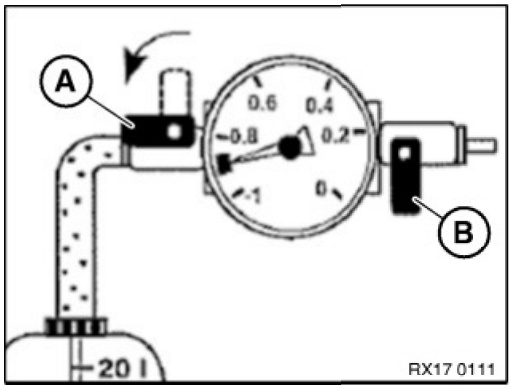
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

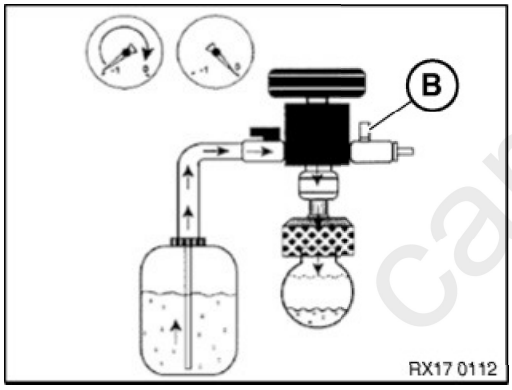
» Vacuum remains constant.

Measure

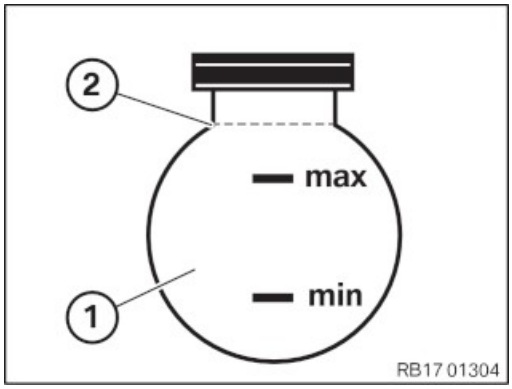
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

39 – Disconnecting all battery earth leads

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- See additional information.

40 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

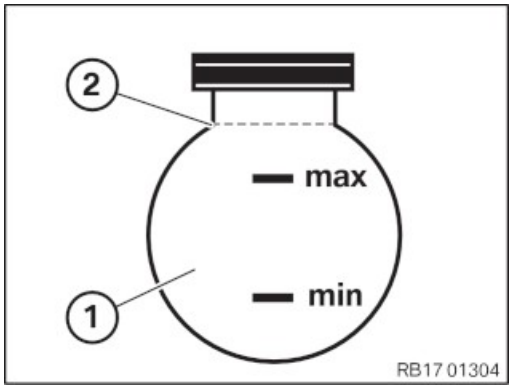
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

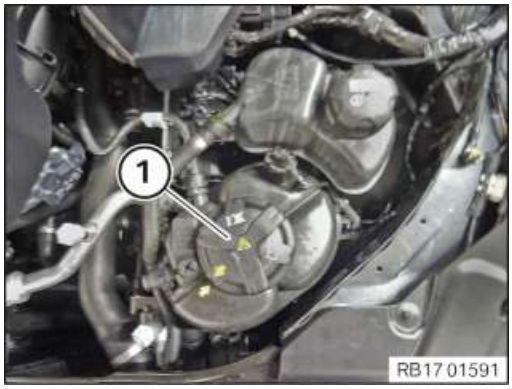
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

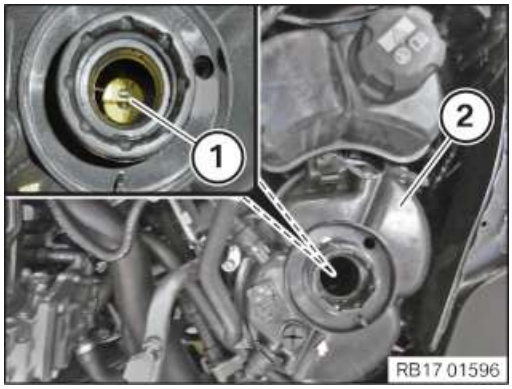
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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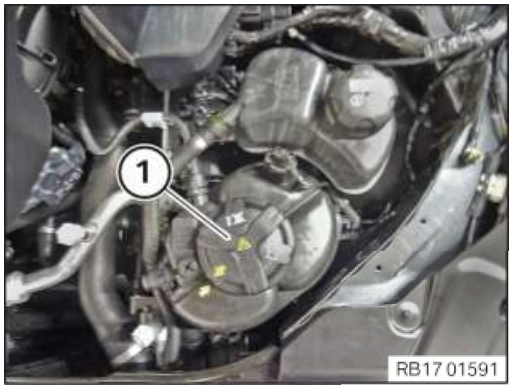
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

41 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

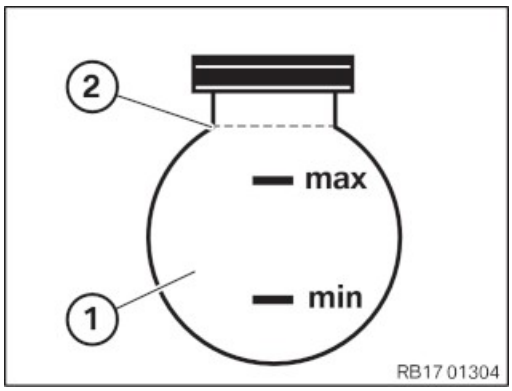
Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

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TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

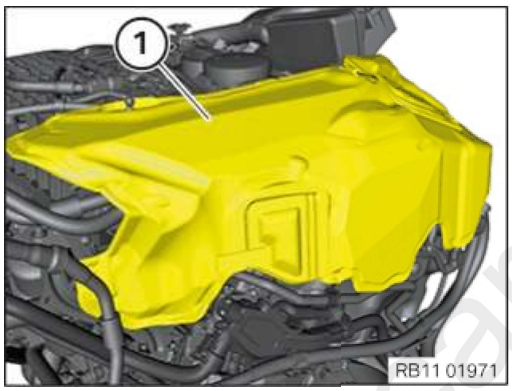
The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

42 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

43 – Installing acoustic cover at rear



- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

44 – Install acoustic cover

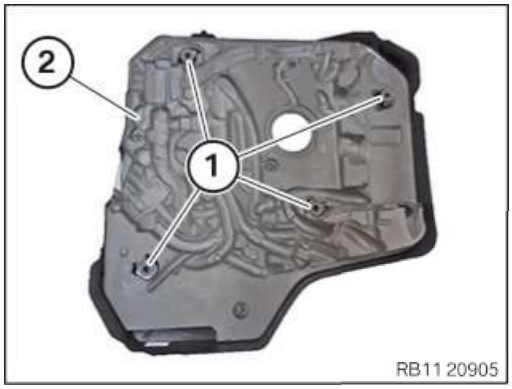
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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



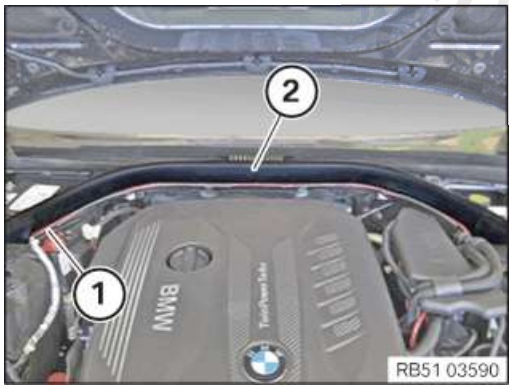
- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

45 – Install the seal for the bonnet



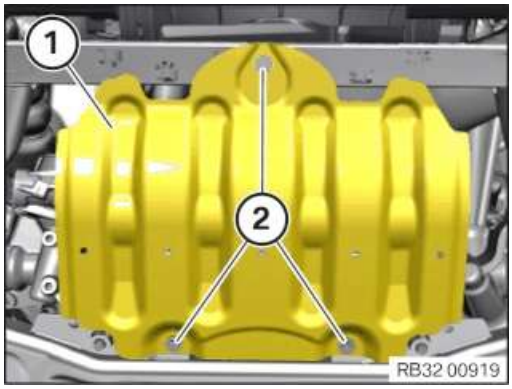
- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

46 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

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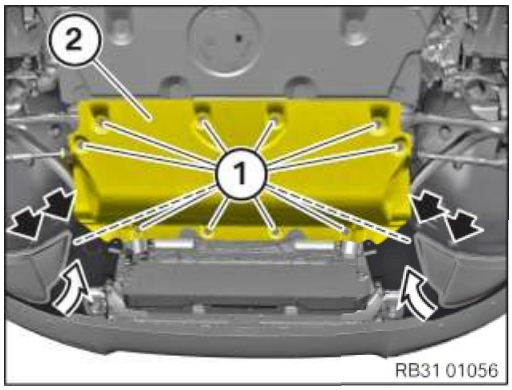


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

47 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

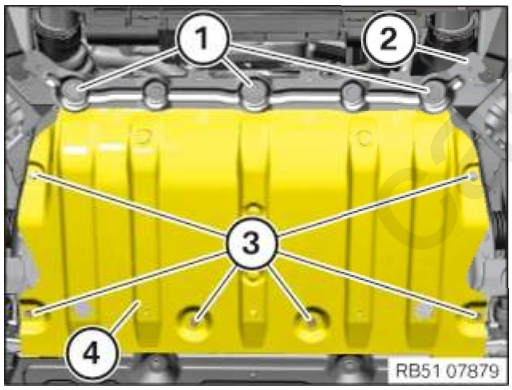
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

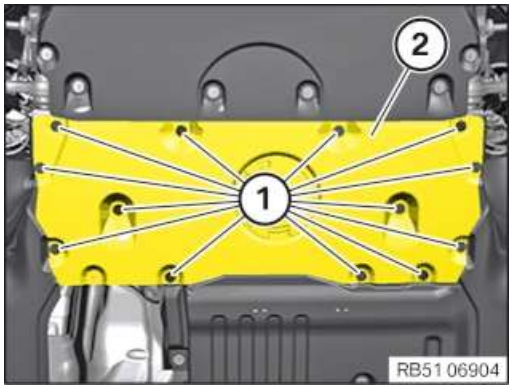
- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

48 – Installing the centre underbody protection

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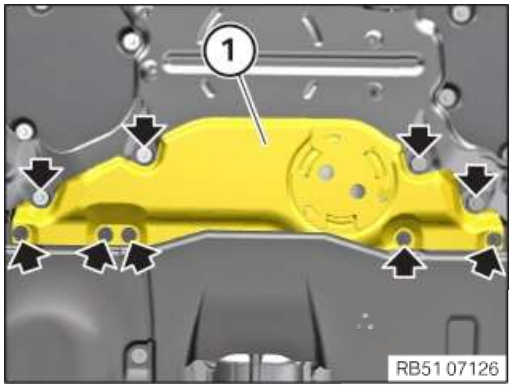
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

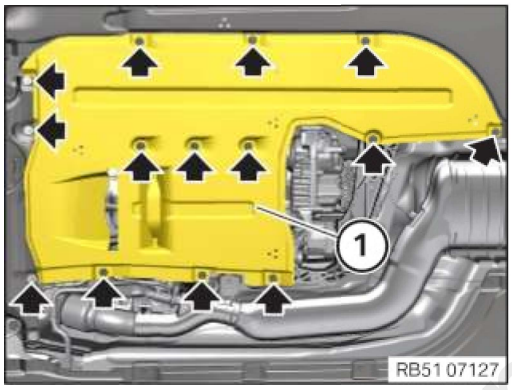
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

49 – Installing underbody protection at rear



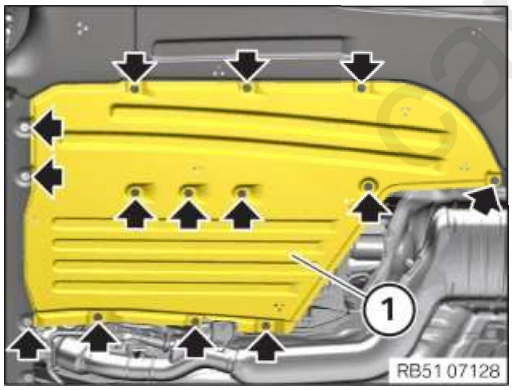
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

  Insert and install the rear underbody protection (1).

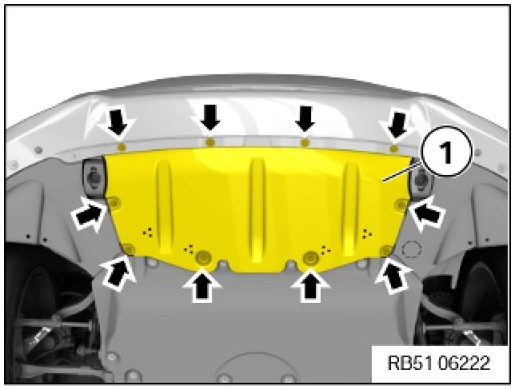
  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

50 – Installing the front underbody protection

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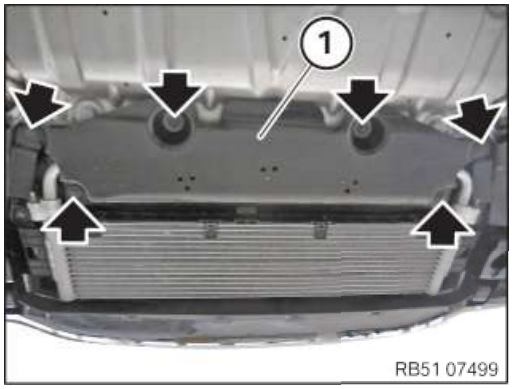
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



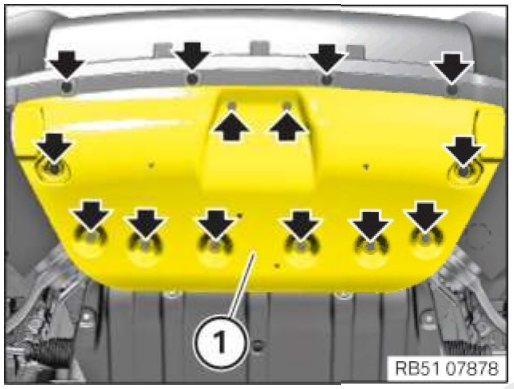
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Oil drain plug — Used in step 14

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Cover, front bottom on side — Used in step 21

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Full-flow oil filter to crankcase — Used in step 26

M6	Observe tightening sequence.	Jointing torque	4 Nm
		Tightening torque	10 Nm

Manifold support to crankcase — Used in step 26

M6x16		Tightening torque	8 Nm

Positive battery cable to the alternator — Used in step 26

M8		Tightening torque	19 Nm

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Oil filter cover to oil filter module			Used in step 27
O-ring lightly oiled.		Tightening torque	25 Nm

Intake plenum to cylinder head			Used in step 28
M6		Tightening torque	10 Nm

Intake plenum to support			Used in step 28
M6X25		Tightening torque	8 Nm

Throttle body to holder			Used in step 28
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 28
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body			Used in step 28
M6		Tightening torque	8 Nm

Control unit holder on spring strut dome			Used in step 30
Hexagon screw		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 34
Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support			Used in step 46
M10		Tightening torque	56 Nm

Underbody protection of the steering gear			Used in step 47
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 47
Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support			Used in step 47
M10		Tightening torque	56 Nm

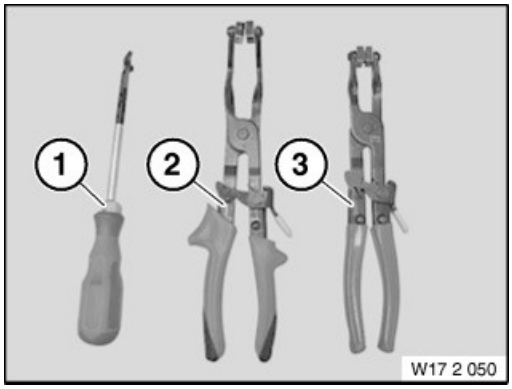
Underbody protection			Used in step 4849
Hexagon screw		Tightening torque	3 Nm

Underbody protection front			Used in step 50
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

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0 495 794 (17 2 050) Pliers



Common Used in step 2428

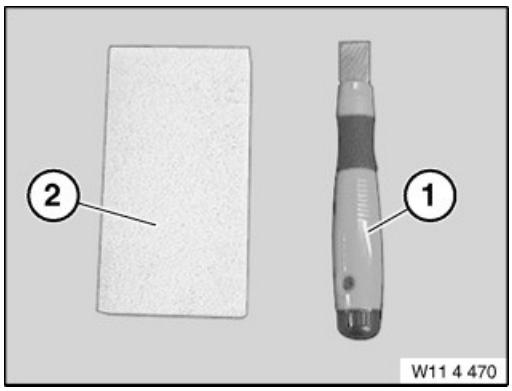
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 495 102 (11 4 470) Tool



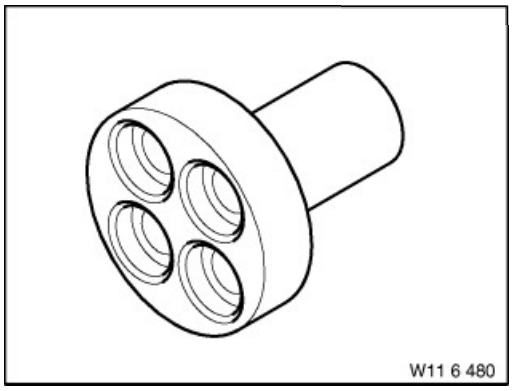
Common	Used in step 26
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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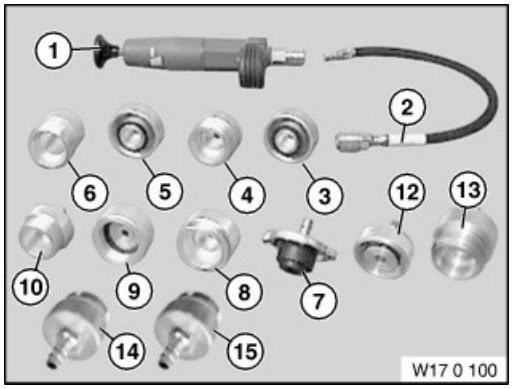
0 493 380 (11 6 480) Connector



Common	Used in step 26
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

0 494 417 (17 0 100) Tester

Common	Used in step 3738
Usage	For checking engine cooling system on watertightness. For checking radiator cap.



Included in the tool or work

Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	

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14	0 495 889 (17 0 115)	**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Engine oil B48B20O1/B46B20O1	Used in step 35
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil	Used in step 35
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Capacity of high-temperature coolant circuit G20	Used in step 37
B48B20O1/B46B20O1	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Capacity of low-temperature coolant circuit G20	Used in step 38
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

General repair instructions	**Used in step**
12 00 ... Instructions for removal and replacement of control units	532

Repair instructions	**Used in step**
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	139
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	139
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	139
61 20 900 Disconnecting and connecting battery earth lead	139
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61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139

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61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 20 900 Disconnecting and connecting battery earth lead	139
61 35 ... Notes on ESD protection (Electro Static Discharge)	561031
61 35 ... Notes on ESD protection (Electro Static Discharge)	10
61 00 730 Encode/program control unit(s) (after vehicle test)	32
17 00 ... Notes for working on cooling system.	3738

Operating materials	Used in step
3.0 Technically appropriate engine oils for BMW Group engines	35

Operating materials	Used in step
Main group 17	3738

Parts

Parts required

Designation	Used in step
Seals, oil filter element to full-flow oil filter and to oil filter cover	27
Seal, oil filter cover to full-flow oil filter	27

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11 42 200 Removing and installing/sealing or replacing oil feed line for exhaust turbocharger

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

PRELIMINARY WORK

1 – Bring front compartment lid in the service position

Prerequisite

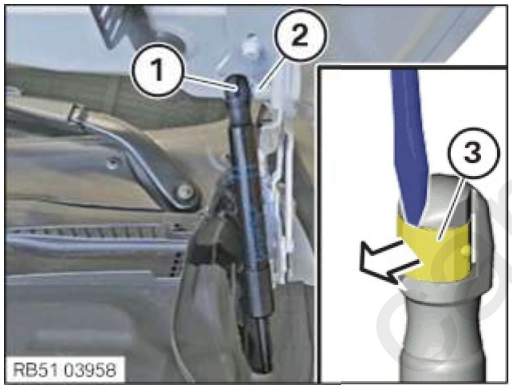
Engine compartment lid is open.

CAUTION

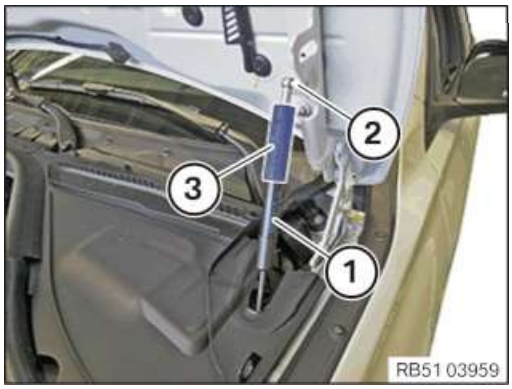
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

2 – Removing the acoustic cover

carsdiagn.com

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

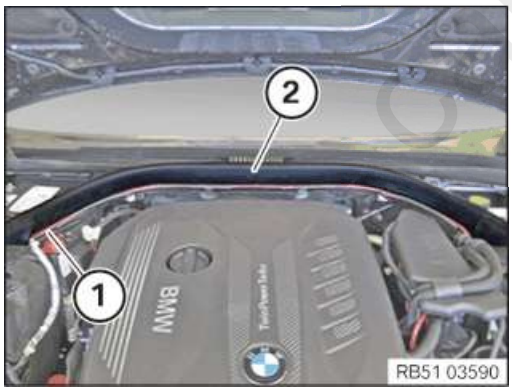
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

4 – Removing acoustic cover at rear

ordiagn.com



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

5 – Removing the clean air pipe with the resonator

WARNING

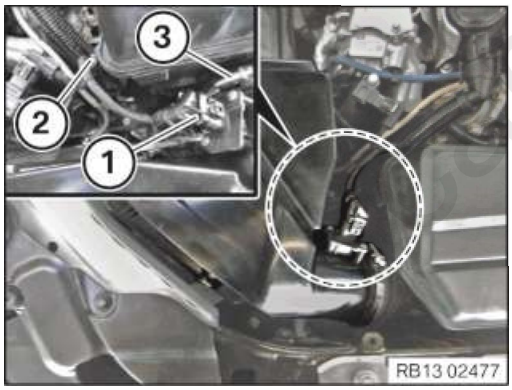
Hot surfaces.

Risk of burning!

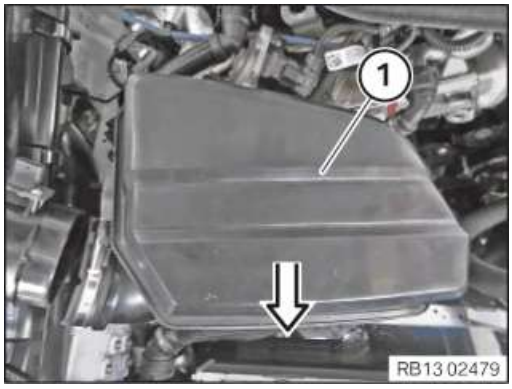
- Perform all work only on components that have cooled down.



- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

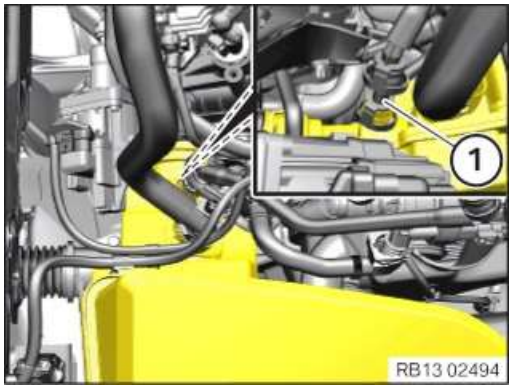


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

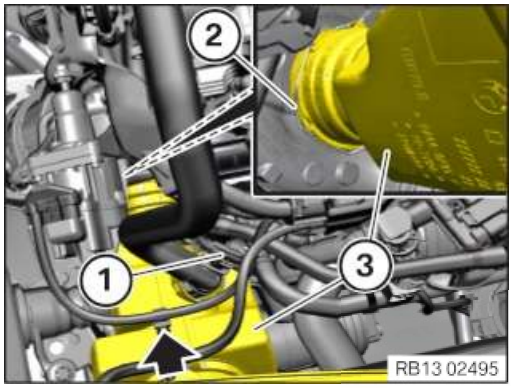


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

partdiagn.com



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

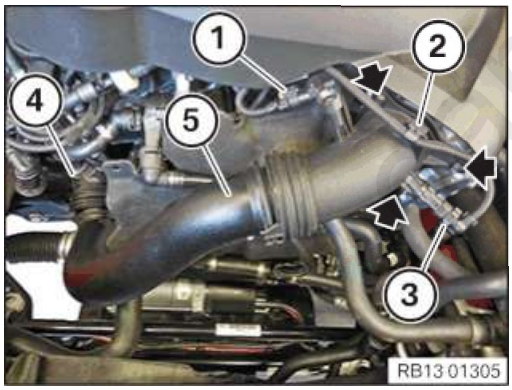
6 – Remove charge air line

WARNING

Hot surfaces.

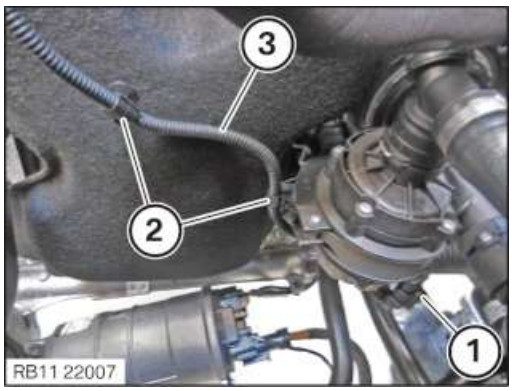
Risk of burning!

- Perform all work only on components that have cooled down.



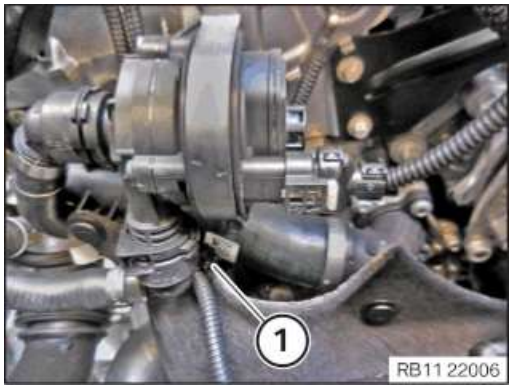
- Unlock and loosen the connector (1) on the charging pressure sensor.
- Unlock and loosen clamp (2).
- Unlock and disconnect the connector (3) from the charge-air temperature sensor.
- Remove screws (arrows).
- Unlock and loosen the clamp (4) on the exhaust turbocharger.
- Guide out and remove charge air line (5).

7 – Removing the acoustic cover for the engine at the front

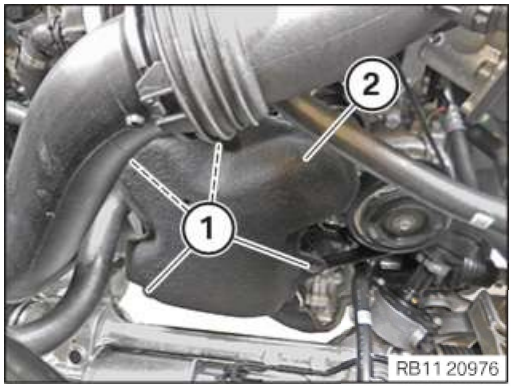


- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

erdiagn.com



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

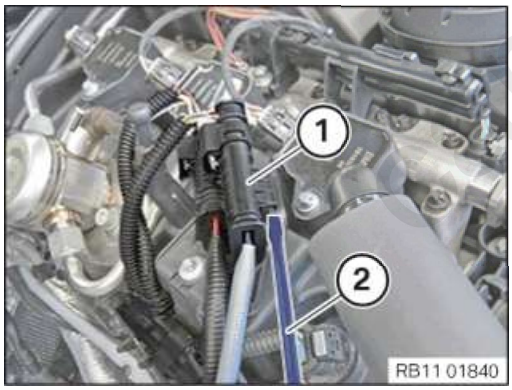
8 – Remove the control sensor

WARNING

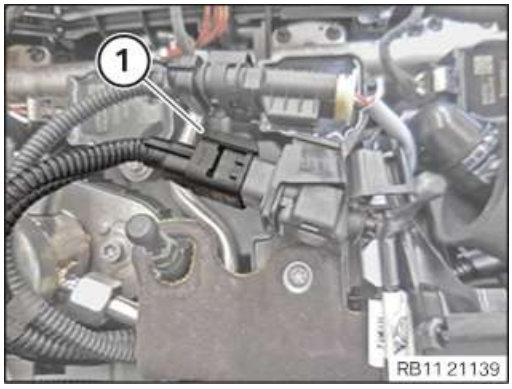
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

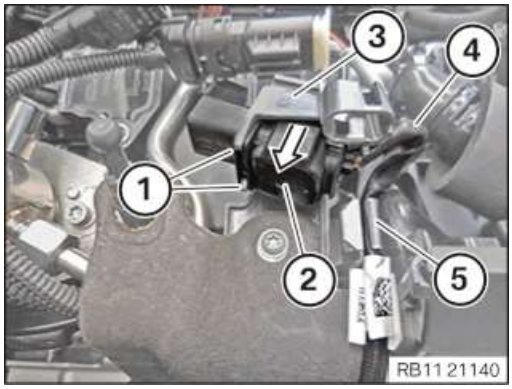


- Unlock connector (1) with screwdriver (2) and remove from the carrier plate.
- Unlock and loosen connector (1).

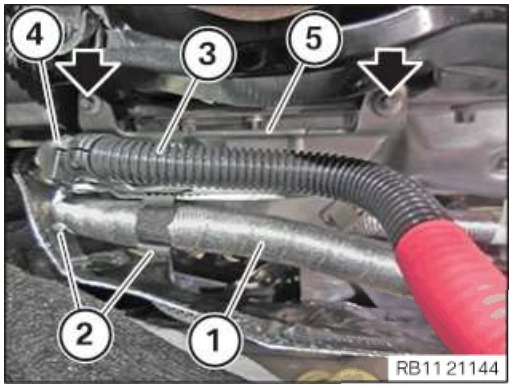


- Unlock and loosen connector (1).

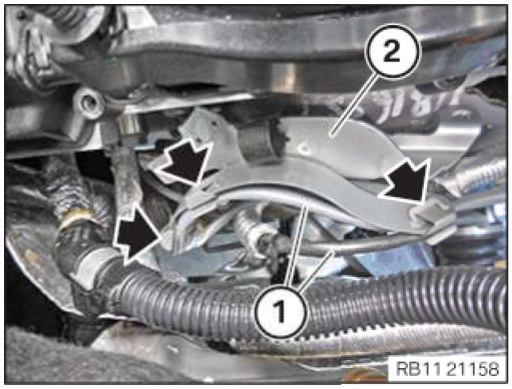
carldiagn.com



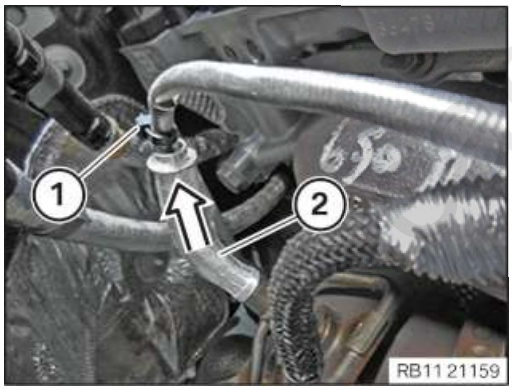
- Unlock the locks (1).
- Guide the connector (2) out of the bracket (3)in the **direction of the arrow** and set it aside.
- Release the cable (4) from the clamp (5).



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.



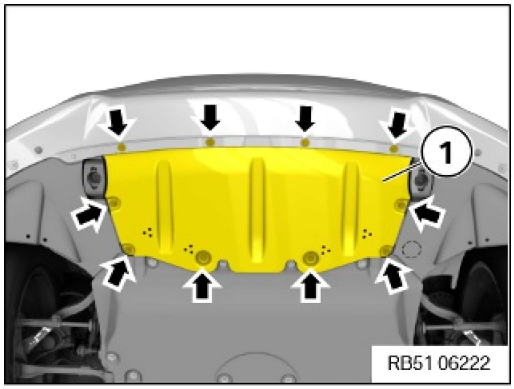
- Unfasten cable strap (1).
- Feed out the heat shield (2) **in direction of arrow** and set it aside.



- Release and remove the control sensor (1) with the special tool 0 491 074 (11 7 020).

9 – Removing the front underbody protection

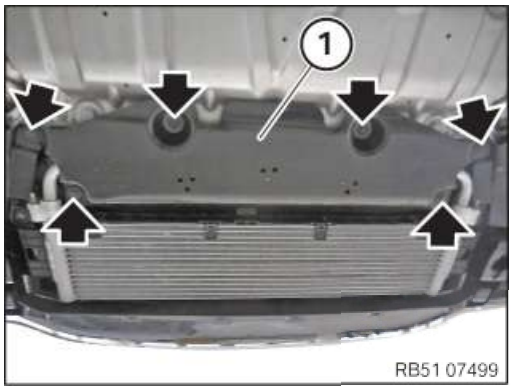
rdiagn.com



- **Version 1:**

  Remove screws (arrows).

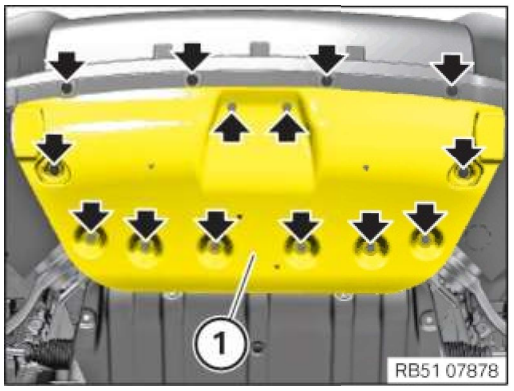
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

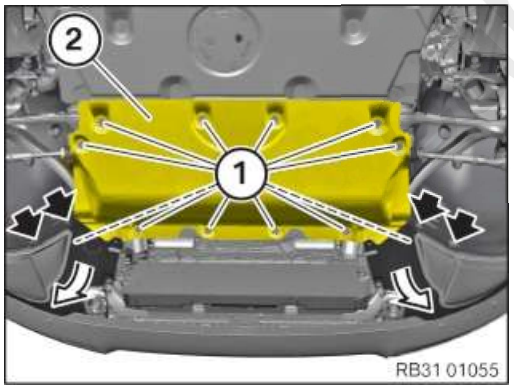


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

10 – Remove the underbody protection of the steering gear



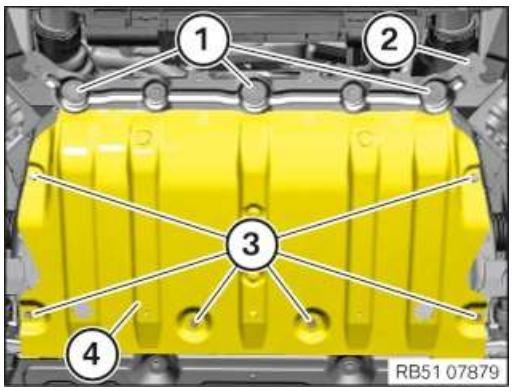
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

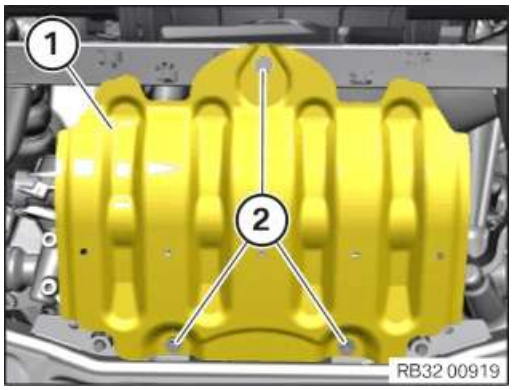
  Slide the steering gear underbody protection (4) out and remove.

11 – If installed: Removing the steering start protection

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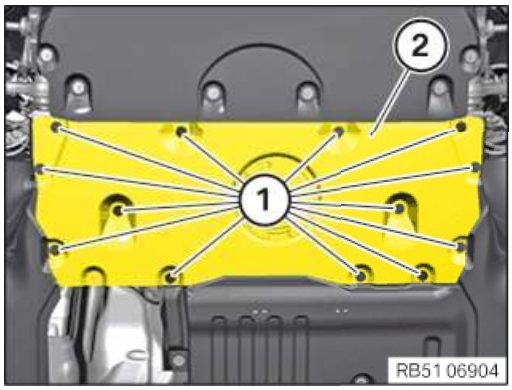
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

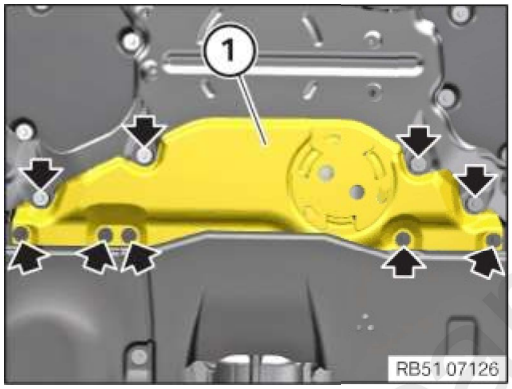
12 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



- **Version with all-wheel drive:**

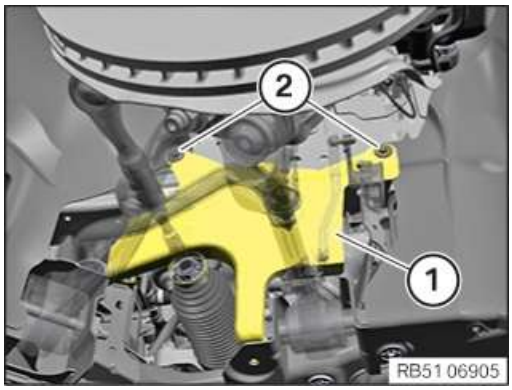
  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

13 – Remove the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.



- Loosen screws (2).
- Remove the cover (1).

14 – Draining the coolant from the high-temperature cooling system

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

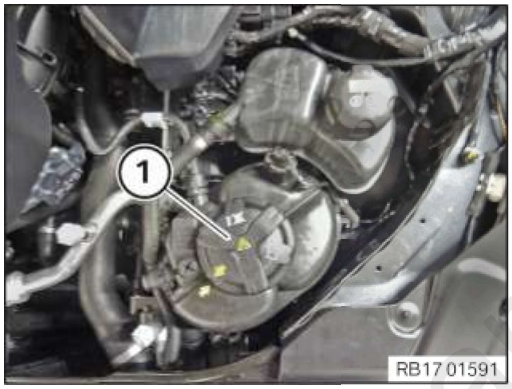
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

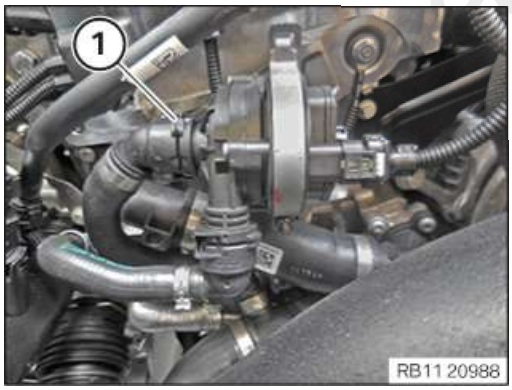
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

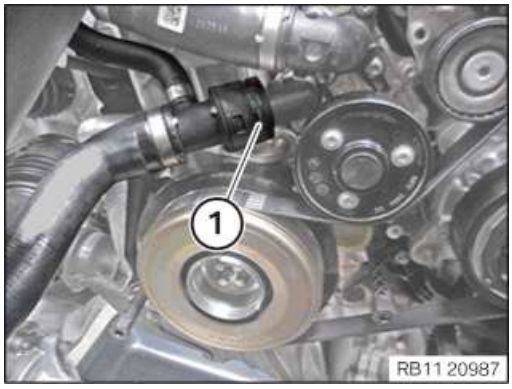
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



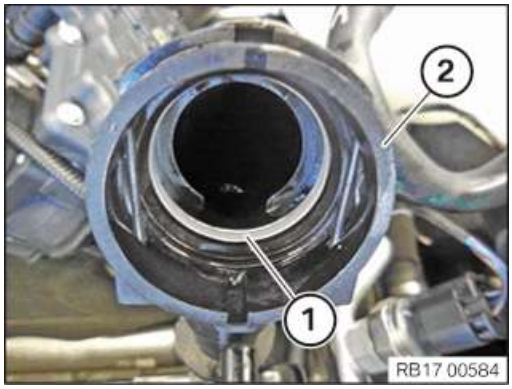
- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

.diagn.com

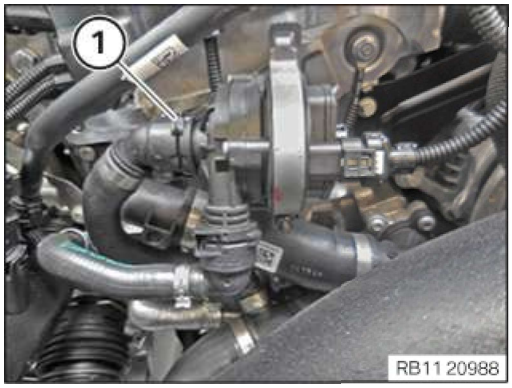
15 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

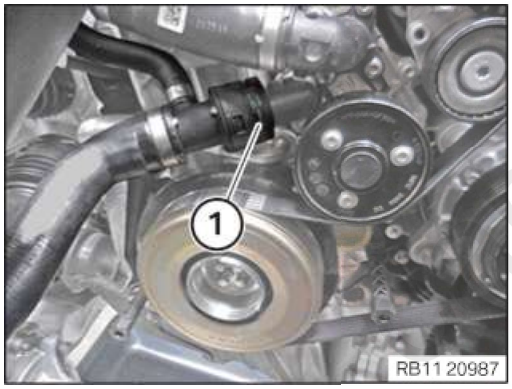


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

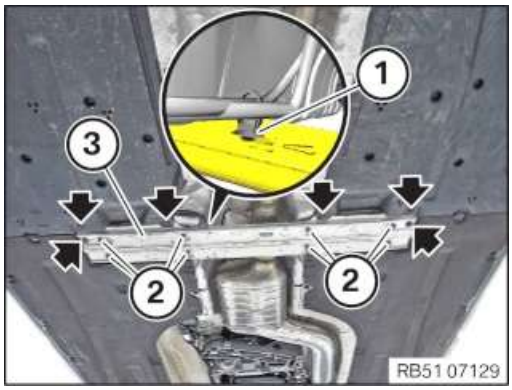
  Coolant line (1) must audibly engage.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

16 – Remove the connecting support from the tunnel



- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

17 – Remove complete exhaust system

mdiagn.com

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

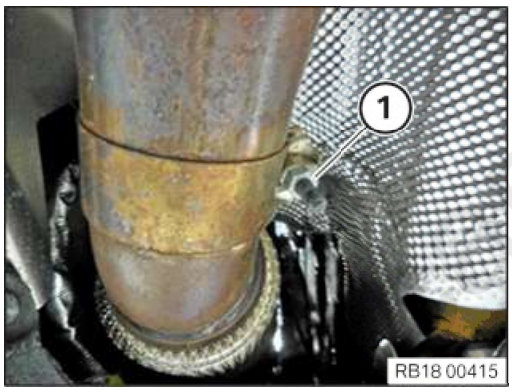
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

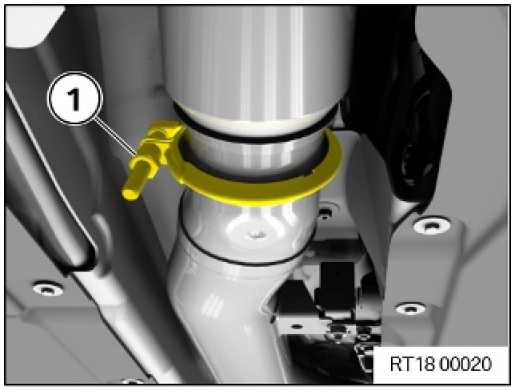
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).



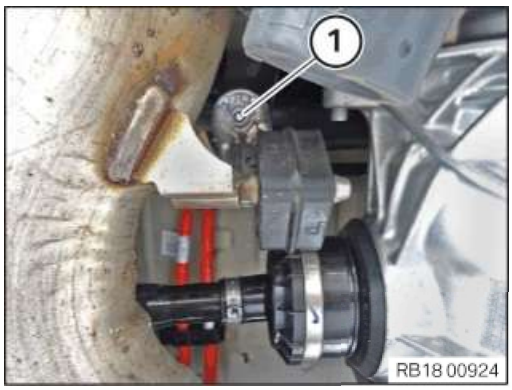
- **Equipment specification 2 (V-clips)**

  Unfasten clamp (1).

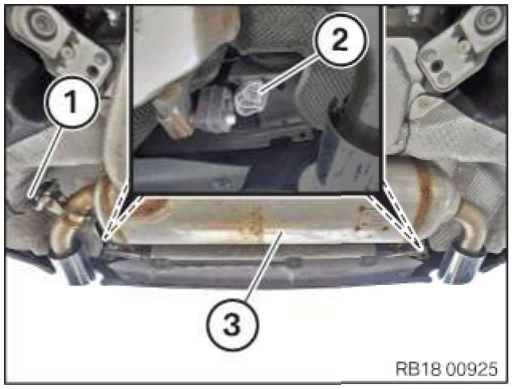
tdiag.com



- Loosen nut (1).



- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

18 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

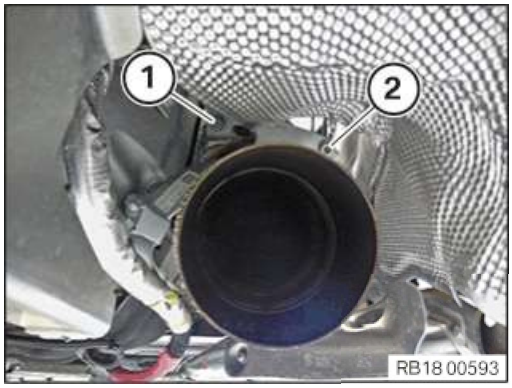
cardiagn.com

CAUTION

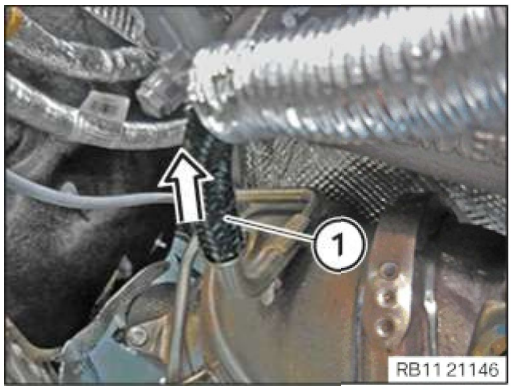
Component with heavy weight.

Danger of injury!

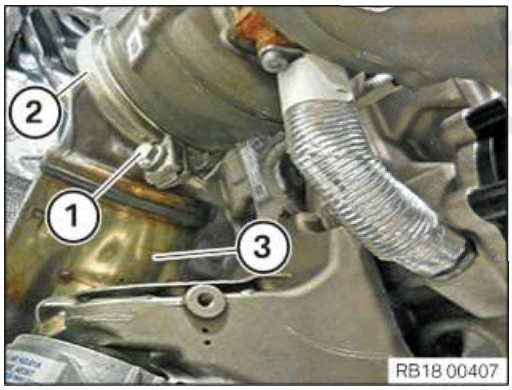
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.



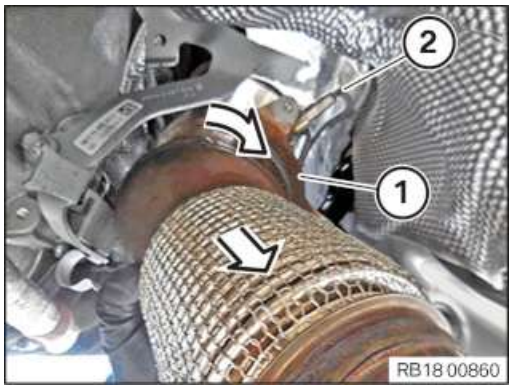
- Loosen screw (1).
- Loosen nut (2).



- Pull off pressure hose (1) in direction of arrow and set it aside.



- Loosen screw (1).
- Feed out V-clip (2) on catalytic converter (3) and remove.



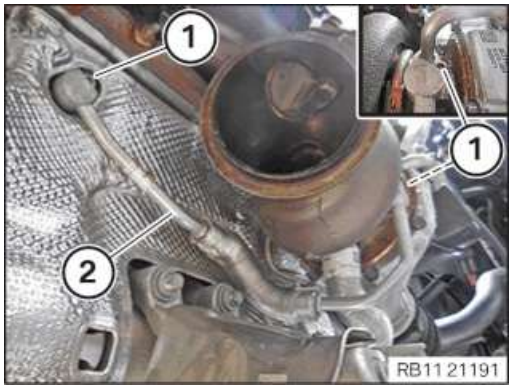
- Guide out catalytic converter (1) in direction of arrow and remove.
- Ensure that monitoring oxygen sensor (2) is**not** damaged.

19 – Remove the coolant feed line for the exhaust turbocharger

rdiagn.com

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

20 – Remove the coolant return line for the exhaust turbocharger

WARNING

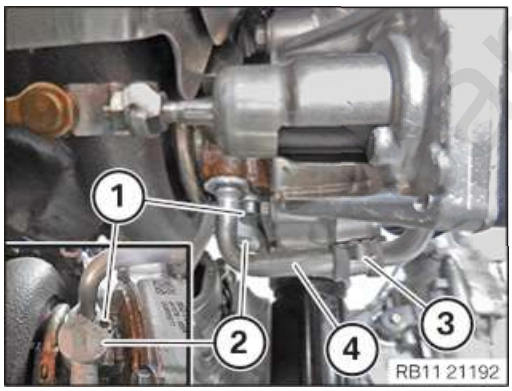
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

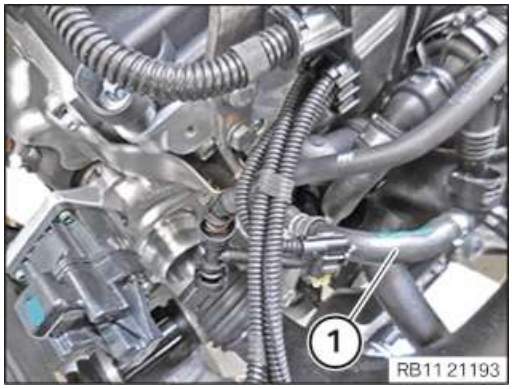
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

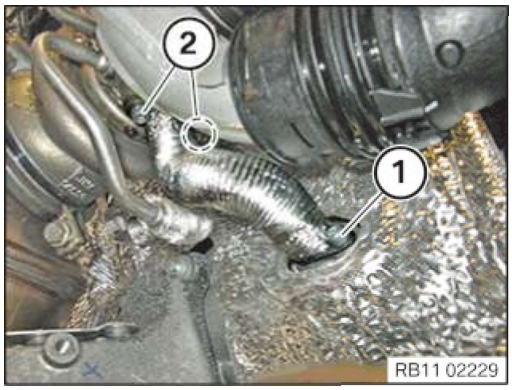


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

21 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

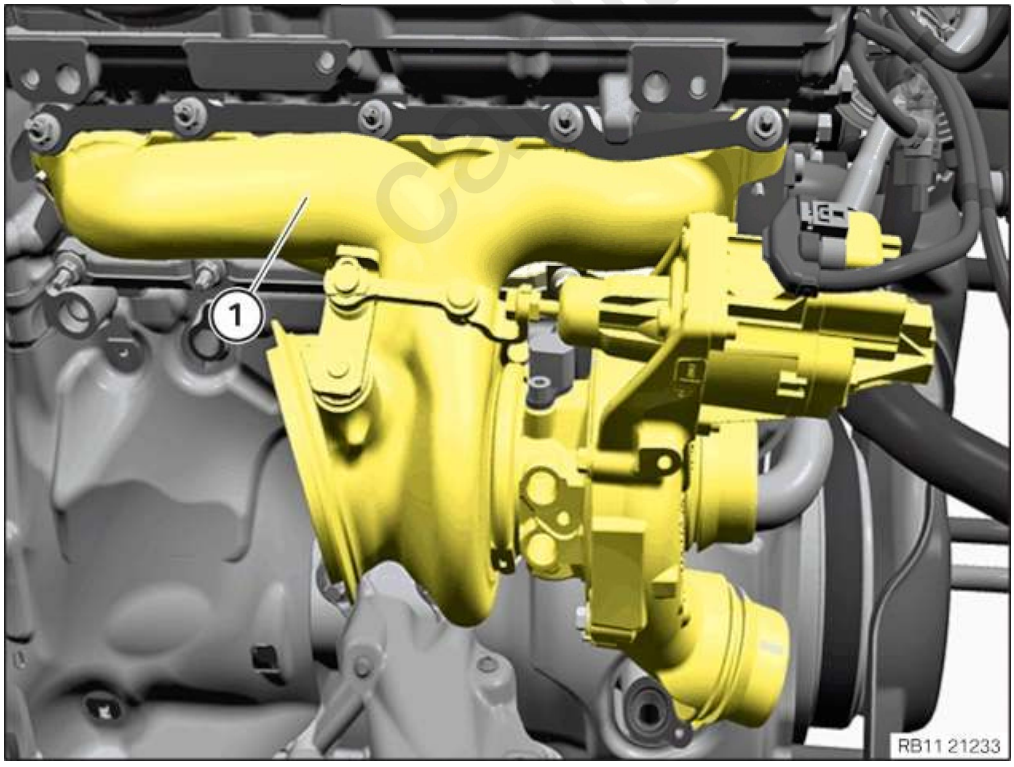
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

22 – Remove exhaust turbocharger

Exhaust turbocharger



1 Exhaust turbocharger

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

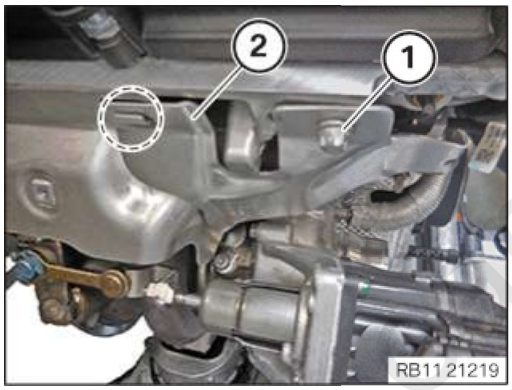
- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

TECHNICAL INFORMATION

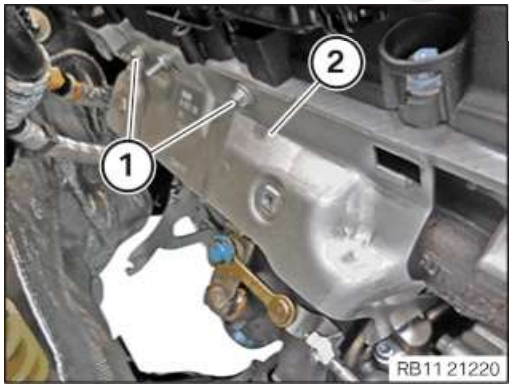
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).

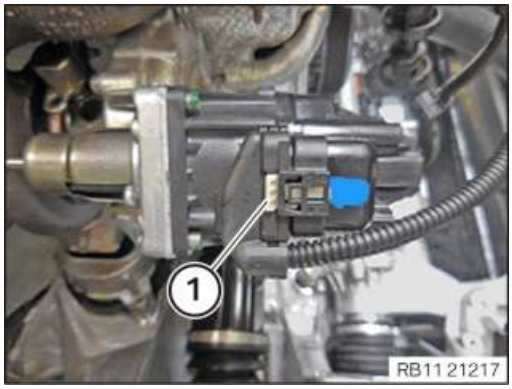


- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.

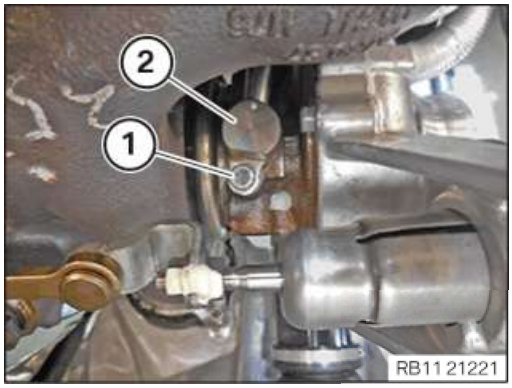


- Loosen screws (1).
- Feed out and remove the heat shield (2).

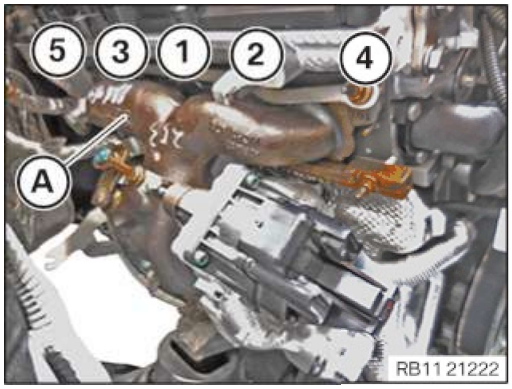
mdiagn.com



- Unlock and loosen connector (1).



- Loosen screw (1).
- Guide out oil feed line (2) for the exhaust turbocharger and place it aside.

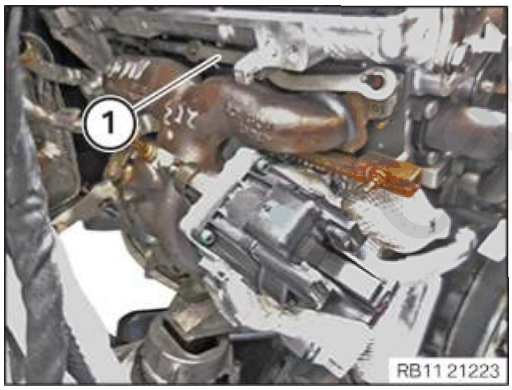


- Protect the exhaust turbocharger (A) from falling.

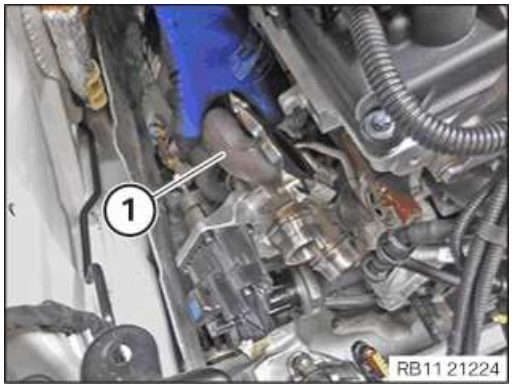
TECHNICAL INFORMATION

Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (5) to (1).



- Remove reinforcement plate (1).



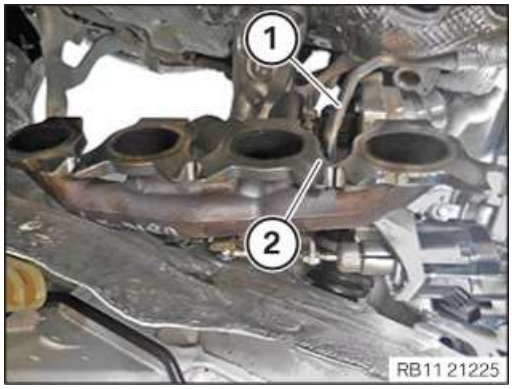
CAUTION

Heavy component.

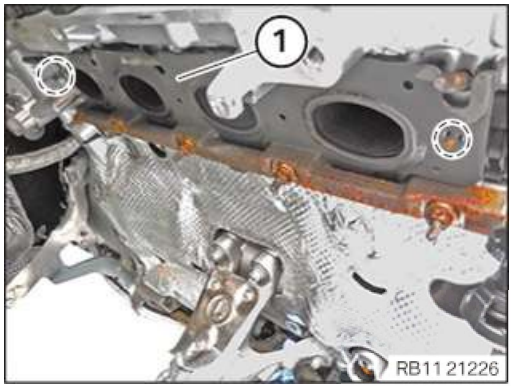
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide out exhaust turbocharger (1) and set it aside.



- Guide out oil feed line (1) for the exhaust turbocharger and place it aside.
- Thread out and remove exhaust turbocharger (2).



- Guide seal (1) out of the **marked** area and remove it.

MAIN WORK

23 – Remove the oil feed line for the exhaust turbocharger

RISK OF DAMAGE

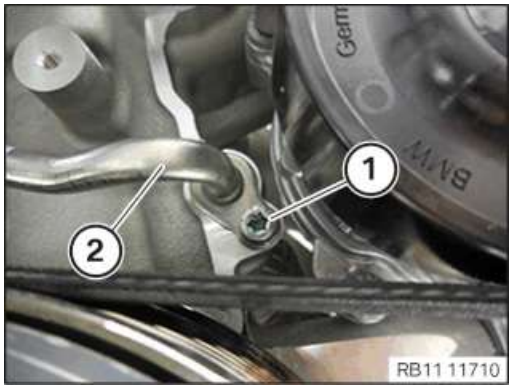
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

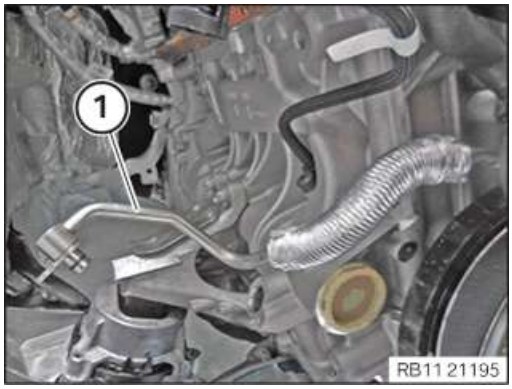
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



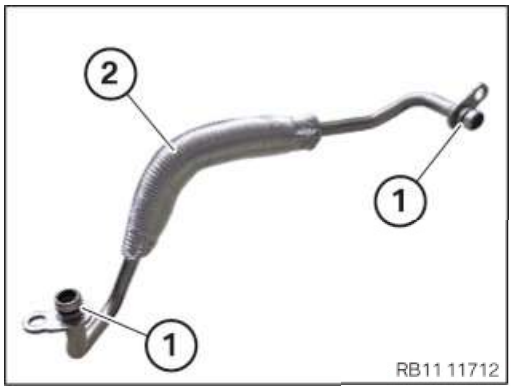
- Engine oil may emerge when removing the oil return line (2), keep a cleaning cloth ready.
- Loosen screw (1).

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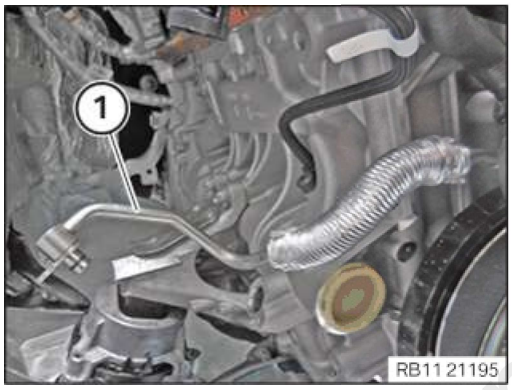
- Feed out and remove the oil feed line (1).

24 – Install the oil feed line for the exhaust turbocharger

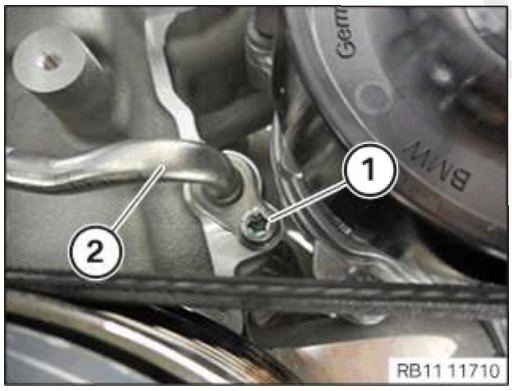


- Renew the sealing rings (1) at the oil feed line (2).

  Parts: Seals



- Insert and install the oil feed line (1).



- Tighten screw (1) on the oil feed line (2).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm

POSTPROCESSES

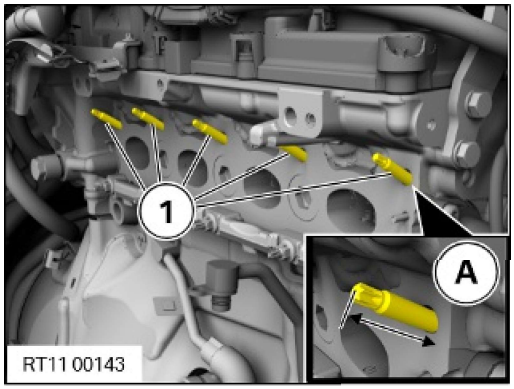
25 – Installing exhaust turbocharger

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

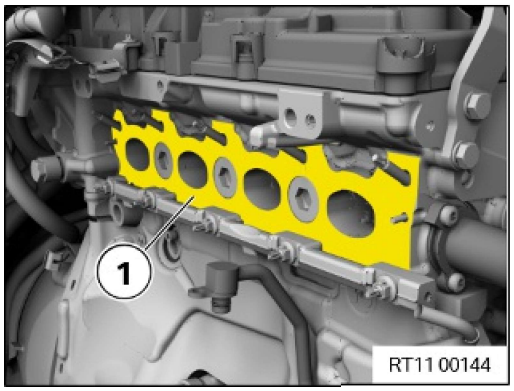


- Check stud bolt (1) for damage, renew stud bolt (1) if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1); if necessary screw in stud bolt further.

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm



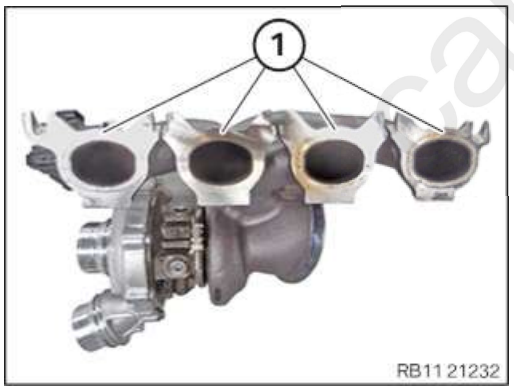
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the cylinder head (1) using the special tool 0 495 102 (11 4 470).



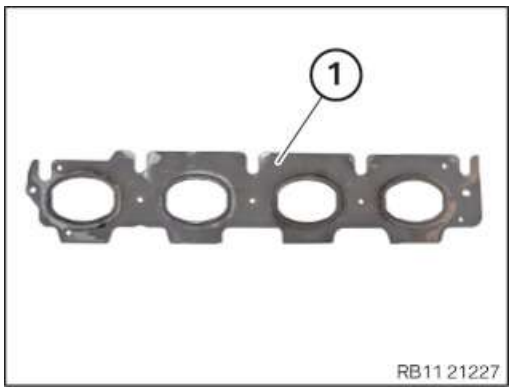
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

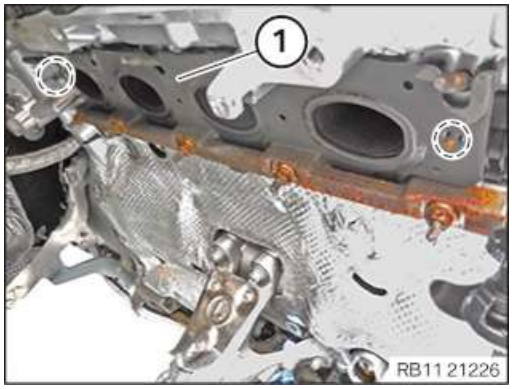
- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the exhaust turbocharger (1) using the special tool 0 495 102 (11 4 470).

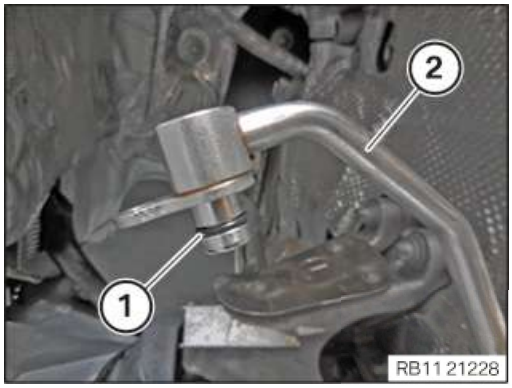


- Renew gasket (1).

  Parts: Seals



- Insert and install the gasket (1).
- Make sure the seal (1) has been **correctly** installed in the guide pins in the **marked** area.



- Renew O-rings (1) on the oil feed line (2) for the exhaust turbocharger with the special tool 0 496 714 (00 9 030).

  Parts: O-ring

TECHNICAL INFORMATION

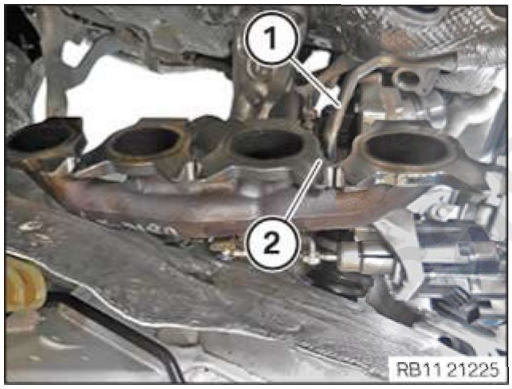
- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

- Fill oil feed line (2) for the exhaust turbocharger with engine oil till the rim.

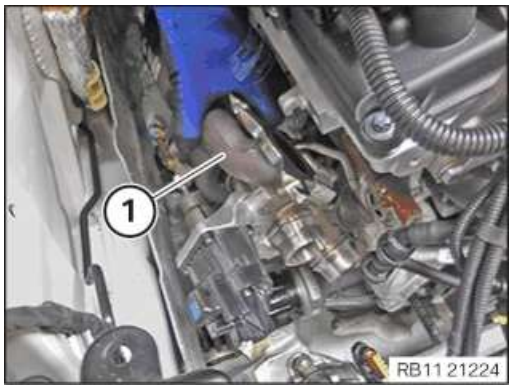
Engine oil

Technically suitable engine oils for BMW Group engines	

3.0 Technically appropriate engine oils for BMW Group engines



- Feed in and position the exhaust turbocharger (2).
- Feed in and position the oil feed line (1) for the exhaust turbocharger on the exhaust turbocharger (2).



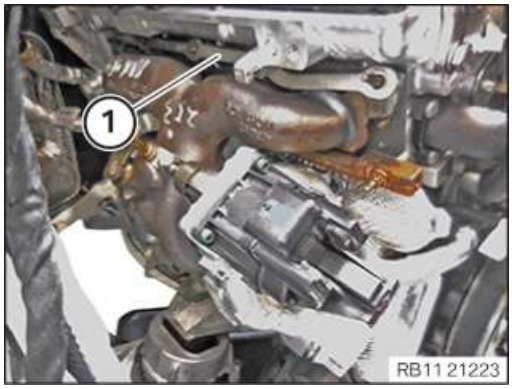
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

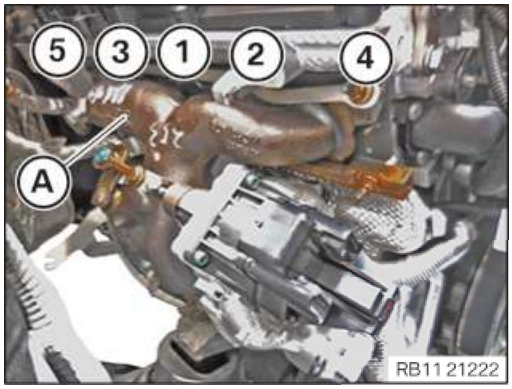
- Insert and install the exhaust turbocharger (1).



TECHNICAL INFORMATION

- Note the installation position of the component. The component may be installed in various installation positions.

- Mount sliding rail (1).
- The original BMW part number of the sliding rail (1) must be **legible** from the rear.



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

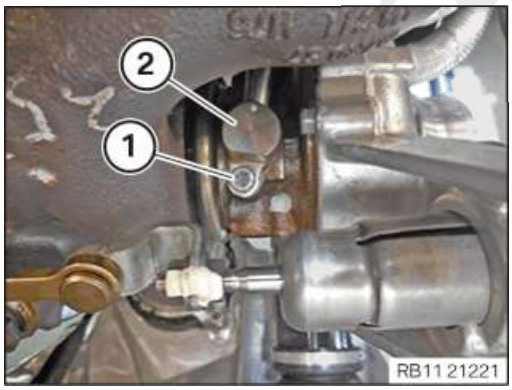
- Renew nuts (1) to (5).

  Parts: Nuts

- Tighten the nuts in sequence (1) to (5).

Exhaust turbocharger to cylinder head

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

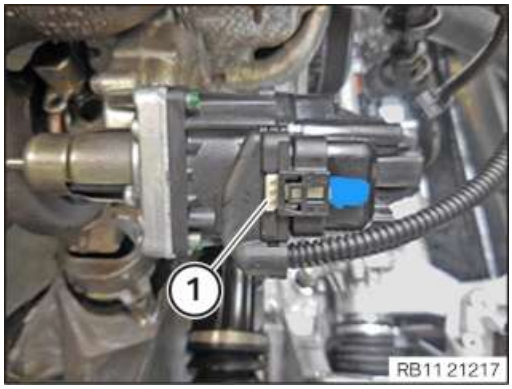


- Feed in and install the oil feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

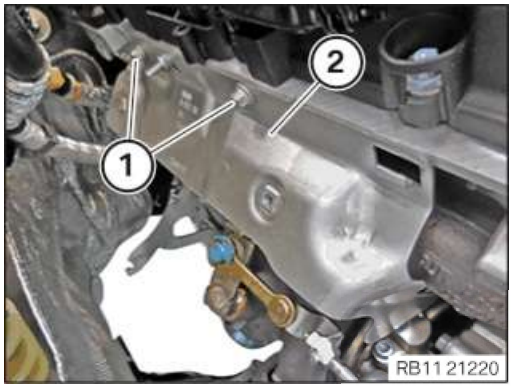
Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm

cardiagn.com



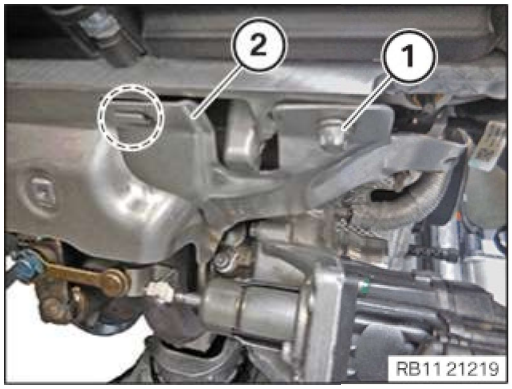
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Feed in and install the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

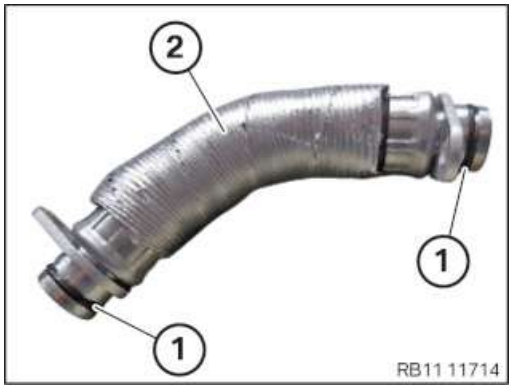


- Tighten down screw (1).

Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

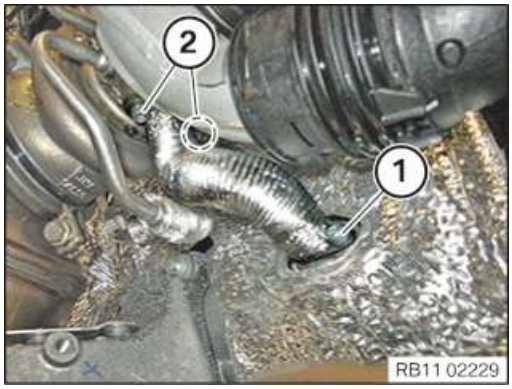
26 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring

.com



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

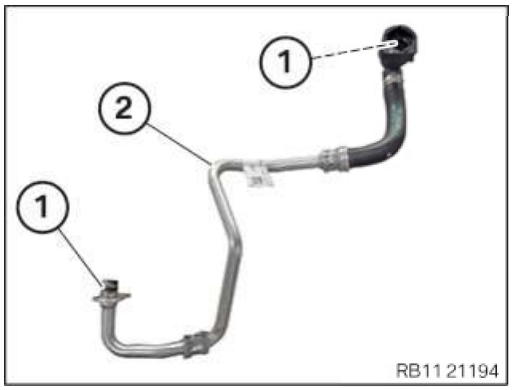
Oil return line to exhaust turbocharger/crankcase

M6x14		Tightening torque	8 Nm

27 – Install the coolant return line for the exhaust turbocharger

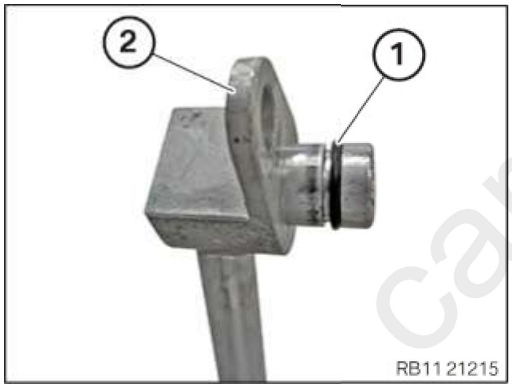
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



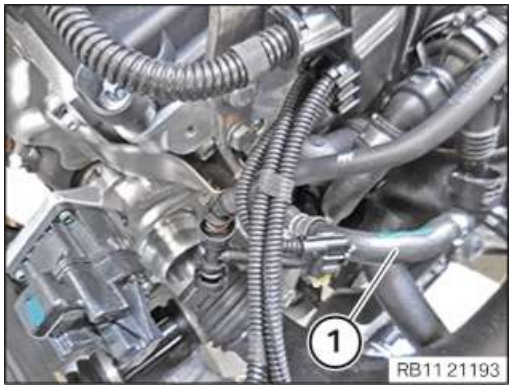
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-ring

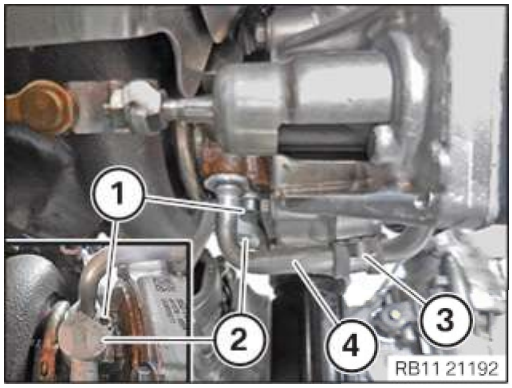


- Insert and position the coolant return line (1) for the exhaust turbocharger.

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- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

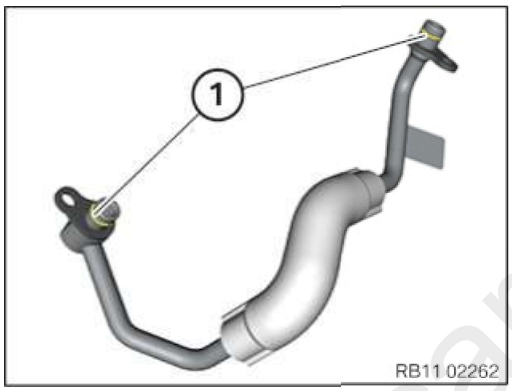
M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

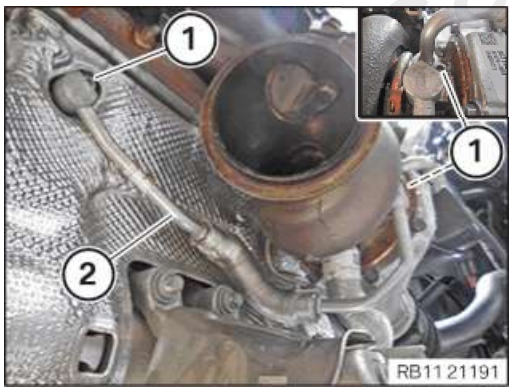
M6		Tightening torque	8 Nm

28 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

29 – Install catalytic converter

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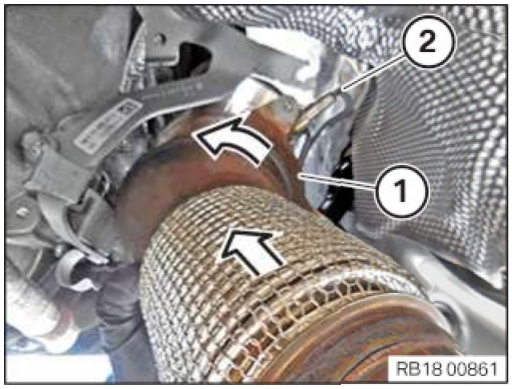
- Renew the V-clip (1).

  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket



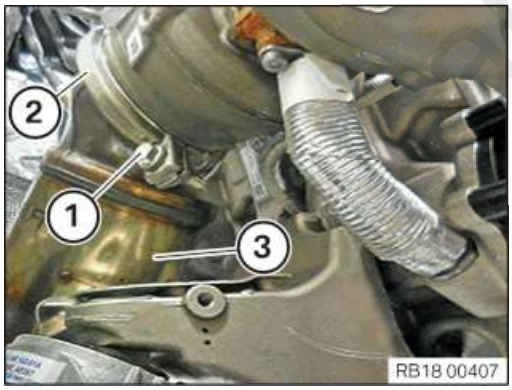
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

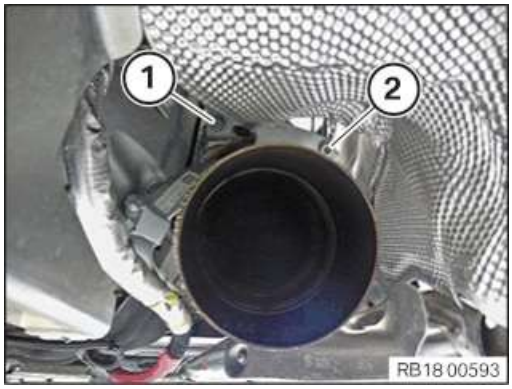
- Guide in and install the catalytic converter (1) in the direction of arrow.
- Make sure that the monitoring oxygen sensor (2) **is not damaged.**



- Renew the V-clip (2).

  Parts: V-band clamp

- Feed in and install V-clip (2) on the catalytic converter (3).
- Position the bolt (1).



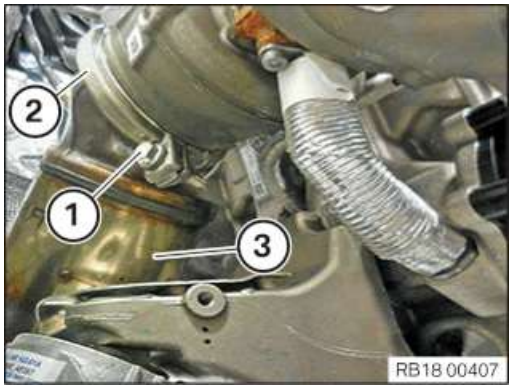
- Renew the screw (1).

  Parts: Screw

- Position the bolt (1).
- Renew nut (2).

  Parts: Nut

- Position the nut (2).



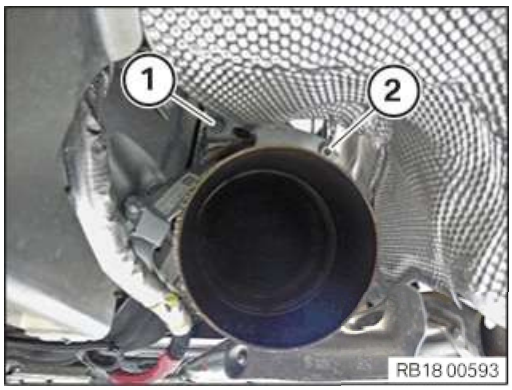
- Position the catalytic converter (3).
- Position V-clip (2).

Note: Ensure correct mounting orientation of the V-clip.

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm



- Tighten down screw (1).

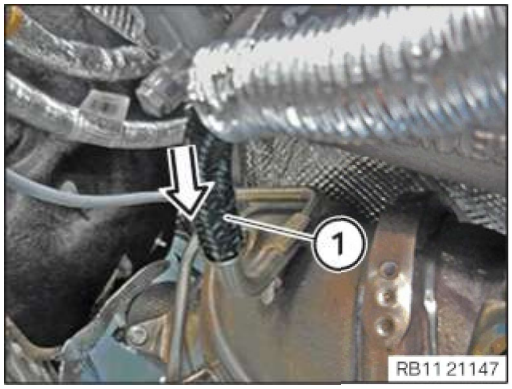
Catalytic converter to holder

M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm



- Check the pressure hose (1) for damage and renew hardened pressure hose (1) if necessary.
- Connect the pressure hose (1) in direction of arrow to the limit position.

30 – Installing the complete exhaust system

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

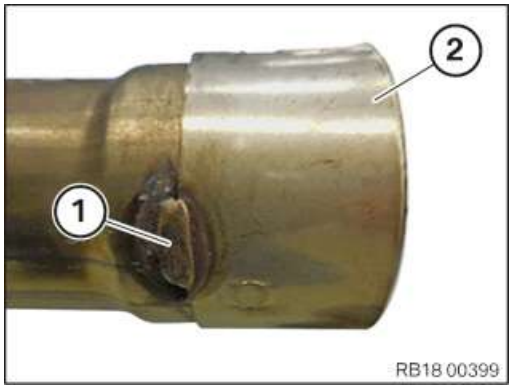
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

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CAUTION

Swarf resulting from sawing or grinding components.

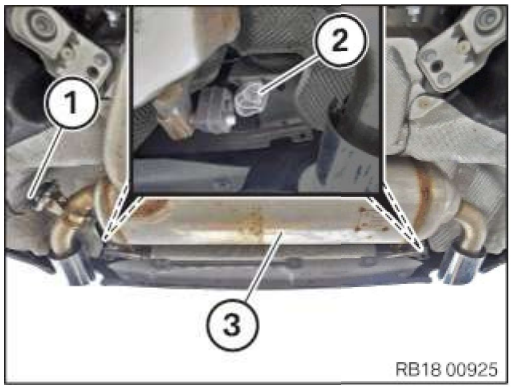
Danger of injury!

- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp



- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

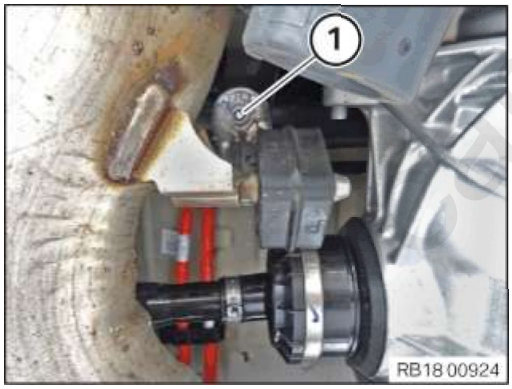
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm



- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

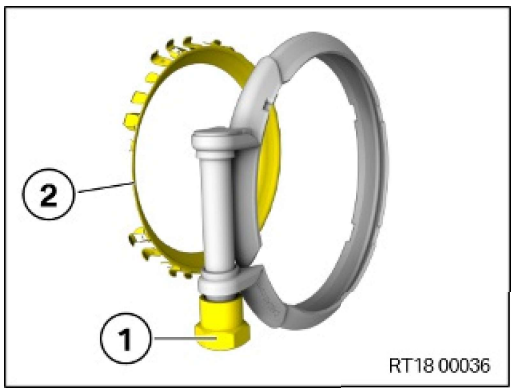
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

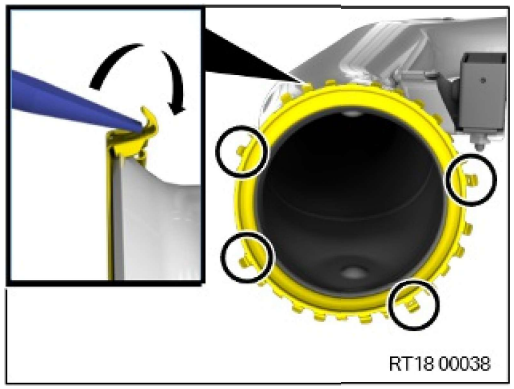


- **Equipment specification 2 (V-clips)**

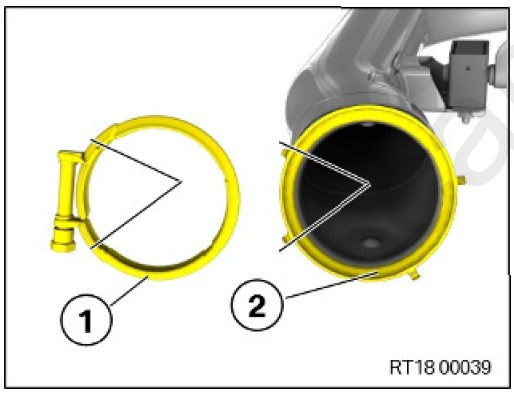
  Renew V-band clamp.

  Parts: V-band clamp

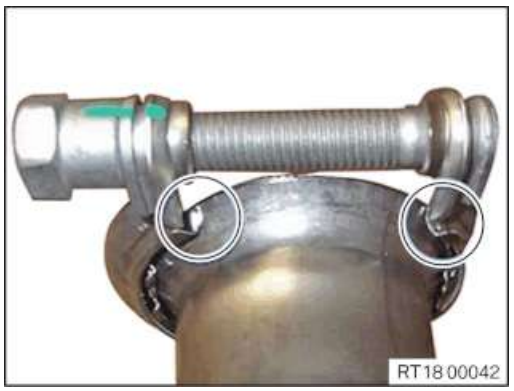
  Unscrew the nut (1) and remove the sealing ring (2).



- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.

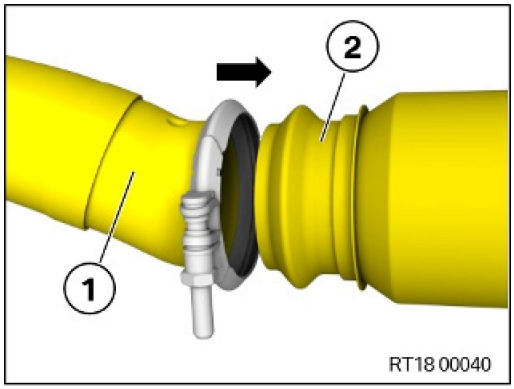


- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).

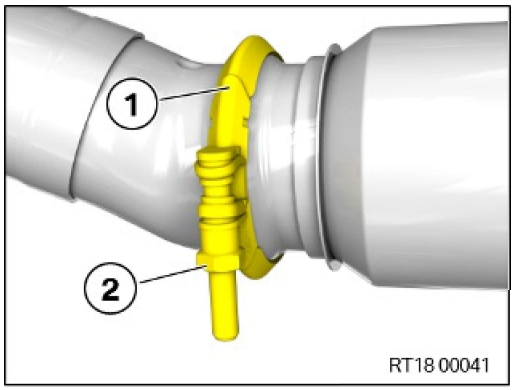


- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.

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- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).

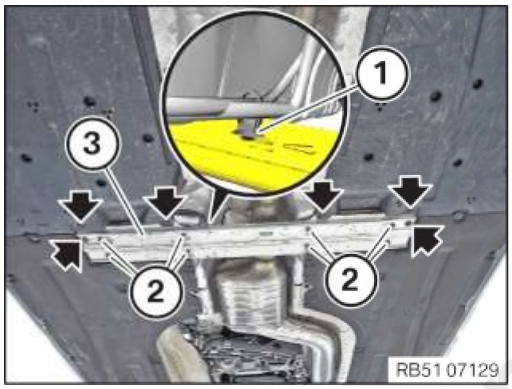


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

31 – Install the connecting supports on the tunnel



- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- Tighten screws (arrows).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

32 – Install the control sensor

TECHNICAL INFORMATION

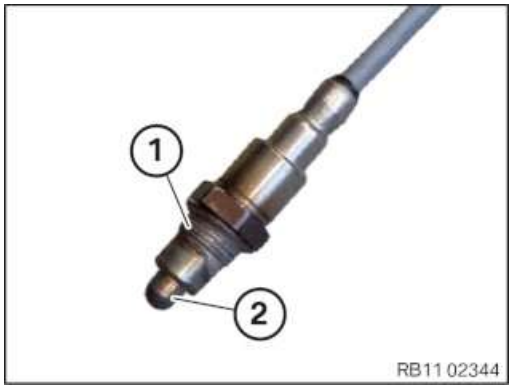
New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

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TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

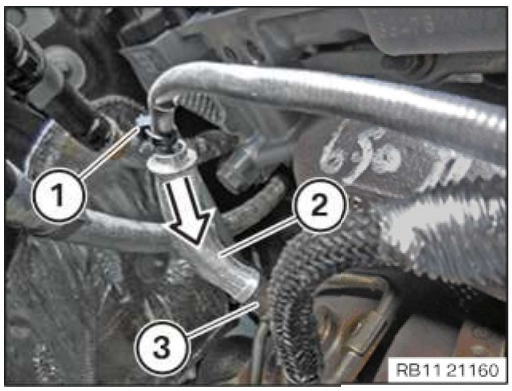
  (2) = Sensor ceramics



- Screw the control sensor (1) in and tighten it with the special tool 0 491 074 (11 7 020).

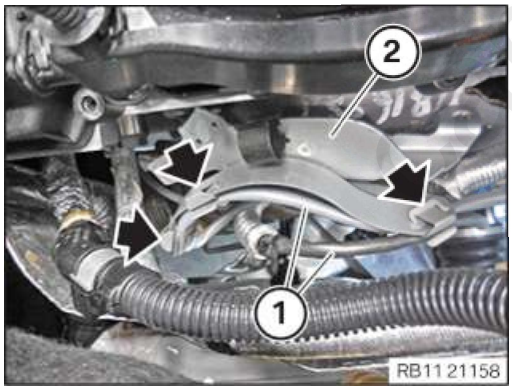
Control sensor

M18x1.5		Tightening torque	50 Nm



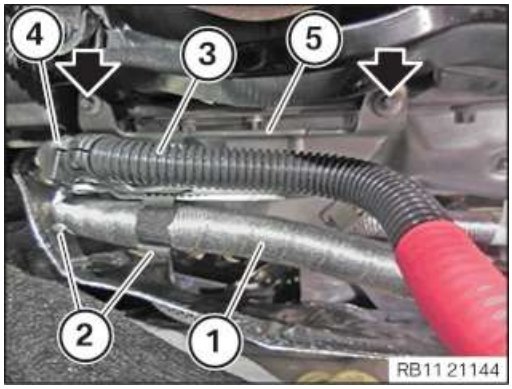
- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

  Parts: Cable strap
- Guide in and install the cable strap (1).



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).

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CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

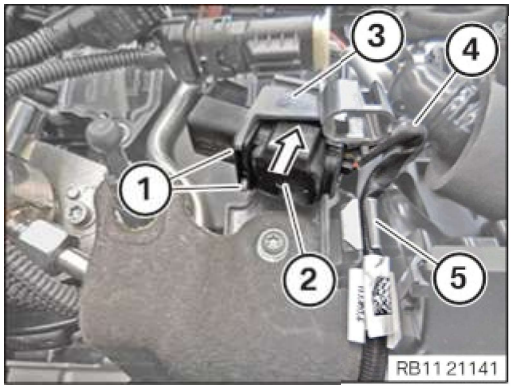
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

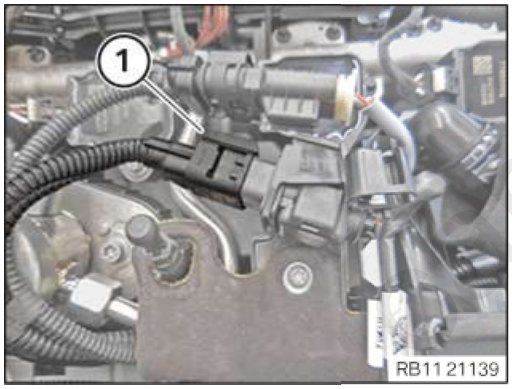
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).



- Guide in the connector (2) in the direction of arrow at the carrier plate (3) and install.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).



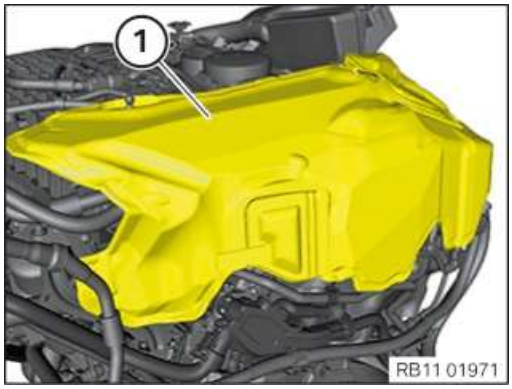
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Connect and lock the connector (1).
- Guide the connector (1) into the carrier plate in the direction of arrow.
- Ensure the connector (1) audibly engages with the carrier plate.

33 – Installing acoustic cover at rear

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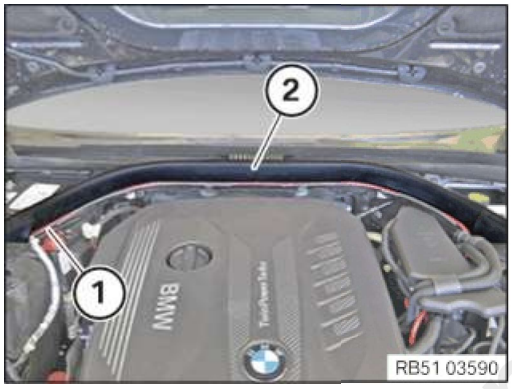


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



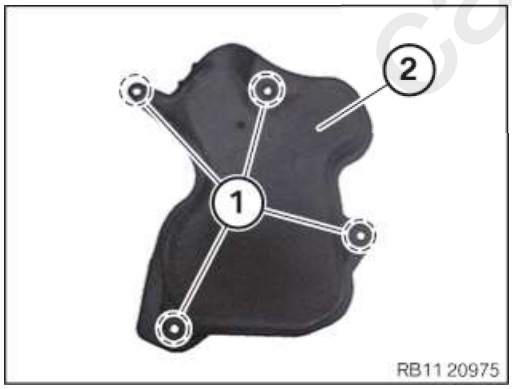
- Install the acoustic cover (1) from the top and clip it in into the marked areas.

34 – Install the seal for the bonnet



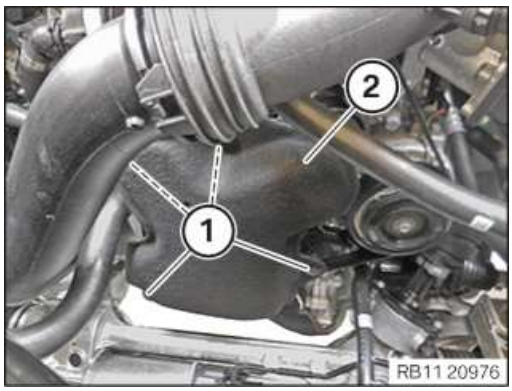
- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

35 – Install the acoustic cover for the engine at the front



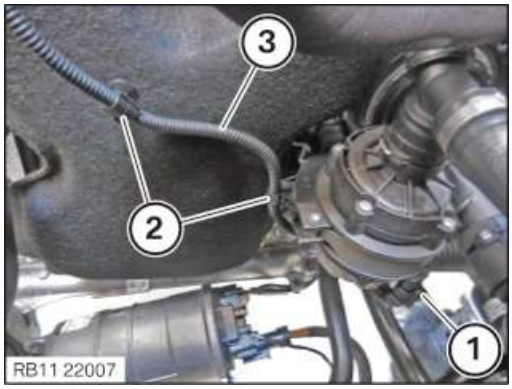
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



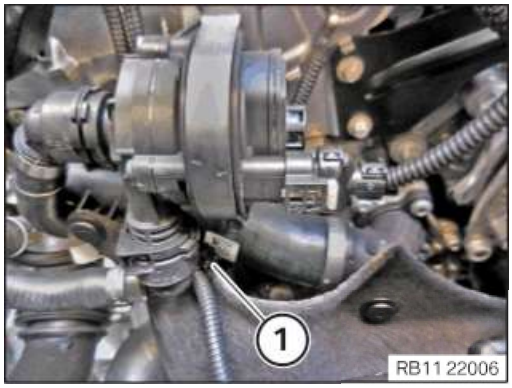
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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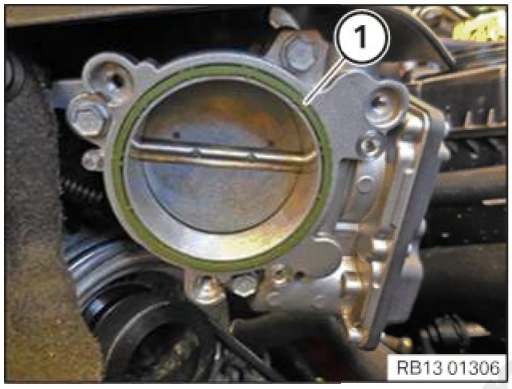
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



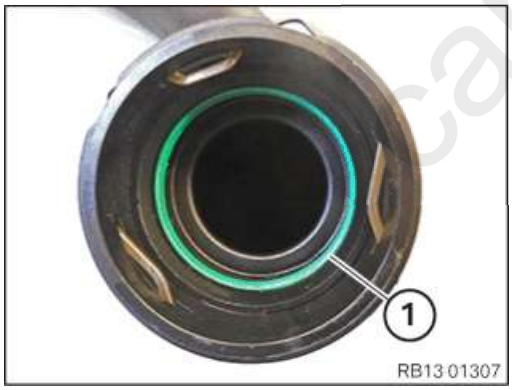
- Secure clamps (1).

36 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring



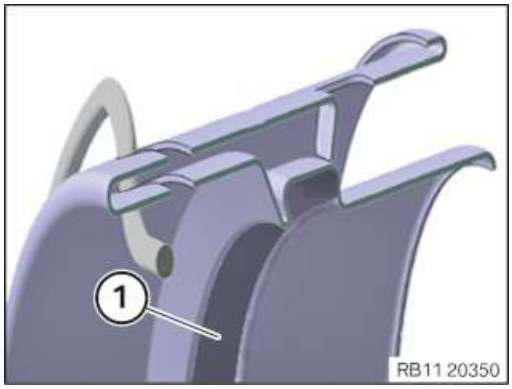
- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

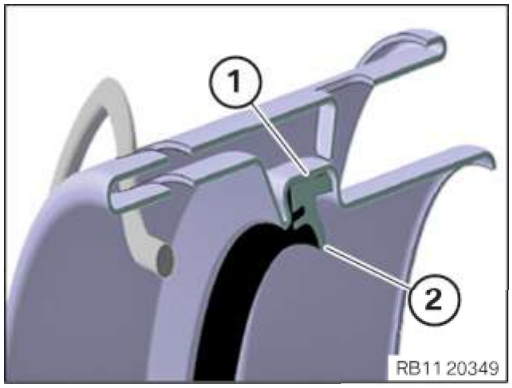
Do not use pointed or sharp-edged tools for the installation and/or removal.

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- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



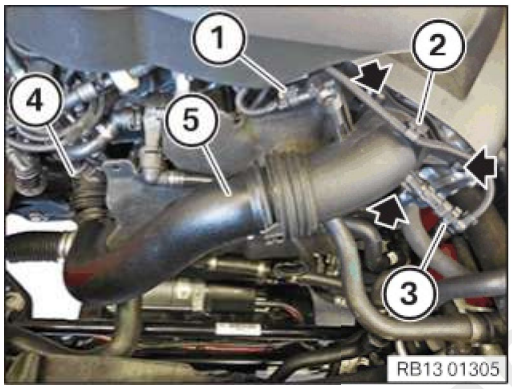
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

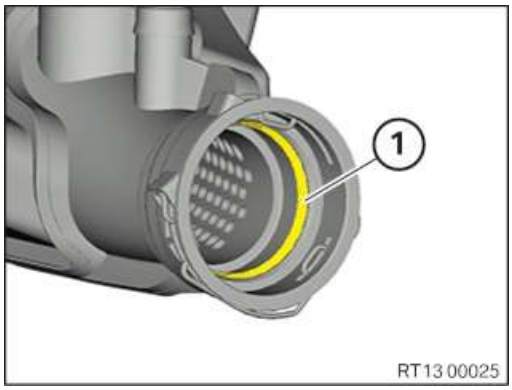
Charge air line to throttle body

M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

37 – Installing the clean air pipe with resonator



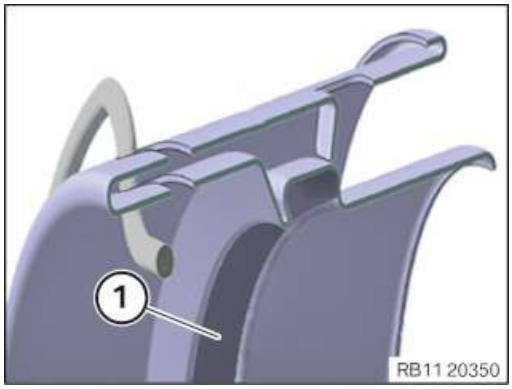
- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

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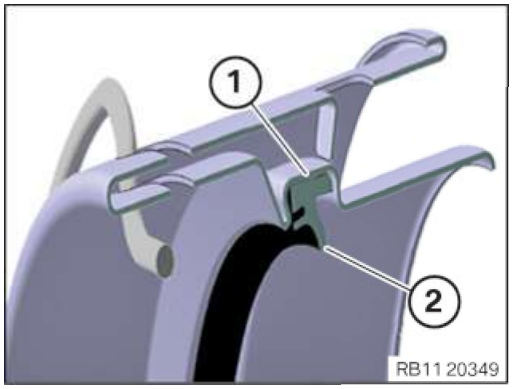
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



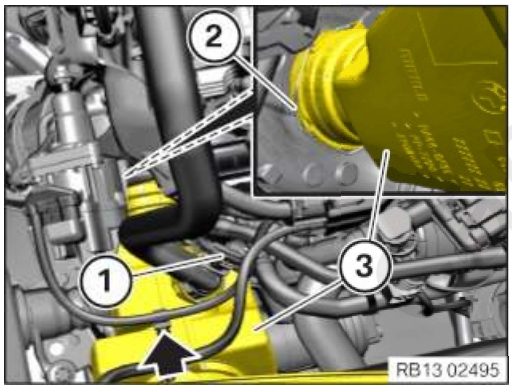
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

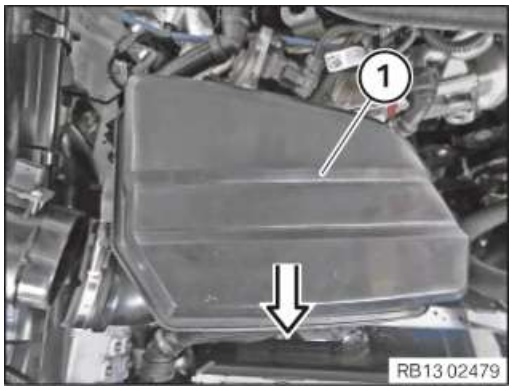
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



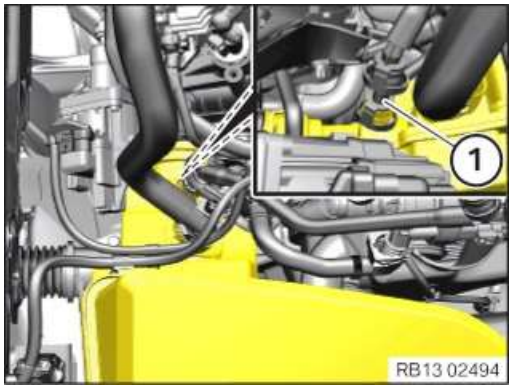
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

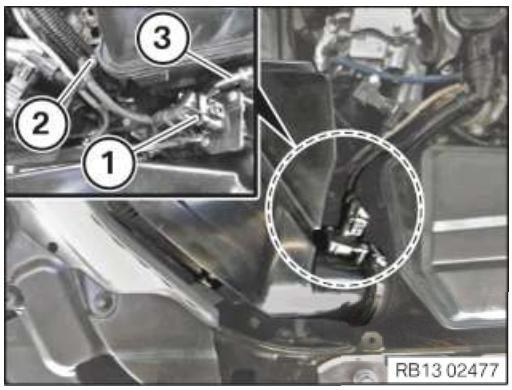
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

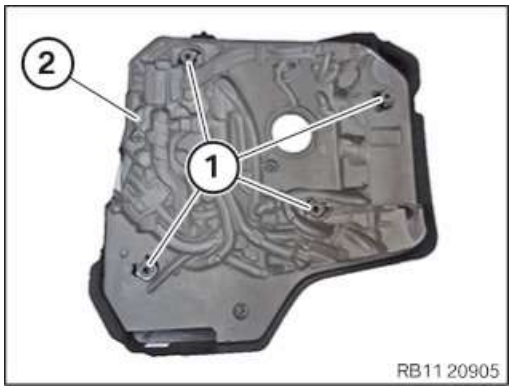
38 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

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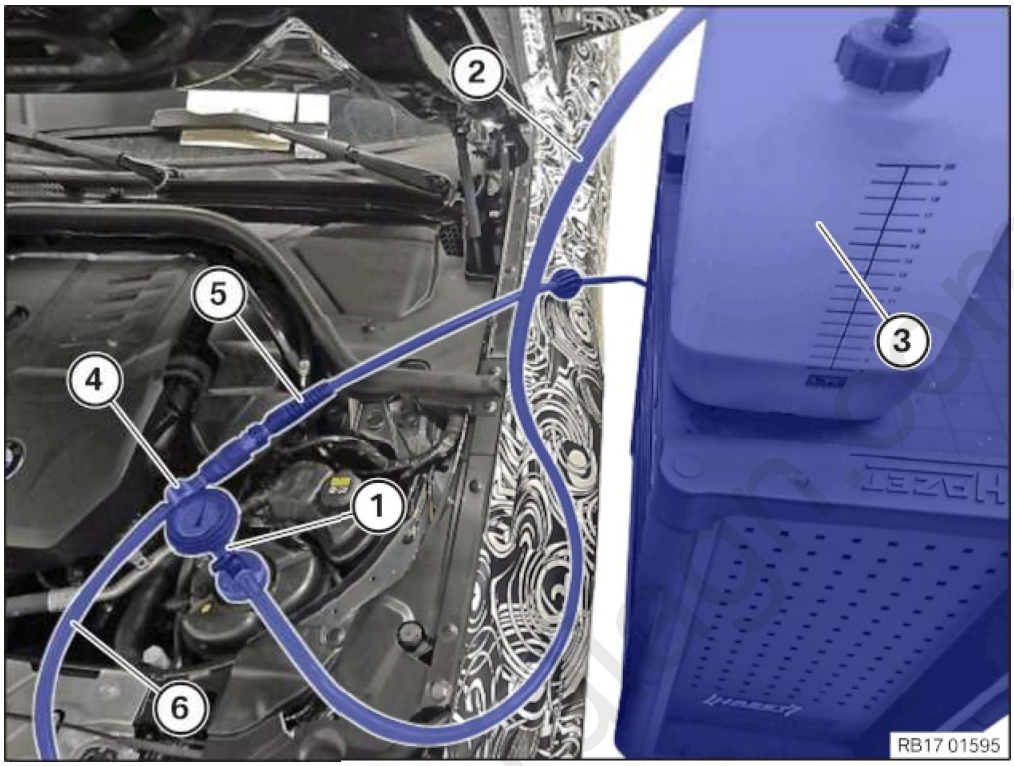


- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

39 – Fill the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

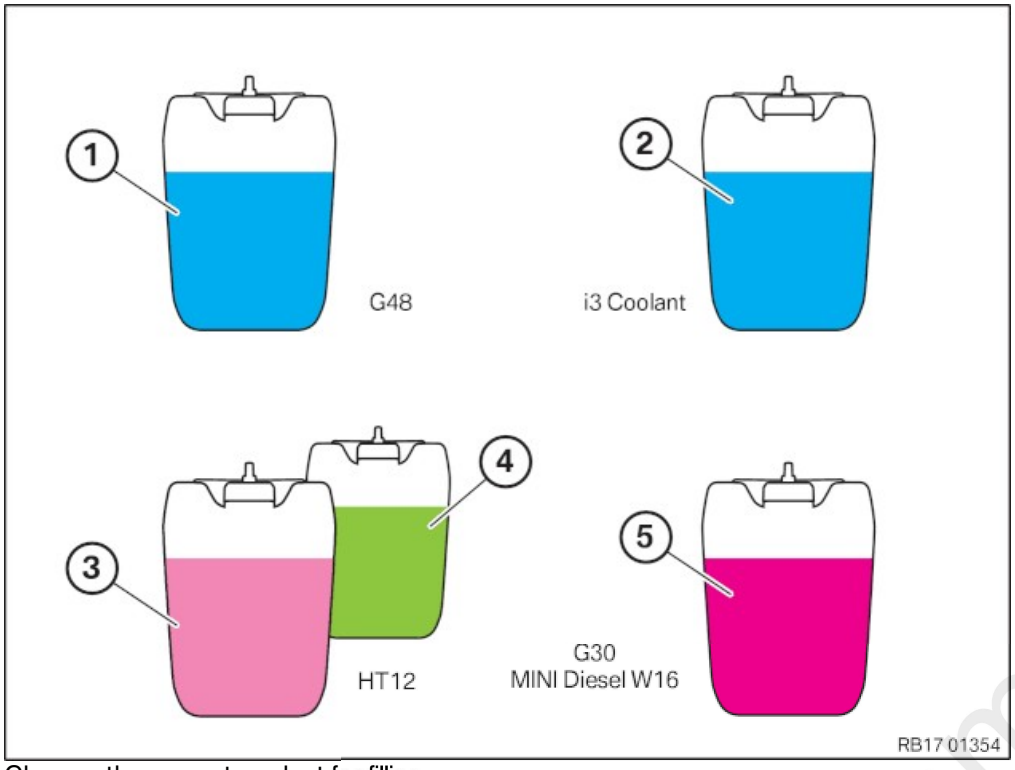
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

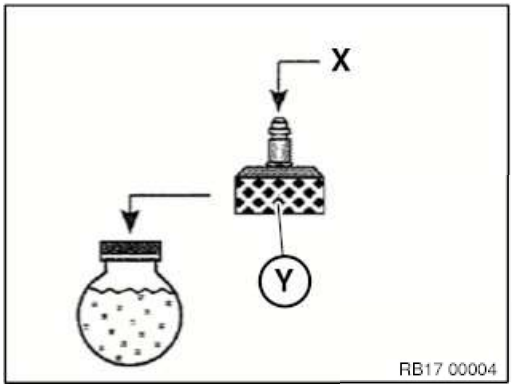
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

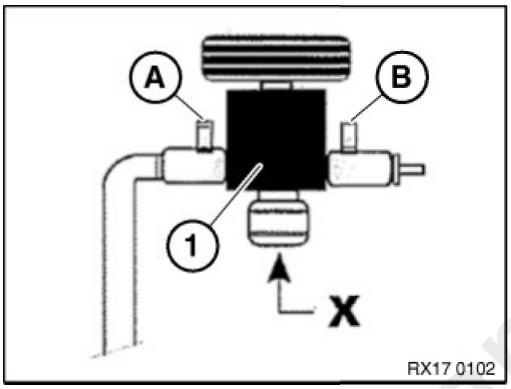
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

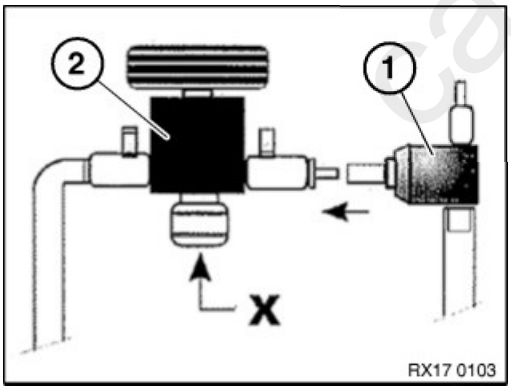
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

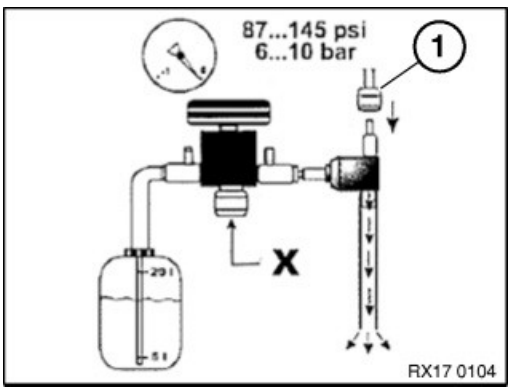


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

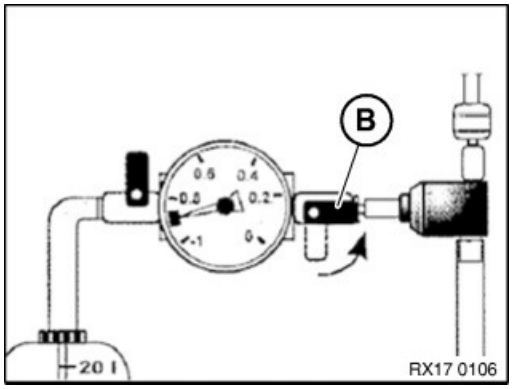
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

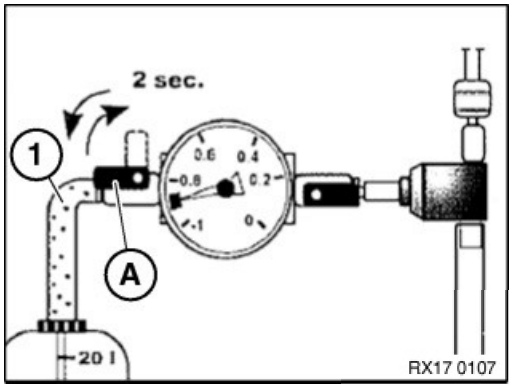
  (X)is the connection on the coolant expansion tank.

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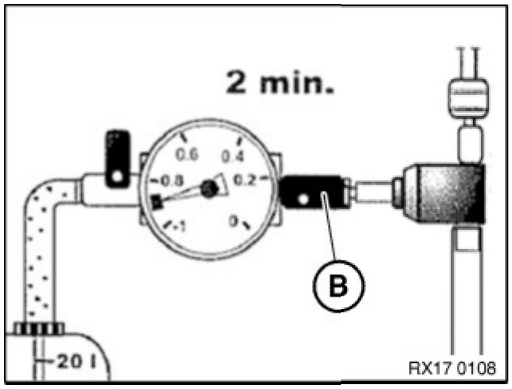
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

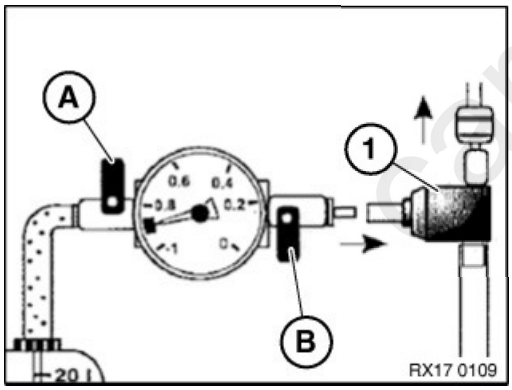


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

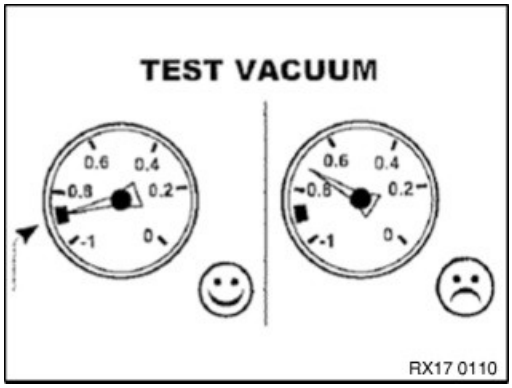
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

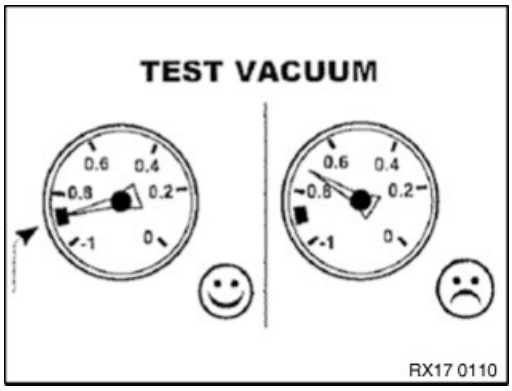
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



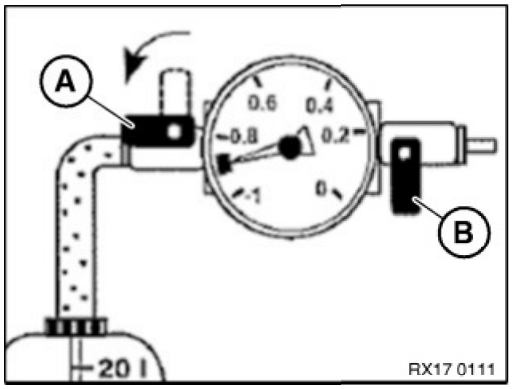
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

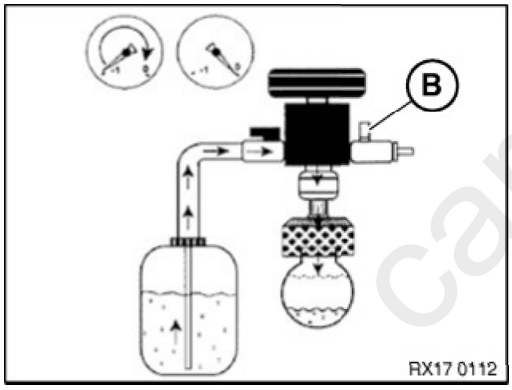
» Vacuum remains constant.

Measure

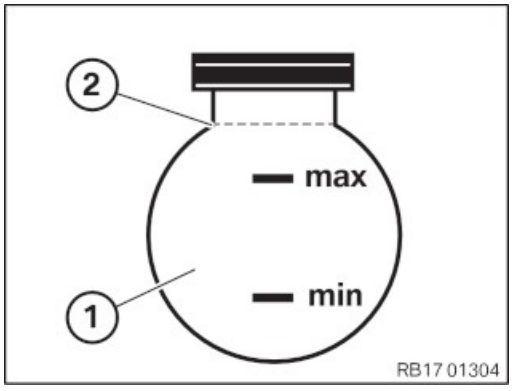
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

40 – Bleed the high-temperature coolant circuit

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

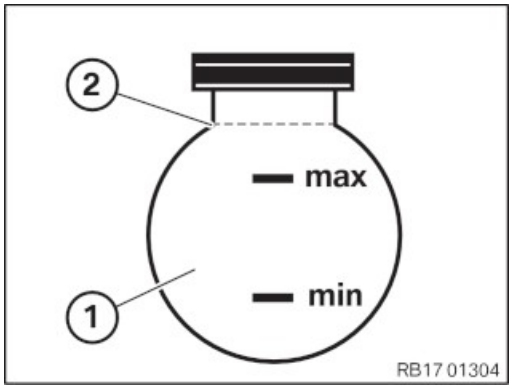
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

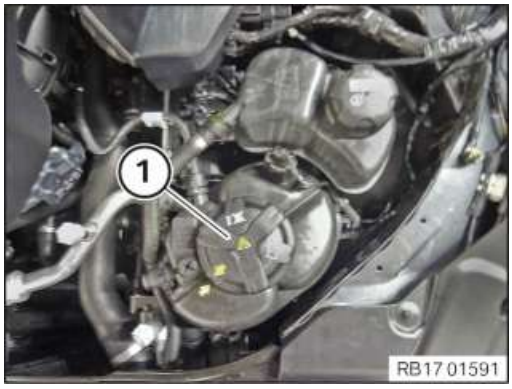
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

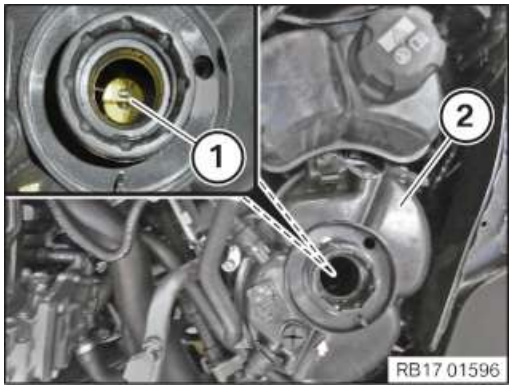
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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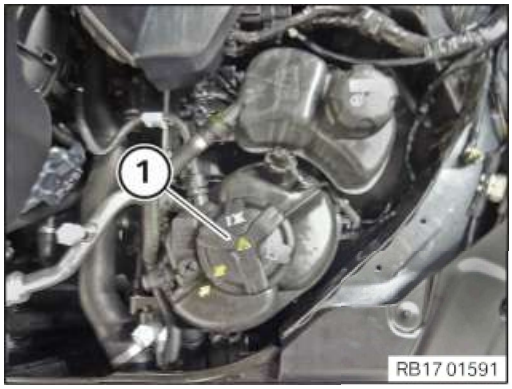
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .

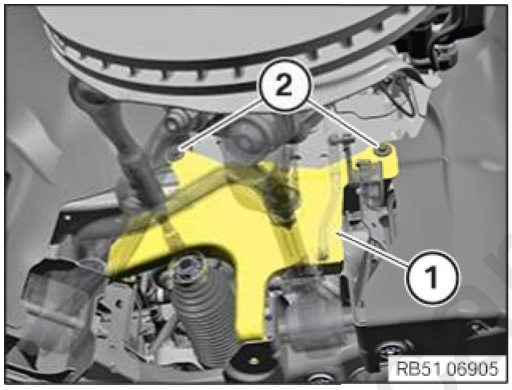


- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

41 – Install the cover of the steering assembly

Prerequisite

The underbody protection of the steering gear is removed.



- Position the cover (1).
- Tighten the screws (2).

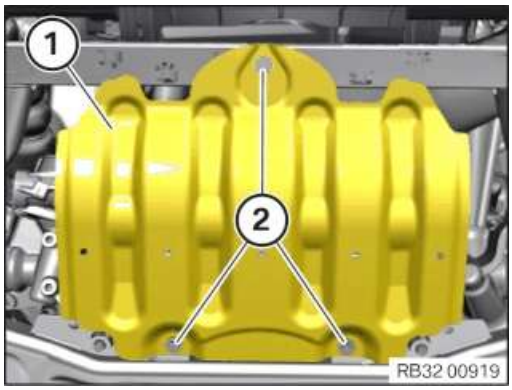
Cover, steering unit

Screw		Tightening torque	3 Nm

42 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



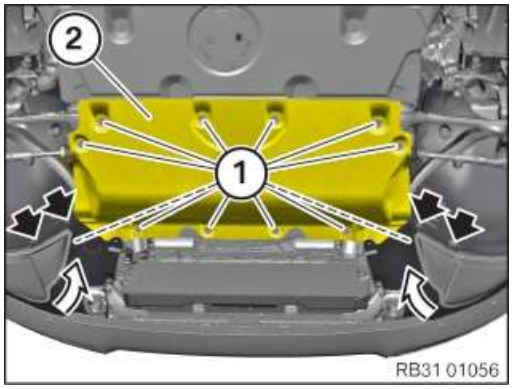
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

43 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

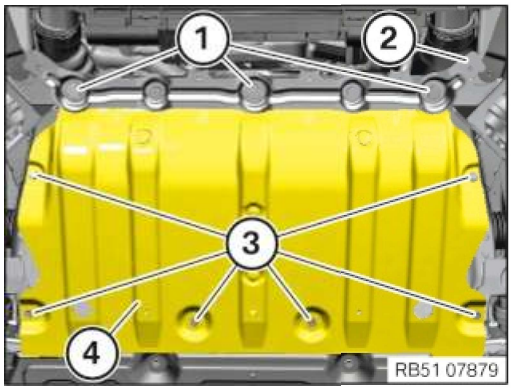
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

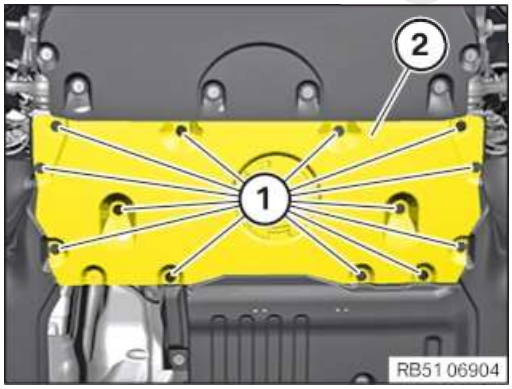
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

44 – Installing the centre underbody protection



- **Version with rear-wheel drive:**

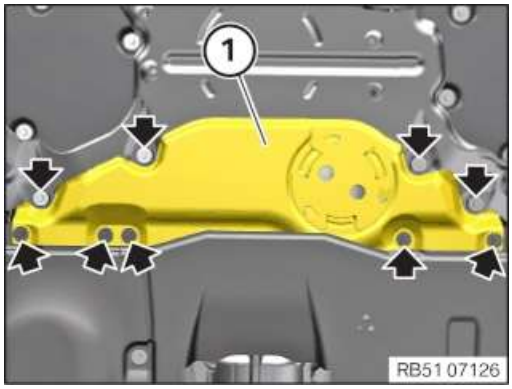
  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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- **Version with all-wheel drive:**

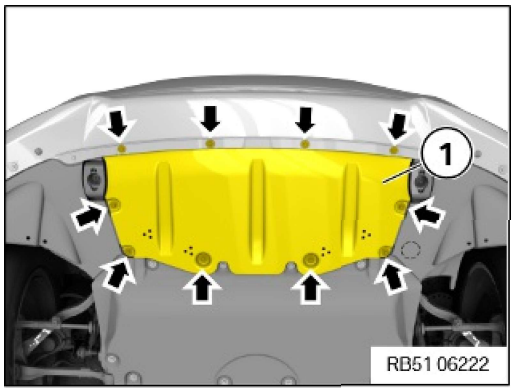
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

45 – Installing the front underbody protection



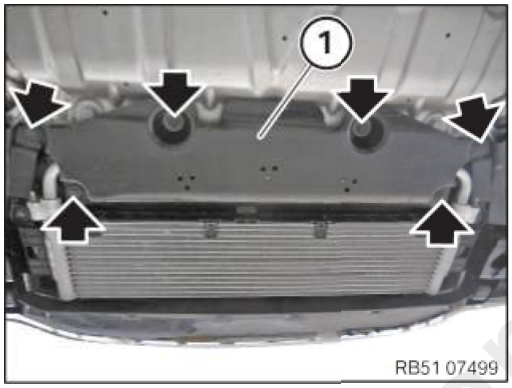
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



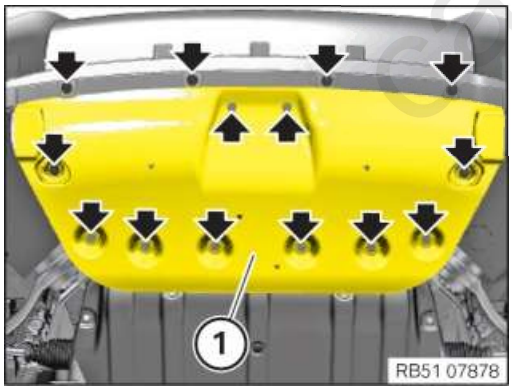
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

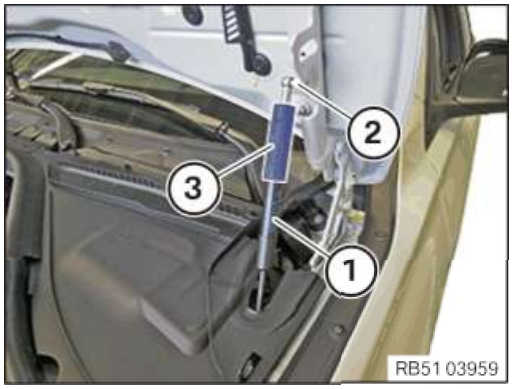
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

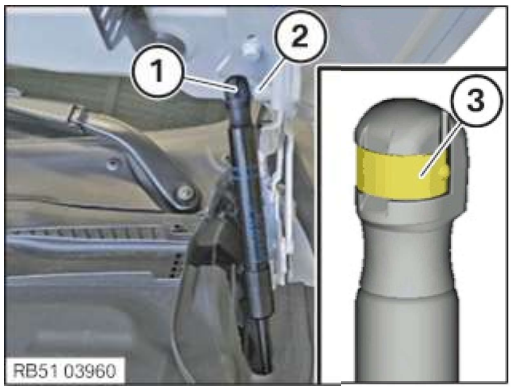
46 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

47 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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Additional Information

Overview of Tightening Torques

Oil feed line to exhaust turbocharger/crankcase — Used in step 2425

M6x12		Tightening torque	8 Nm

Exhaust turbocharger to cylinder head — Used in step 25

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Heat shield to cylinder head — Used in step 25

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip			Used in step 25
M6 x 12		Tightening torque	8 Nm

Oil return line to exhaust turbocharger/crankcase			Used in step 26
M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger			Used in step 2728
M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger			Used in step 27
M6		Tightening torque	8 Nm

Coolant feed line to crankcase			Used in step 28
M6 x 12		Tightening torque	8 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger			Used in step 29
V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Catalytic converter to holder			Used in step 29
M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder			Used in step 29
M8	Renew nut.	Tightening torque	19 Nm

Rear silencer to body / bumper support			Used in step 30
M8	Replace nuts.	Tightening torque	19 Nm

Exhaust system to rear axle carrier			Used in step 30
Nut M8	Renew nut.	Tightening torque	19 Nm

Front silencer / petrol particulate filter on transmission bracket			Used in step 30
M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter			Used in step 30
Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter			Used in step 30
V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

Connecting support to tunnel			Used in step 31
M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Control sensor			Used in step 32
M18x1.5		Tightening torque	50 Nm

Holder, positive battery cable to cylinder head cover			Used in step 32
6X18		Tightening torque	6 Nm

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Charge air line to throttle body — Used in step 36

M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 37

Clamp		Tightening torque	3 Nm

Cover, steering unit — Used in step 41

Screw		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 42

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 43

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 43

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 43

M10		Tightening torque	56 Nm

Underbody protection — Used in step 44

Hexagon screw		Tightening torque	3 Nm

Underbody protection front — Used in step 45

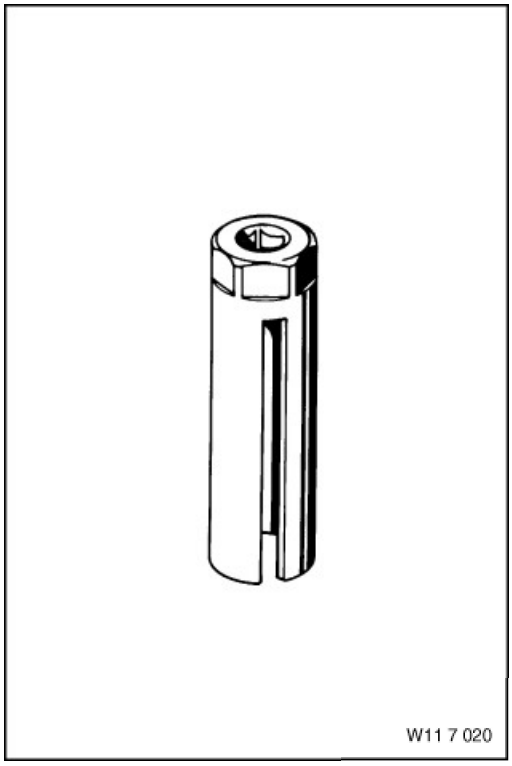
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

0 491 074 (11 7 020) Socket wrench insert

Used in step 832

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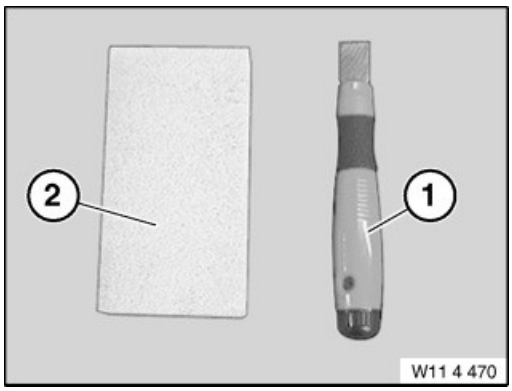


Common

Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool

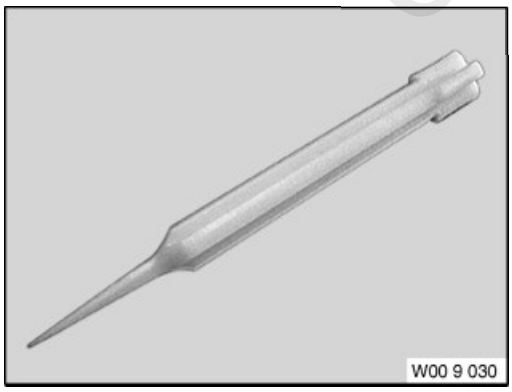


Common	Used in step 25
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

0 496 714 (00 9 030) Wedge

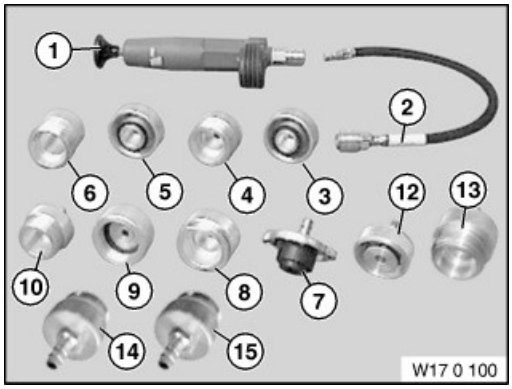


Common	Used in step 252728
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

0 494 417 (17 0 100) Tester

Common	Used in step 39
Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	

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Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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Overview Technical Data

Capacity of high-temperature coolant circuit G20	Used in step 39
B48B20O1/B46B20O1	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Screw-in depth of upper stud bolt on cylinder head	Used in step 25
Dimension A	30 mm

Links

General repair instructions	Used in step
11 00 ... Overview of consumables (Electronic Parts Catalogue)	32

Repair instructions	Used in step
17 00 ... Notes for working on cooling system.	39

Operating materials	Used in step
3.0 Technically appropriate engine oils for BMW Group engines	25

Operating materials	Used in step
Main group 17	39

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11 42 210 Removing and installing/sealing or replacing oil return line for exhaust turbocharger

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

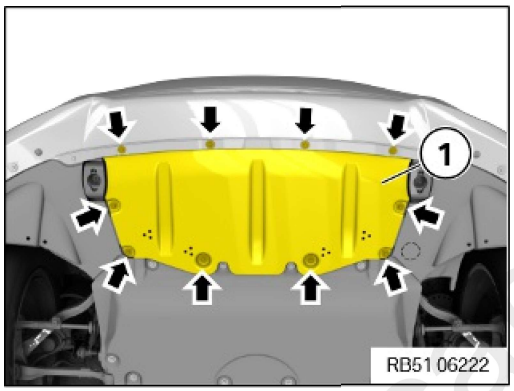
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

PRELIMINARY WORK

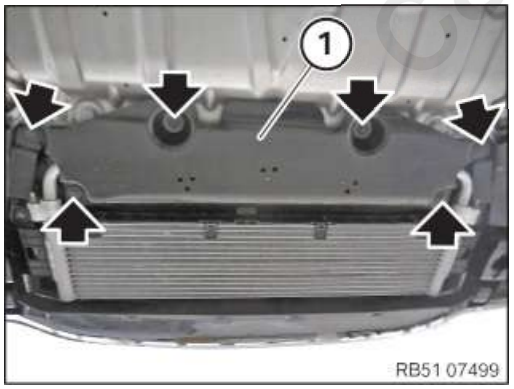
1 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

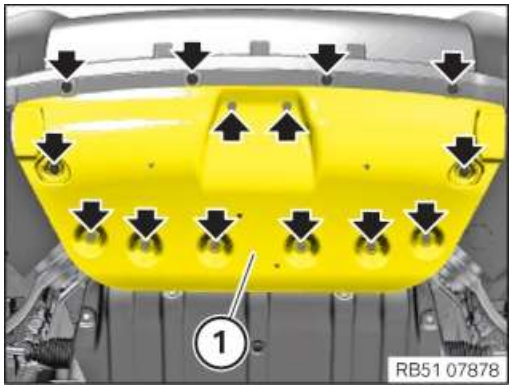
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

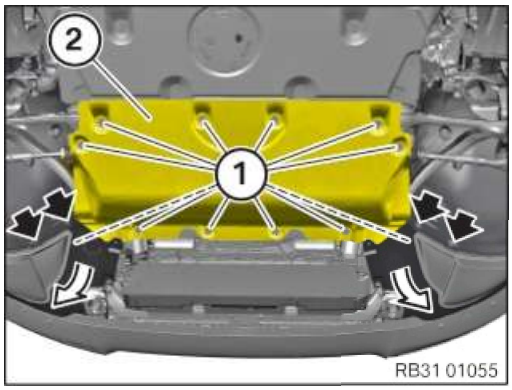


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

2 – Remove the underbody protection of the steering gear



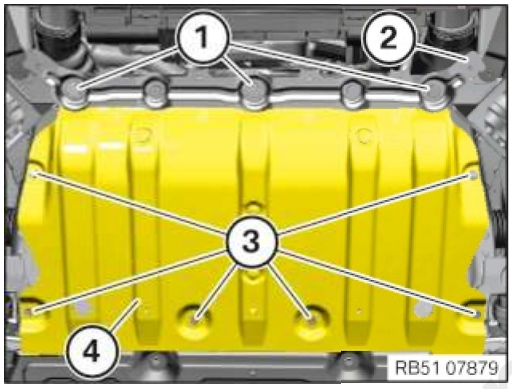
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

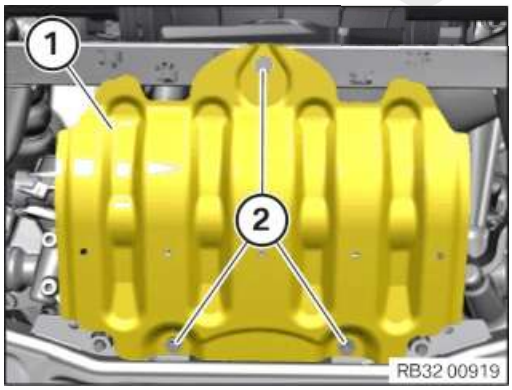
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

3 – If installed: Removing the steering start protection

Prerequisite

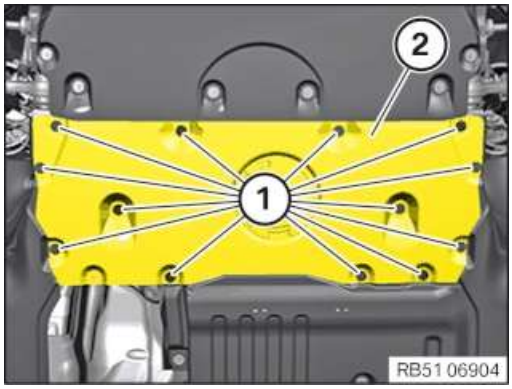
The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

4 – Removing the centre underbody protection

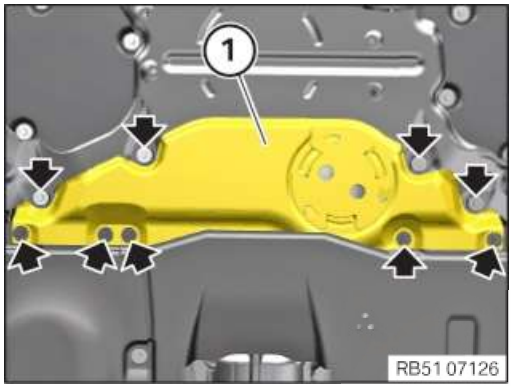
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- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



- **Version with all-wheel drive:**

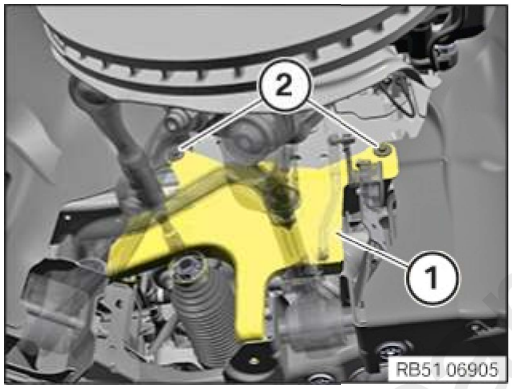
  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

5 – Remove the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.



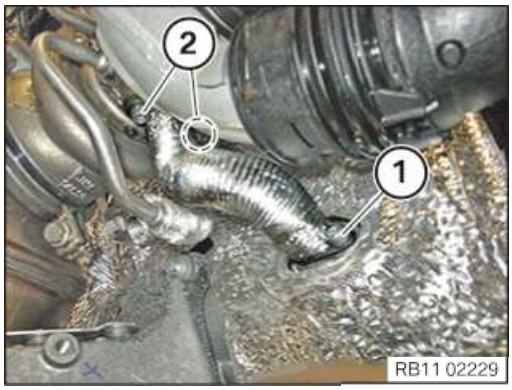
- Loosen screws (2).
- Remove the cover (1).

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6 – Removing the oil return line for the exhaust turbocharger

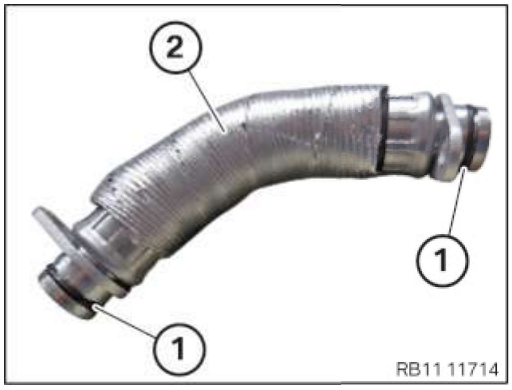
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



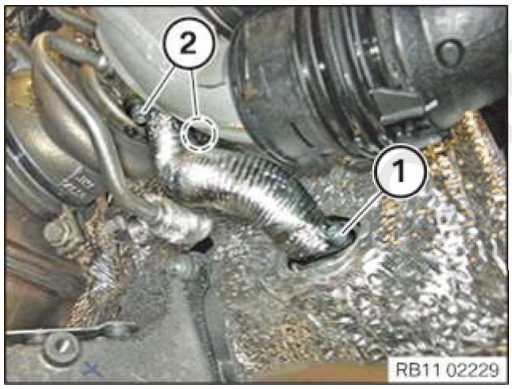
- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

7 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

Oil return line to exhaust turbocharger/crankcase

M6x14		Tightening torque	8 Nm

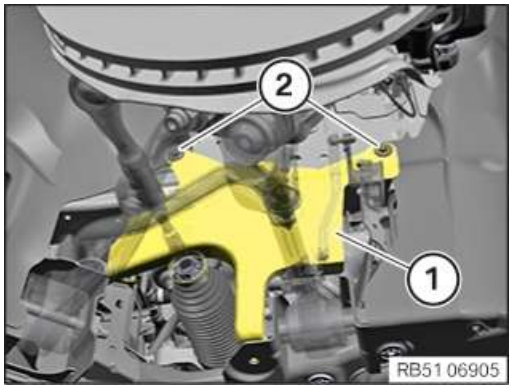
rdiagn.com

POSTPROCESSES

8 – Install the cover of the steering assembly

Prerequisite

The underbody protection of the steering gear is removed.



- Position the cover (1).
- Tighten the screws (2).

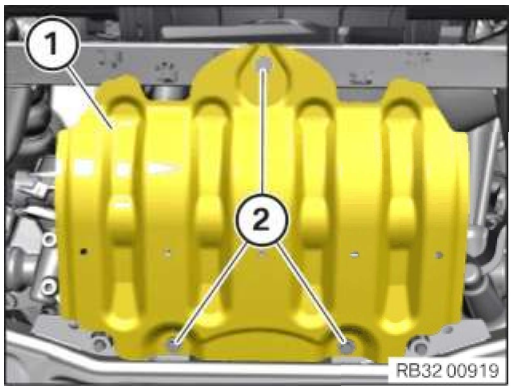
Cover, steering unit

Screw		Tightening torque	3 Nm

9 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

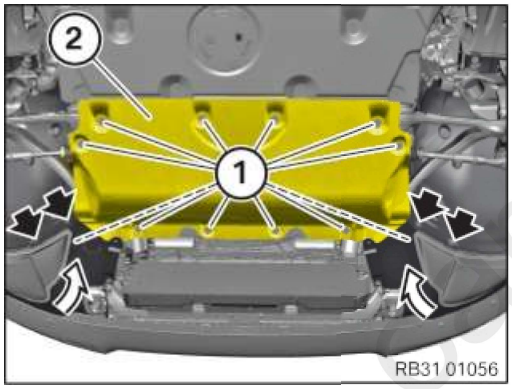


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

10 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

Underbody protection of the steering gear

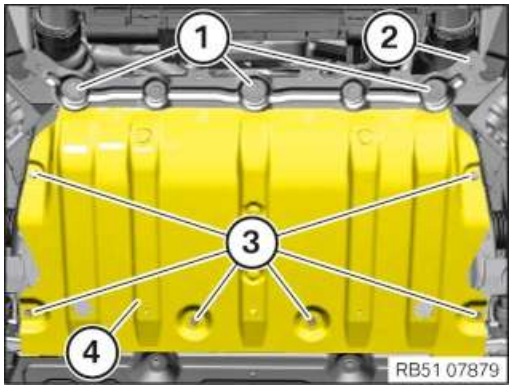
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm

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- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

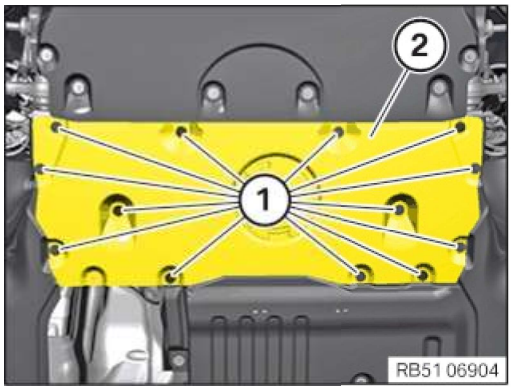
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

11 – Installing the centre underbody protection



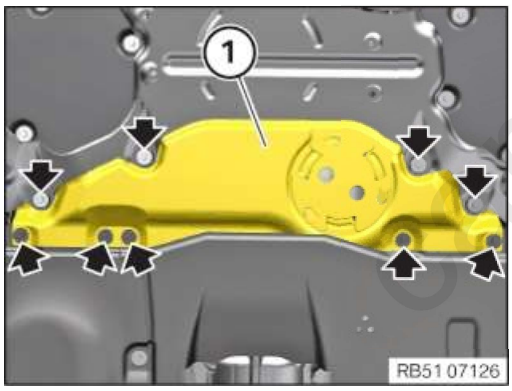
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

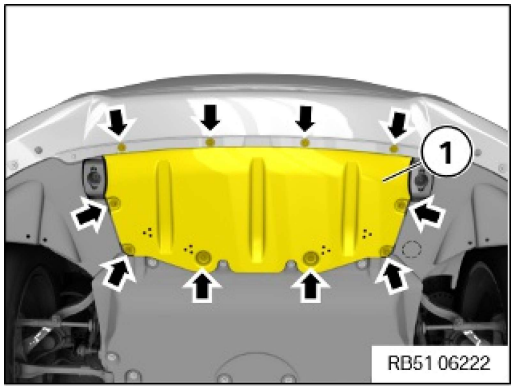
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

12 – Installing the front underbody protection



- **Version 1:**

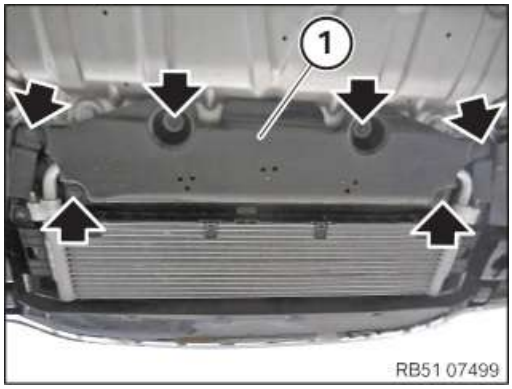
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

ordiagn.com



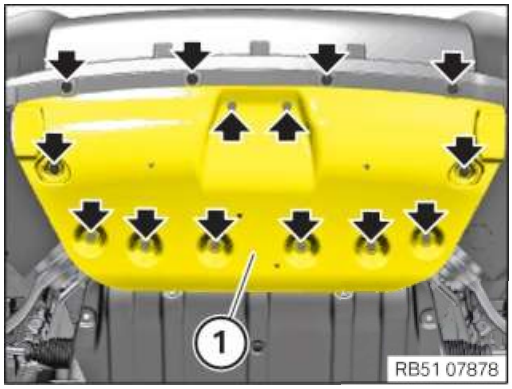
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

13 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

Additional Information

Overview of Tightening Torques

Oil return line to exhaust turbocharger/crankcase — Used in step 7

M6x14		Tightening torque	8 Nm

Cover, steering unit — Used in step 8

Screw		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 9

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 10

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 10

Thermoplastic hexagon screw		Tightening torque	3 Nm

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Holder underride guard to front axle support			Used in step 10
M10		Tightening torque	56 Nm

Underbody protection			Used in step 11
Hexagon screw		Tightening torque	3 Nm

Underbody protection front			Used in step 12
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview Technical Data

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11 51 027 Remove and install/replace electric coolant pump for charge air/capacitor

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

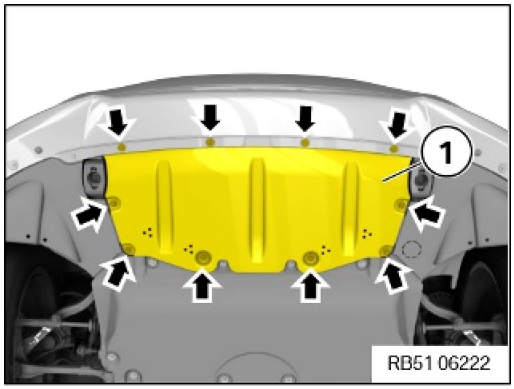
- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Removing the front underbody protection

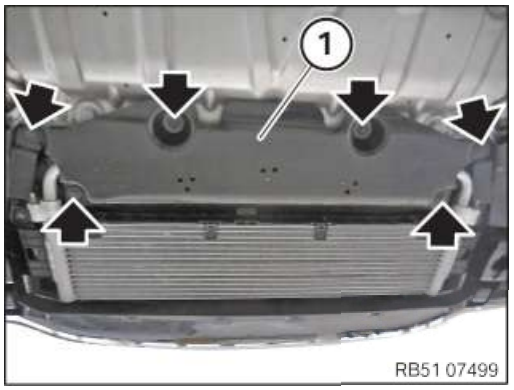
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- **Version 1:**

  Remove screws (arrows).

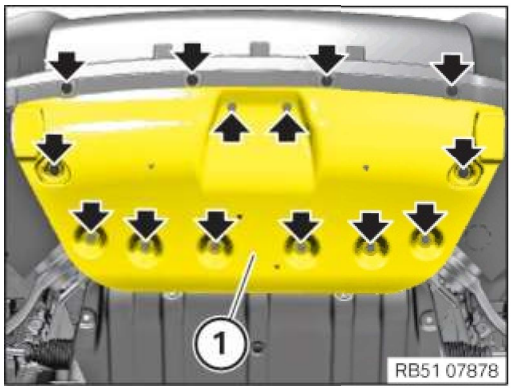
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

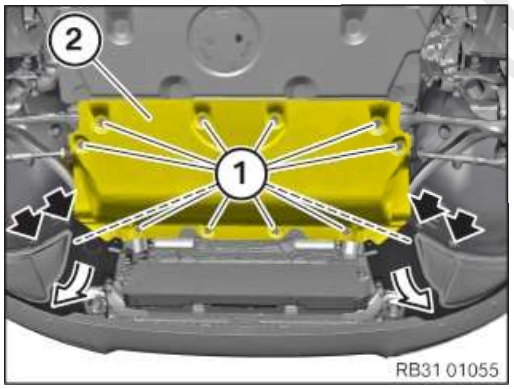


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

3 – Remove the underbody protection of the steering gear



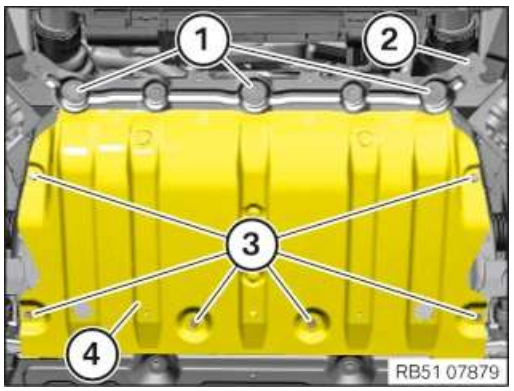
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

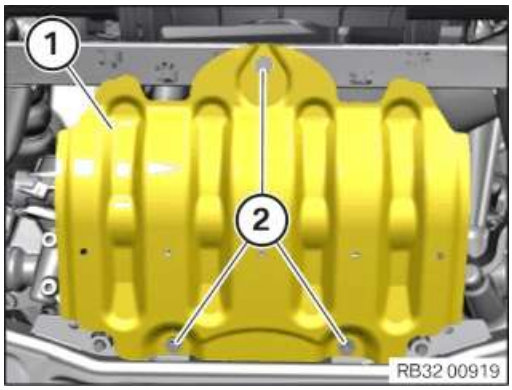
  Slide the steering gear underbody protection (4) out and remove.

4 – If installed: Removing the steering start protection

rdiagn.com

Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

5 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

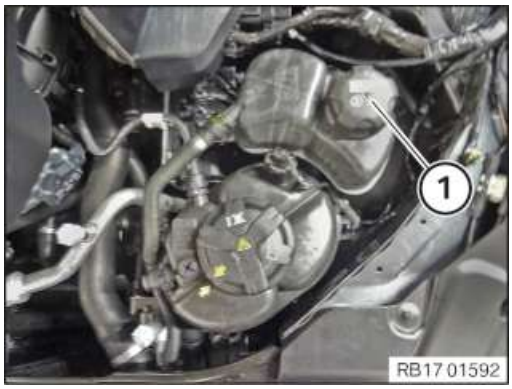
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

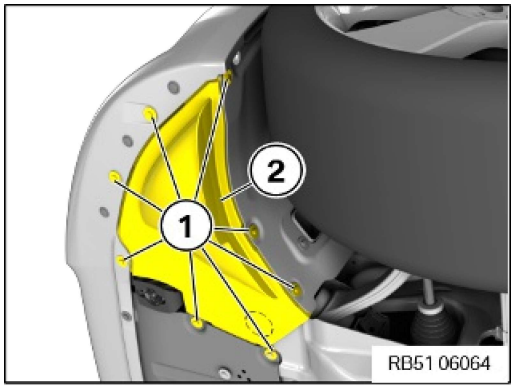
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

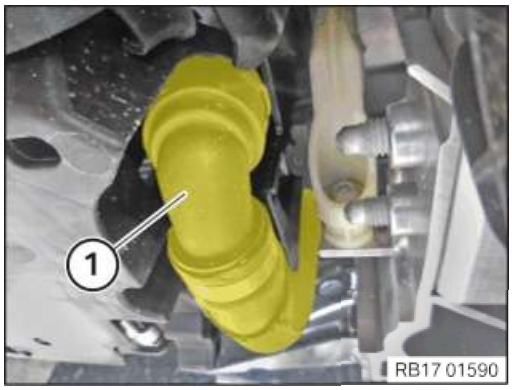


- Loosen sealing cap (1).

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- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

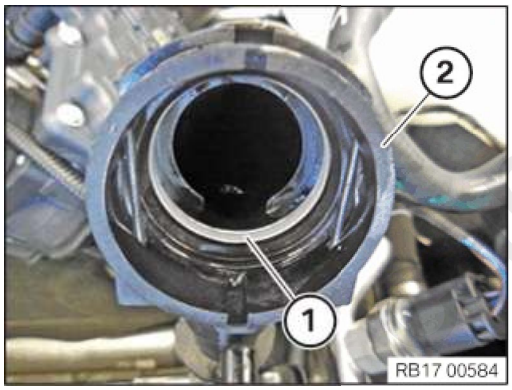


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

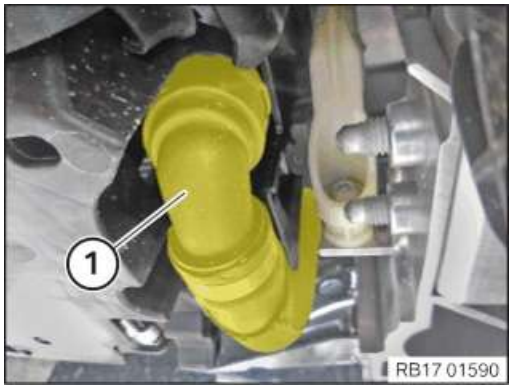
6 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



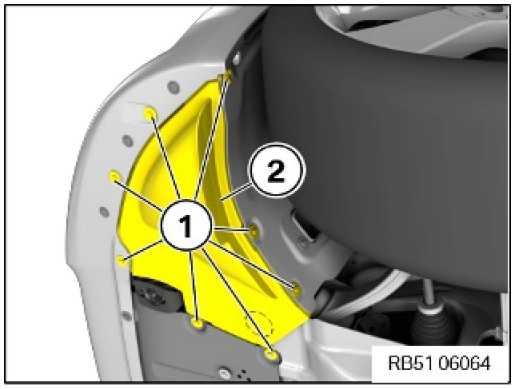
- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.

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- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

MAIN WORK

7 – Remove the electrical auxiliary coolant pump for the charge air cooler or the air conditioning condenser

RISK OF DAMAGE

Non-visible damage to the coolant pump.

Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.

RISK OF DAMAGE

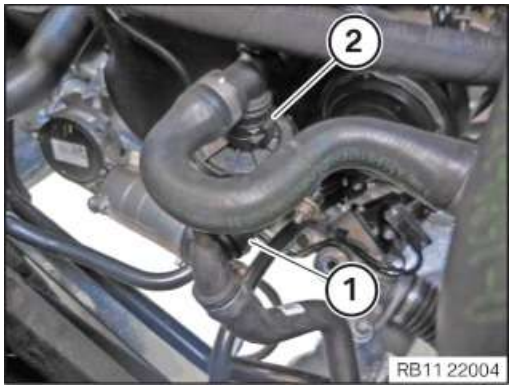
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

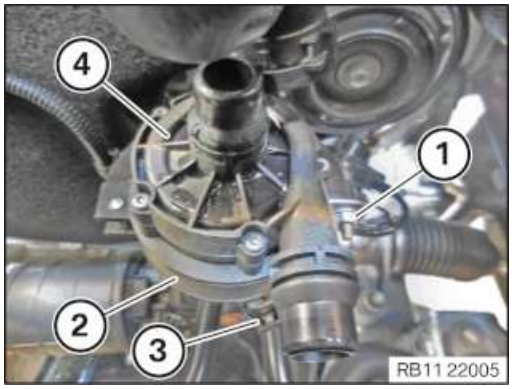
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



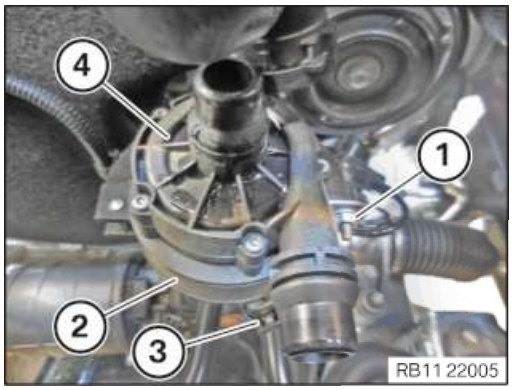
- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.
- Unlock and loosen coolant line (2).

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- Loosen nut (1).
- Thread out holder (2) and set aside.
- Unlock plug connection (3) and disconnect.
- Guide out and remove electrical auxiliary coolant pump (4).

8 – Installing the electrical auxiliary coolant pump for the charge air cooler/air conditioning condenser



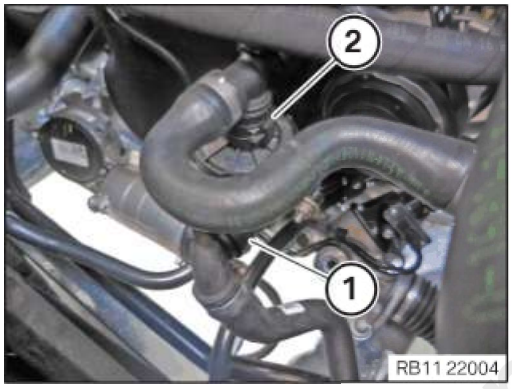
- Feed in and position the electrical auxiliary coolant pump (4).
- Insert and install the holder (2).
- Tighten nut (1).

Electric coolant pump to holder

M6		Tightening torque	8 Nm

- Connect connectors (3) and lock.

  The connector (3) must engage audibly.



TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

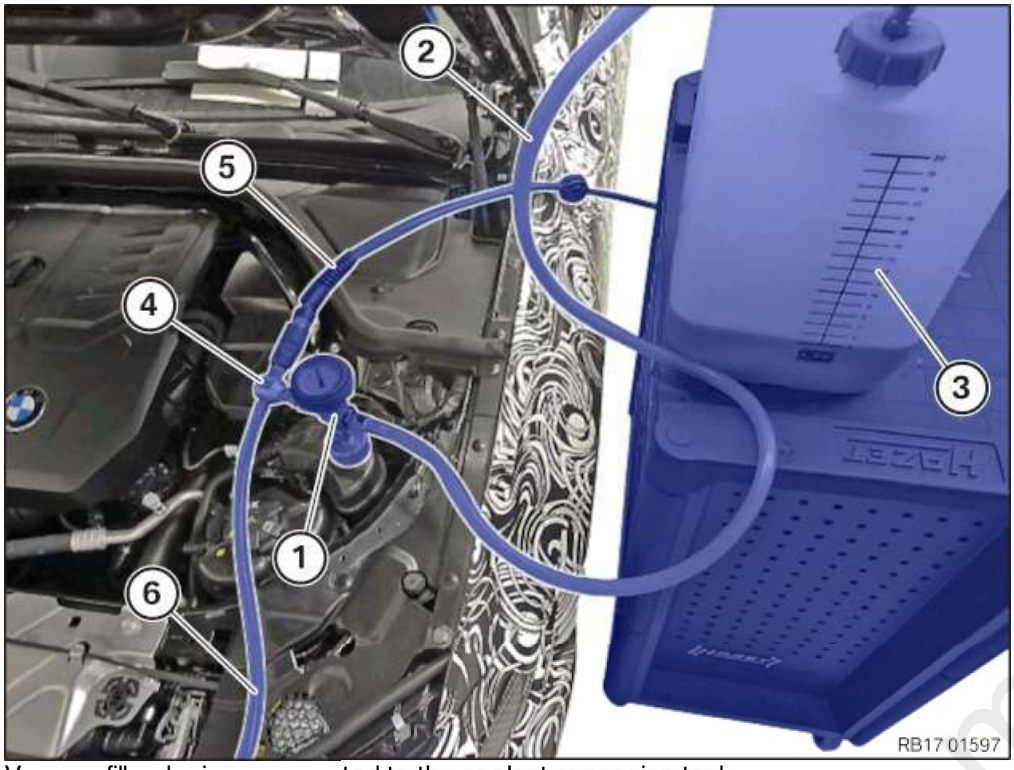
- Connect and lock coolant lines (1) and (2).
- Make sure that the coolant lines (1) and (2) engage audibly.

POSTPROCESSES

9 – Filling the low-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

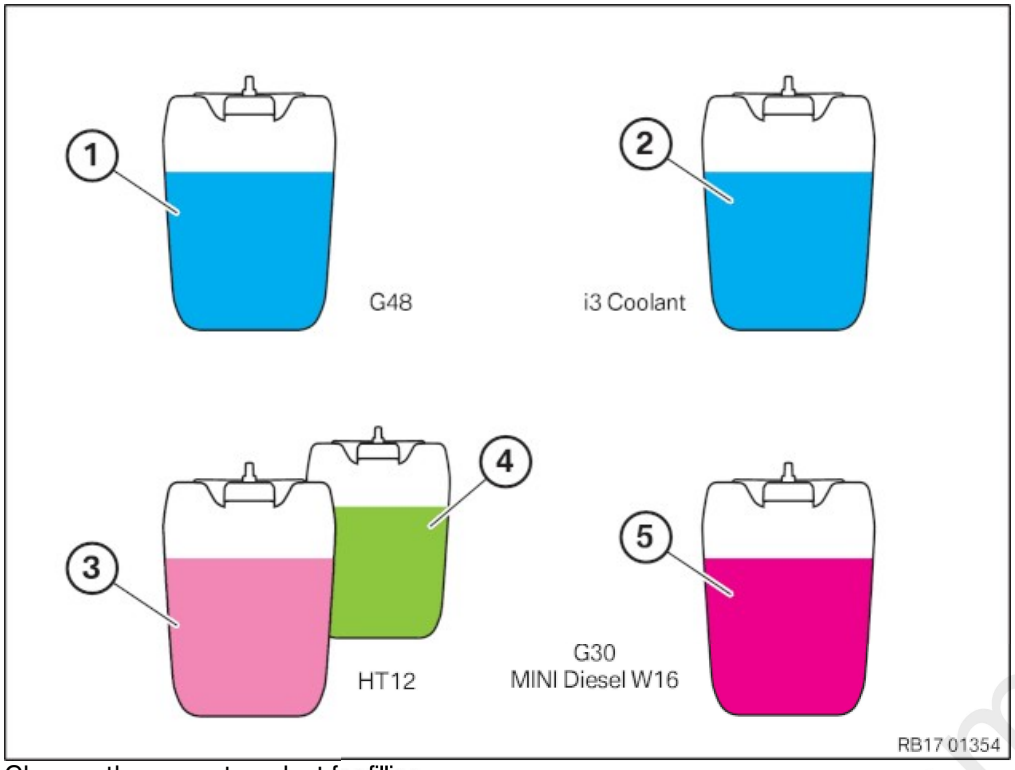
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

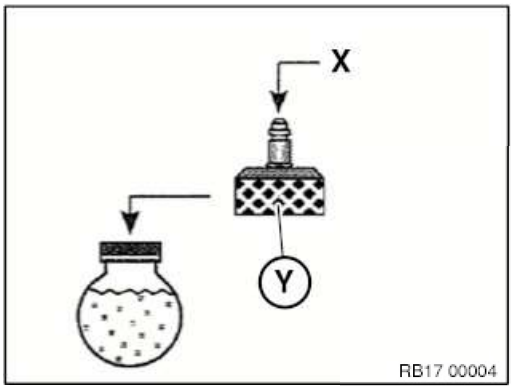
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

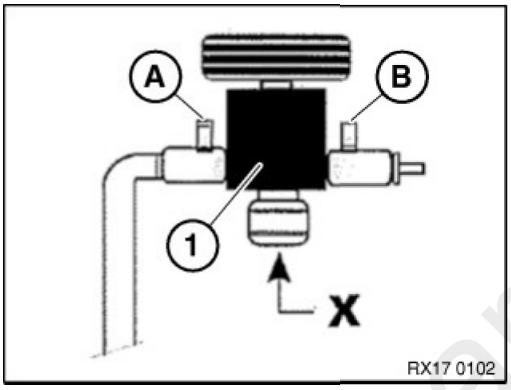
Capacity of low-temperature coolant circuit G20

B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

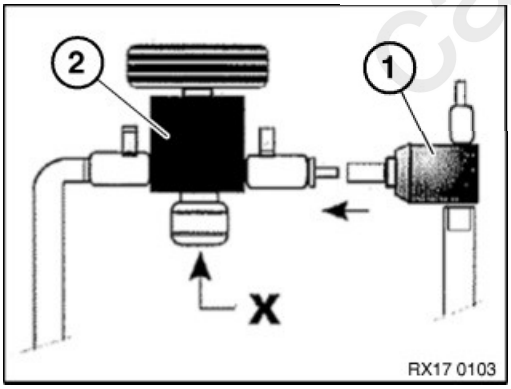
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

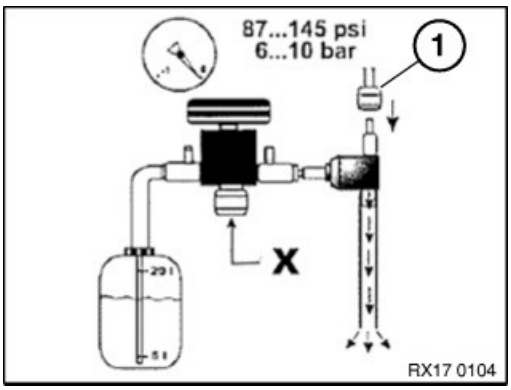


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

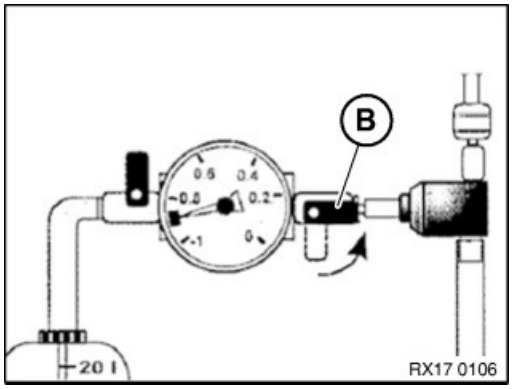
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

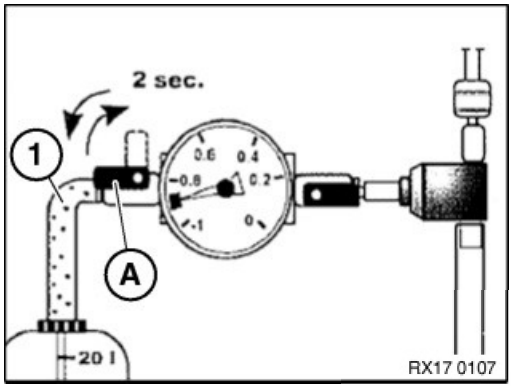
  (X)is the connection on the coolant expansion tank.

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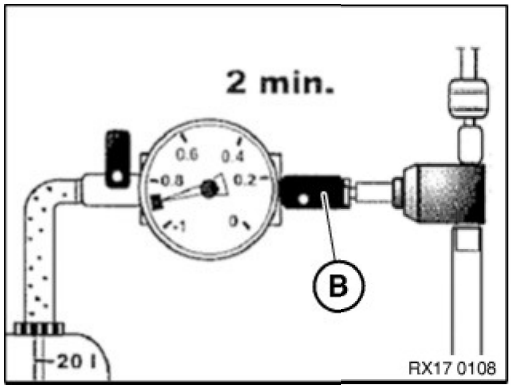
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

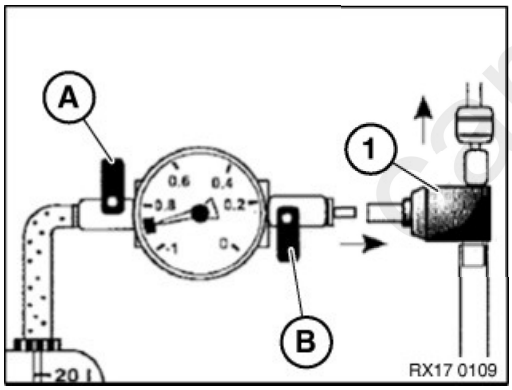


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

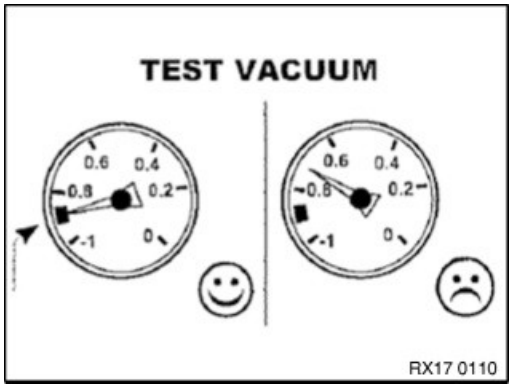
The coolant hoses contract during vacuum build-up.

- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

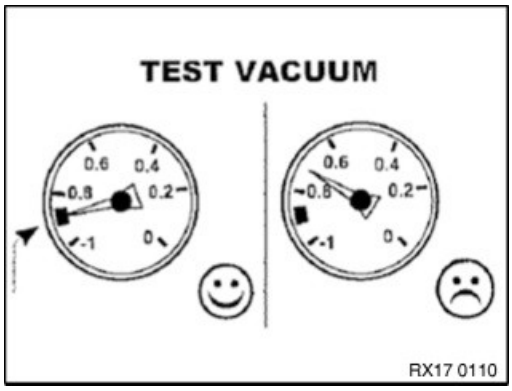
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



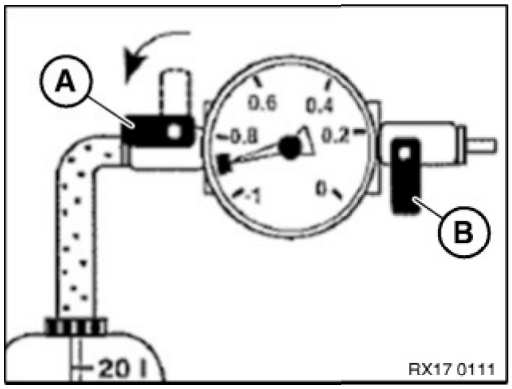
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

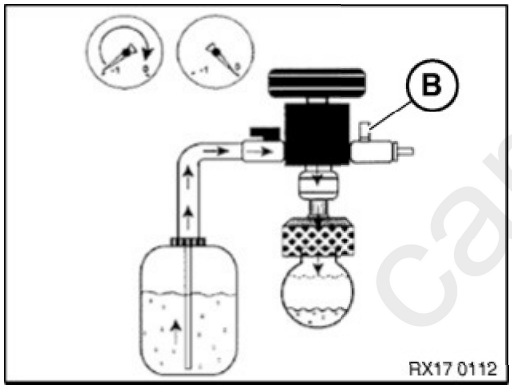
» Vacuum remains constant.

Measure

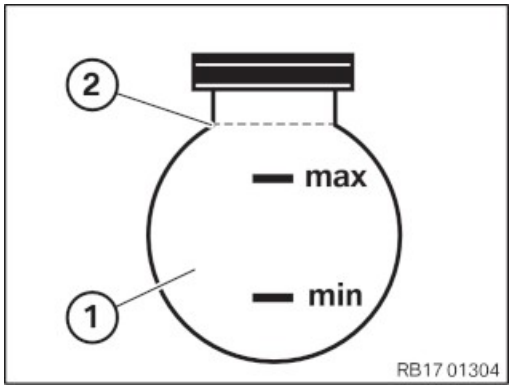
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

10 – Bleeding the low-temperature cooling system

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

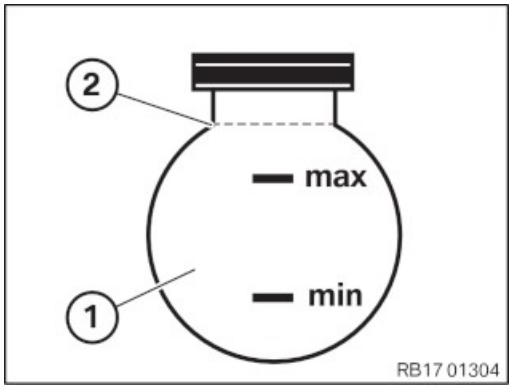
Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

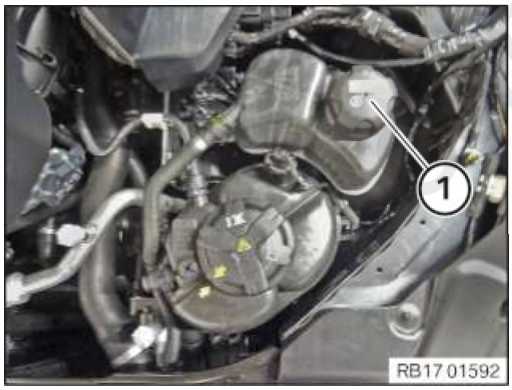
  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).



TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

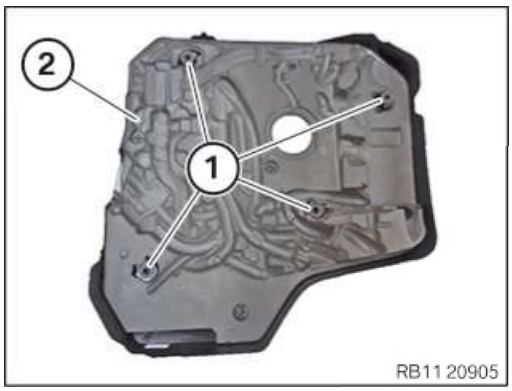
11 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



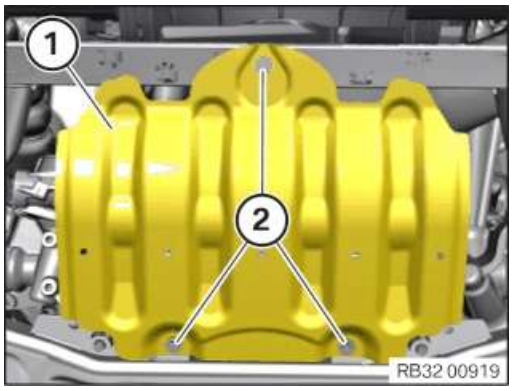
- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

12 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



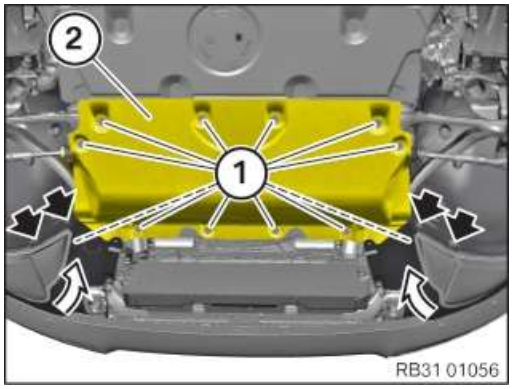
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

13 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

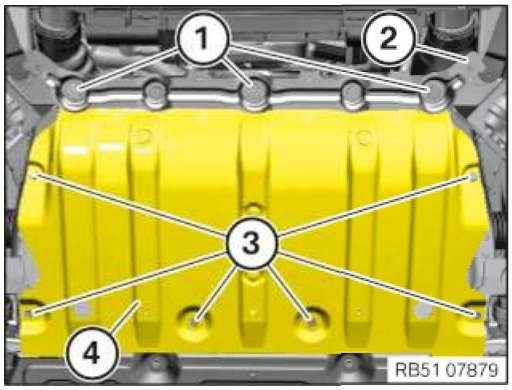
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

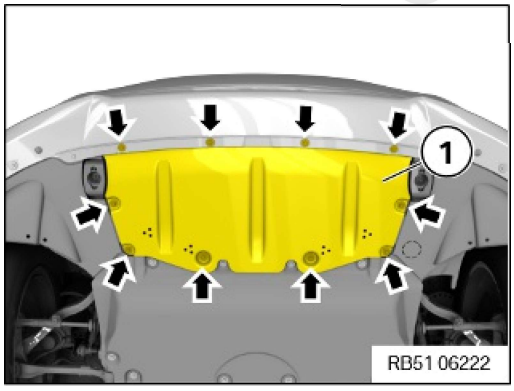
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

14 – Installing the front underbody protection



- **Version 1:**

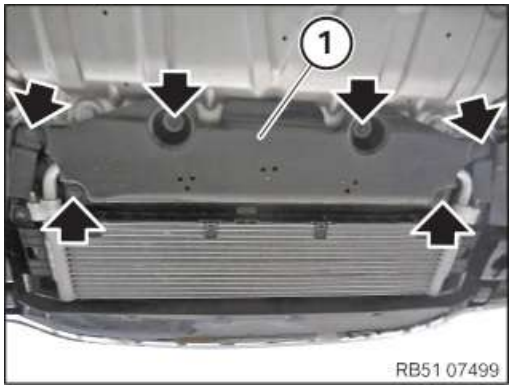
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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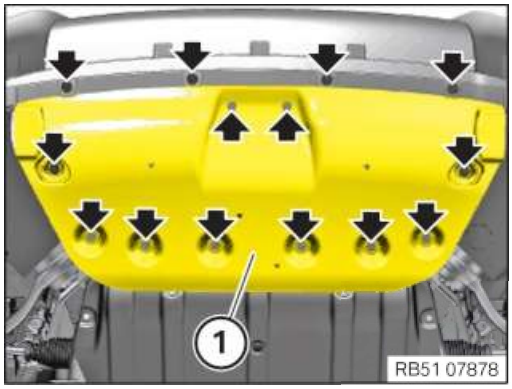
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 6

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Electric coolant pump to holder — Used in step 8

M6		Tightening torque	8 Nm

Bumper buffer device steering on front axle support — Used in step 12

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 13

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 13

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 13

M10		Tightening torque	56 Nm

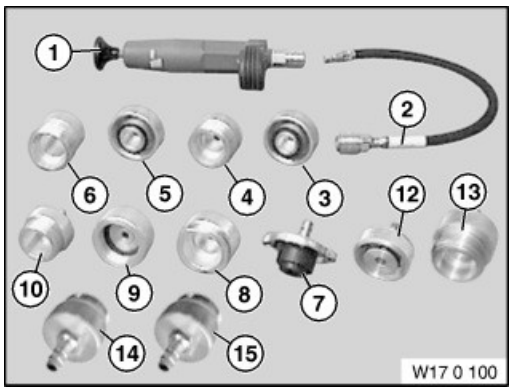
Underbody protection front — Used in step 14

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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Overview of Special Tools

0 494 417 (17 0 100) Tester



Common Used in step 9

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	

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13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Capacity of low-temperature coolant circuit G20	Used in step 9
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

Repair instructions	**Used in step**
61 35 ... Notes on ESD protection (Electro Static Discharge)	7
17 00 ... Notes for working on cooling system.	9

Operating materials	**Used in step**
Main group 17	9

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11 51 028 Removing and installing/replacing auxiliary coolant pump for exhaust turbocharger

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

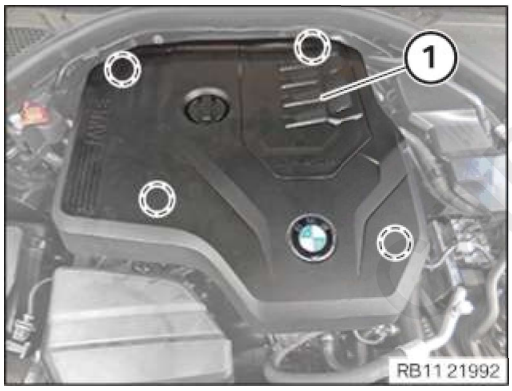
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Removing the clean air pipe with the resonator

WARNING

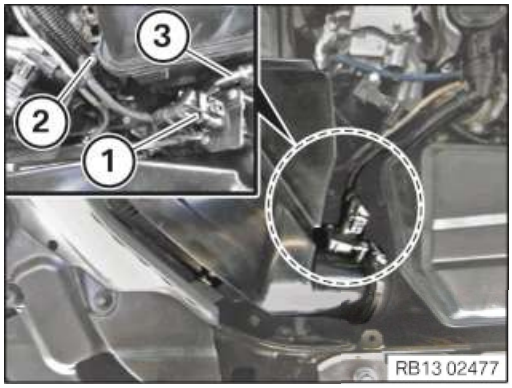
Hot surfaces.

Risk of burning!

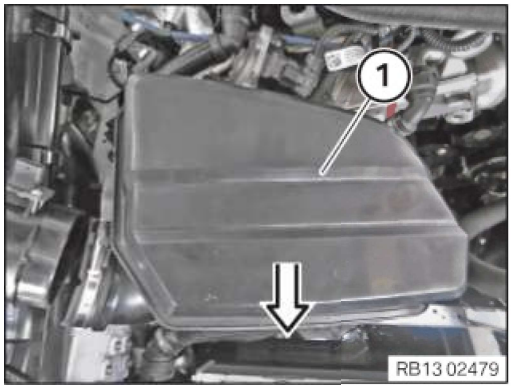
- Perform all work only on components that have cooled down.



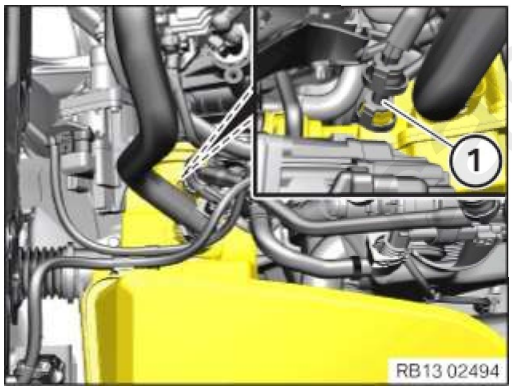
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



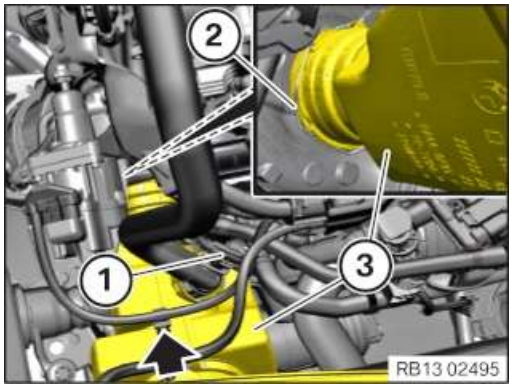
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



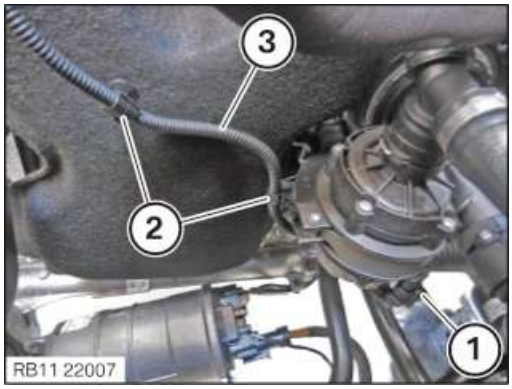
- Unlock and disconnect the tank ventilation line (1).



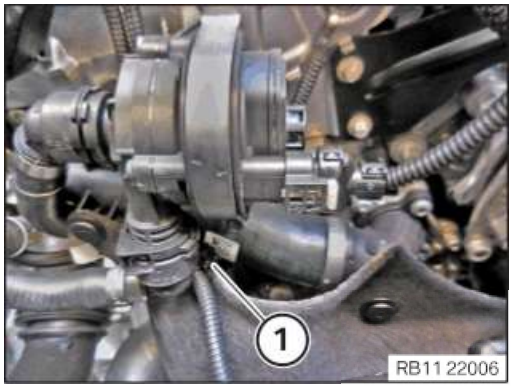
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

3 – Removing the acoustic cover for the engine at the front

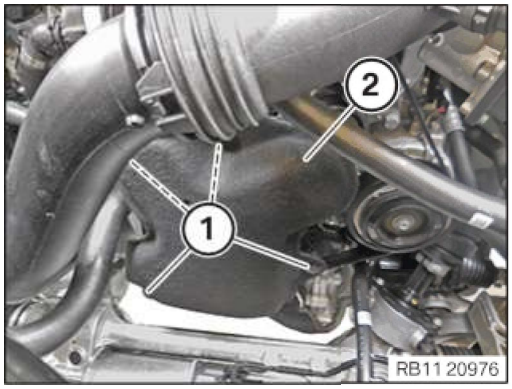
rdiagn.com



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

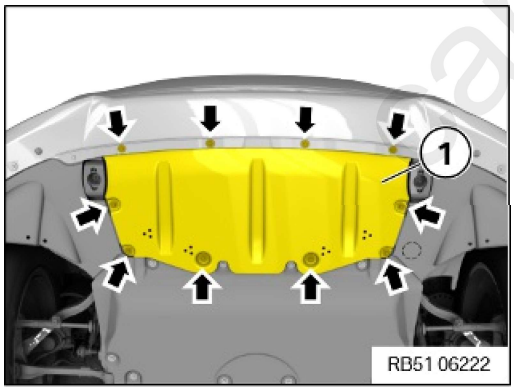


- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

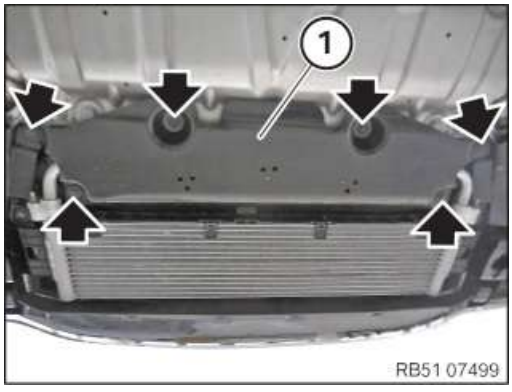
4 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed front underbody protection (1) backwards out of the bumper panel.

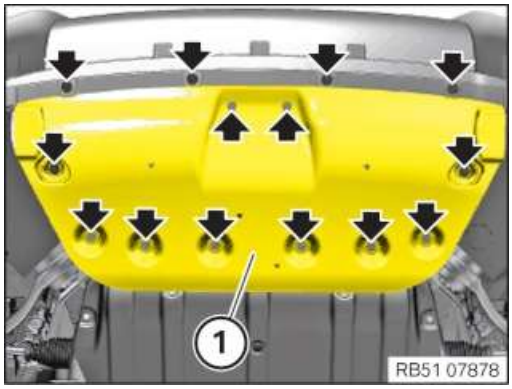


- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

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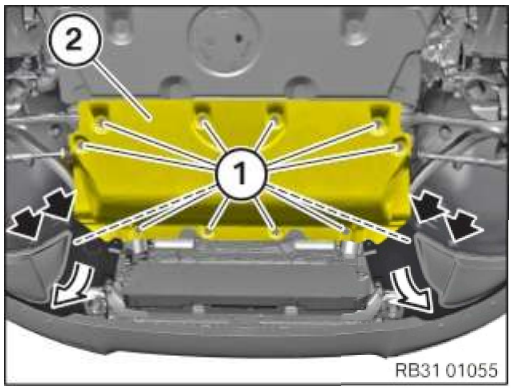


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

5 – Remove the underbody protection of the steering gear



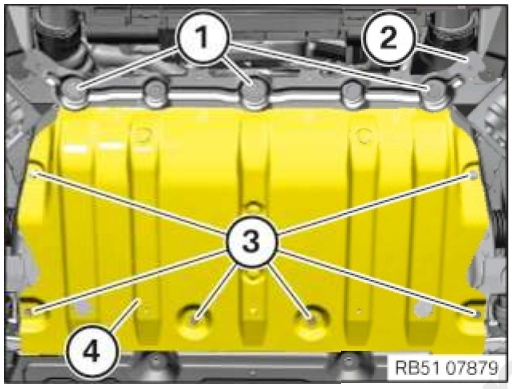
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

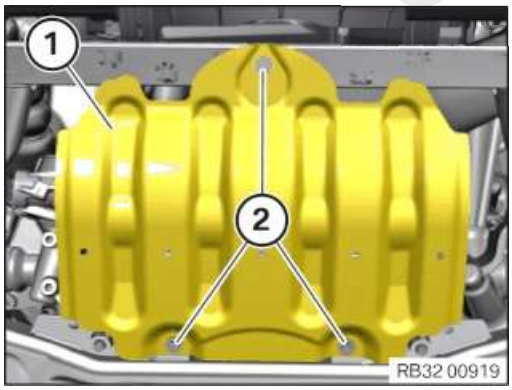
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

6 – If installed: Removing the steering start protection

Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

7 – Draining the coolant from the high-temperature cooling system

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

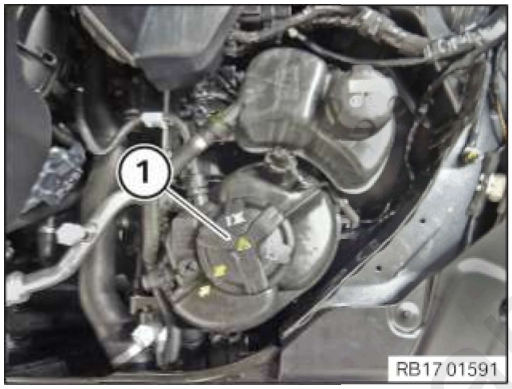
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

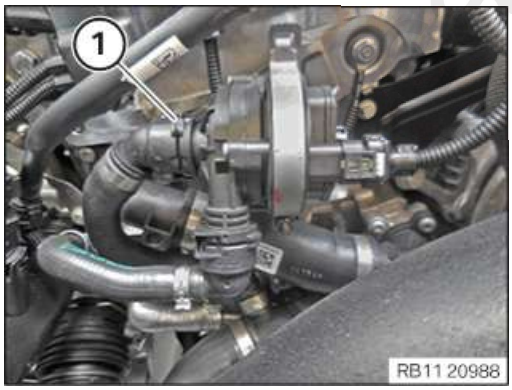
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

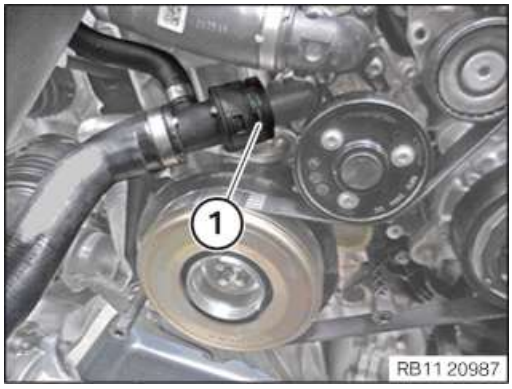
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



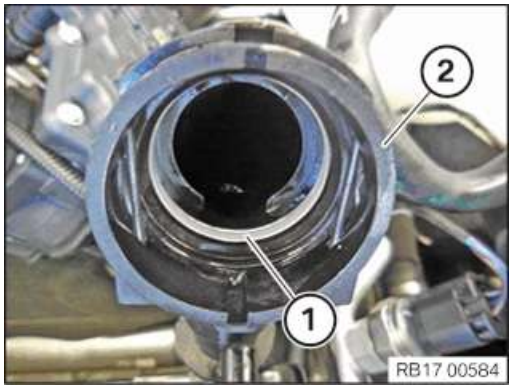
- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

partdiagn.com

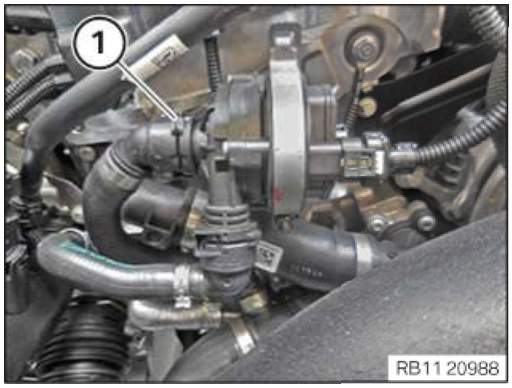
8 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

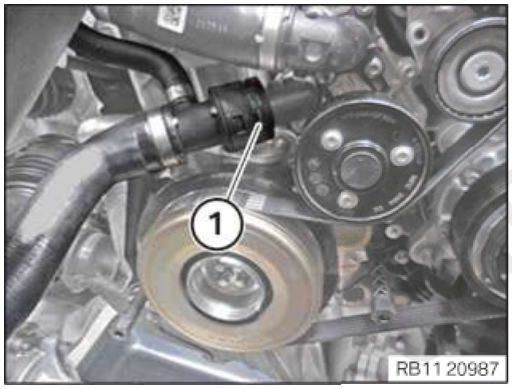


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

MAIN WORK

9 – Removing auxiliary coolant pump for the exhaust turbocharger

RISK OF DAMAGE

Non-visible damage to the coolant pump.

Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.

RISK OF DAMAGE

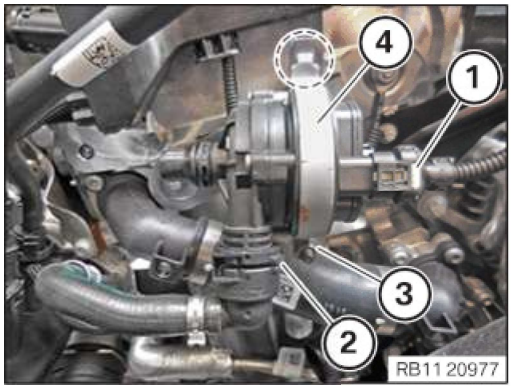
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Unlock and loosen connector (1).
- Unlock and loosen coolant line (2).
- Loosen nut (3).
- Guide out and remove retaining bracket (4) in the **marked** area.
- Feed out and remove auxiliary coolant pump.

10 – Installing auxiliary coolant pump for the exhaust turbocharger

RISK OF DAMAGE

Non-visible damage to the coolant pump.

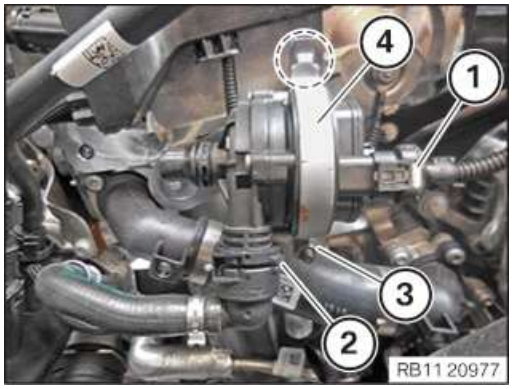
Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

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- Guide in and position the auxiliary coolant pump.
- Guide retaining bracket (4) into the **marked** area and install it.
- Tighten nut (3).

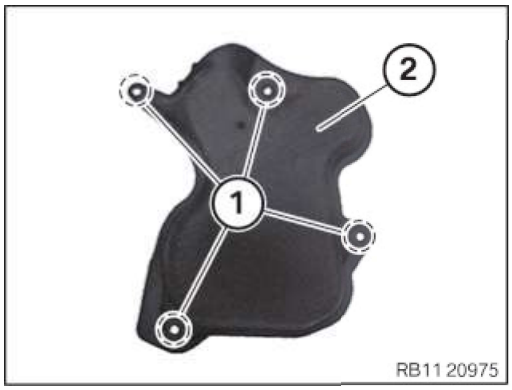
Auxiliary coolant pump holder to cylinder head

M6		Tightening torque	8 Nm

- Feed in and install coolant line (2).
- Make sure that the cooling line (2) engages audibly.
- Connect and lock the connector (1).
- Make sure that connector (1) locks audibly.

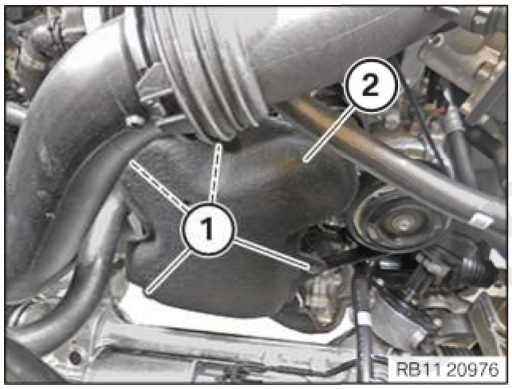
POSTPROCESSES

11 – Install the acoustic cover for the engine at the front

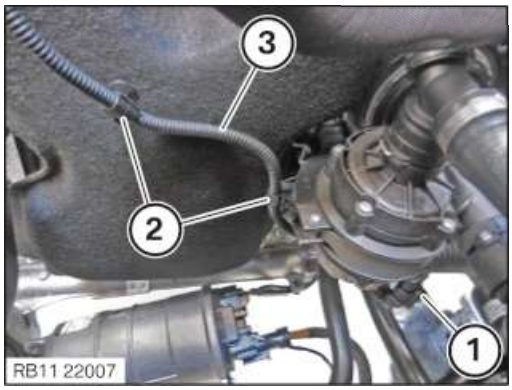


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



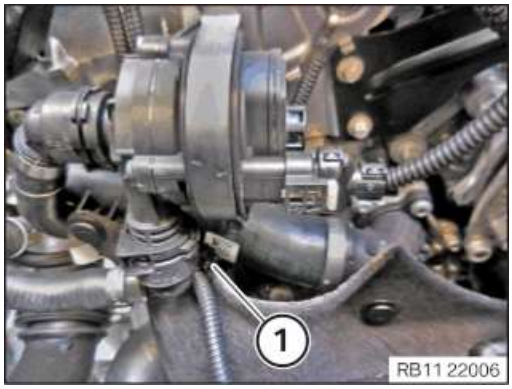
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

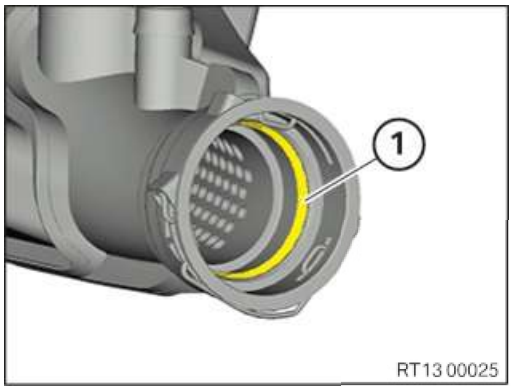
  The connector (1) must engage audibly.

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- Secure clamps (1).

12 – Installing the clean air pipe with resonator

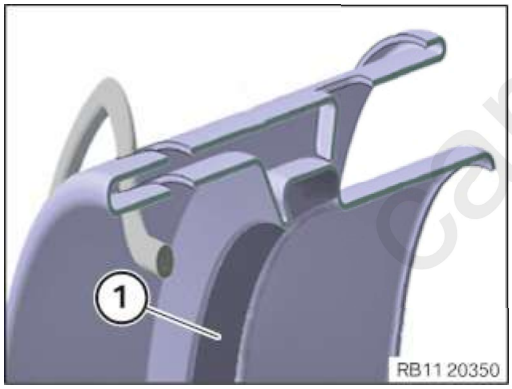


- Check the seal (1) for damages, replace if necessary.

▶ **Replace damaged gasket**

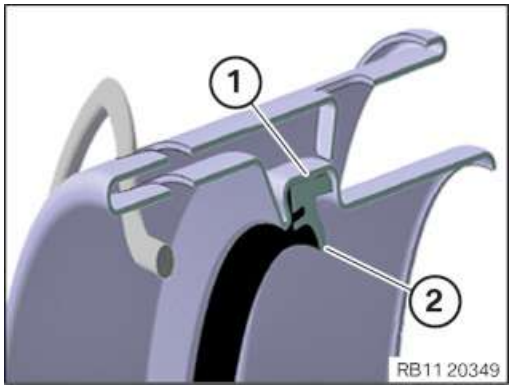
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



- Renew gasket.

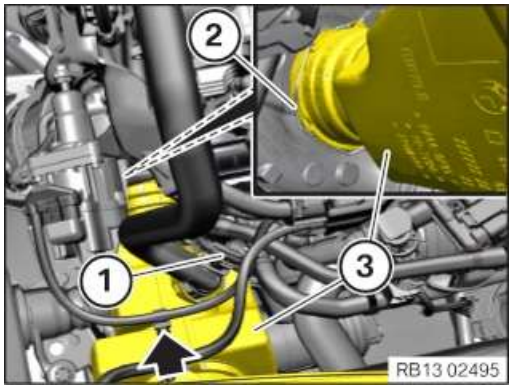
  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).

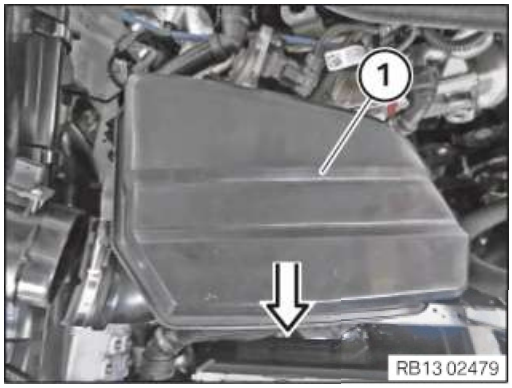
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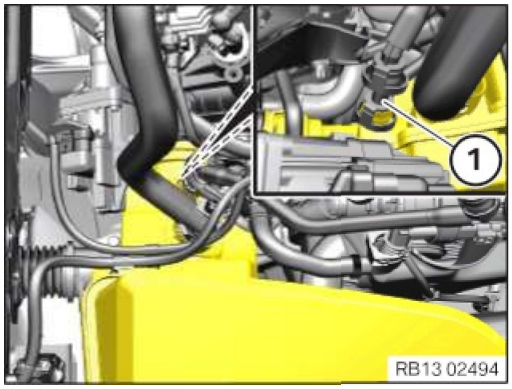
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

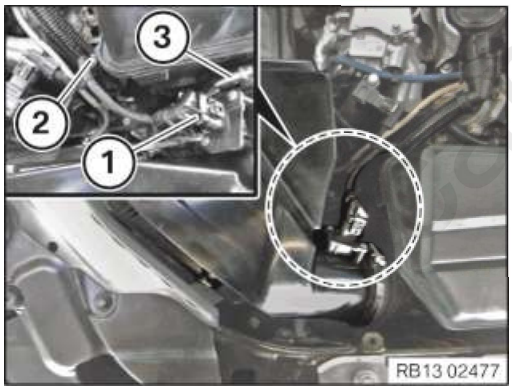
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

13 – Install acoustic cover

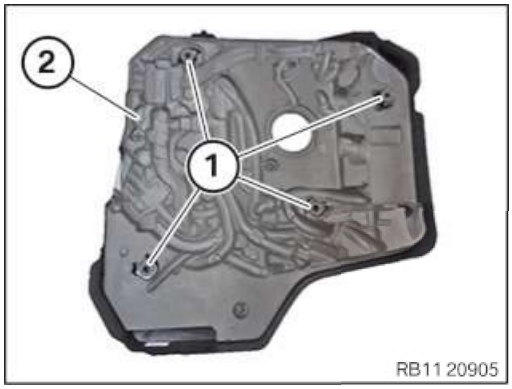
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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



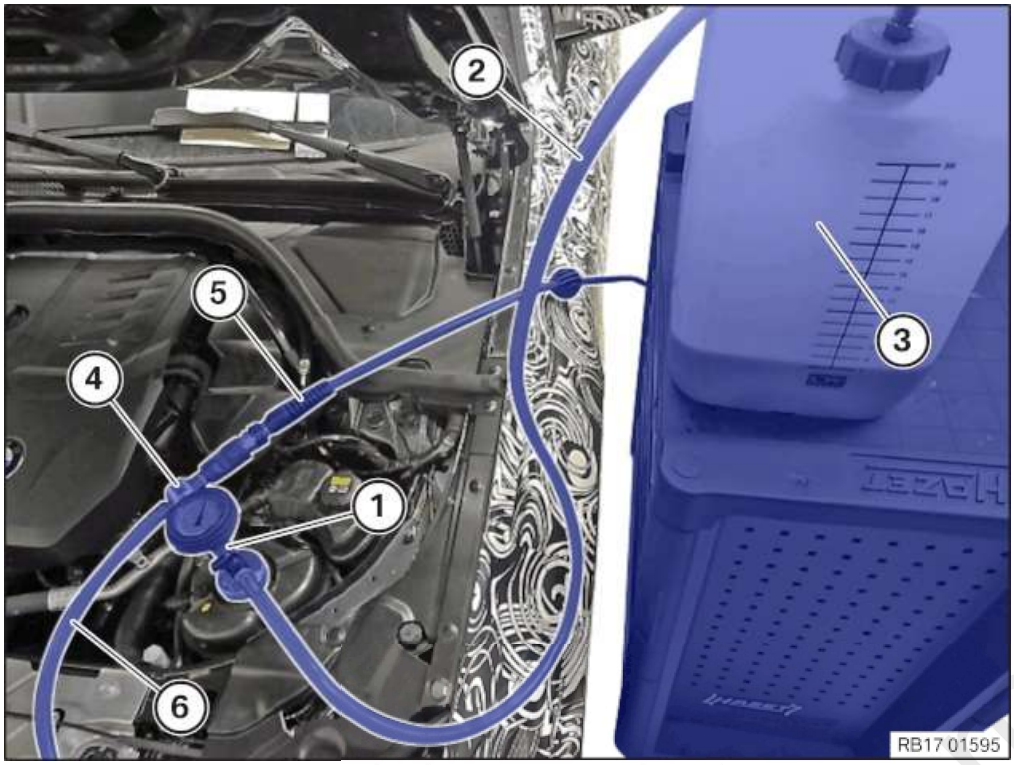
- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

14 – Fill the high-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

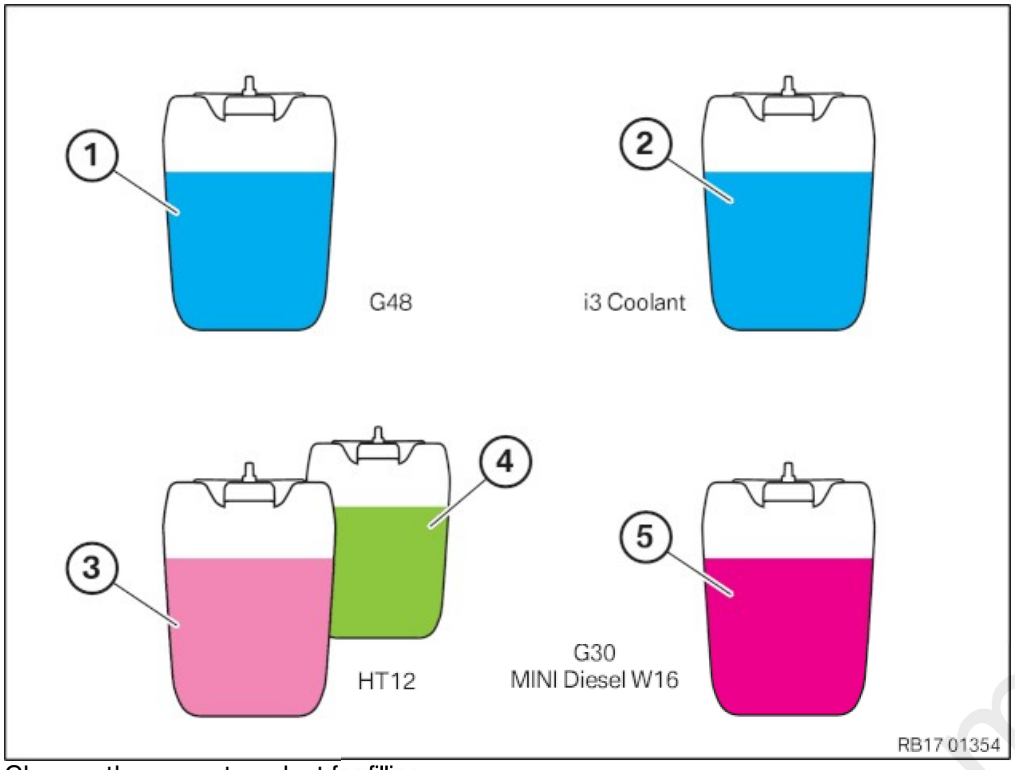
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

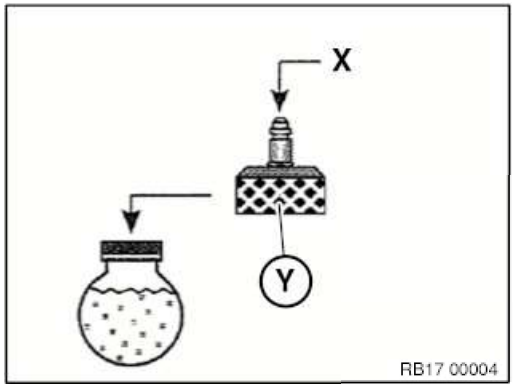
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

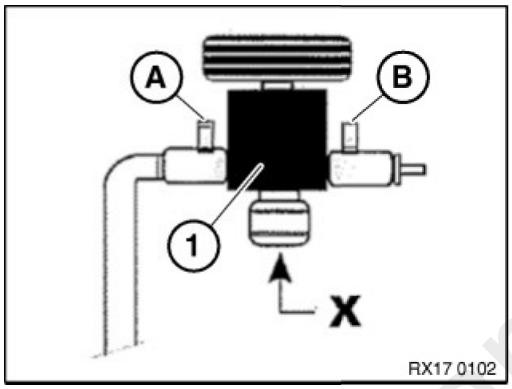
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

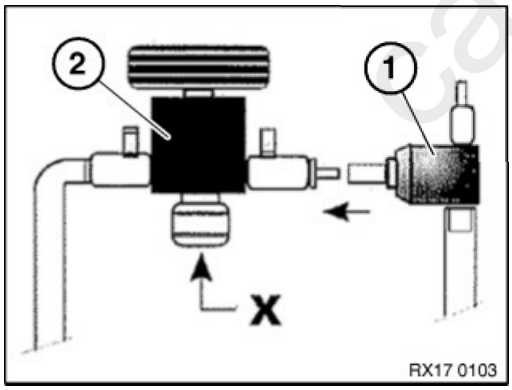
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

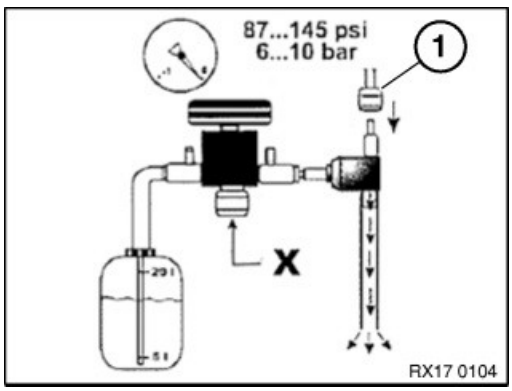


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

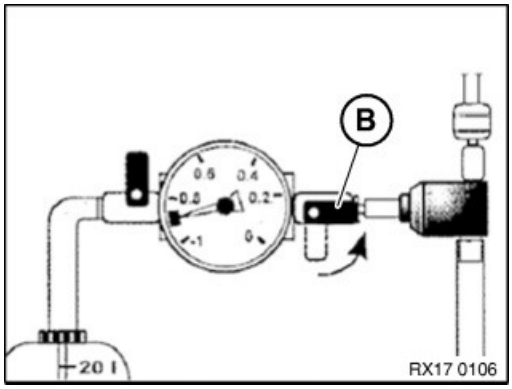
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

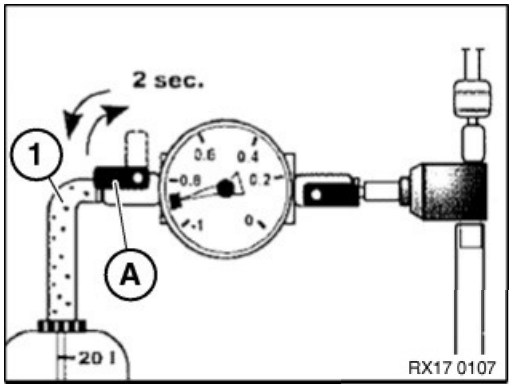
  (X)is the connection on the coolant expansion tank.

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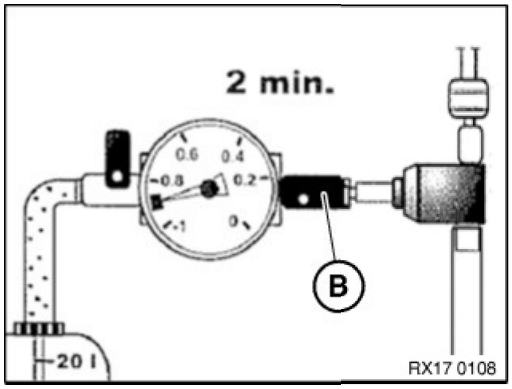
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

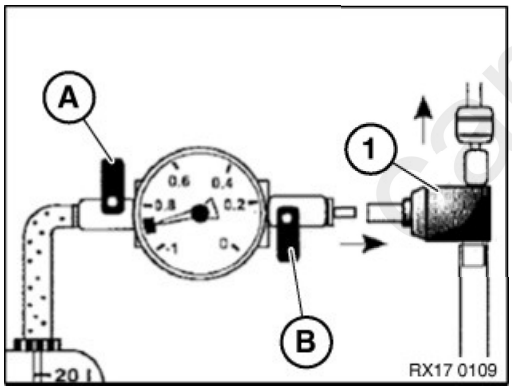


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

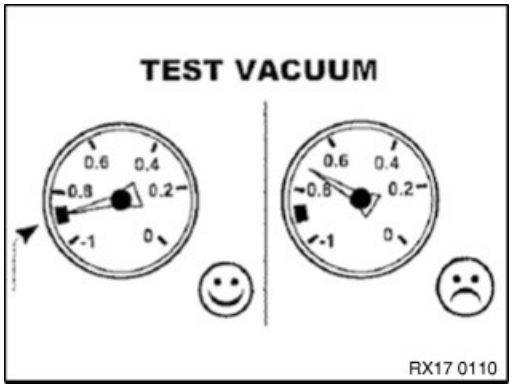
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

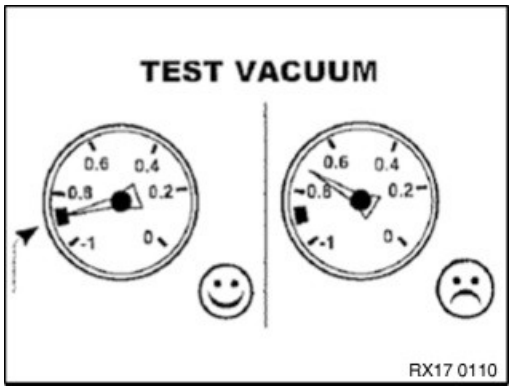
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



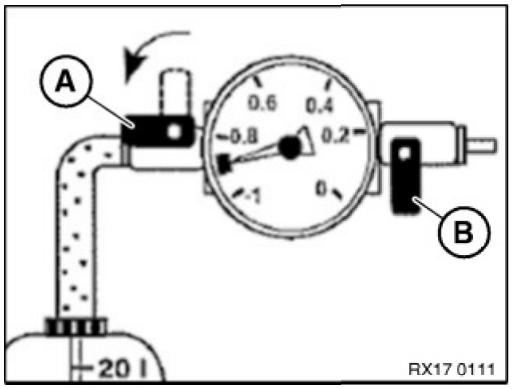
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

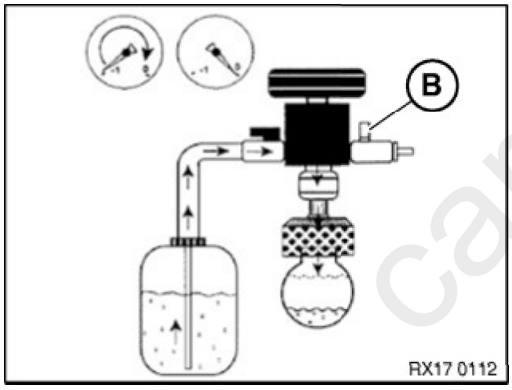
» Vacuum remains constant.

Measure

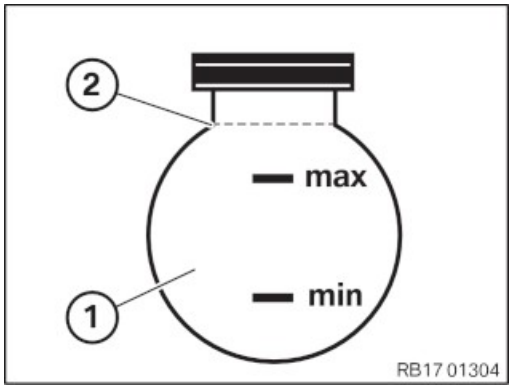
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

15 – Bleed the high-temperature coolant circuit

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

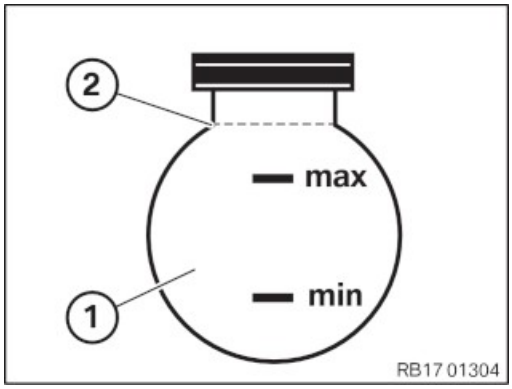
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

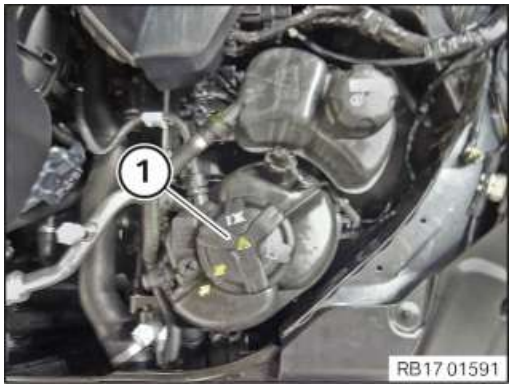
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

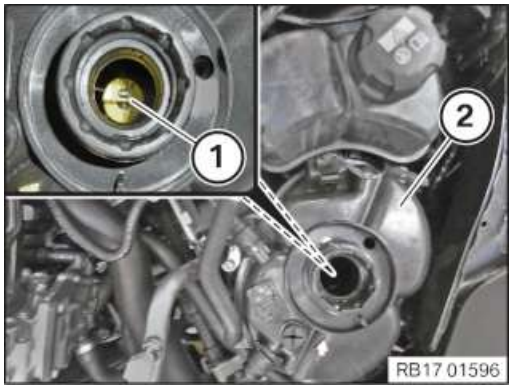
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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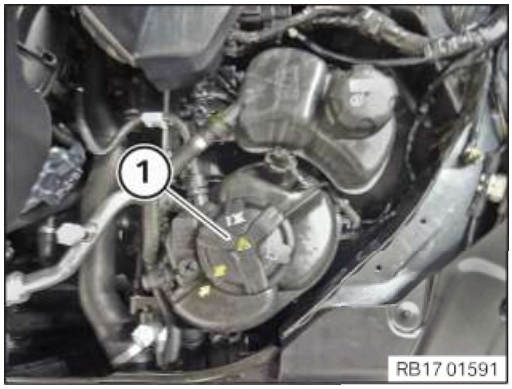
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .

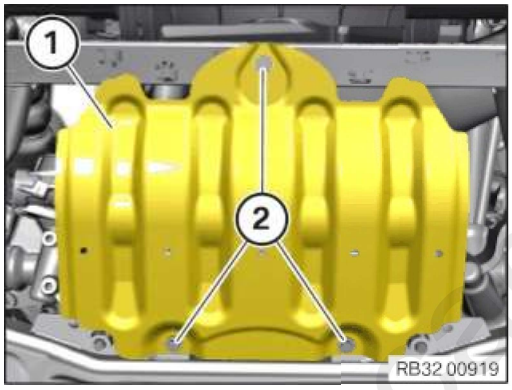


- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

16 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



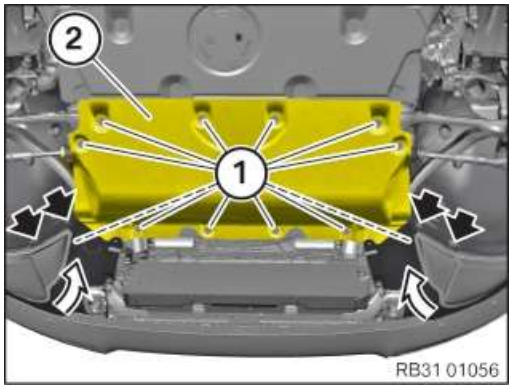
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

17 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

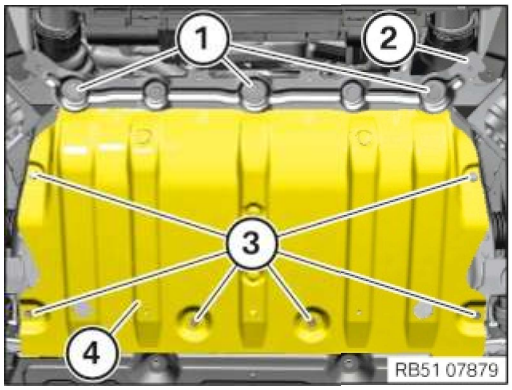
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

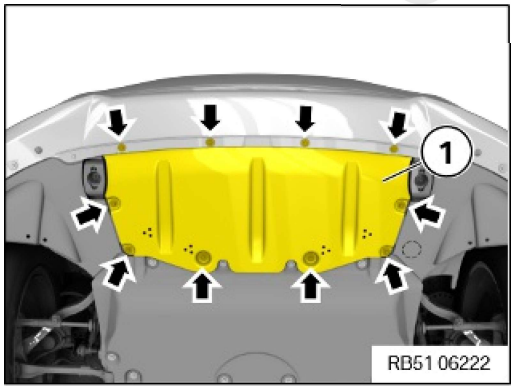
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

18 – Installing the front underbody protection



- **Version 1:**

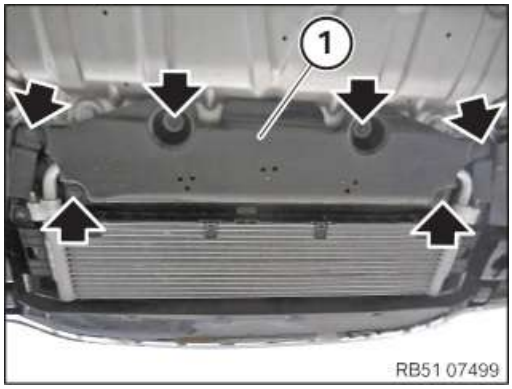
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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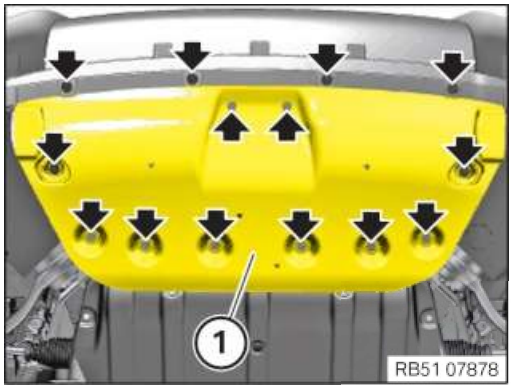
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Auxiliary coolant pump holder to cylinder head — Used in step 10

M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 12

Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 16

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 17

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 17

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 17

M10		Tightening torque	56 Nm

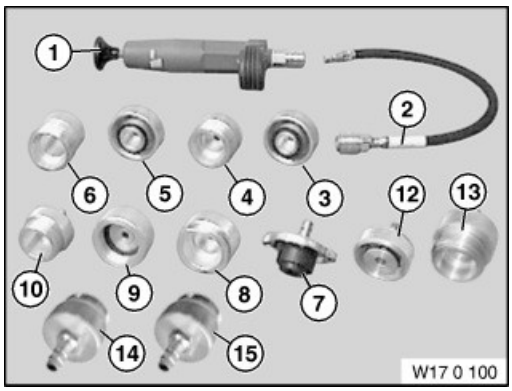
Underbody protection front — Used in step 18

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

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0 494 417 (17 0 100) Tester



Common Used in step 14

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	

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13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Capacity of high-temperature coolant circuit G20 Used in step 14

B48B20O1/B46B20O1	9.8 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	9
17 00 ... Notes for working on cooling system.	14

Operating materials	Used in step
Main group 17	14

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11 51 030 Removing and installing/replacing component carrier

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Removing the clean air pipe with the resonator

WARNING

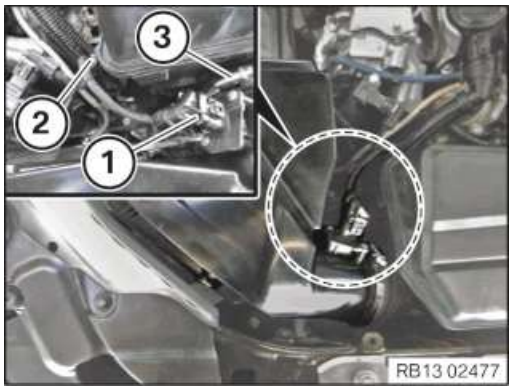
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

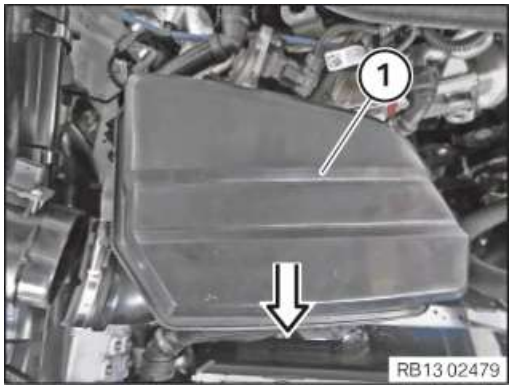


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

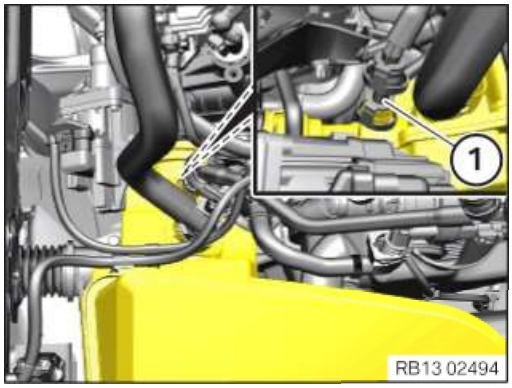


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

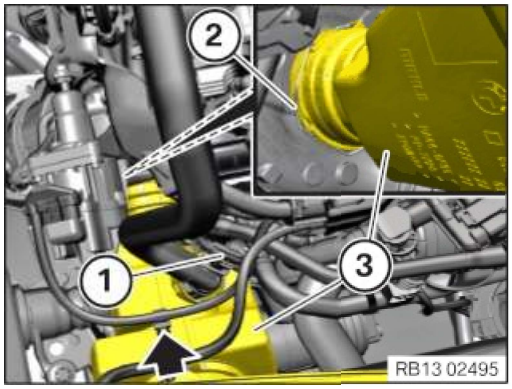
bmwdiagn.com



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

4 – Removing the throttle body

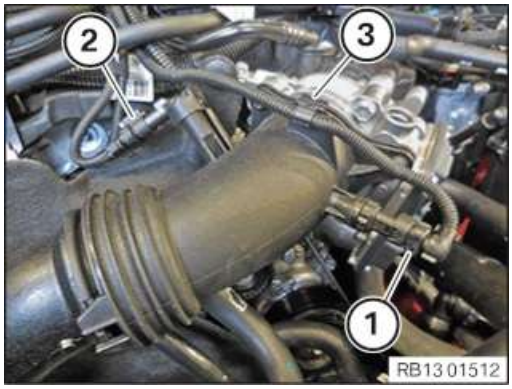
RISK OF DAMAGE

Electrostatic discharge.

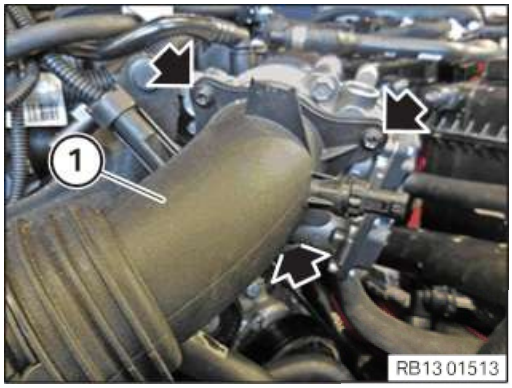
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

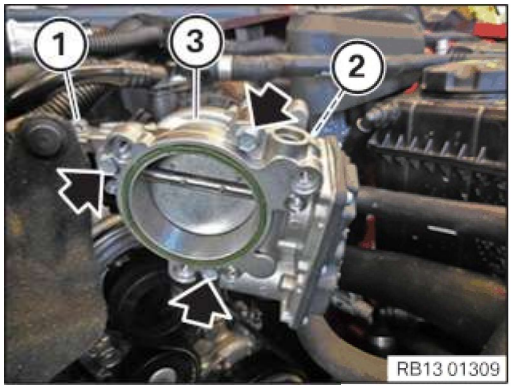
cardiagn.com



- Unlock and loosen connector (1).
- Unlock and loosen connector (2).
- Unlock and loosen clamp (3).

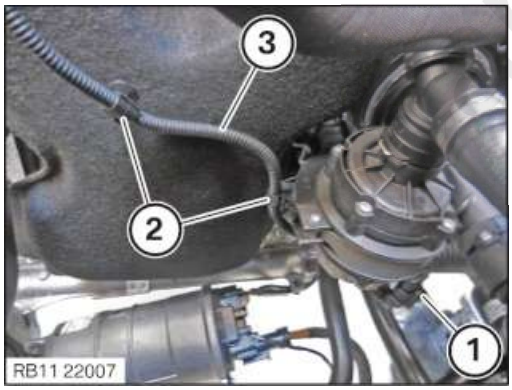


- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.

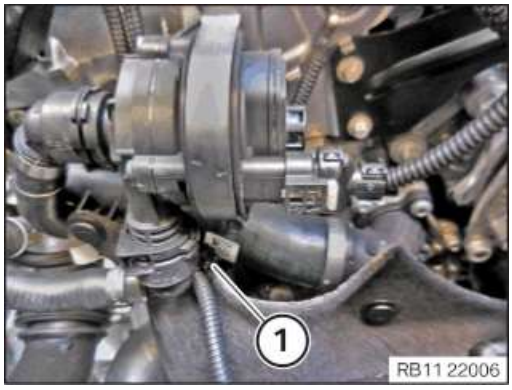


- Loosen screw (1).
- Remove screws (arrows).
- Unlock and loosen connector (2).
- Remove the throttle bodies (3).

5 – Removing the acoustic cover for the engine at the front

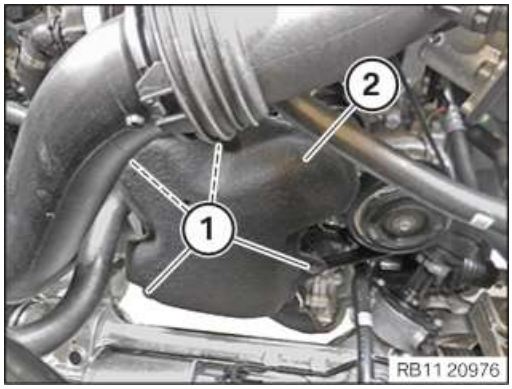


- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).

mdiagn.com



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

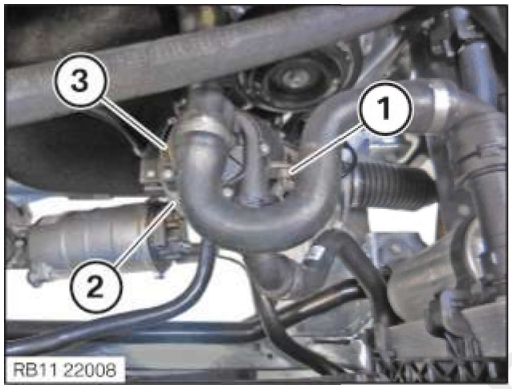
6 – Releasing the electrical auxiliary coolant pump for the charge air cooler or the air conditioning condenser

RISK OF DAMAGE

Non-visible damage to the coolant pump.

Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.



- Loosen nut (1).
- Thread out holder (2) and set aside.
- Guide out the electrical auxiliary coolant pump (3) and set it aside.

7 – Removing the drive belt for alternator

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

Component with preload.

Danger of injury!

- Reduce preload as far as possible before disassembly. Relieve component.

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TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.



- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Secure the belt tensioner with the special tool 0 496 268 (11 0 390).
- Guide out the drive belt for the alternator (2) and remove it.

8 – Removing the alternator

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

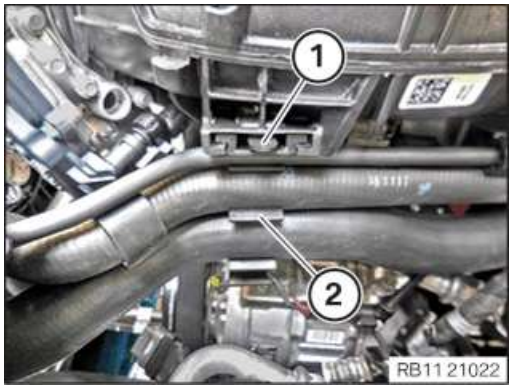
RISK OF DAMAGE

Electrostatic discharge.

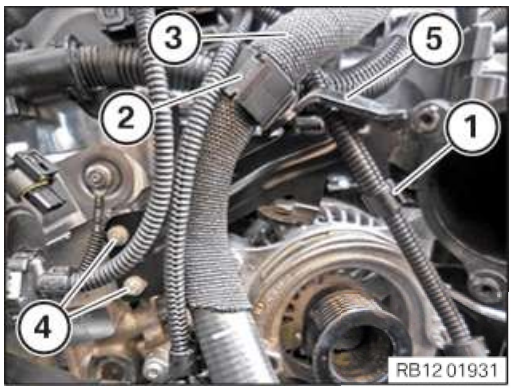
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

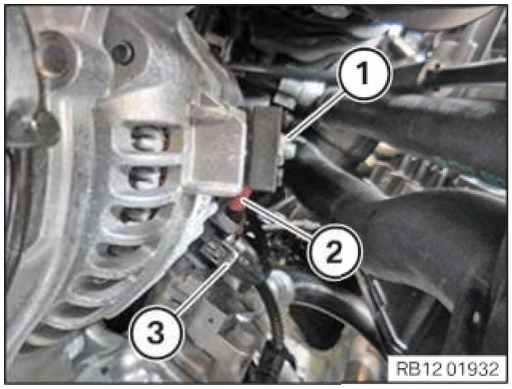
cardiagn.com



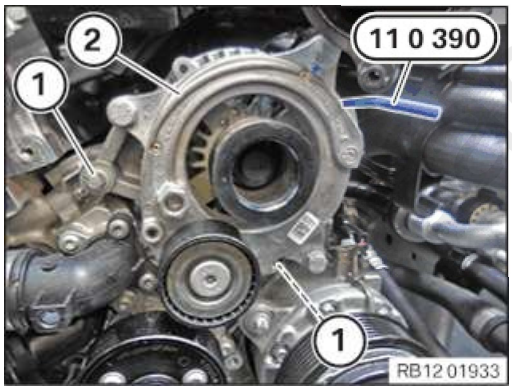
- Unlock the lock (1).
- Thread out holder (2) and set aside.



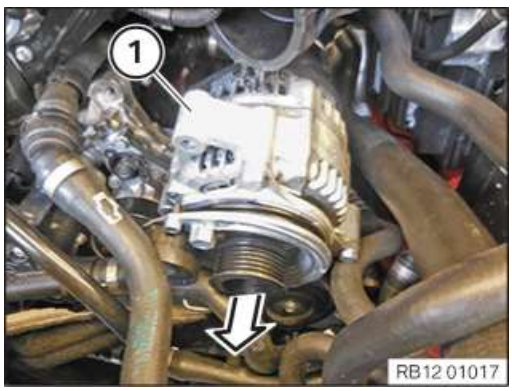
- Loosen clamp (1).
- Loosen clamp (2).
- Feed out coolant line (3) and place to one side.
- Loosen screws (4).
- Thread out holder (5) and set aside.



- Unfasten nut (1).
- Thread out positive battery cable (2) and set it aside.
- Unlock and loosen connector (3).



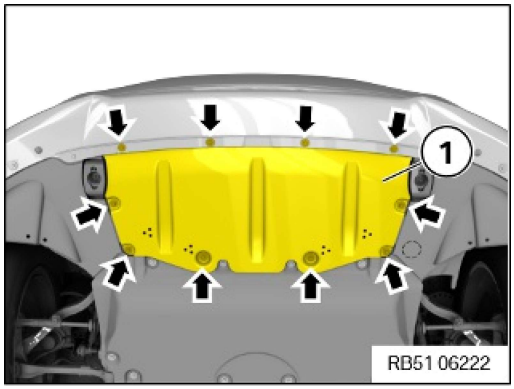
- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.
- Loosen screws (1).
- Disconnect the alternator (2).



- Feed the alternator (1) out toward the front in the direction of the arrow.

9 – Removing the front underbody protection

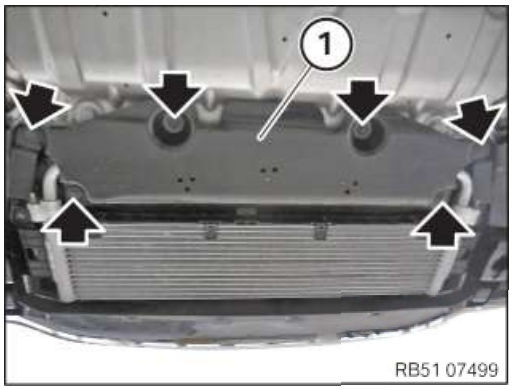
fordiagn.com



- **Version 1:**

  Remove screws (arrows).

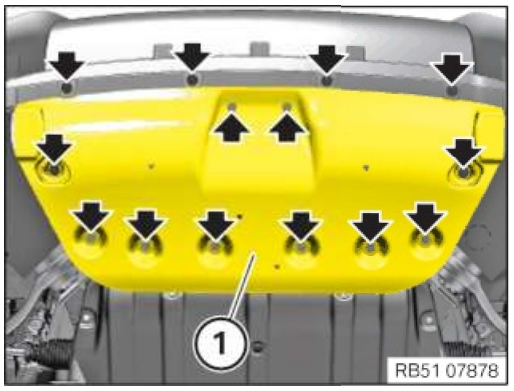
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

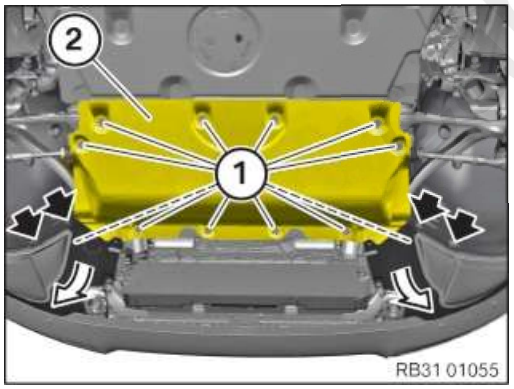


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

10 – Remove the underbody protection of the steering gear



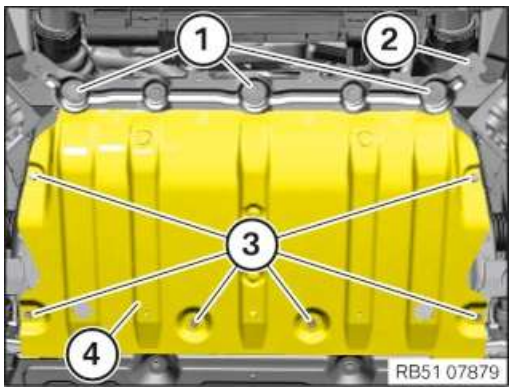
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

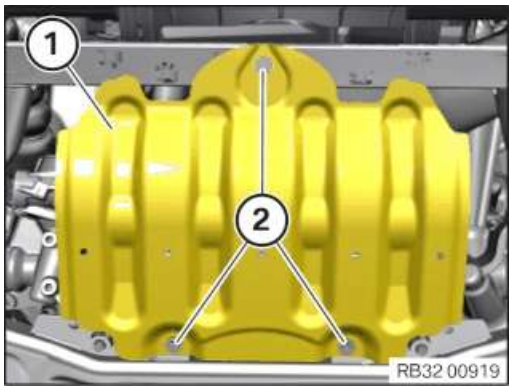
  Slide the steering gear underbody protection (4) out and remove.

11 – If installed: Removing the steering start protection

rdiagn.com

Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

12 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

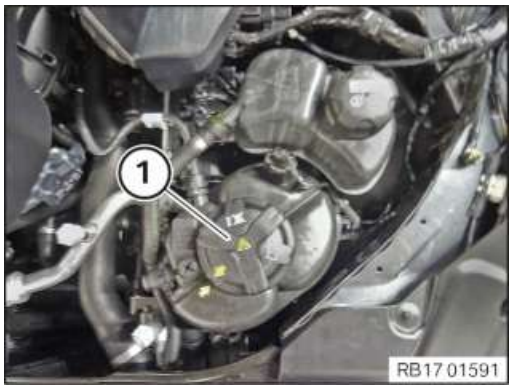
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

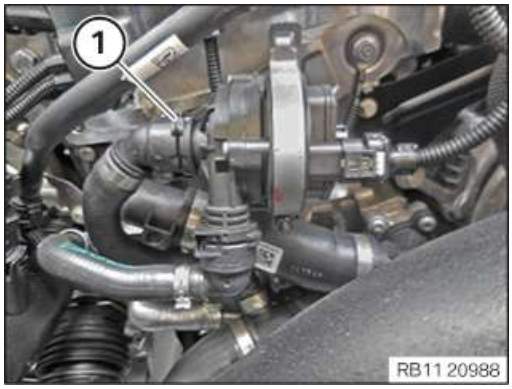
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

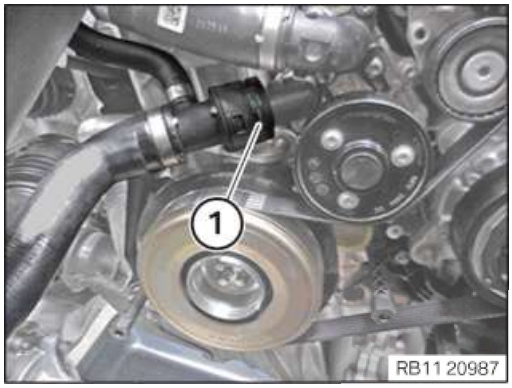


- Loosen sealing cap (1).

cardiagn.com



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

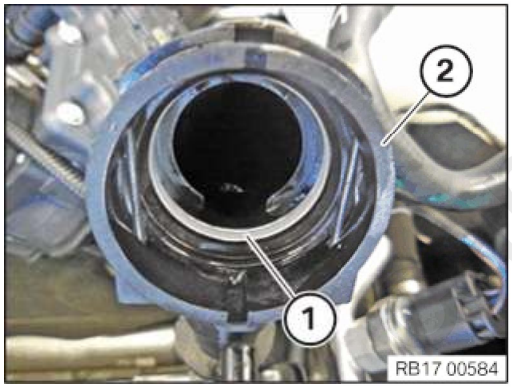


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

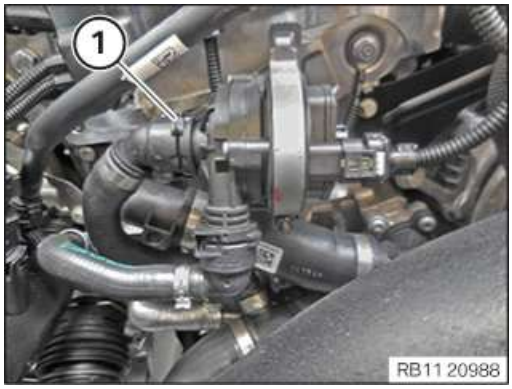
13 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

mdiag.com



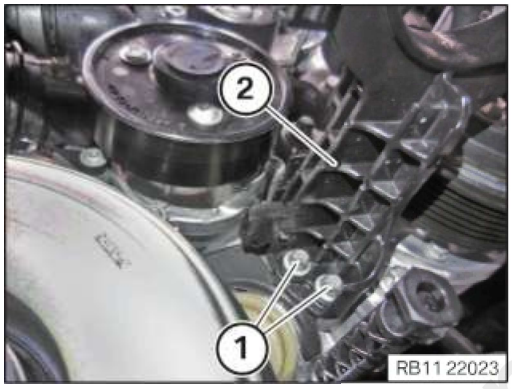
- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

14 – Removing the holder for the electric coolant pump on the engine support



- Loosen screw (1).



- Loosen screws (1).
- Guide out and remove holder (2) of the electric coolant pump.

15 – Remove the coolant line between the coolant pump and the cylinder head

WARNING

Hot surfaces.

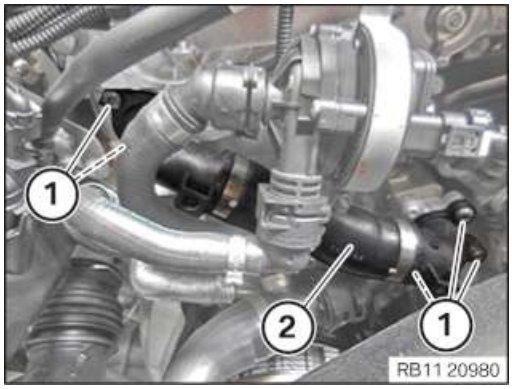
Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

cardiagn.com

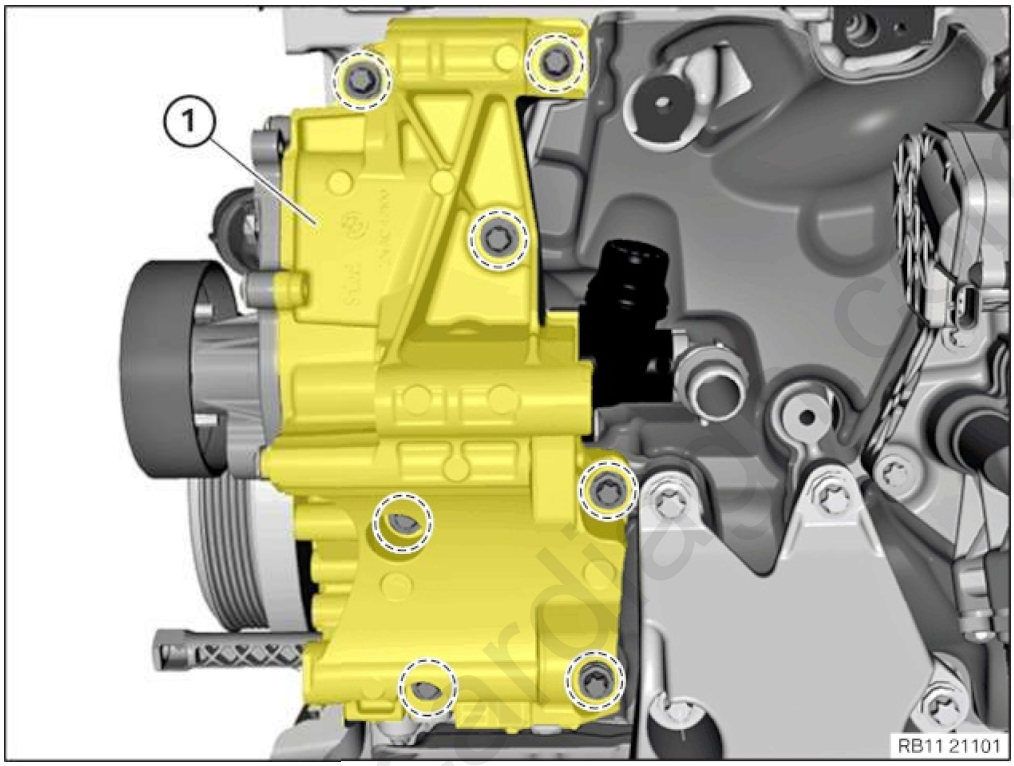


- Loosen screws (1).
- Remove the coolant line (2).
- Catch and dispose of escaping coolant.

MAIN WORK

16 – Removing the component carrier

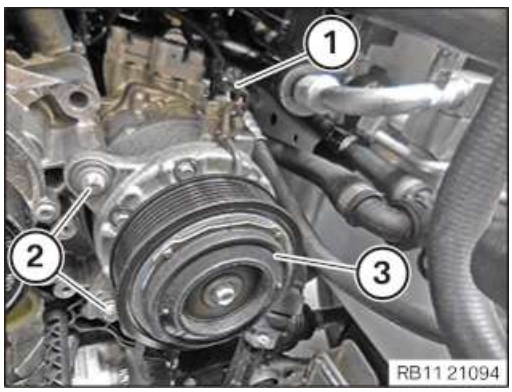
Component carrier



1 Component carrier

TECHNICAL INFORMATION

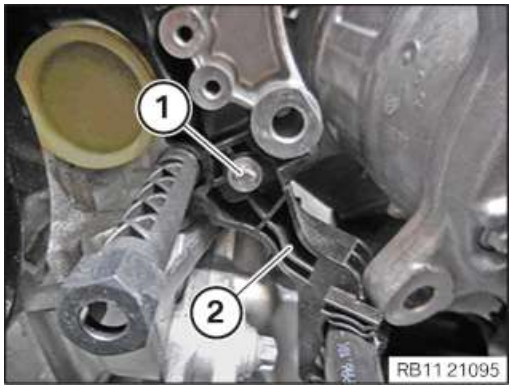
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



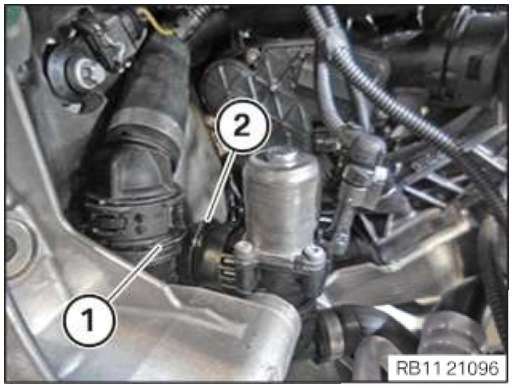
TECHNICAL INFORMATION

Only loosen the air conditioning compressor, do not remove it.
Do not draw off the refrigerant.
Do not loosen the refrigerant lines.

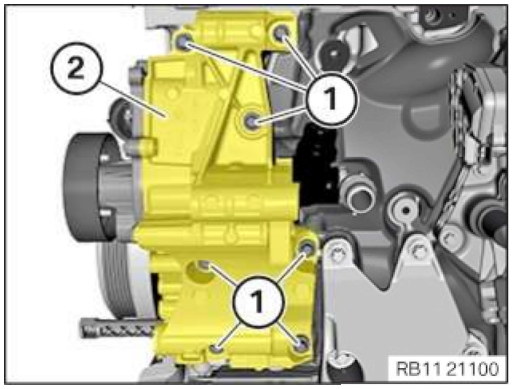
- Unlock plug connection (1) and disconnect.
- Loosen screws (2).
- Slide the air conditioning compressor (3) out and set it aside.



- Loosen screw (1).
- Thread out holder (2) and set aside.



- Unlock and loosen coolant line (1).
- Unlock and loosen coolant line (2).
- Catch and dispose of escaping coolant.



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Loosen screws (1).

Note: Set the air conditioning compressor aside with an auxiliary person for easier unscrewing of the screws on the component carrier.

- Guide out the component carrier (2) and remove.
- Catch and dispose of escaping coolant.

17 – Installing the component carrier

RISK OF DAMAGE

Damage to the surface.

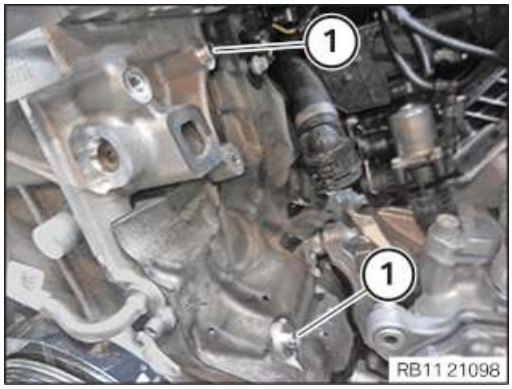
The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

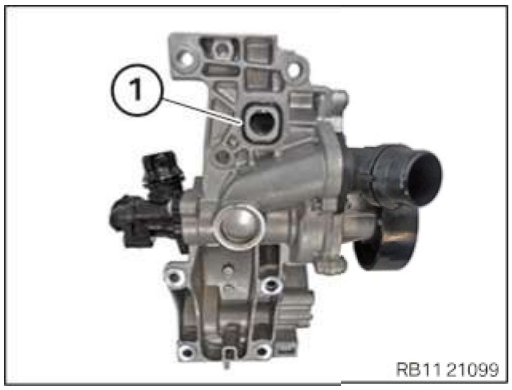
carmanuals.com



- Check centering sleeves (1) for damage and renew centering sleeves (1) if necessary.



- Clean sealing surfaces (1) with special tool 0 495 102 (11 4 470).



Check

- Check the sealing bead (1) for damage.

TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Check the protrusion of the sealing bead (1).

Result

» The sealing bead (1) is not protruding or the sealing bead (1) is damaged.

Measure

- Renew the sealing bead (1).



TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

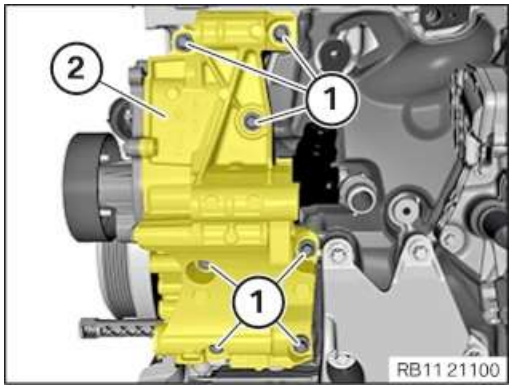
- Apply the sealing compound with a height of approximately 2 mm to 2.5 mm.

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)

cardiagn.com



CAUTION

Heavy component.

Heavy components can lead to injury or damage.

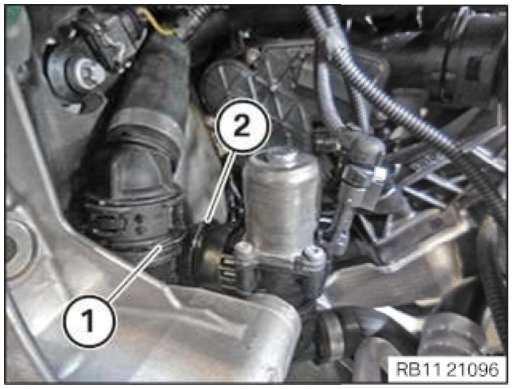
- Remove and install heavy components with the aid of another person/other persons.

- Insert and install the component carrier (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

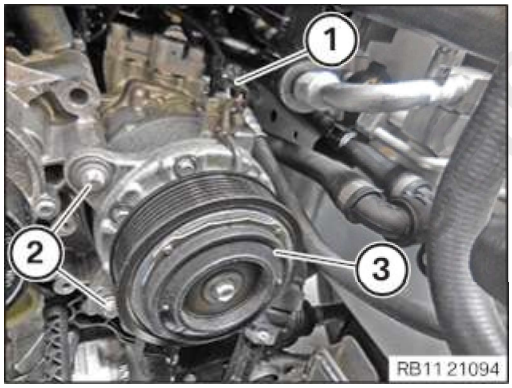
Note: Put the air conditioning compressor to one side with the help of an auxiliary person to be able to tighten the screws at the component carrier more easily.

Component carrier to crankcase

M8 x 35		Tightening torque	19 Nm



- Connect and lock coolant line (1) and (2).
- Make sure that coolant line (1) and (2) engage audibly.

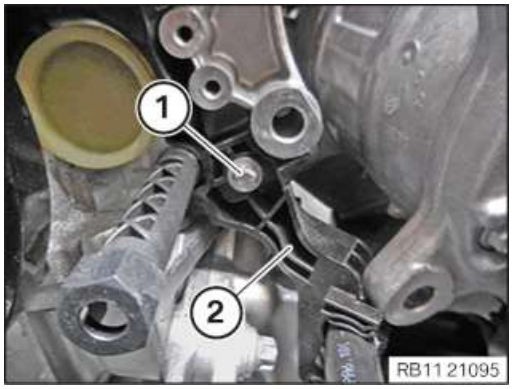


- Insert and install the air conditioning compressor (3).
- Tighten down screws (2).

Air conditioning compressor in component carrier

M10		Tightening torque	38 Nm

- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Insert and install the holder (2).
- Tighten down screw (1).

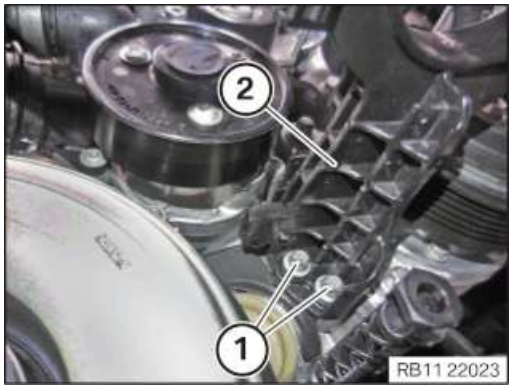
Transmission oil line holders to component carrier

M6X16		Tightening torque	12 Nm

POSTPROCESSES

18 – Installing holder for the electric coolant pump on the function carrier

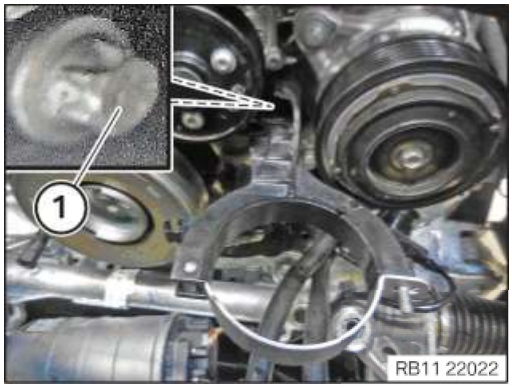
rdiagn.com



- Insert and position holder (2) of the electric coolant pump.
- Tighten the screws (1).

Holder of electric coolant pump to component carrier

M6X20		Tightening torque	8 Nm

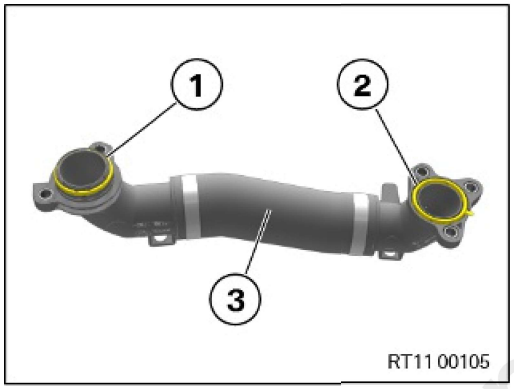


- Tighten down screw (1).

Holder of electric coolant pump to component carrier

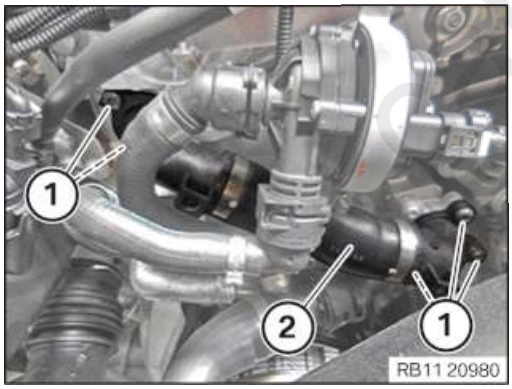
M6X20		Tightening torque	8 Nm

19 – Install the coolant line between the coolant pump and the cylinder head



- Check the sealing rings (1) and (2) for damage and if necessary, renew the coolant line (3).

  Parts: Sealing ring



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

- Feed in and install coolant line (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

Coolant line to coolant pump/cylinder head

M6x20		Tightening torque	8 Nm

20 – Installing the alternator

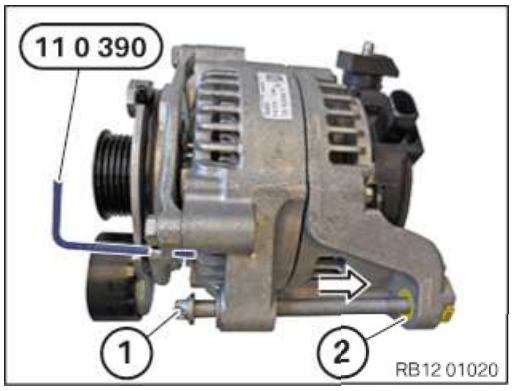
cardiagn.com

WARNING

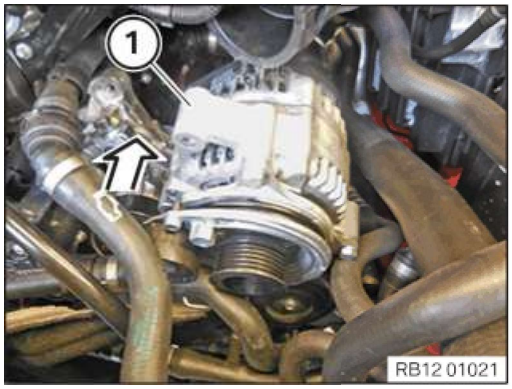
Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

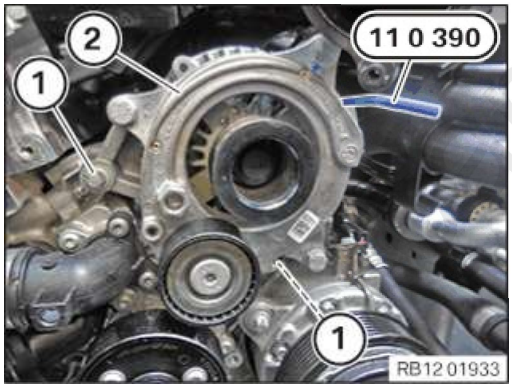
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.



- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.
- Slightly push back the threaded support sleeve (2) in the direction of the arrow to facilitate the installation of the alternator.
- Screw the screw (1) into the threaded support sleeve (2).
- Press back the threaded support sleeve (2) using the bolt (1).
- Once again unscrew the screw (1) from the threaded support sleeve (2).



- Guide in alternator (1) in the direction of the arrow and position it.

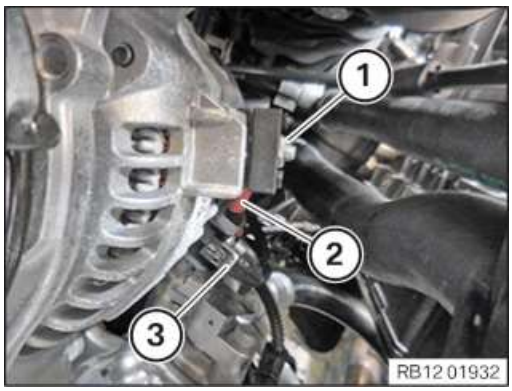


- Install the alternator (2).
- Tighten the screws (1).

Alternator to component carrier

M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm

- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.



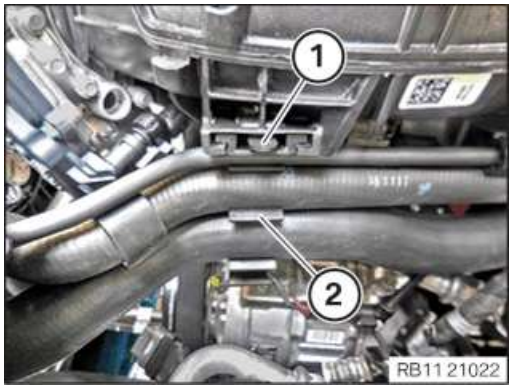
- Insert and install the positive battery cable (2).
- Tighten nut (1).

Positive battery cable to the alternator

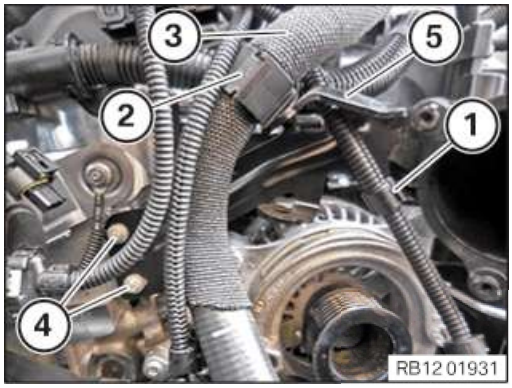
M8		Tightening torque	19 Nm

- Connect and lock the connector (3).
- The connector (3) must engage audibly.

.diagn.com



- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Insert and position the holders (5).
- Tighten down screws (4).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm

- Guide coolant line (3) into clamp (2) and install it.
- Secure clamps (2).
- Secure the clamp (1).

21 – Installing the drive belt for alternator

Overview of drive belt for alternator



1. Drive belt for alternator

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

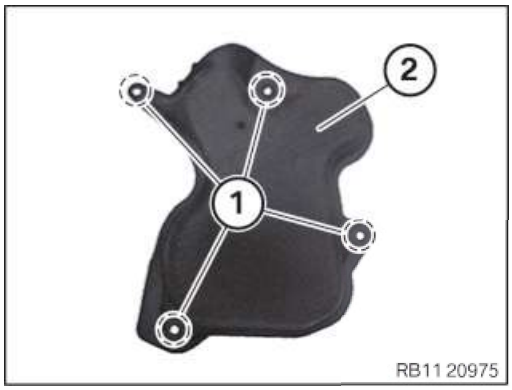
The drive belt must be replaced if contaminated with coolant- and oil residues.

cardiagn.com



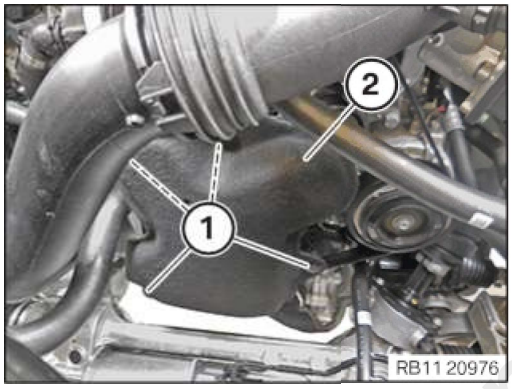
- Position the drive belt for alternator (2) on the ancillary components.
- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Feed the special tool 0 496 268 (11 0 390) out of the belt tensioner and remove it.

22 – Install the acoustic cover for the engine at the front

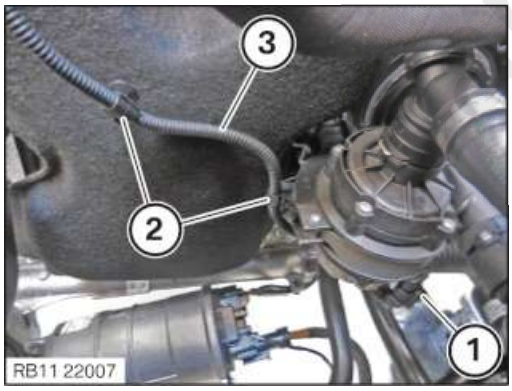


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

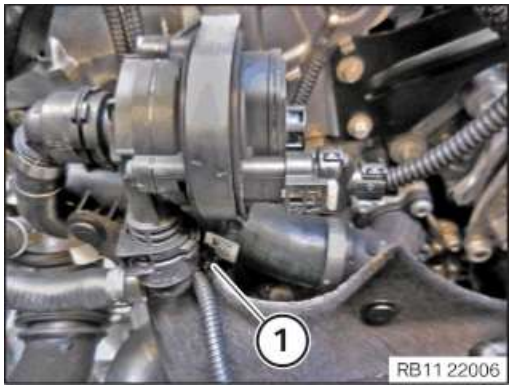


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



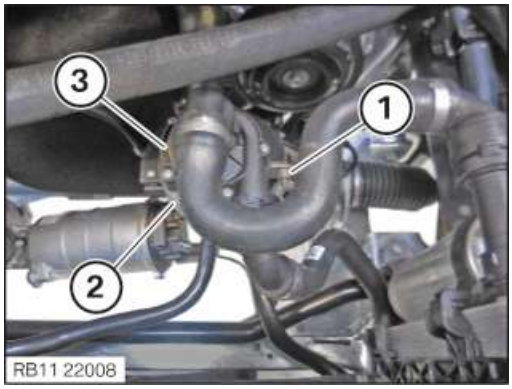
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

23 – Mounting the electrical auxiliary coolant pump for the charge air cooler/air conditioning condenser

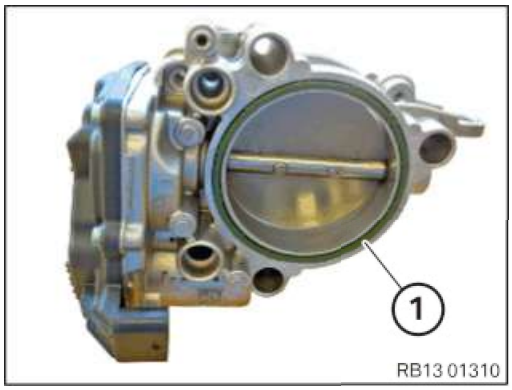


- Feed in and position the electrical auxiliary coolant pump (3).
- Insert and install the holder (2).
- Tighten nut (1).

Electric coolant pump to holder

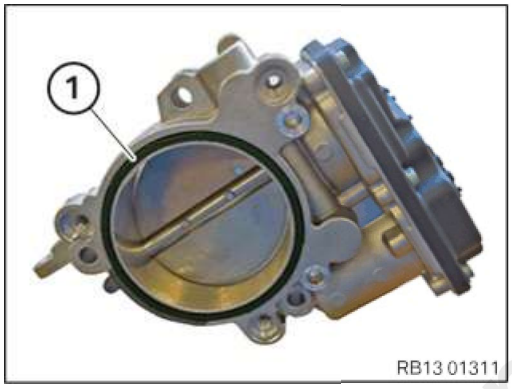
M6		Tightening torque	8 Nm

24 – Installing the throttle body



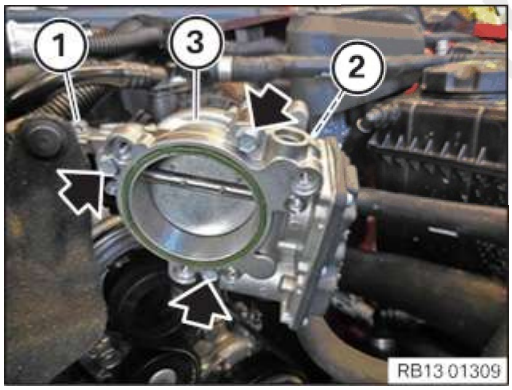
- Renew sealing ring (1).

  Parts: Sealing ring



- Renew sealing ring (1).

  Parts: Sealing ring



- Feed in and install the throttle body (3).
- Connect and lock the connector (2).
- Tighten screws (arrows).

Throttle body to intake plenum

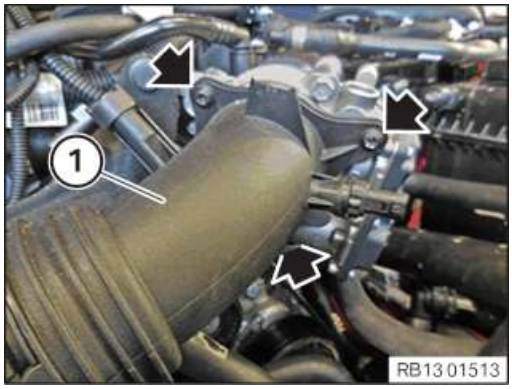
M6X50		Tightening torque	7 Nm

- Tighten down screw (1).

Throttle body to holder

M6X25		Tightening torque	8 Nm

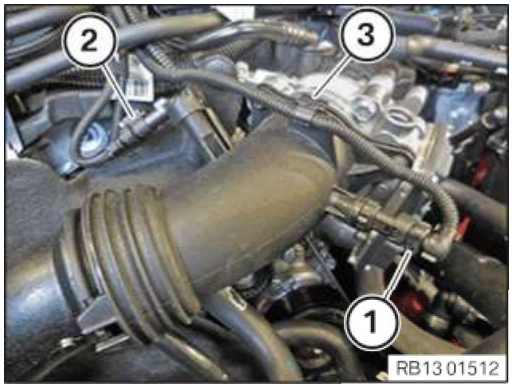
.diagn.com



- Insert and install charge air line (1).
- Tighten screws (arrows).

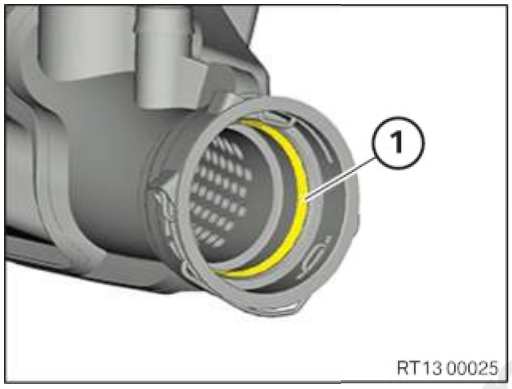
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect and lock the connector (1).
- Connect and lock the connector (2).
- Secure clamps (3).

25 – Installing the clean air pipe with resonator

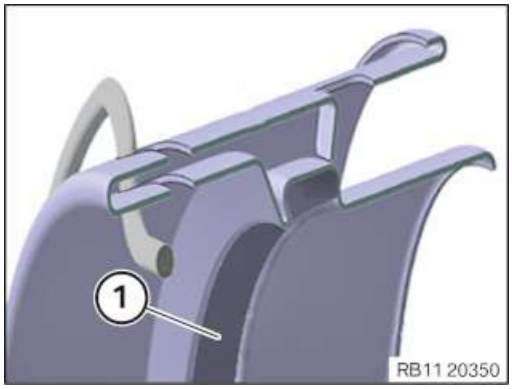


- Check the seal (1) for damages, replace if necessary.

▶ **Replace damaged gasket**

TECHNICAL INFORMATION

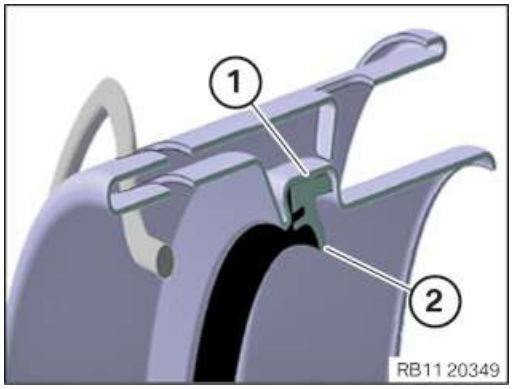
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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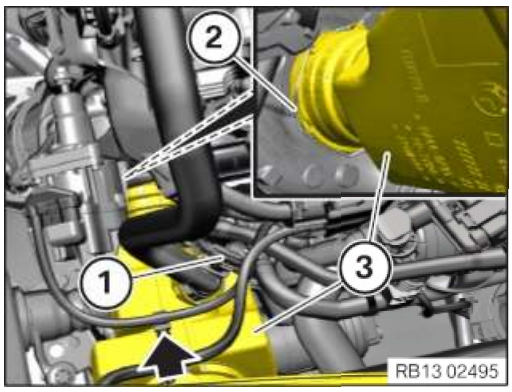
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

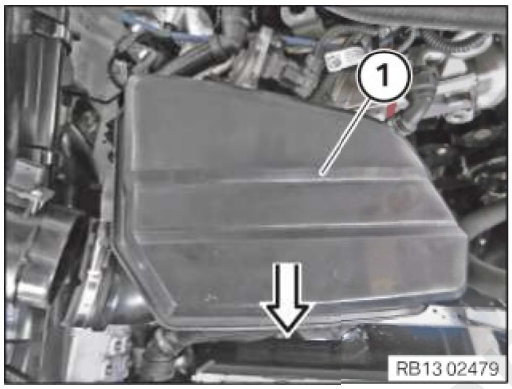
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



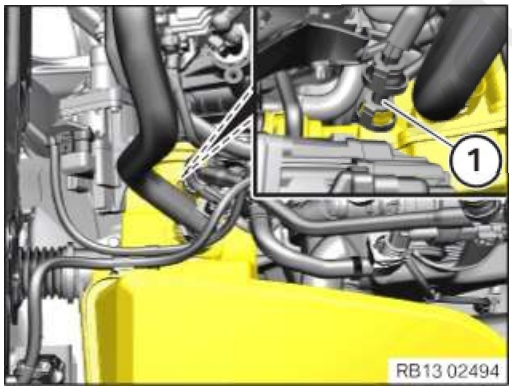
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

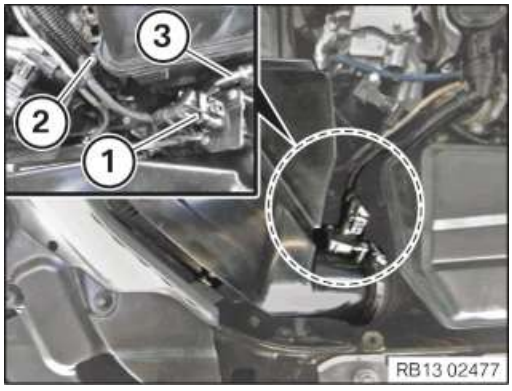
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

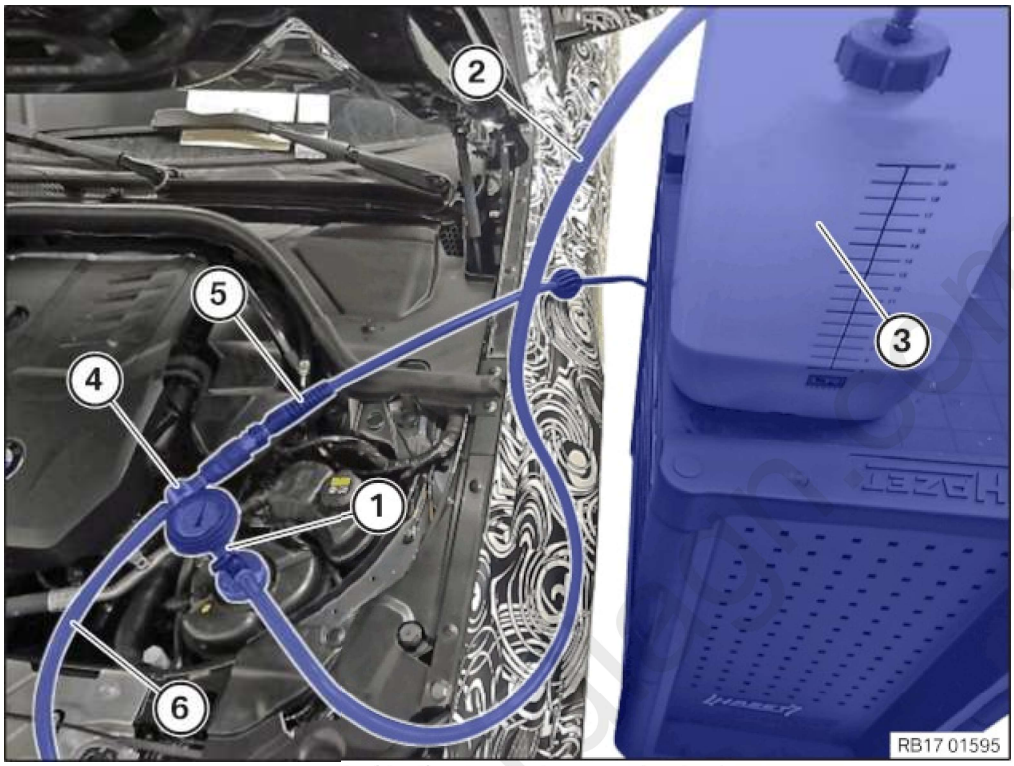
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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

26 – Fill the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

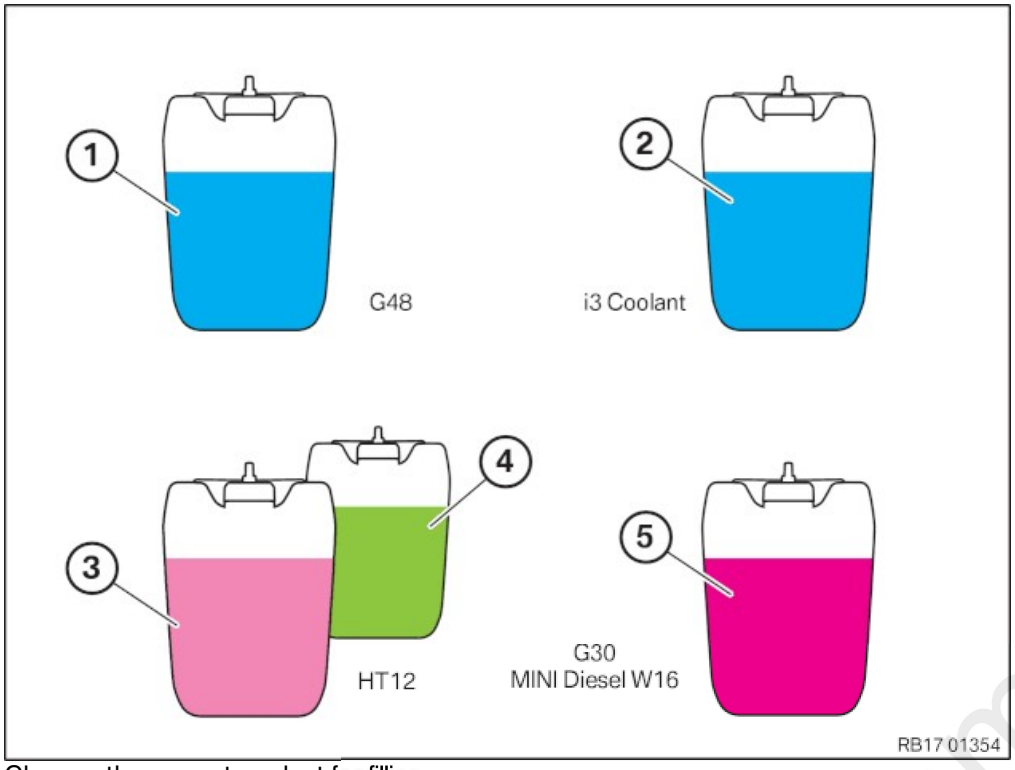
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

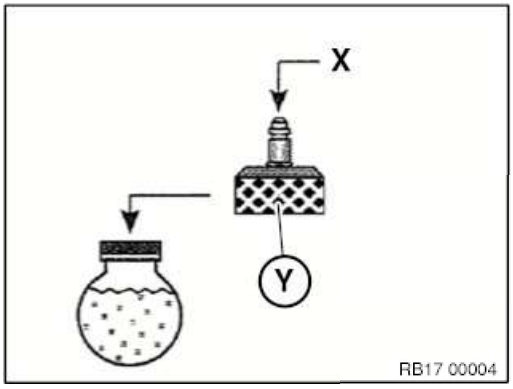
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

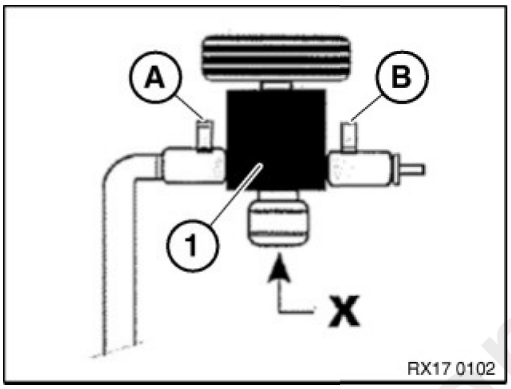
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

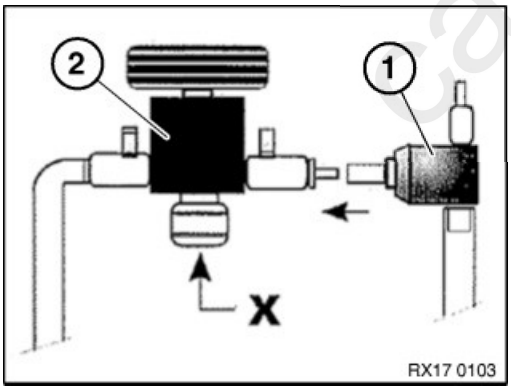
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

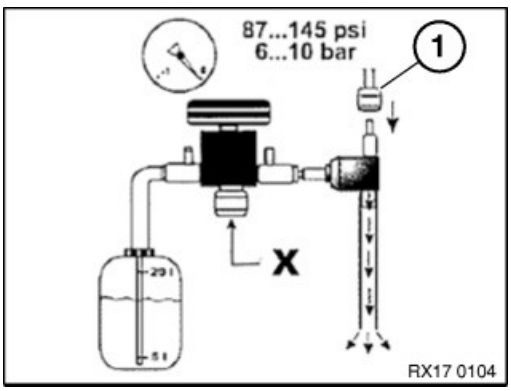


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

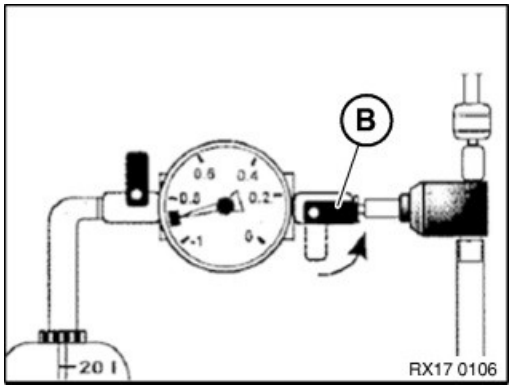
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

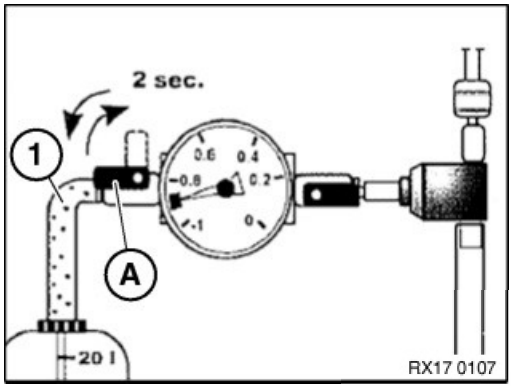
  (X)is the connection on the coolant expansion tank.

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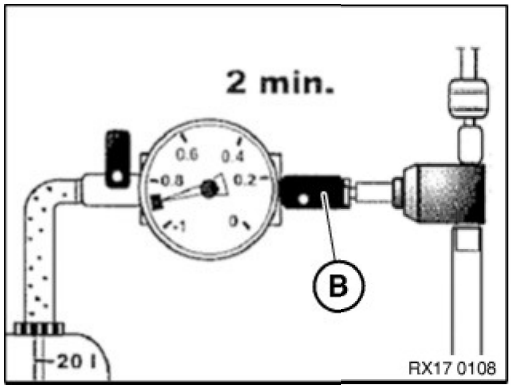
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

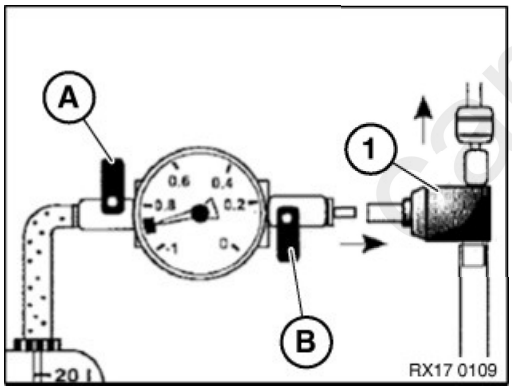


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

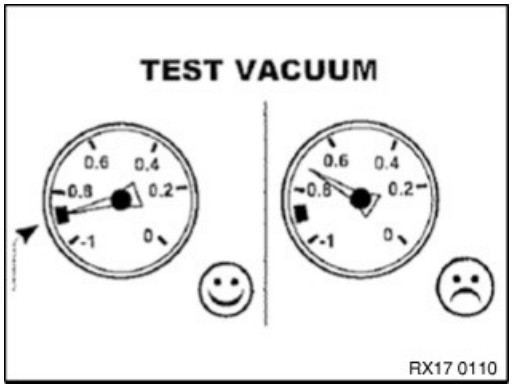
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

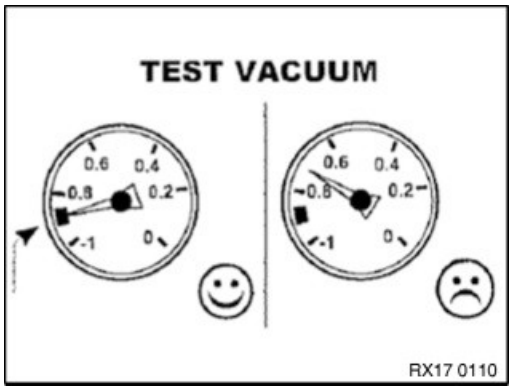
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



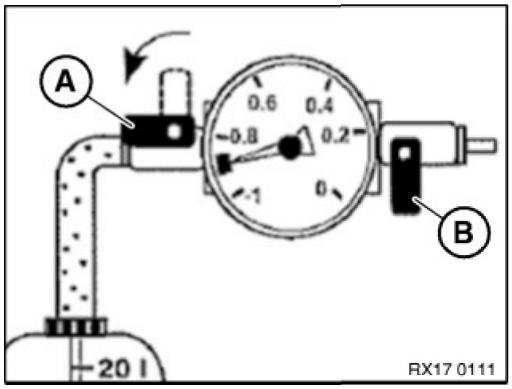
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

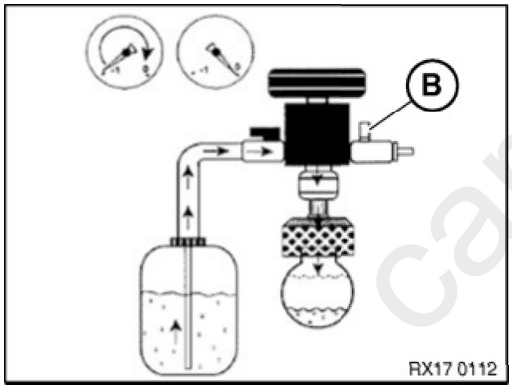
» Vacuum remains constant.

Measure

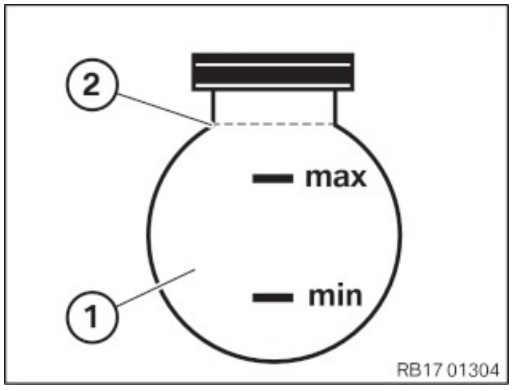
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

27 – Disconnecting all battery earth leads

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- See additional information.

28 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

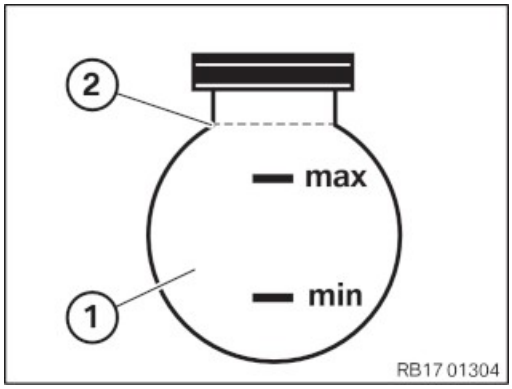
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

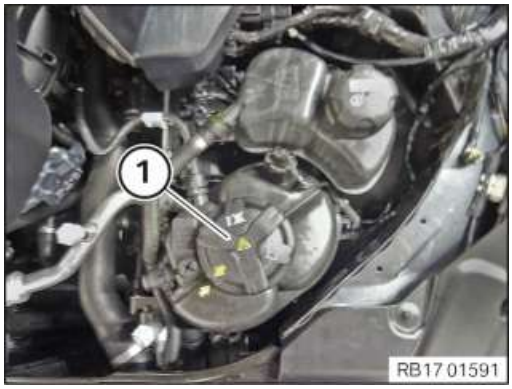
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

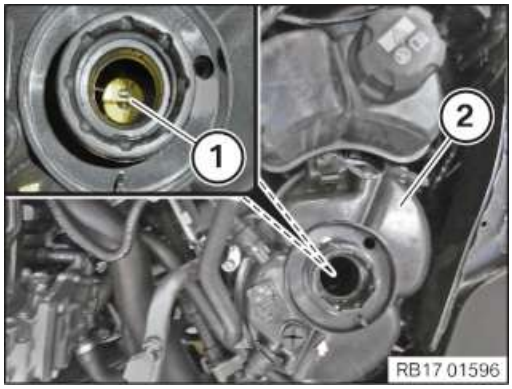
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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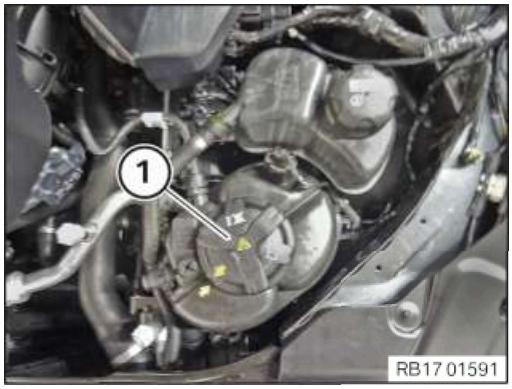
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .

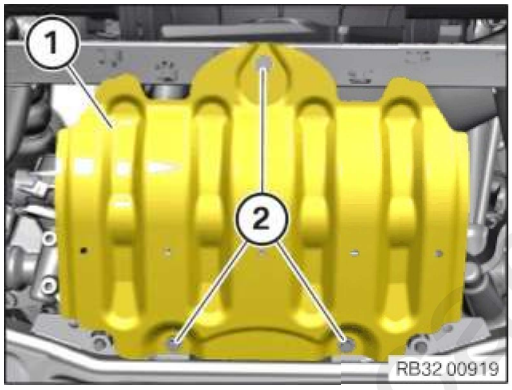


- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

29 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



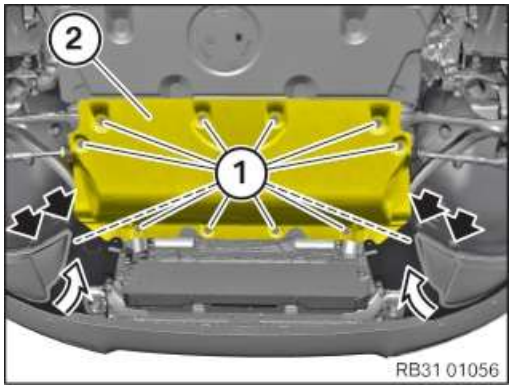
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

30 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

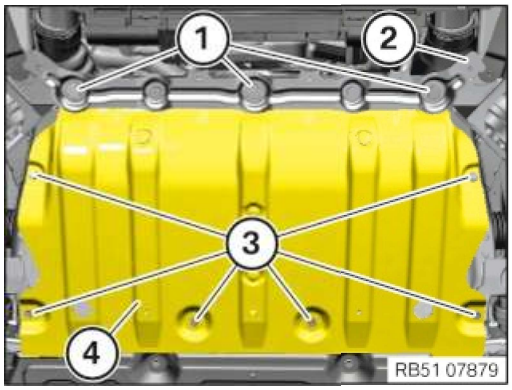
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

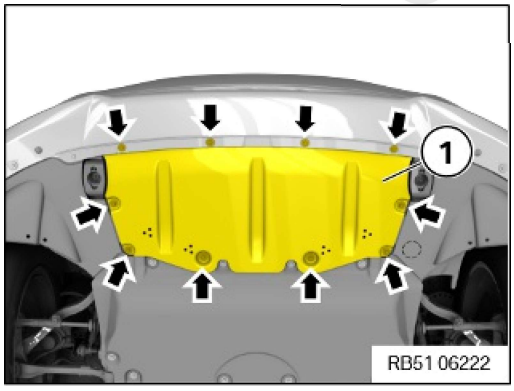
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

31 – Installing the front underbody protection



- **Version 1:**

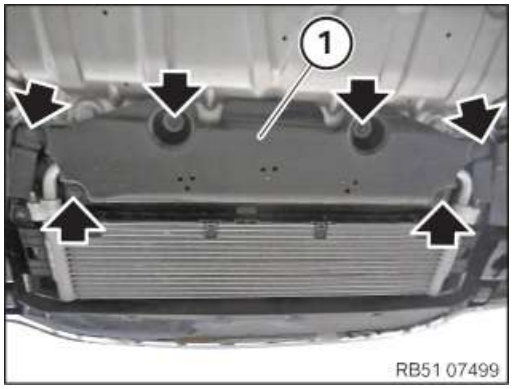
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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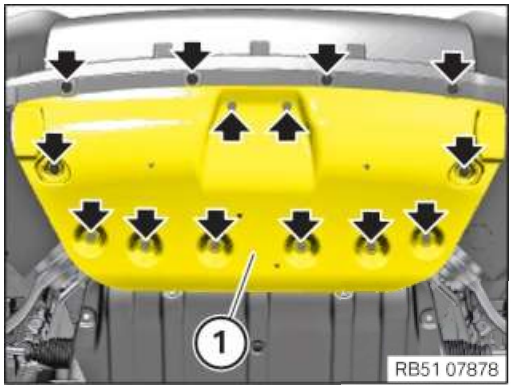
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

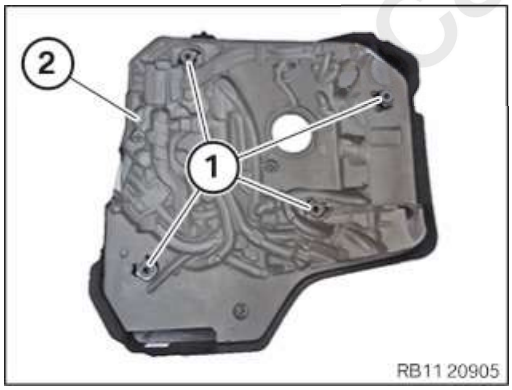
32 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

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- Clip in the acoustic cover (1) into the holders in the **marked** areas.
  The acoustic cover (1) must audibly engage into place.

Additional Information

Overview of Tightening Torques

Component carrier to crankcase			Used in step 17
M8 x 35		Tightening torque	19 Nm

Air conditioning compressor in component carrier			Used in step 17
M10		Tightening torque	38 Nm

Transmission oil line holders to component carrier			Used in step 17
M6X16		Tightening torque	12 Nm

Holder of electric coolant pump to component carrier			Used in step 18
M6X20		Tightening torque	8 Nm

Coolant line to coolant pump/cylinder head			Used in step 19
M6x20		Tightening torque	8 Nm

Alternator to component carrier			Used in step 20
M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm

Positive battery cable to the alternator			Used in step 20
M8		Tightening torque	19 Nm

Manifold support for intake air to cylinder head			Used in step 20
M6X16		Tightening torque	8 Nm

Electric coolant pump to holder			Used in step 23
M6		Tightening torque	8 Nm

Throttle body to intake plenum			Used in step 24
M6X50		Tightening torque	7 Nm

Throttle body to holder			Used in step 24
M6X25		Tightening torque	8 Nm

Charge air line to throttle body			Used in step 24
M6		Tightening torque	8 Nm

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Clean air pipe to upper section of intake filter housing Used in step 25

Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support Used in step 29

M10		Tightening torque	56 Nm

Underbody protection of the steering gear Used in step 30

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) Used in step 30

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support Used in step 30

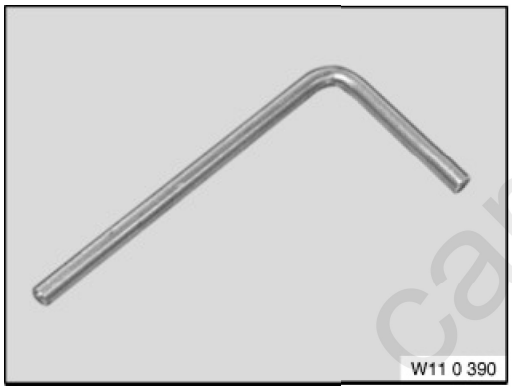
M10		Tightening torque	56 Nm

Underbody protection front Used in step 31

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

0 496 268 (11 0 390) Pin

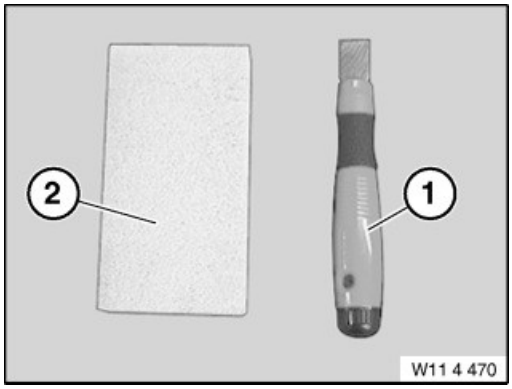


Common Used in step 782021

Usage	(roll pin) For securing new tensioning pulley (poly-V belt)
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 15 07 (390)

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0 495 102 (11 4 470) Tool



Common Used in step 17

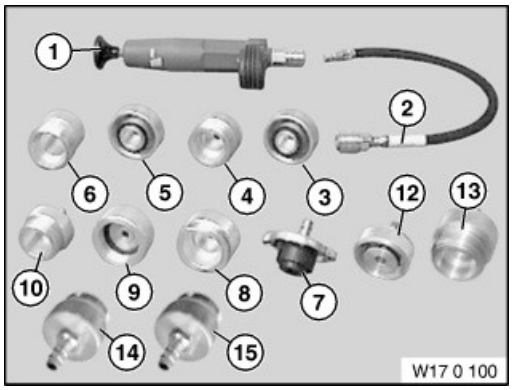
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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0 494 417 (17 0 100) Tester



Common Used in step 26

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with

5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Capacity of high-temperature coolant circuit G20 Used in step 26

B48B20O1/B46B20O1	9.8 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

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General repair instructions	Used in step

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	127
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	127
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
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61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
61 20 900 Disconnecting and connecting battery earth lead	127
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61 35 ... Notes on ESD protection (Electro Static Discharge)	4
61 35 ... Notes on ESD protection (Electro Static Discharge)	468
17 00 ... Notes for working on cooling system.	26

Operating materials	Used in step
Main group 17	26

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11 51 000 Removing and installing/replacing the coolant pump

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Removing the clean air pipe with the resonator

WARNING

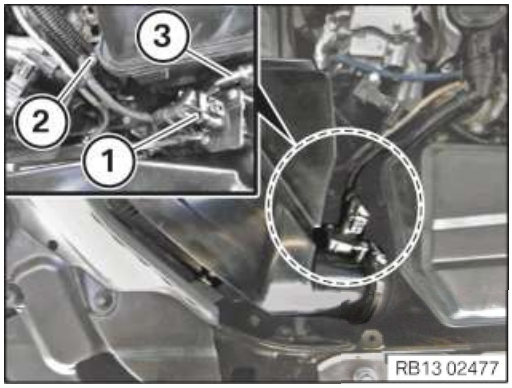
Hot surfaces.

Risk of burning!

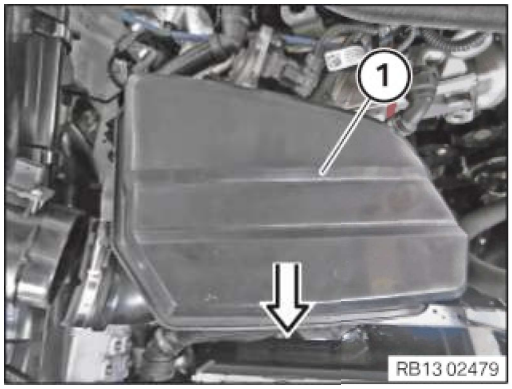
- Perform all work only on components that have cooled down.



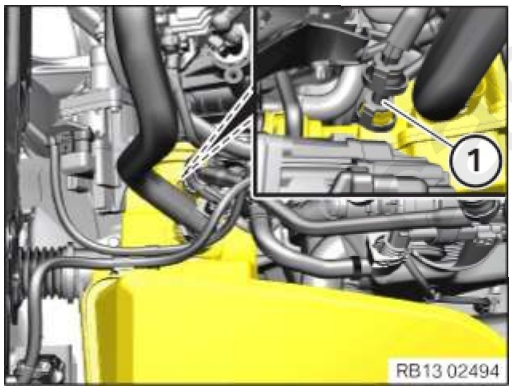
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



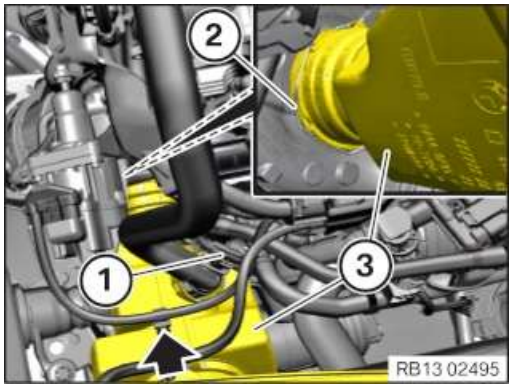
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

3 – Remove charge air line

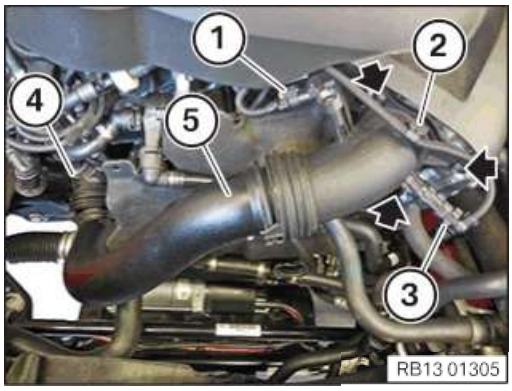
rdiagn.com

WARNING

Hot surfaces.

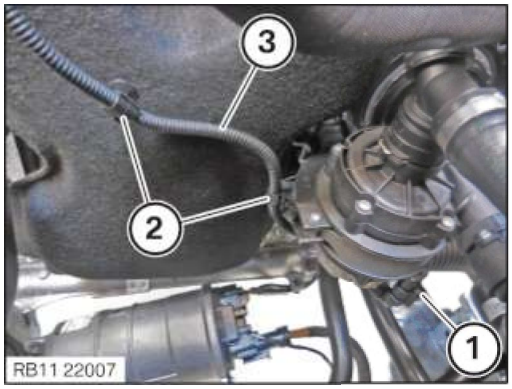
Risk of burning!

- Perform all work only on components that have cooled down.

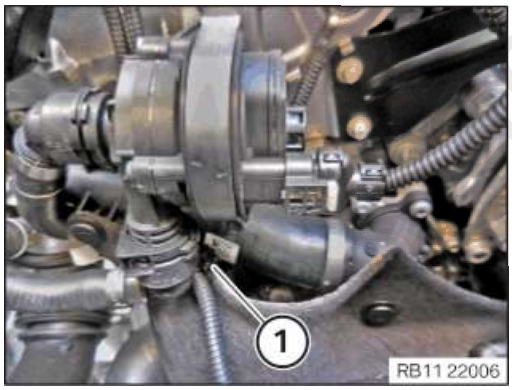


- Unlock and loosen the connector (1) on the charging pressure sensor.
- Unlock and loosen clamp (2).
- Unlock and disconnect the connector (3) from the charge-air temperature sensor.
- Remove screws (arrows).
- Unlock and loosen the clamp (4) on the exhaust turbocharger.
- Guide out and remove charge air line (5).

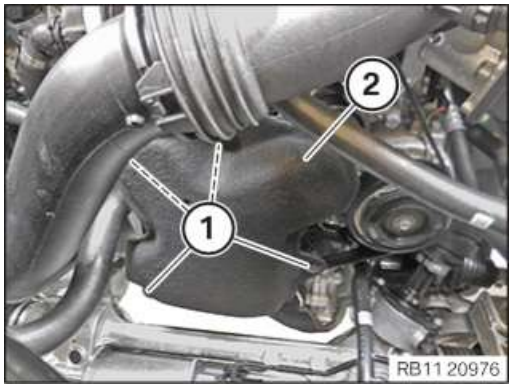
4 – Removing the acoustic cover for the engine at the front



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

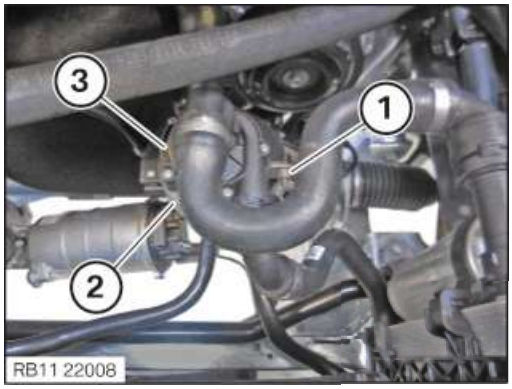
5 – Releasing the electrical auxiliary coolant pump for the charge air cooler or the air conditioning condenser

RISK OF DAMAGE

Non-visible damage to the coolant pump.

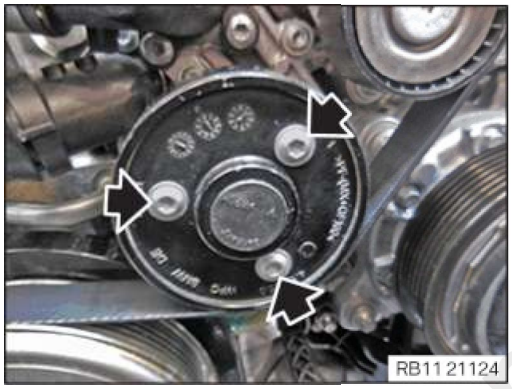
Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.



- Loosen nut (1).
- Thread out holder (2) and set aside.
- Guide out the electrical auxiliary coolant pump (3) and set it aside.

6 – Detaching belt pulley



- Slacken the screws (arrows).

Note: Slacken the bolts by **180 °** only. **Do not** unscrew completely.

7 – Removing the drive belt for alternator

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

Component with preload.

Danger of injury!

- Reduce preload as far as possible before disassembly. Relieve component.

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TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

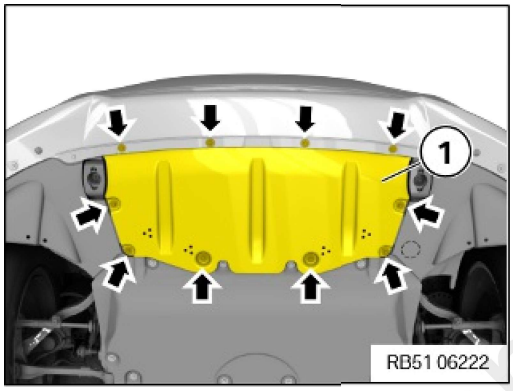
TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.



- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Secure the belt tensioner with the special tool 0 496 268 (11 0 390).
- Guide out the drive belt for the alternator (2) and remove it.

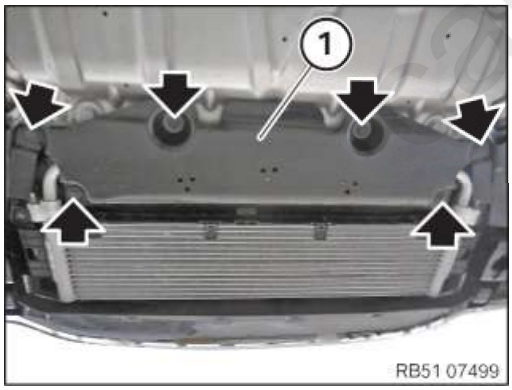
8 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

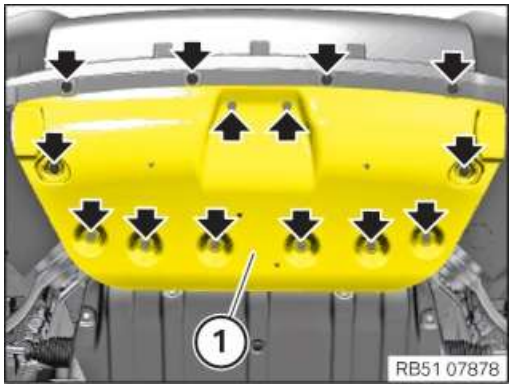
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

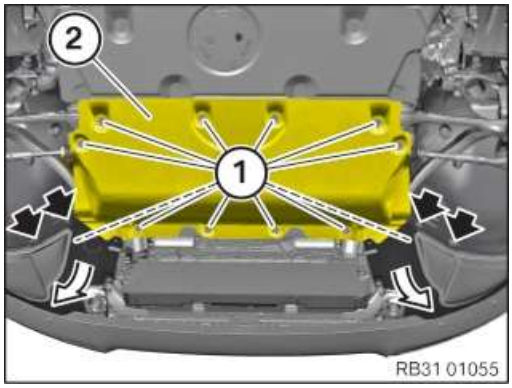


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

9 – Remove the underbody protection of the steering gear



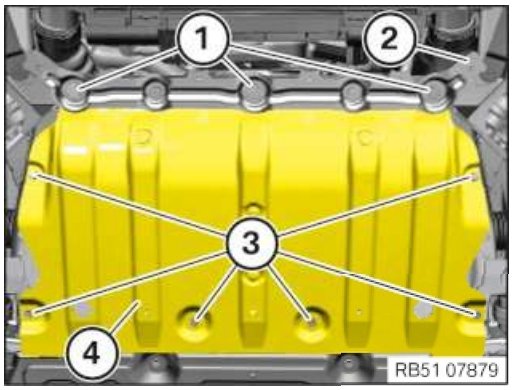
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

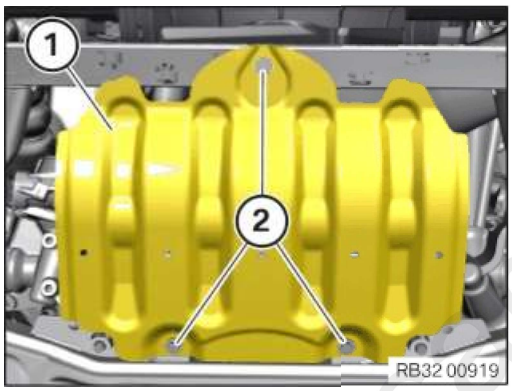
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

10 – If installed: Removing the steering start protection

Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

11 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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TECHNICAL INFORMATION

Life-long fill of coolant!

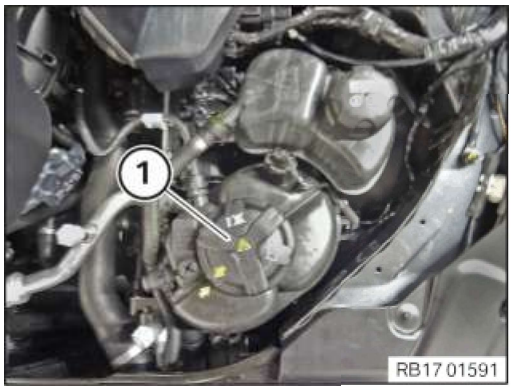
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

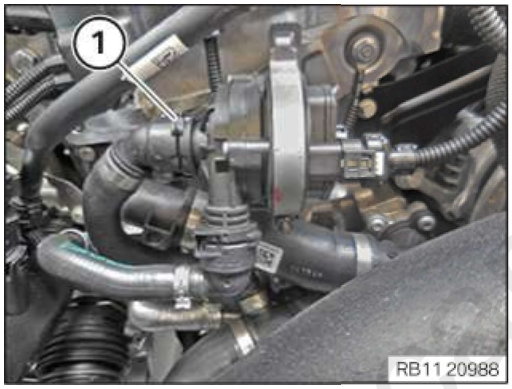
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



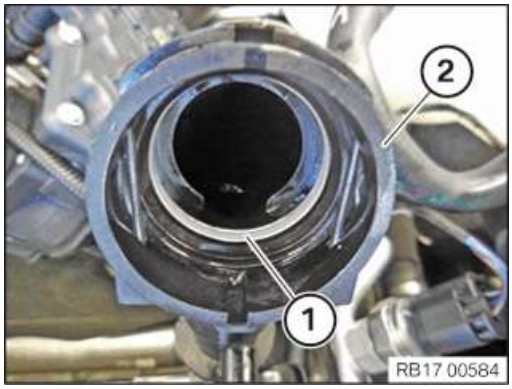
- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

12 – Connecting the coolant lines for the high-temperature coolant circuit

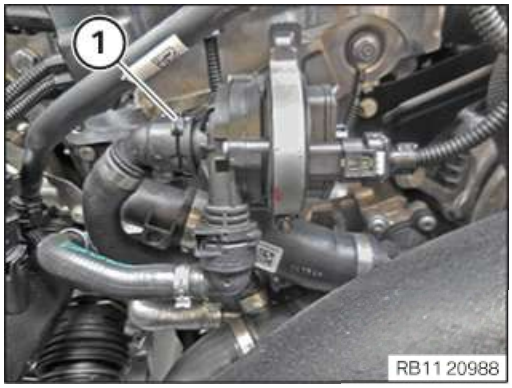
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

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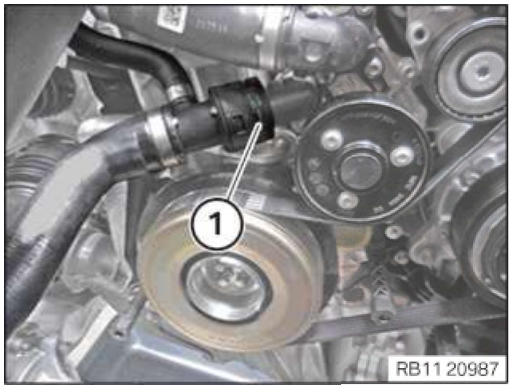


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

13 – Remove the coolant line between the coolant pump and the cylinder head

WARNING

Hot surfaces.

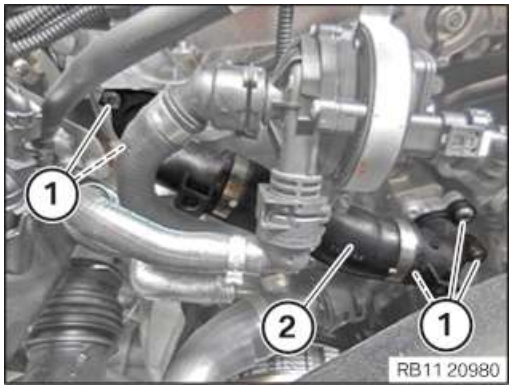
Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

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- Loosen screws (1).
- Remove the coolant line (2).
- Catch and dispose of escaping coolant.

MAIN WORK

14 – Removing the coolant pump

CAUTION

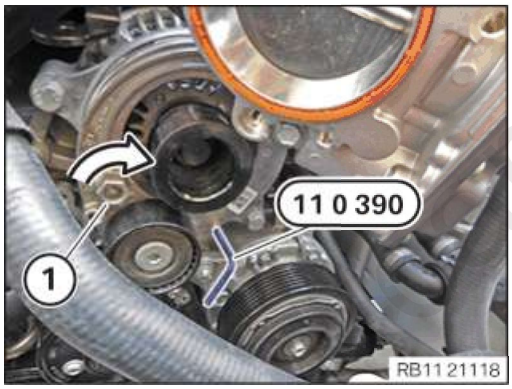
Component with preload.

Danger of injury!

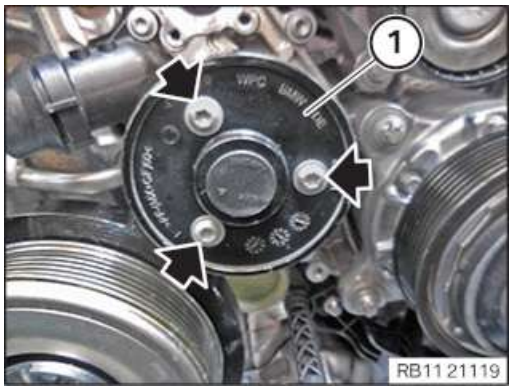
- Reduce preload as far as possible before disassembly. Relieve component.

TECHNICAL INFORMATION

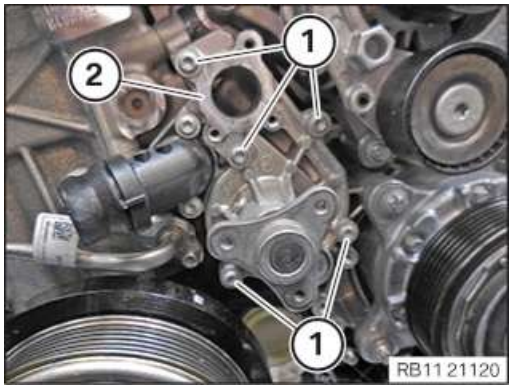
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Raise the preloading on the belt tensioner using the conventional tool (1) in **direction of arrow**.
- Guide the special tool 0 496 268 (11 0 390) out and remove.



- Remove screws (arrows).
- Guide the belt pulley (1) out and remove.



- Loosen screws (1).
- Feed out and remove the coolant pump (2).
- Catch and dispose of escaping coolant.

15 – Prepare the coolant pump and the coolant pump housing

RISK OF DAMAGE

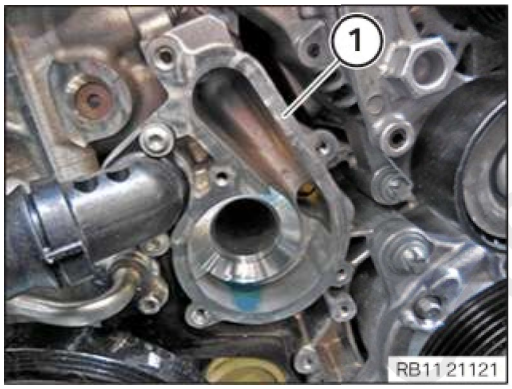
Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.



- Clean sealing surfaces (1) with special tool 0 495 102 (11 4 470).



Check

- Check the sealing bead (1) for damage.

TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Check the protrusion of the sealing bead (1).

Result

» The sealing bead (1) is not protruding or the sealing bead (1) is damaged.

Measure

- Renew the sealing bead (1).



TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound with a height of approximately 2 mm to 2.5 mm.

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)



- Check guide sleeve in the marked area on the coolant pump (1) for **correct** fit.

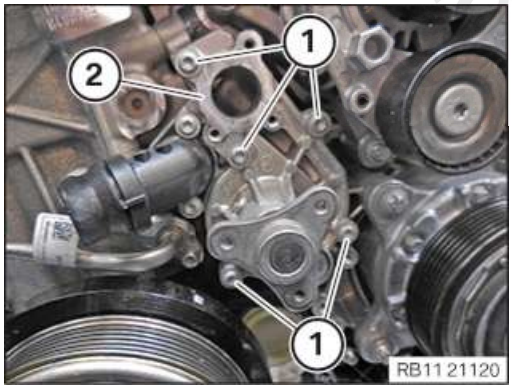
16 – Installing coolant pumps

CAUTION

Component with preload.

Danger of injury!

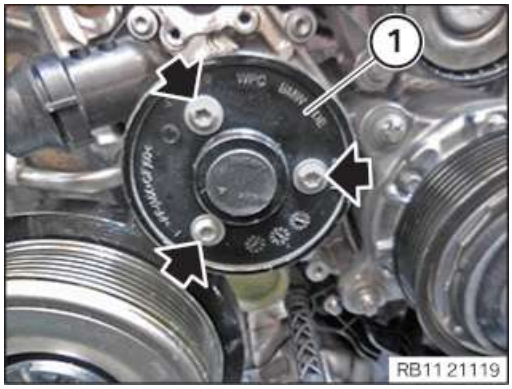
- Reduce preload as far as possible before disassembly. Relieve component.



- Insert and install the coolant pump (2).
- Tighten the screws (1).

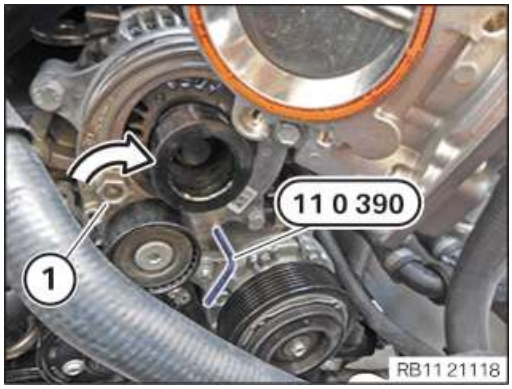
Coolant pump to component carrier

M6x20		Tightening torque	8 ± 1 Nm



- Insert and install the belt pulley (1).
- Hand-tighten the bolts (arrows).

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- Raise the preloading on the belt tensioner using the conventional tool (1) in **direction of arrow**.
- Secure the belt tensioner with the special tool 0 496 268 (11 0 390).

POSTPROCESSES

17 – Installing the drive belt for alternator

Overview of drive belt for alternator



1. Drive belt for alternator

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

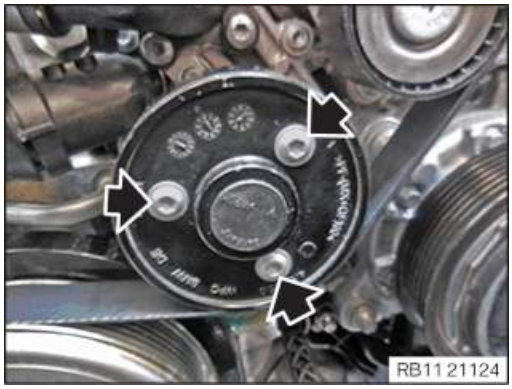
The drive belt must be replaced if contaminated with coolant- and oil residues.



- Position the drive belt for alternator (2) on the ancillary components.
- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Feed the special tool 0 496 268 (11 0 390) out of the belt tensioner and remove it.

18 – Tightening belt pulley

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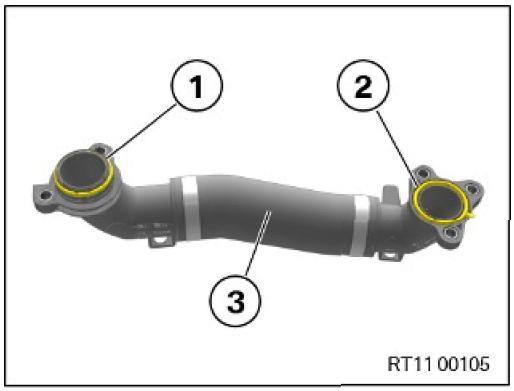


- Tighten screws (arrows).

Belt pulley to coolant pump

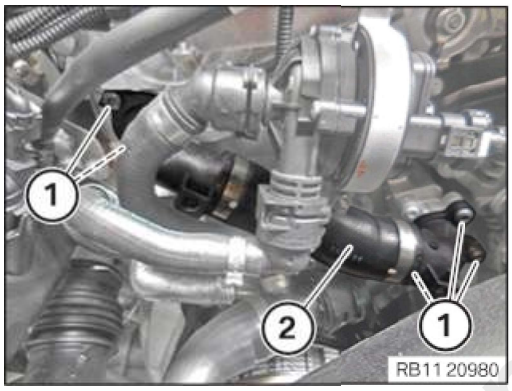
M6		Tightening torque	8 Nm

19 – Install the coolant line between the coolant pump and the cylinder head



- Check the sealing rings (1) and (2) for damage and if necessary, renew the coolant line (3).

  Parts: Sealing ring



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

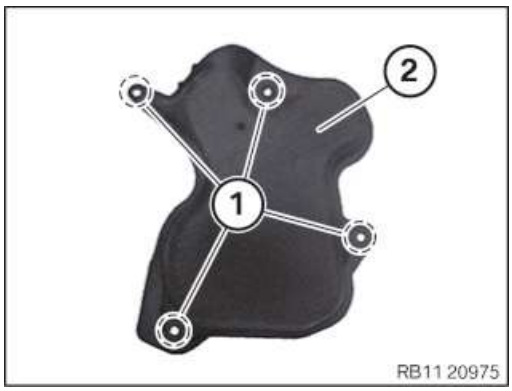
Non-observance of these requirements may result in leaks and damage.

- Feed in and install coolant line (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

Coolant line to coolant pump/cylinder head

M6x20		Tightening torque	8 Nm

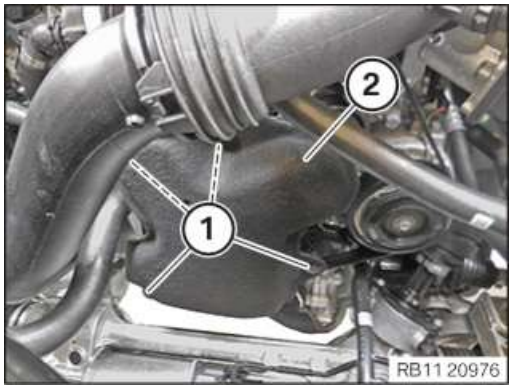
20 – Install the acoustic cover for the engine at the front



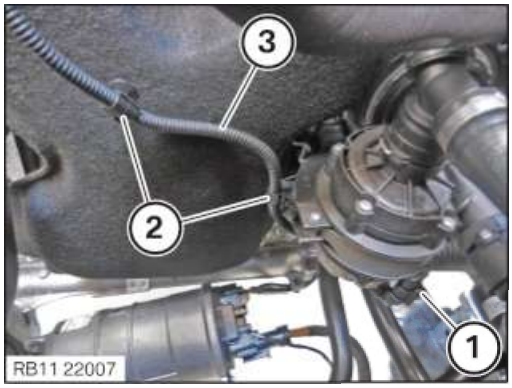
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

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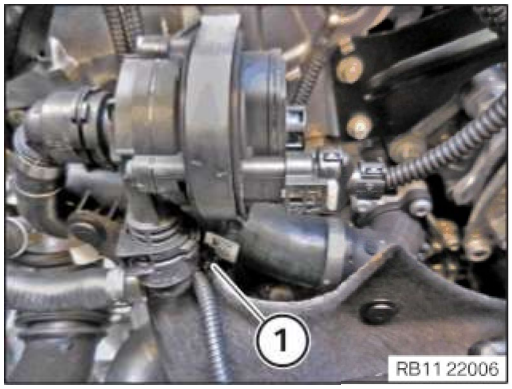


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



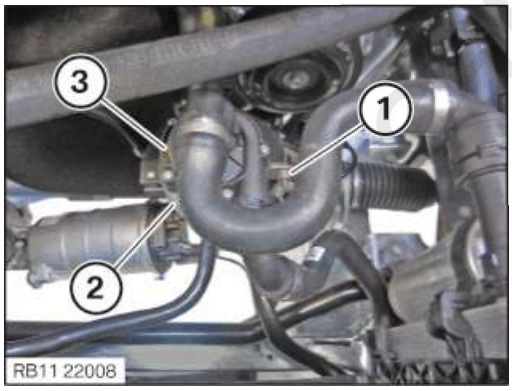
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

21 – Mounting the electrical auxiliary coolant pump for the charge air cooler/air conditioning condenser

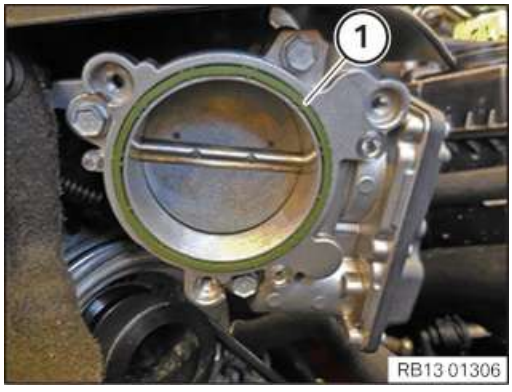


- Feed in and position the electrical auxiliary coolant pump (3).
- Insert and install the holder (2).
- Tighten nut (1).

Electric coolant pump to holder

M6		Tightening torque	8 Nm

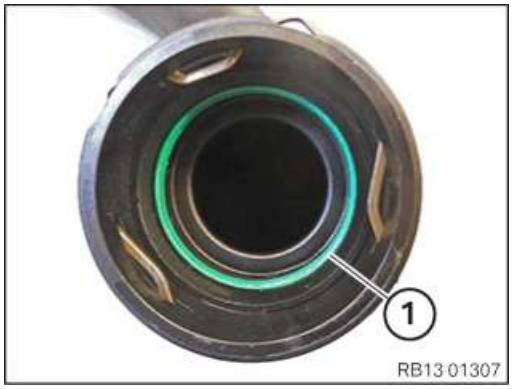
22 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring

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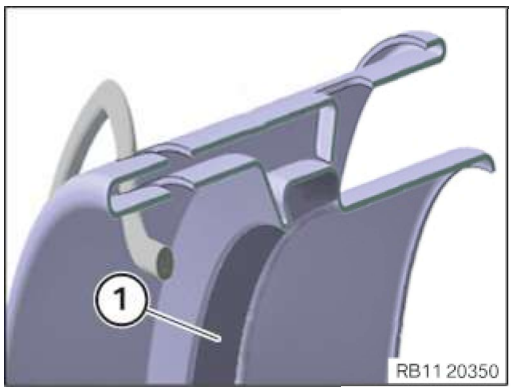


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▸ **Replace damaged gasket**

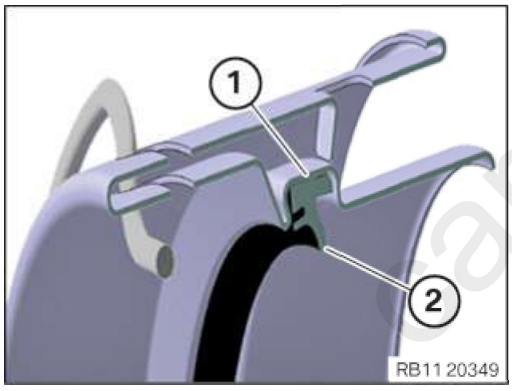
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



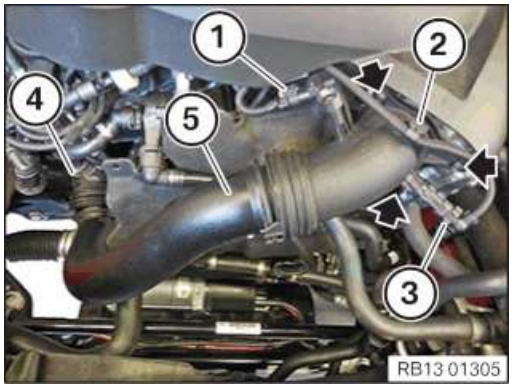
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

Charge air line to throttle body

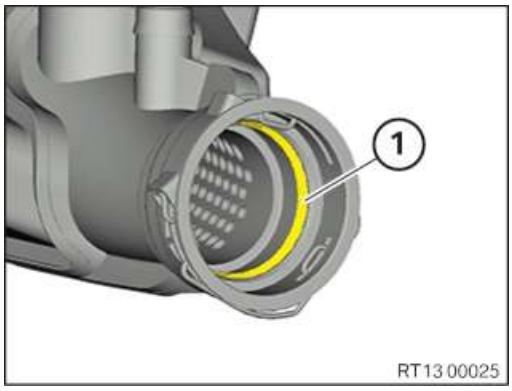
M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

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23 – Installing the clean air pipe with resonator

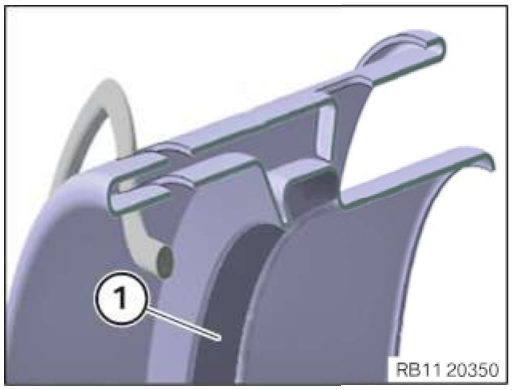


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

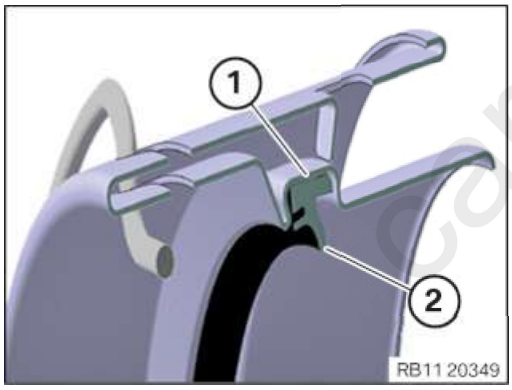
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



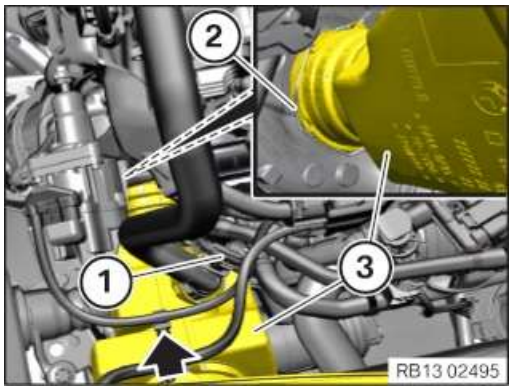
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).

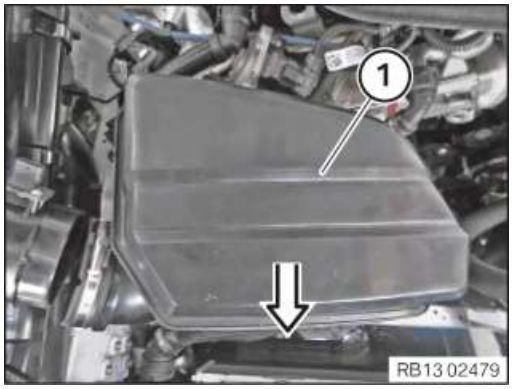


- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

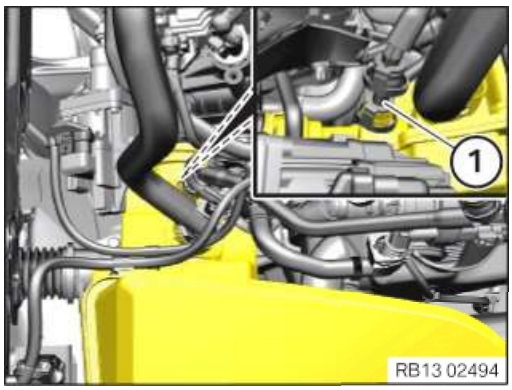
  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Secure clamp (arrow).

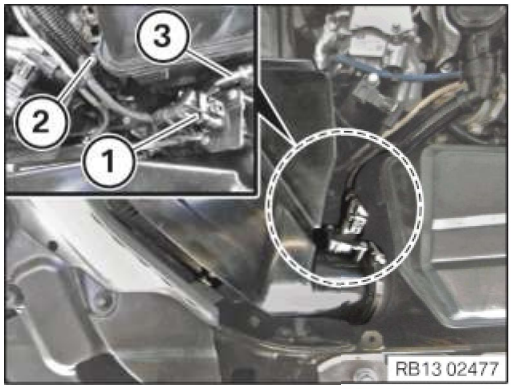
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- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

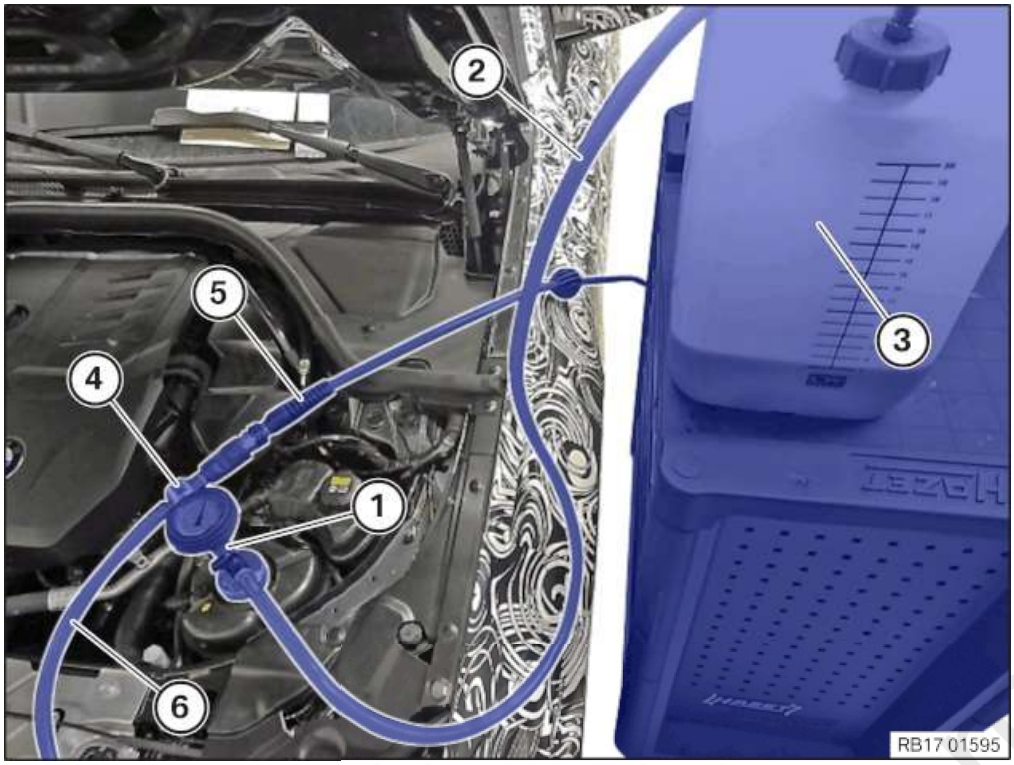
  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

24 – Fill the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

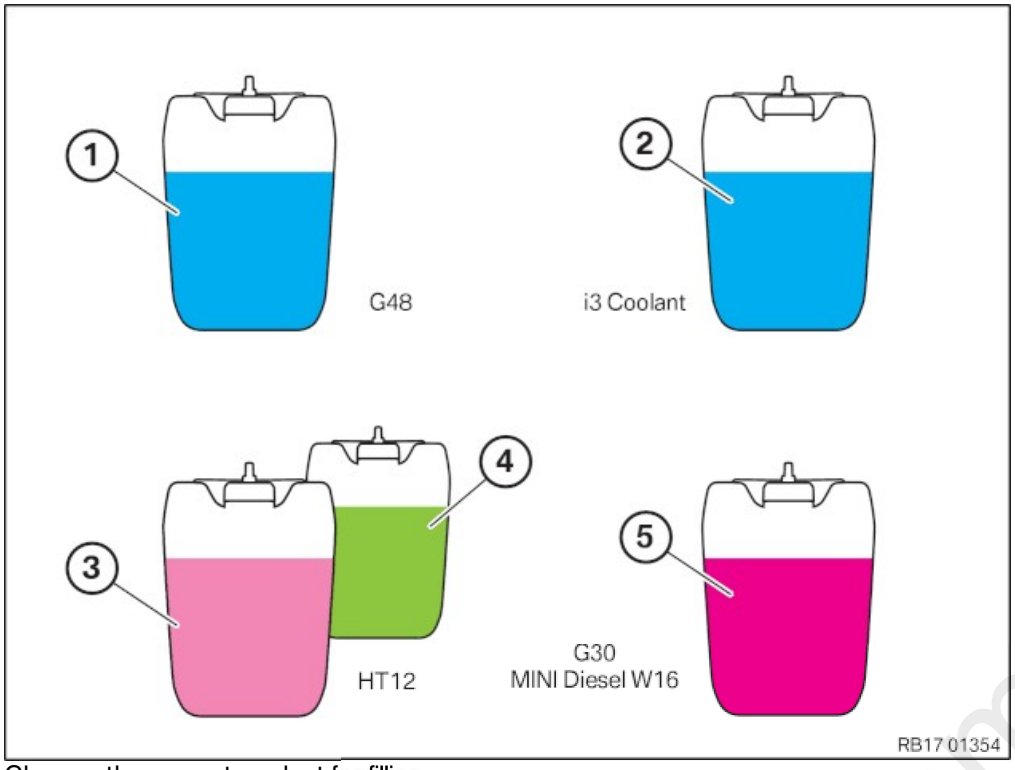
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

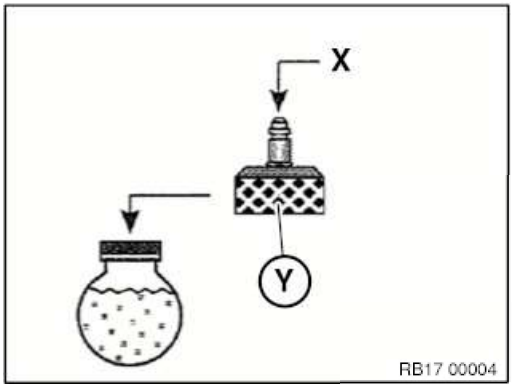
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

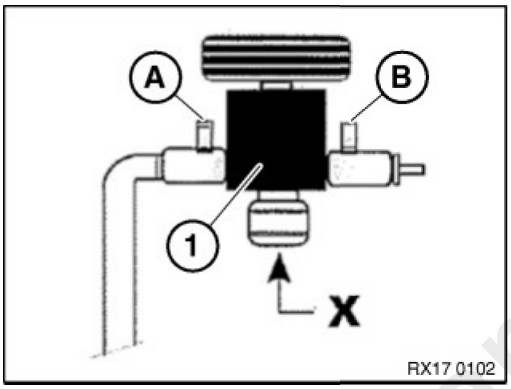
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

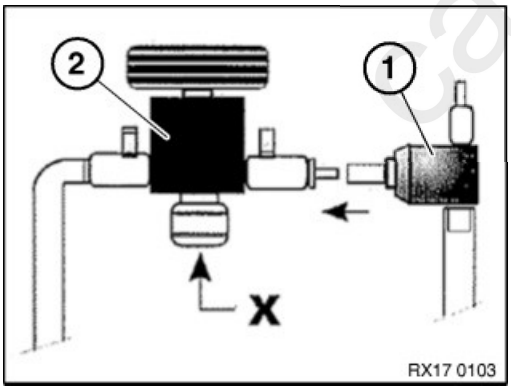
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

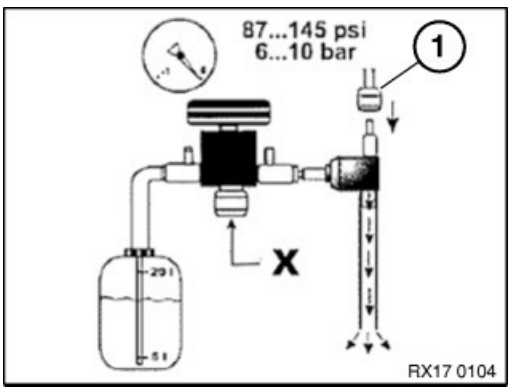


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

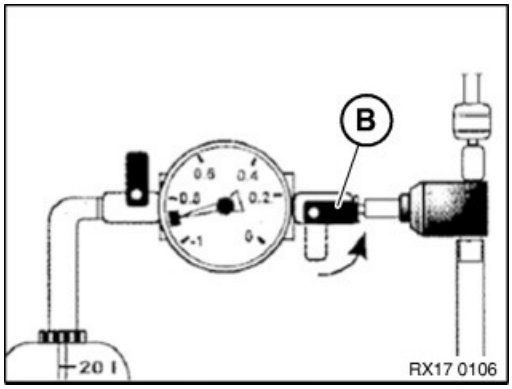
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

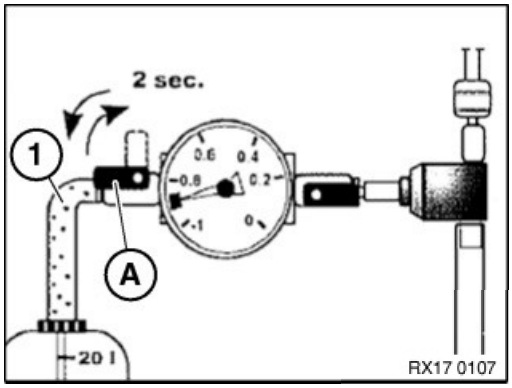
  (X)is the connection on the coolant expansion tank.

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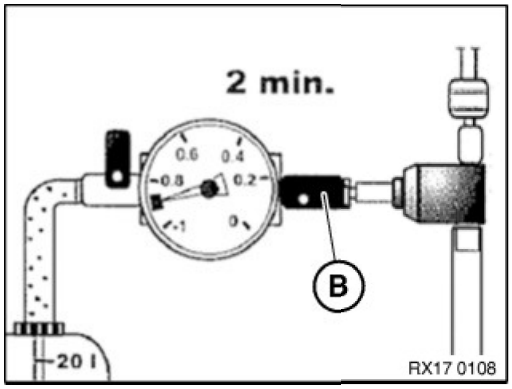
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

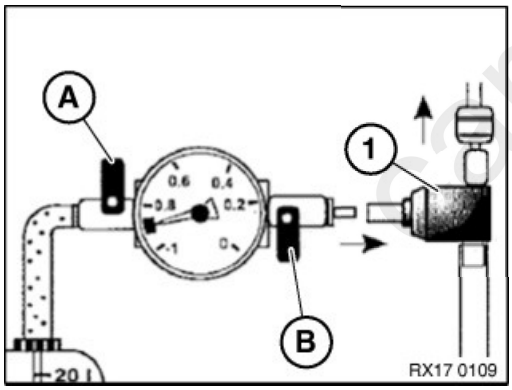


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

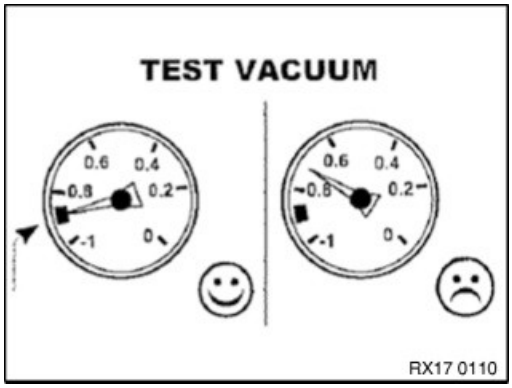
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

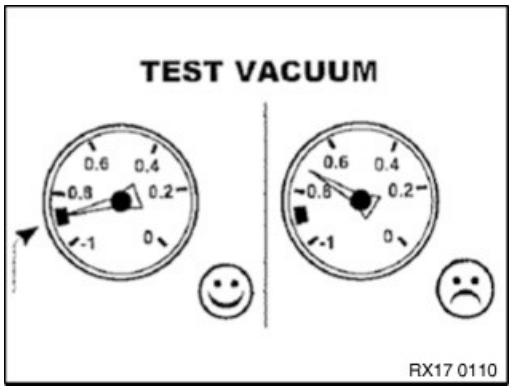
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



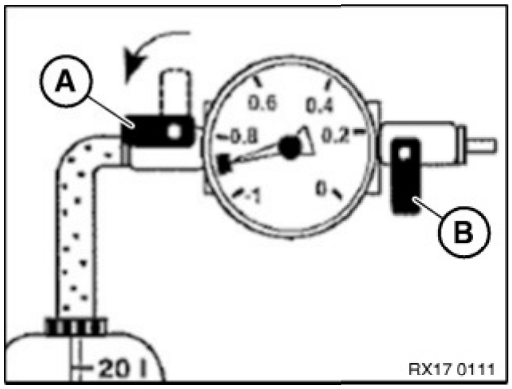
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

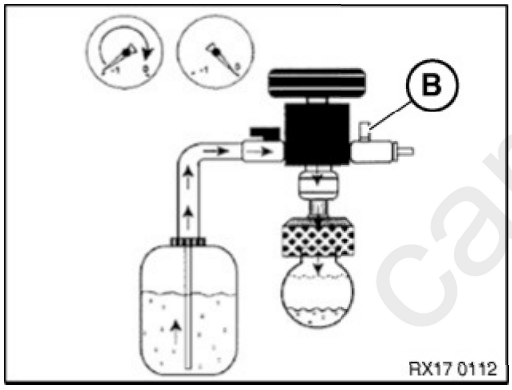
» Vacuum remains constant.

Measure

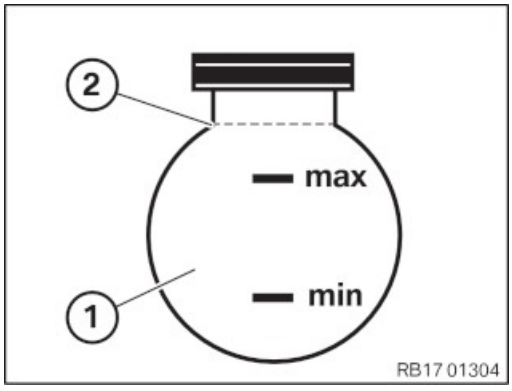
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

25 – Bleed the high-temperature coolant circuit

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

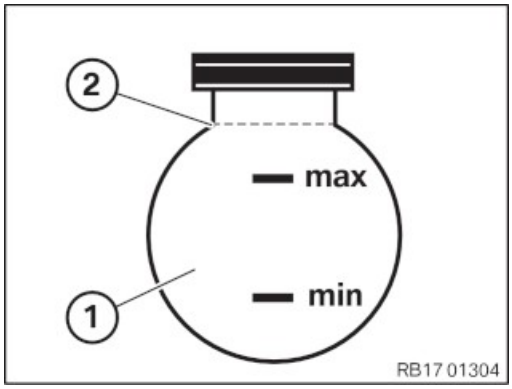
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

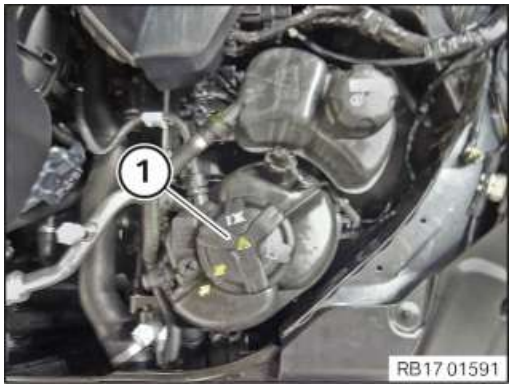
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

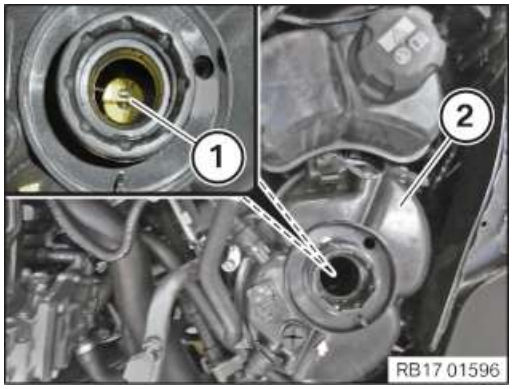
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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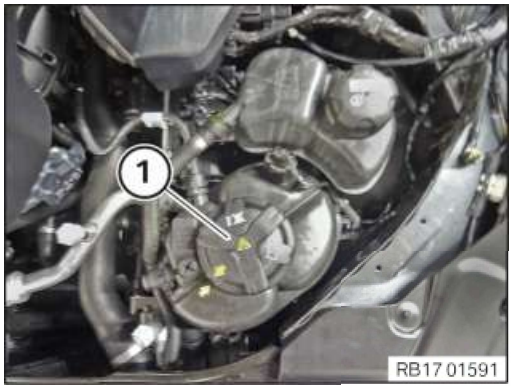
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

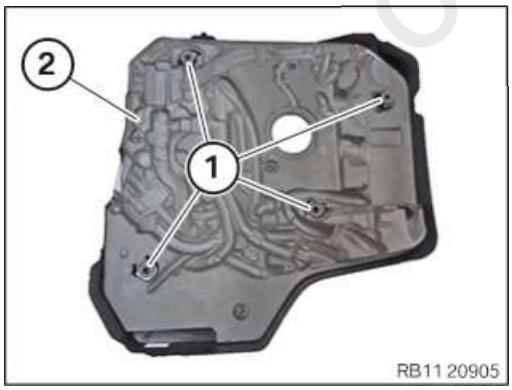
26 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

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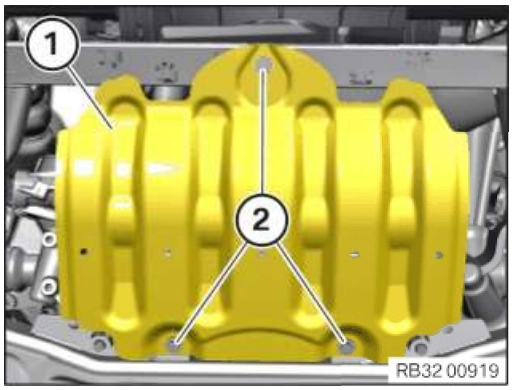
- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

27 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

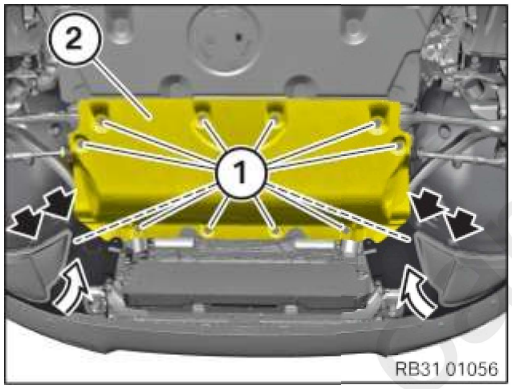


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

28 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

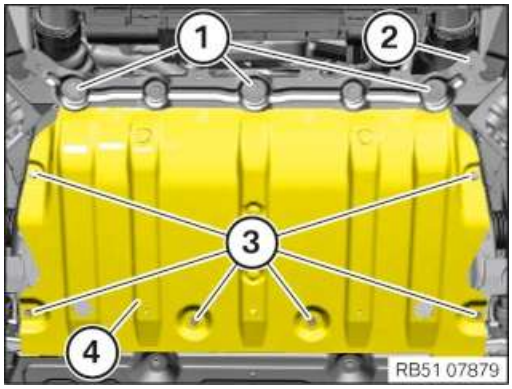
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

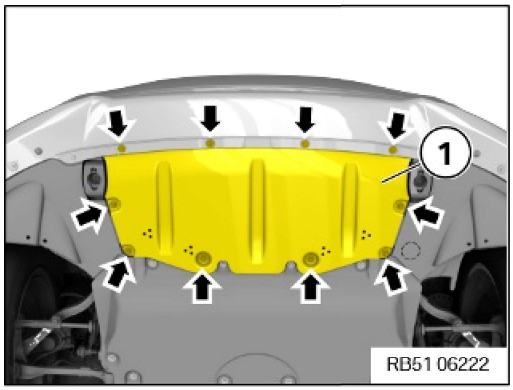
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

29 – Installing the front underbody protection



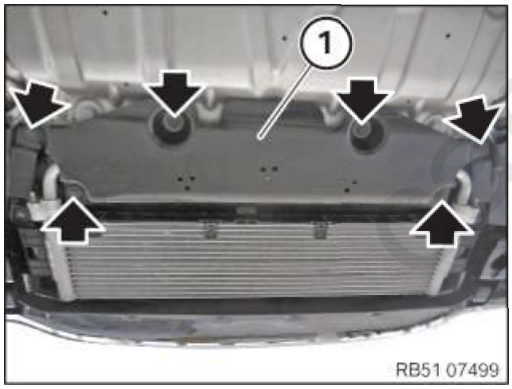
- **Version 1:**

Feed in the front underbody protection (1) towards the front under the bumper panel and position.

Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



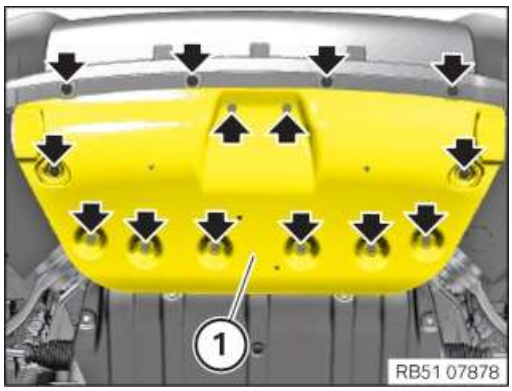
- **Version 2:**

Feed in and position the front underbody protection (1).

Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

Feed in and install front underbody protection (1).

Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Overview of Tightening Torques

Coolant pump to component carrier — Used in step 16

M6x20		Tightening torque	8 ± 1 Nm

Belt pulley to coolant pump — Used in step 18

M6		Tightening torque	8 Nm

Coolant line to coolant pump/cylinder head — Used in step 19

M6x20		Tightening torque	8 Nm

Electric coolant pump to holder — Used in step 21

M6		Tightening torque	8 Nm

Charge air line to throttle body — Used in step 22

M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 23

Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 27

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 28

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 28

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 28

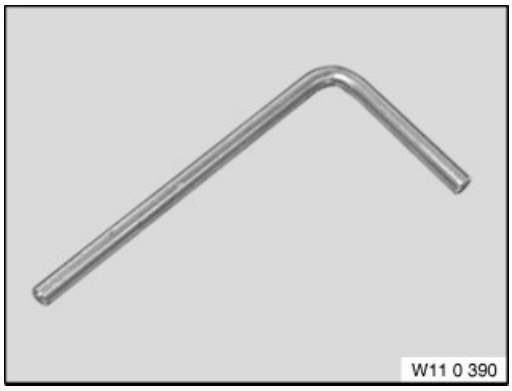
M10		Tightening torque	56 Nm

Underbody protection front — Used in step 29

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

0 496 268 (11 0 390) Pin

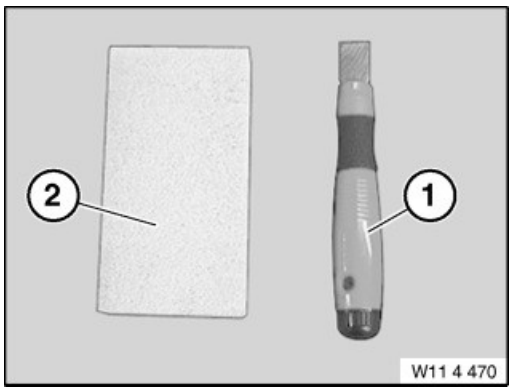


Common — Used in step 7141617

Usage	(roll pin) For securing new tensioning pulley (poly-V belt)
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 15 07 (390)

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0 495 102 (11 4 470) Tool



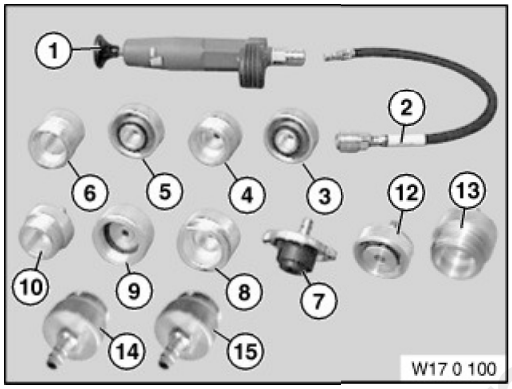
Common Used in step 15

Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

0 494 417 (17 0 100) Tester



Common Used in step 24

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	

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6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Capacity of high-temperature coolant circuit G20	Used in step 24
B48B20O1/B46B20O1	9.8 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

General repair instructions	**Used in step**
11 00 ... Overview of consumables (Electronic Parts Catalogue)	15

Repair instructions	**Used in step**
61 35 ... Notes on ESD protection (Electro Static Discharge)	5
17 00 ... Notes for working on cooling system.	24

Operating materials	**Used in step**
Main group 17	24

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11 51 580 Replacing the relay valve for high-temperature coolant circuit

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Removing the clean air pipe with the resonator

WARNING

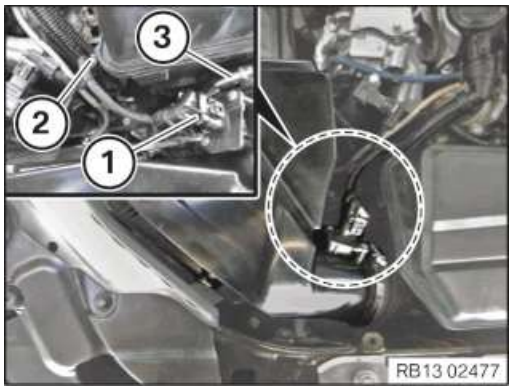
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

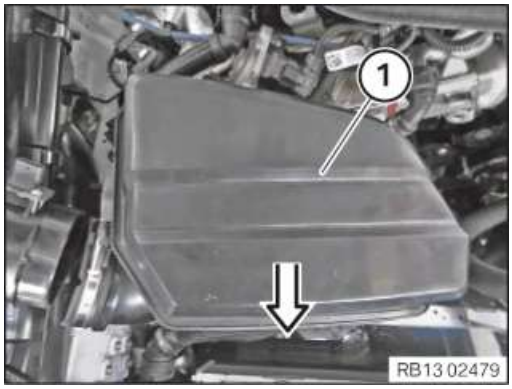


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

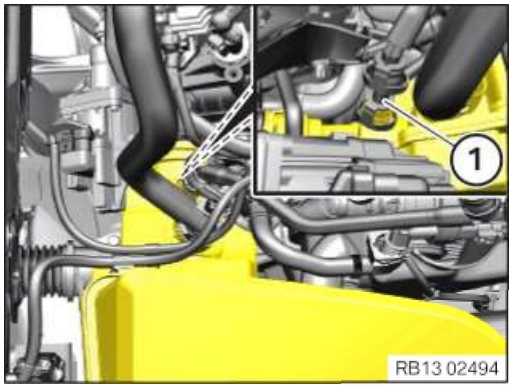


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

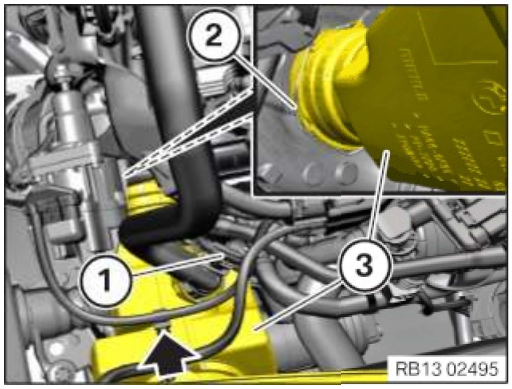
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- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

4 – Removing the throttle body

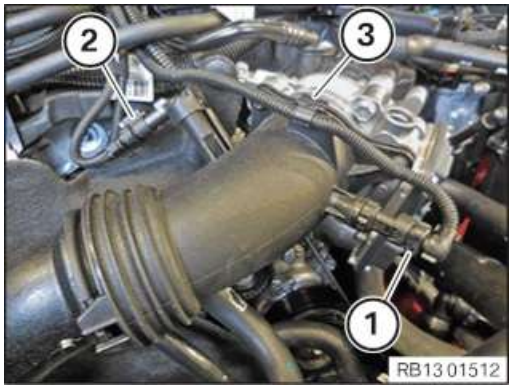
RISK OF DAMAGE

Electrostatic discharge.

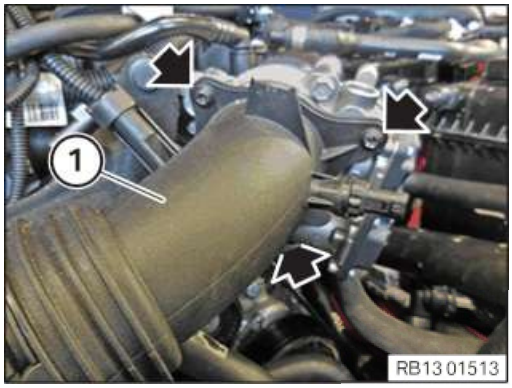
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

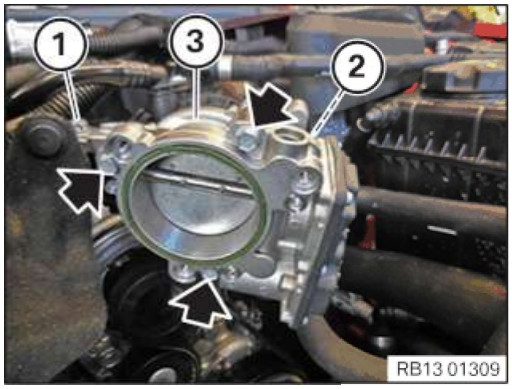
cardiagn.com



- Unlock and loosen connector (1).
- Unlock and loosen connector (2).
- Unlock and loosen clamp (3).

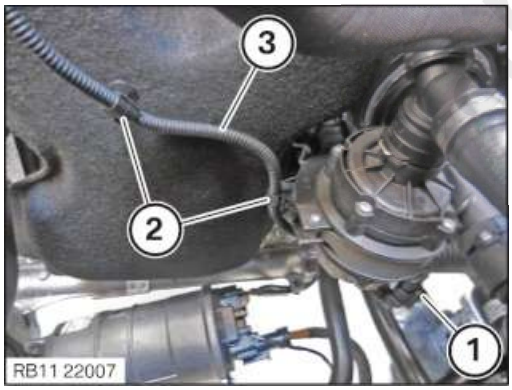


- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.

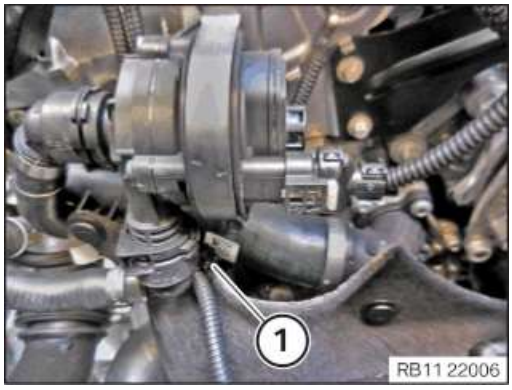


- Loosen screw (1).
- Remove screws (arrows).
- Unlock and loosen connector (2).
- Remove the throttle bodies (3).

5 – Removing the acoustic cover for the engine at the front

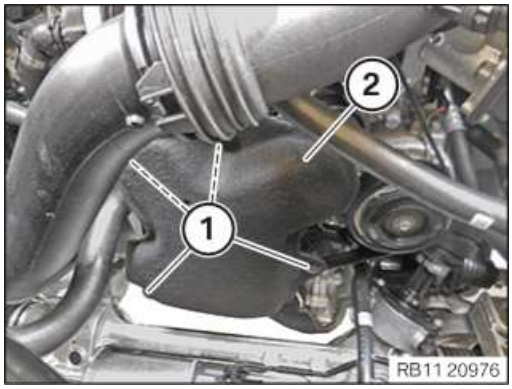


- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).

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- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

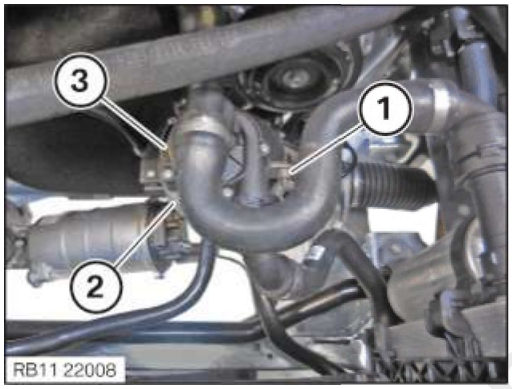
6 – Releasing the electrical auxiliary coolant pump for the charge air cooler or the air conditioning condenser

RISK OF DAMAGE

Non-visible damage to the coolant pump.

Forcibly removing, installing or dropping the coolant pump down will damage it.

- Remove and install the coolant pump without damaging it and without applying external force.
- Avoid impacts/knocks to the coolant pump (e.g.. by tools, falling down, hard contact with base).
- Renew coolant pump after being dropped or hard impacts/knocks.



- Loosen nut (1).
- Thread out holder (2) and set aside.
- Guide out the electrical auxiliary coolant pump (3) and set it aside.

7 – Removing the drive belt for alternator

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

Component with preload.

Danger of injury!

- Reduce preload as far as possible before disassembly. Relieve component.

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TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.



- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Secure the belt tensioner with the special tool 0 496 268 (11 0 390).
- Guide out the drive belt for the alternator (2) and remove it.

8 – Removing the alternator

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

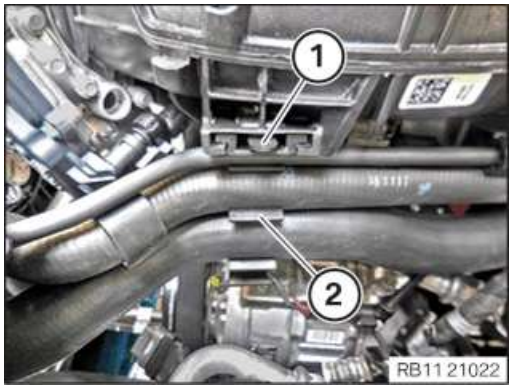
RISK OF DAMAGE

Electrostatic discharge.

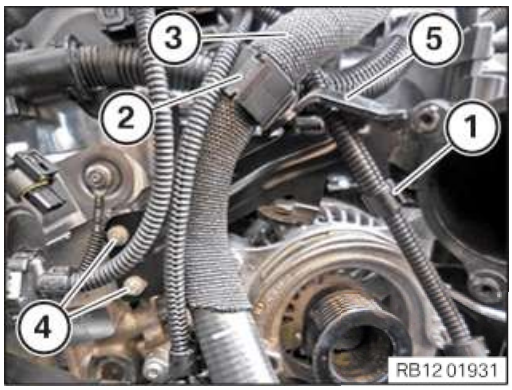
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

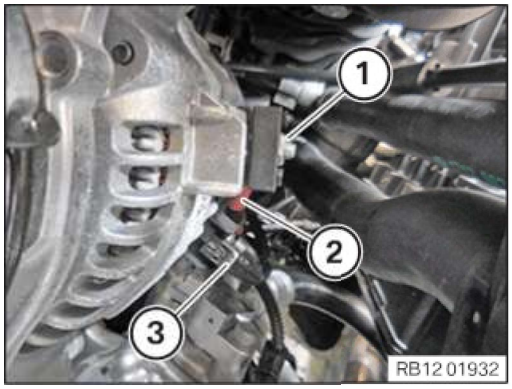
cardiagn.com



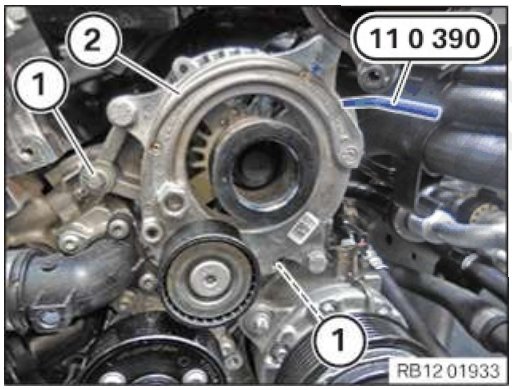
- Unlock the lock (1).
- Thread out holder (2) and set aside.



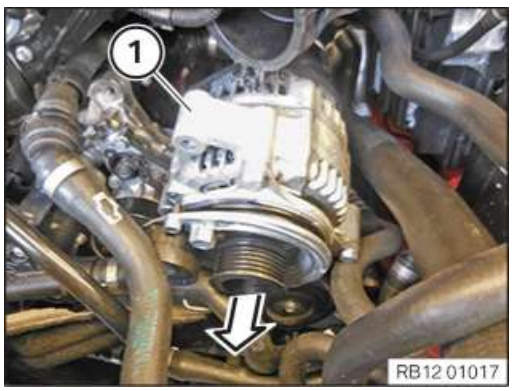
- Loosen clamp (1).
- Loosen clamp (2).
- Feed out coolant line (3) and place to one side.
- Loosen screws (4).
- Thread out holder (5) and set aside.



- Unfasten nut (1).
- Thread out positive battery cable (2) and set it aside.
- Unlock and loosen connector (3).



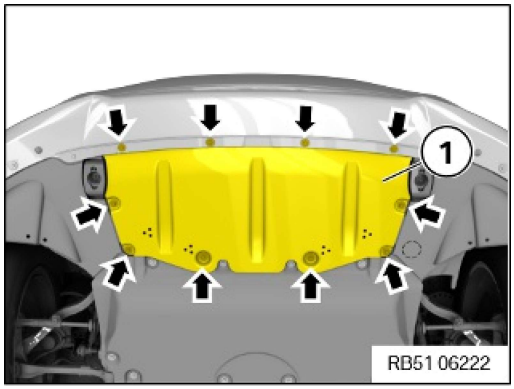
- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.
- Loosen screws (1).
- Disconnect the alternator (2).



- Feed the alternator (1) out toward the front in the direction of the arrow.

9 – Removing the front underbody protection

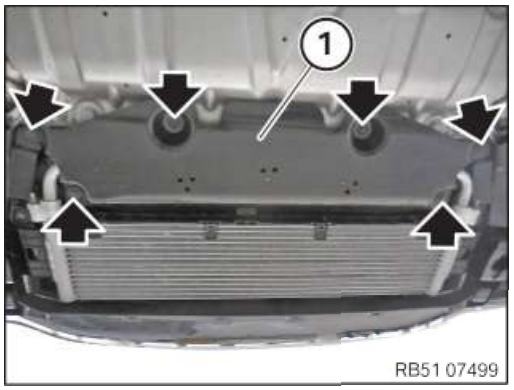
fordiagn.com



- **Version 1:**

  Remove screws (arrows).

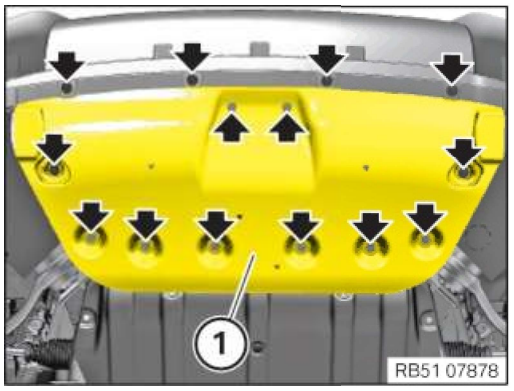
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

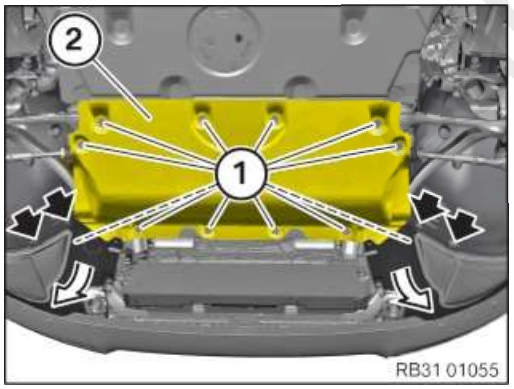


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

10 – Remove the underbody protection of the steering gear



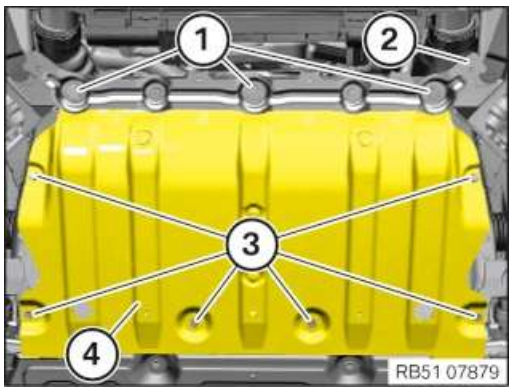
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

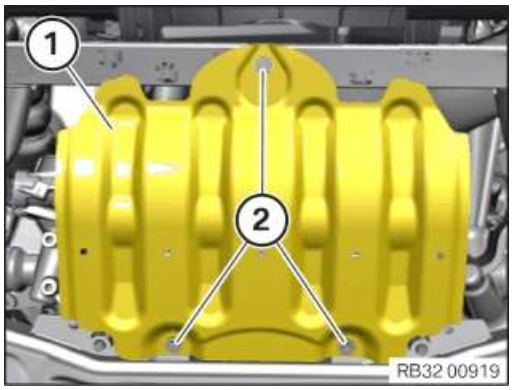
  Slide the steering gear underbody protection (4) out and remove.

11 – If installed: Removing the steering start protection

rdiagn.com

Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

12 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

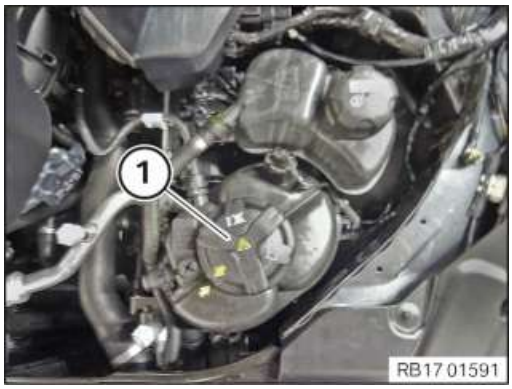
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

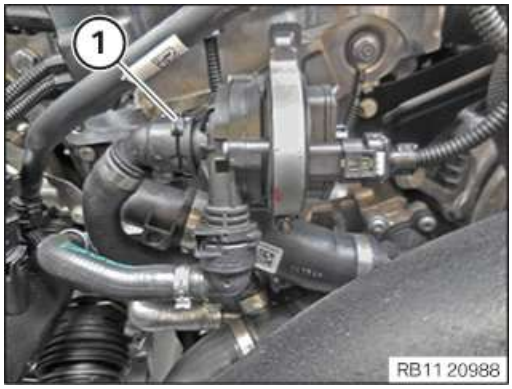
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

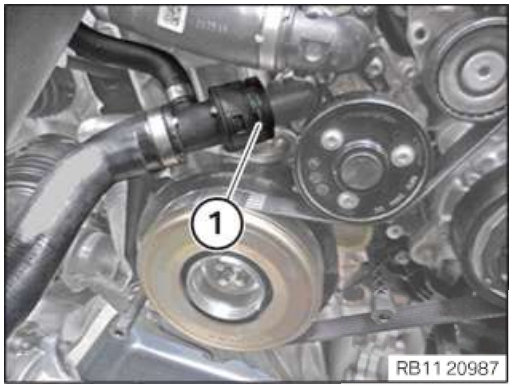


- Loosen sealing cap (1).

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- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

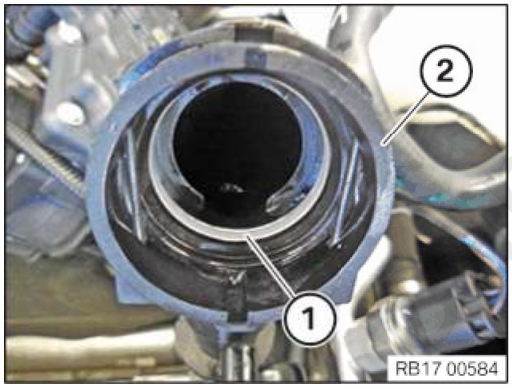


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

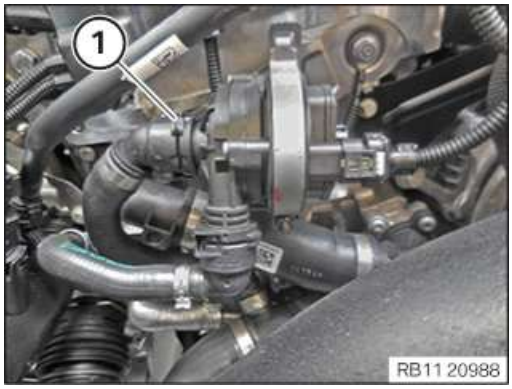
13 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

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- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

MAIN WORK

14 – Removing the relay valve for the high-temperature coolant circuit

RISK OF DAMAGE

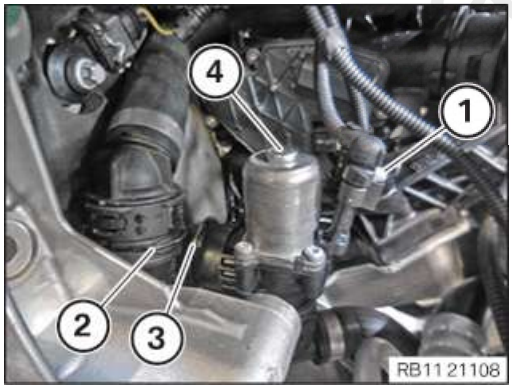
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

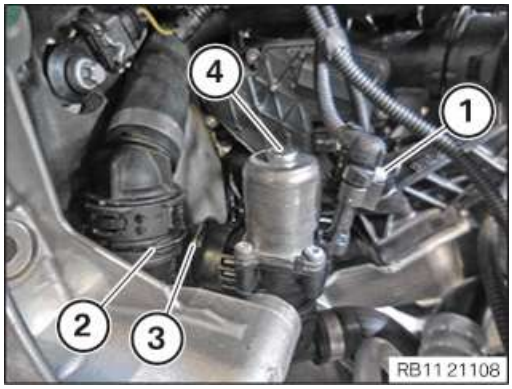


- Unlock and loosen connector (1).
- Unlock and loosen coolant line (2).
- Unlock and loosen coolant line (3).
- Guide out relay valve (4) and remove it.

15 – Installing relay valve for high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Guide in and position relay valve (4).
- Connect and lock coolant line (3).
- Connect and lock coolant line (2).
- Ensure that coolant lines (2) and (3) engage audibly.
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

POSTPROCESSES

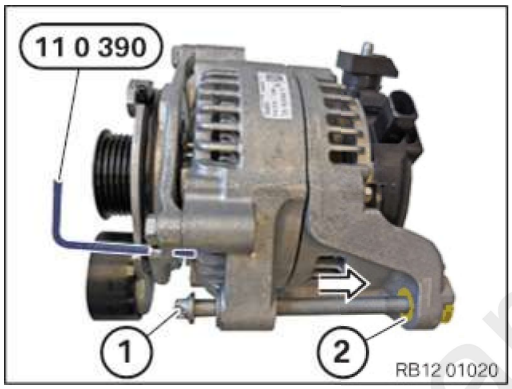
16 – Installing the alternator

WARNING

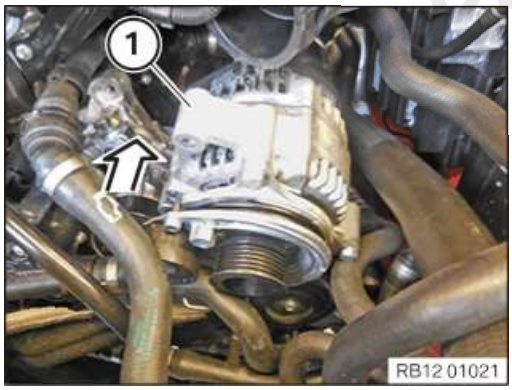
Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

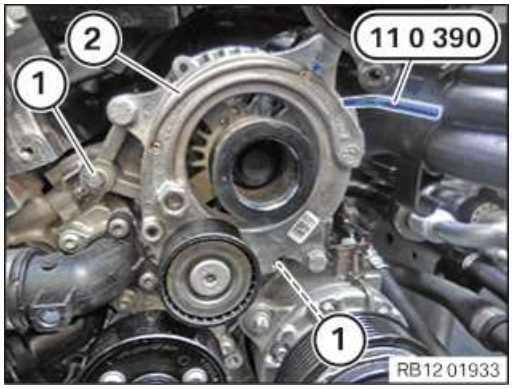
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.



- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.
- Slightly push back the threaded support sleeve (2) in the direction of the arrow to facilitate the installation of the alternator.
- Screw the screw (1) into the threaded support sleeve (2).
- Press back the threaded support sleeve (2) using the bolt (1).
- Once again unscrew the screw (1) from the threaded support sleeve (2).



- Guide in alternator (1) in the direction of the arrow and position it.

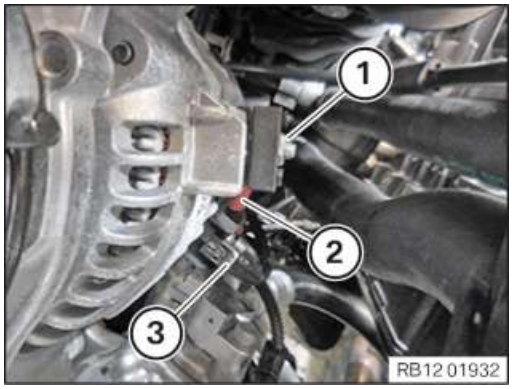


- Install the alternator (2).
- Tighten the screws (1).

Alternator to component carrier

M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm

- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.

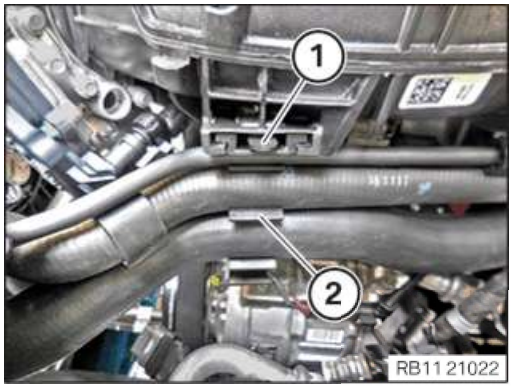


- Insert and install the positive battery cable (2).
- Tighten nut (1).

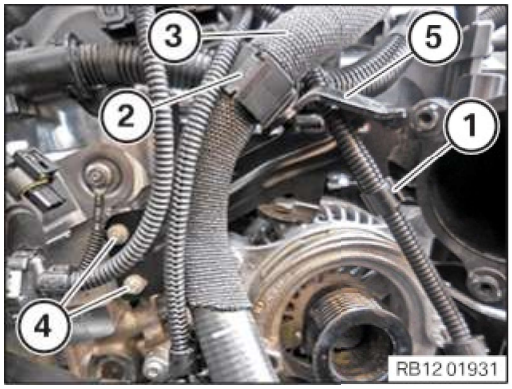
Positive battery cable to the alternator

M8		Tightening torque	19 Nm

- Connect and lock the connector (3).
- The connector (3) must engage audibly.



- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Insert and position the holders (5).
- Tighten down screws (4).

Manifold support for intake air to cylinder head

M6X16		Tightening torque	8 Nm

- Guide coolant line (3) into clamp (2) and install it.
- Secure clamps (2).
- Secure the clamp (1).

17 – Installing the drive belt for alternator

Overview of drive belt for alternator



1. Drive belt for alternator

TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

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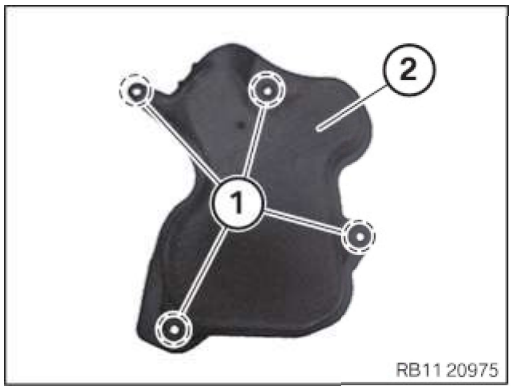
TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.



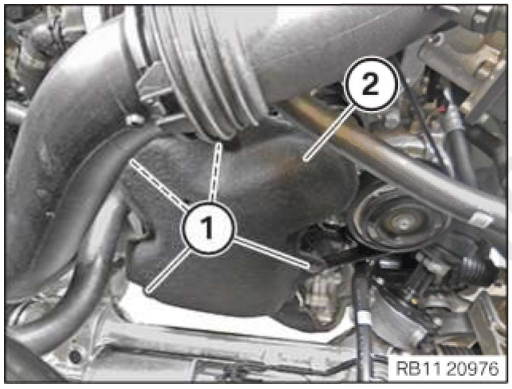
- Position the drive belt for alternator (2) on the ancillary components.
- Increase the preload on the belt tensioner in **the direction of the arrow** using standard tools (1).
- Feed the special tool 0 496 268 (11 0 390) out of the belt tensioner and remove it.

18 – Install the acoustic cover for the engine at the front

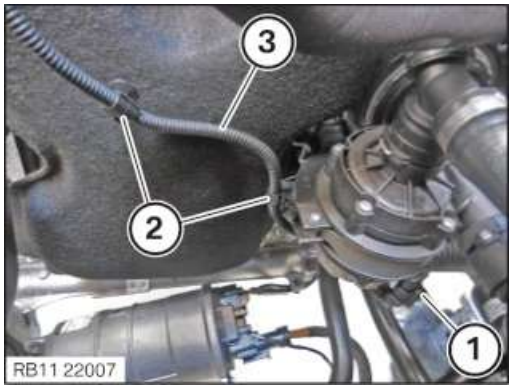


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



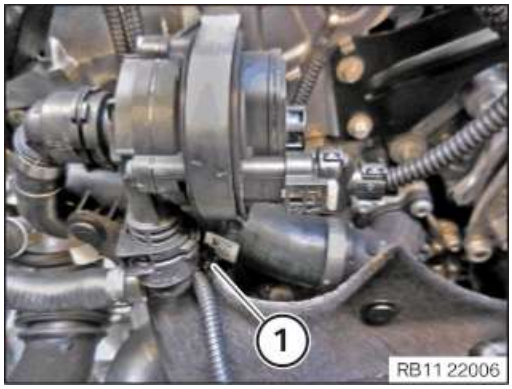
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

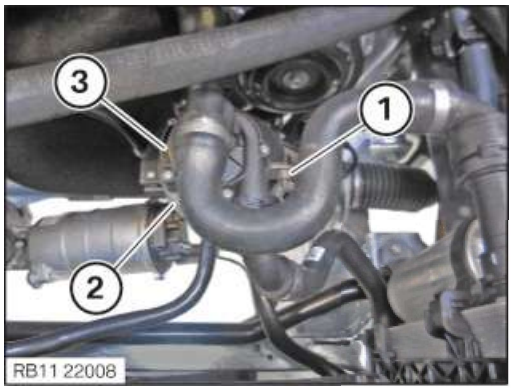
  The connector (1) must engage audibly.

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- Secure clamps (1).

19 – Mounting the electrical auxiliary coolant pump for the charge air cooler/air conditioning condenser

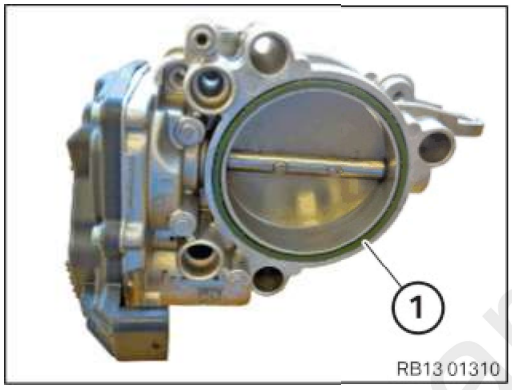


- Feed in and position the electrical auxiliary coolant pump (3).
- Insert and install the holder (2).
- Tighten nut (1).

Electric coolant pump to holder

M6		Tightening torque	8 Nm

20 – Installing the throttle body



- Renew sealing ring (1).

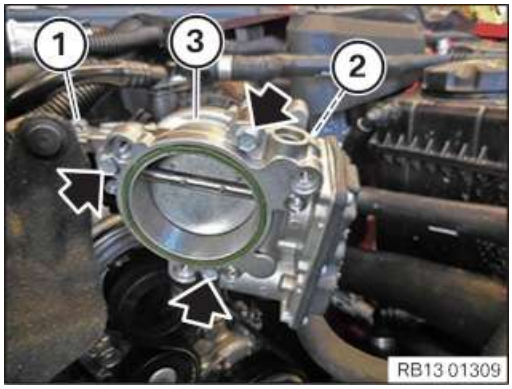
  Parts: Sealing ring



- Renew sealing ring (1).

  Parts: Sealing ring

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- Feed in and install the throttle body (3).
- Connect and lock the connector (2).
- Tighten screws (arrows).

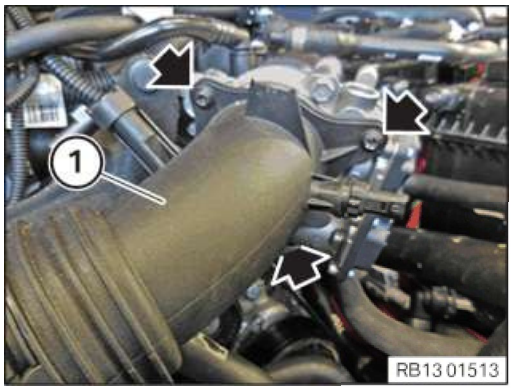
Throttle body to intake plenum

M6X50		Tightening torque	7 Nm

- Tighten down screw (1).

Throttle body to holder

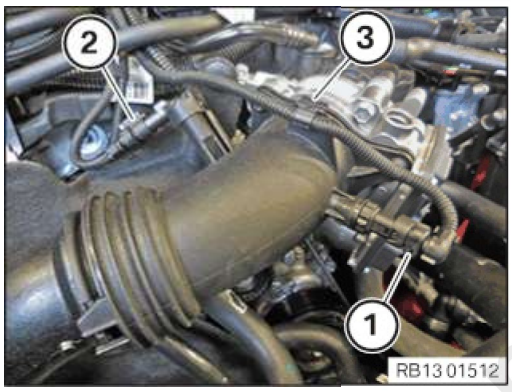
M6X25		Tightening torque	8 Nm



- Insert and install charge air line (1).
- Tighten screws (arrows).

Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect and lock the connector (1).
- Connect and lock the connector (2).
- Secure clamps (3).

21 – Installing the clean air pipe with resonator



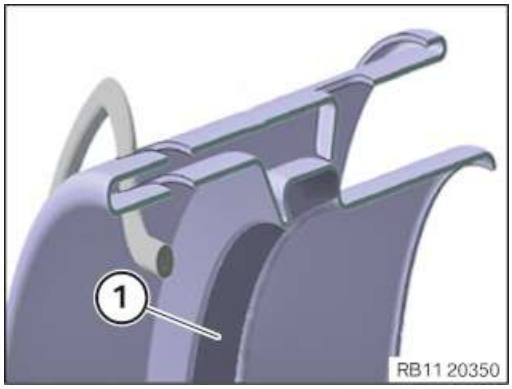
- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

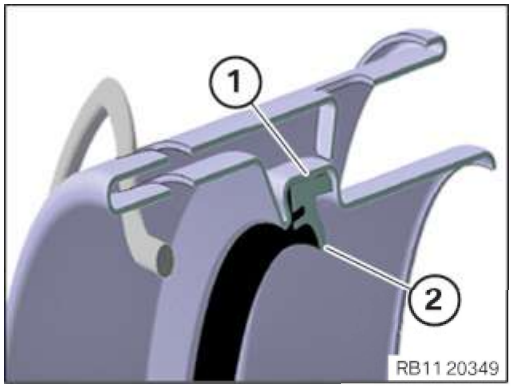
Do not use pointed or sharp-edged tools for the installation and/or removal.

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- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



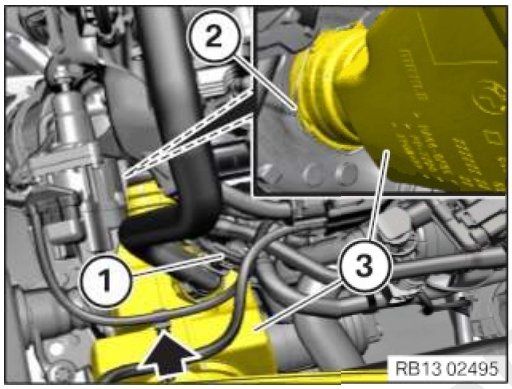
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

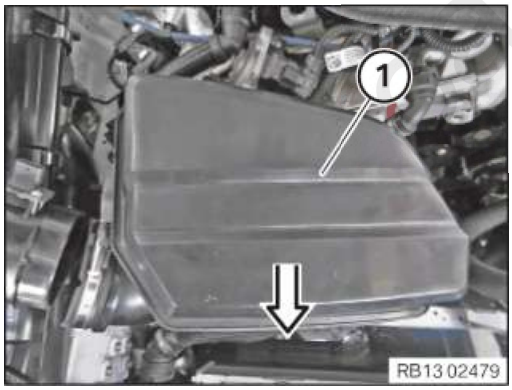
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



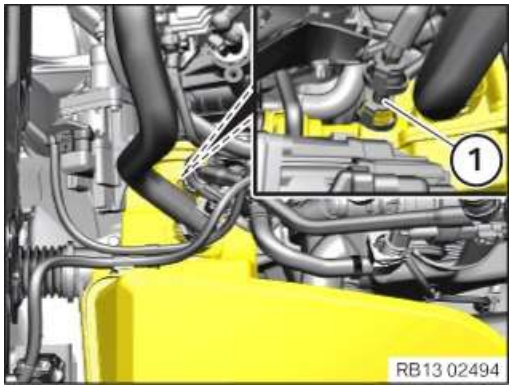
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

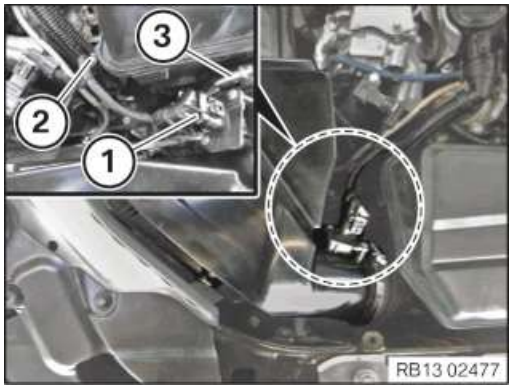
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

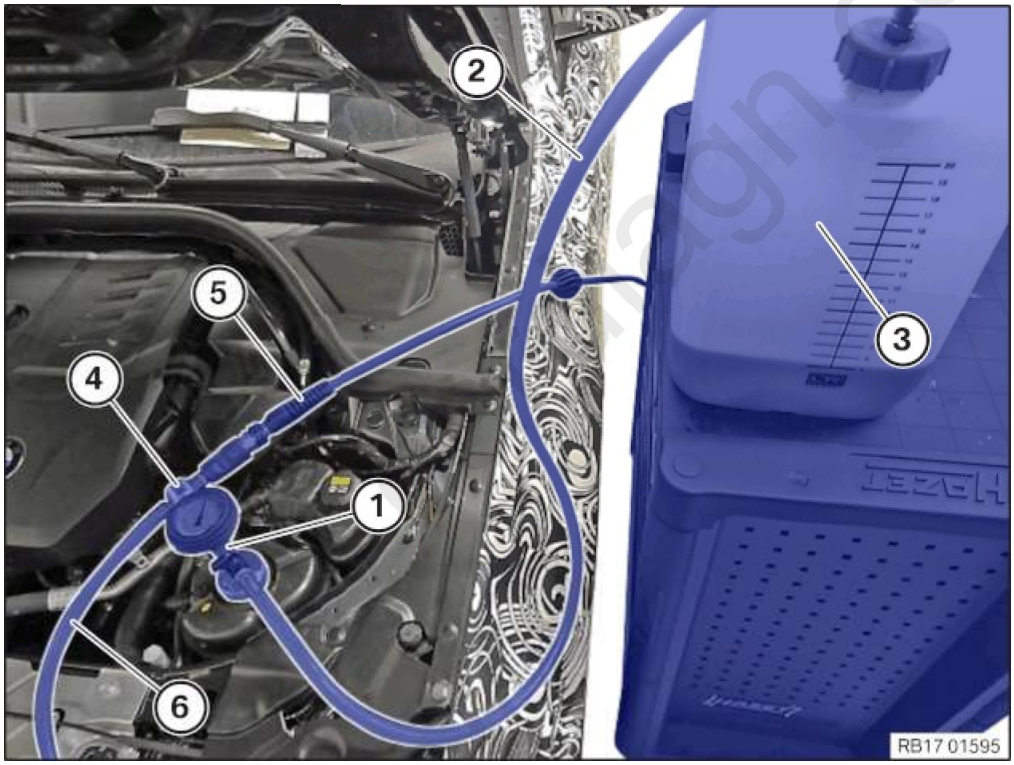
  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

22 – Fill the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

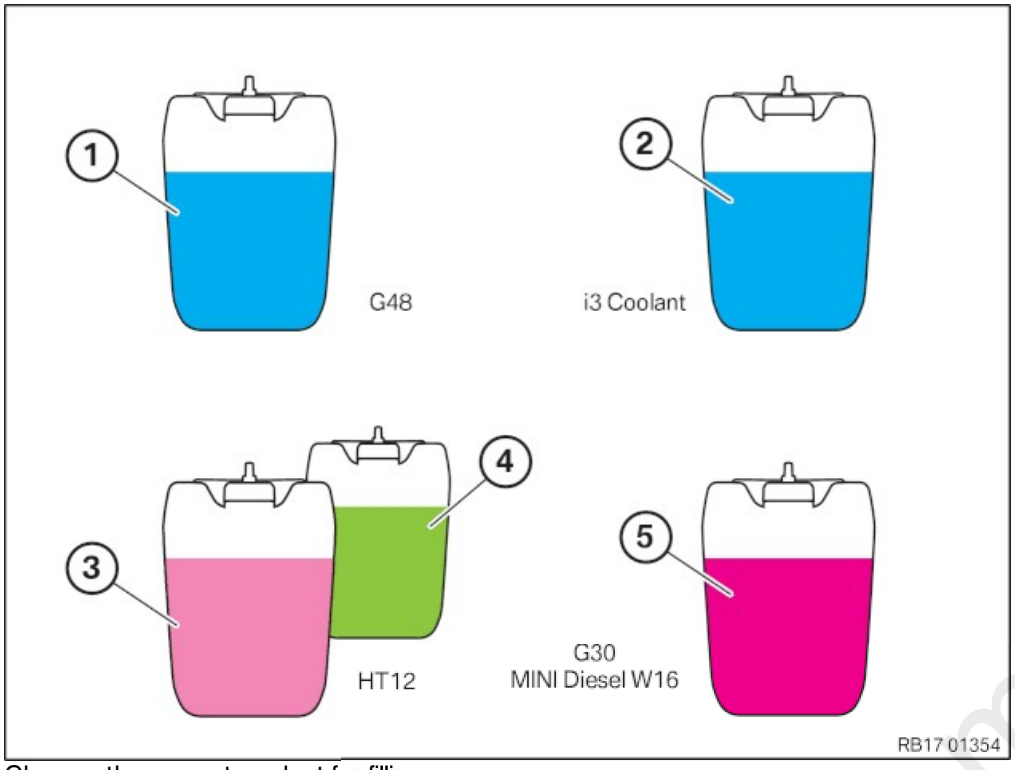
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

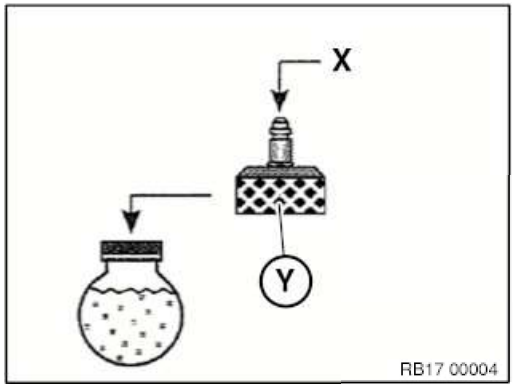
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

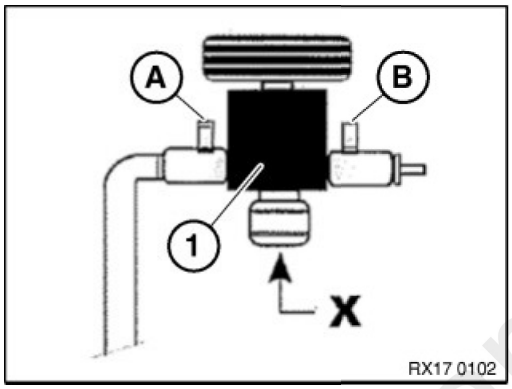
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

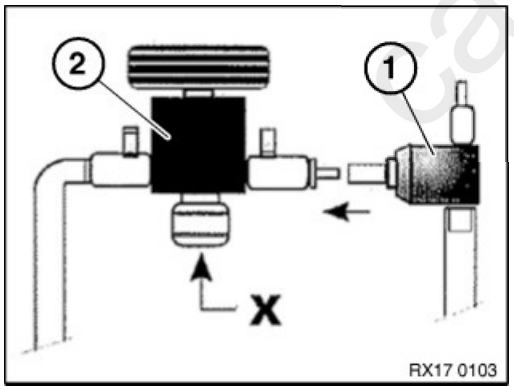
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

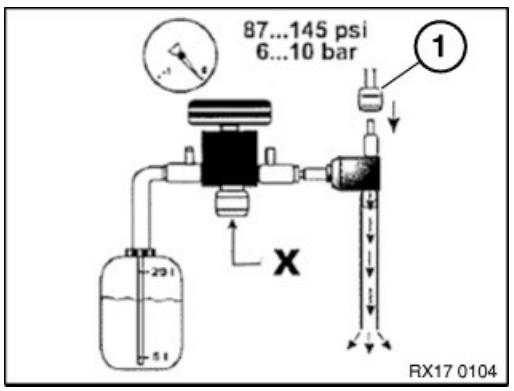


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

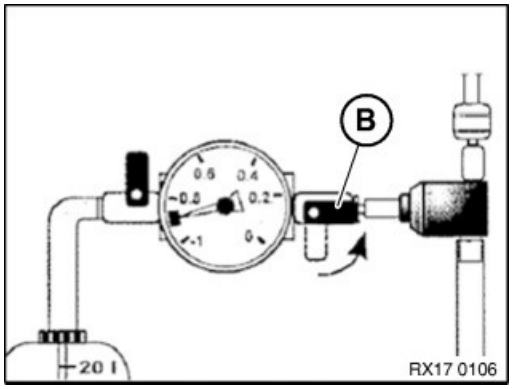
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

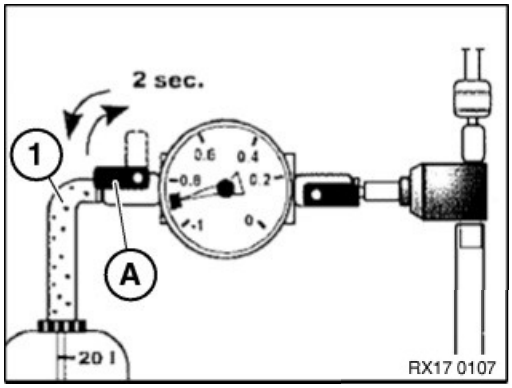
  (X)is the connection on the coolant expansion tank.

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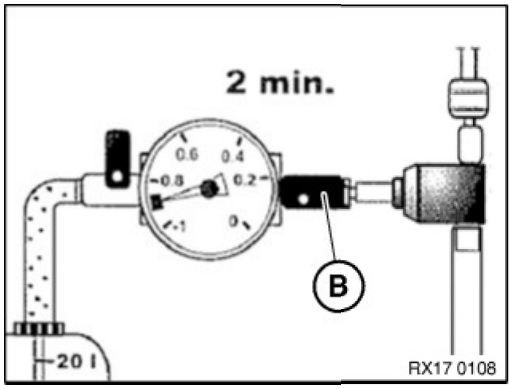
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

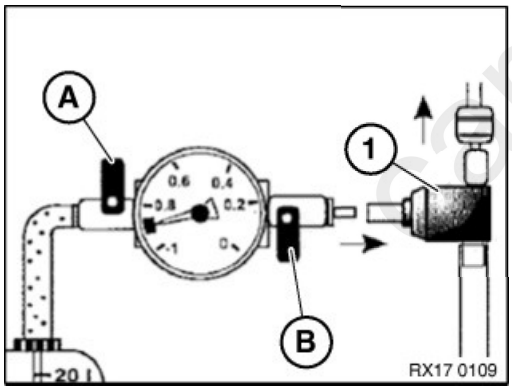


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

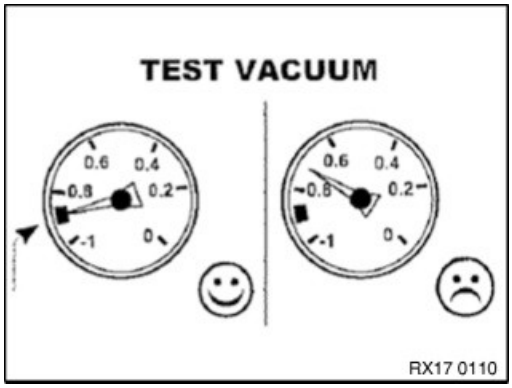
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

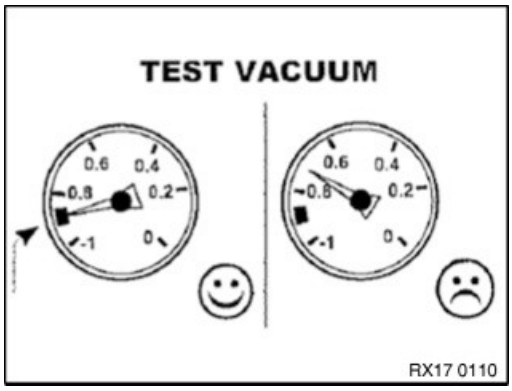
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



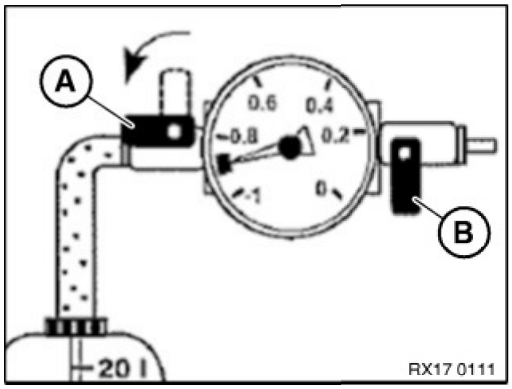
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

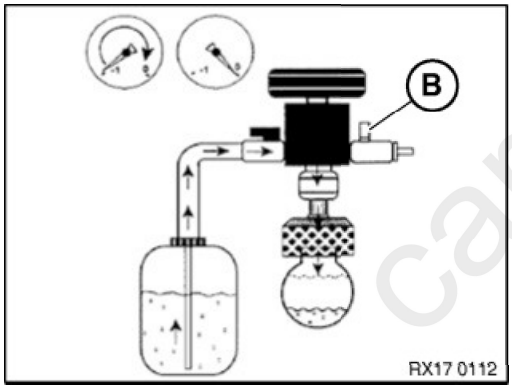
» Vacuum remains constant.

Measure

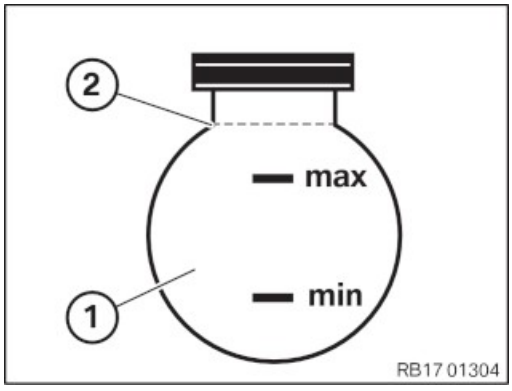
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

23 – Disconnecting all battery earth leads

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- See additional information.

24 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

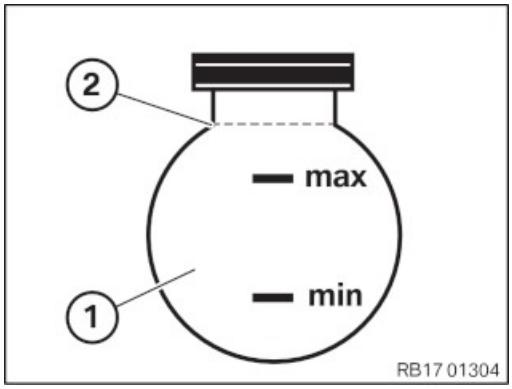
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

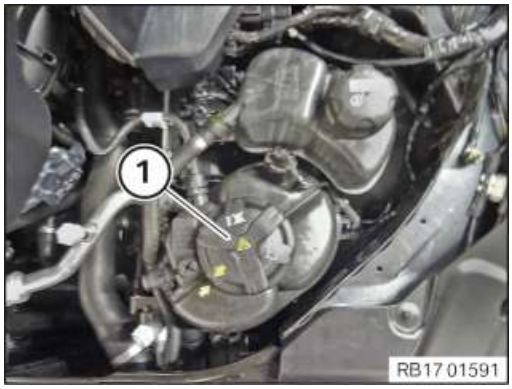
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

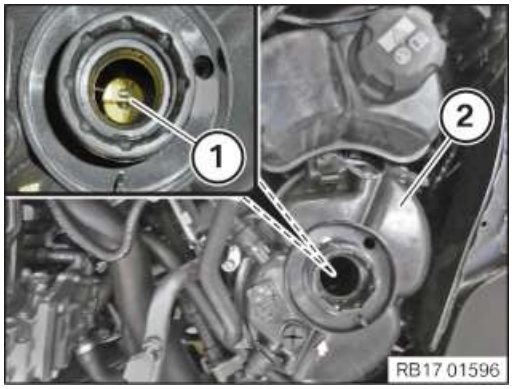
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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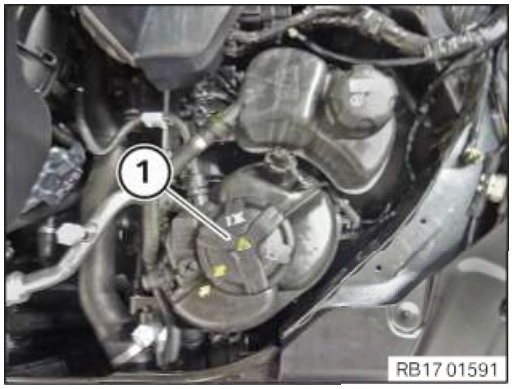
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .

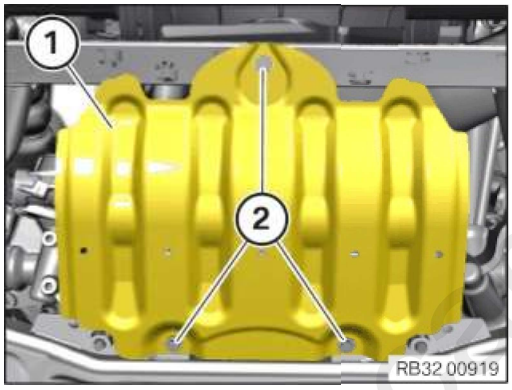


- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

25 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



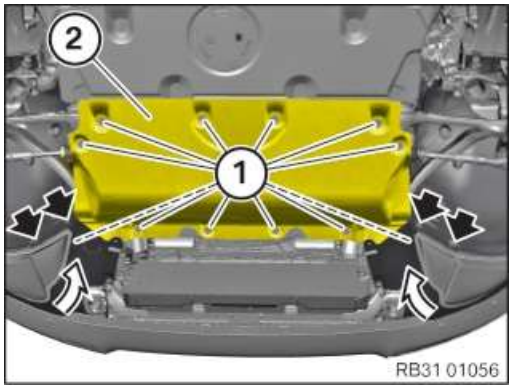
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

26 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

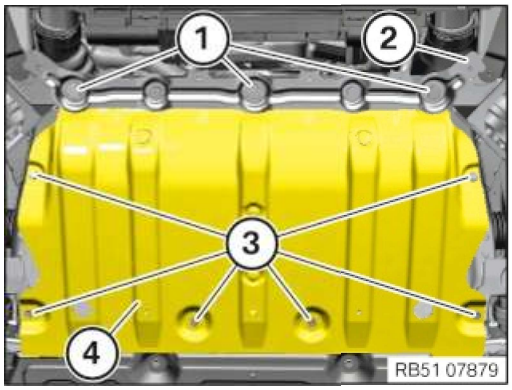
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

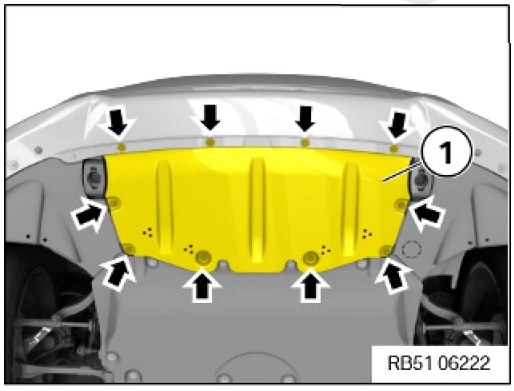
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

27 – Installing the front underbody protection



- **Version 1:**

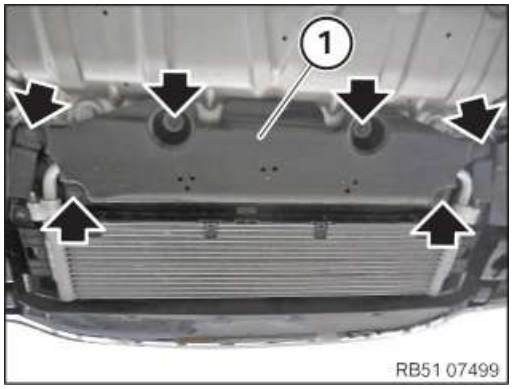
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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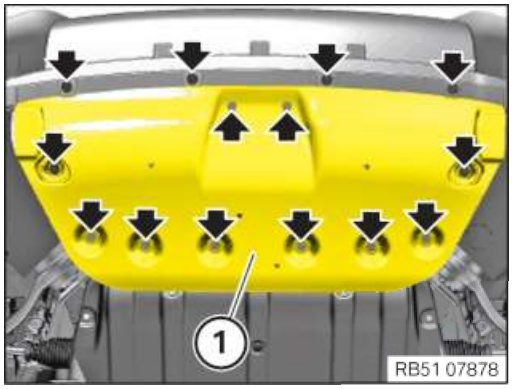
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

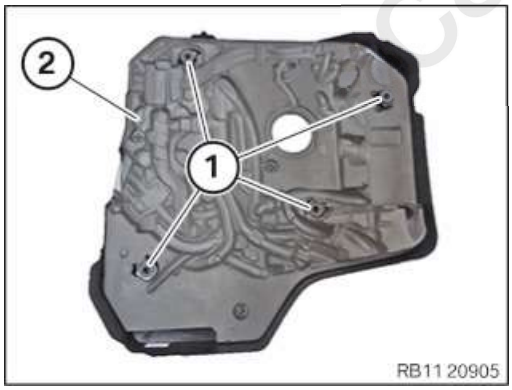
28 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

Additional Information

Overview of Tightening Torques

Alternator to component carrier			Used in step 16
M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm

Positive battery cable to the alternator			Used in step 16
M8		Tightening torque	19 Nm

Manifold support for intake air to cylinder head			Used in step 16
M6X16		Tightening torque	8 Nm

Electric coolant pump to holder			Used in step 19
M6		Tightening torque	8 Nm

Throttle body to intake plenum			Used in step 20
M6X50		Tightening torque	7 Nm

Throttle body to holder			Used in step 20
M6X25		Tightening torque	8 Nm

Charge air line to throttle body			Used in step 20
M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 21
Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support			Used in step 25
M10		Tightening torque	56 Nm

Underbody protection of the steering gear			Used in step 26
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 26
Thermoplastic hexagon screw		Tightening torque	3 Nm

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Holder underride guard to front axle support — Used in step 26

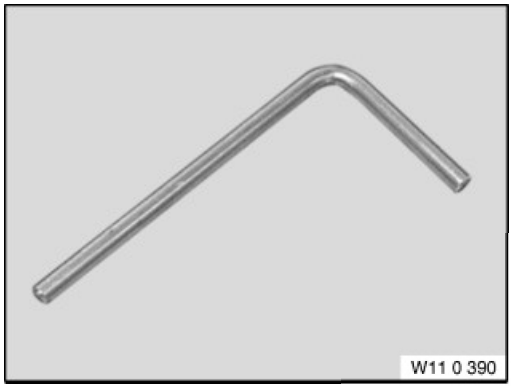
M10		Tightening torque	56 Nm

Underbody protection front — Used in step 27

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

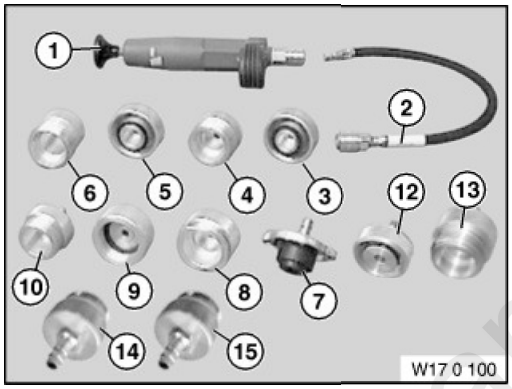
0 496 268 (11 0 390) Pin



Common — Used in step 781617

Usage	(roll pin) For securing new tensioning pulley (poly-V belt)
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 15 07 (390)

0 494 417 (17 0 100) Tester



Common — Used in step 22

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	

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4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Capacity of high-temperature coolant circuit G20	Used in step 22
B48B20O1/B46B20O1	9.8 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

Repair instructions	**Used in step**
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	123
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	123
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	123
61 20 900 Disconnecting and connecting battery earth lead	123

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61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
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61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 20 900 Disconnecting and connecting battery earth lead	123
61 35 ... Notes on ESD protection (Electro Static Discharge)	4
61 35 ... Notes on ESD protection (Electro Static Discharge)	46814
17 00 ... Notes for working on cooling system.	22

Operating materials	**Used in step**
Main group 17	22

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11 53 015 Removing and installing/replacing heat management module

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads

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- See additional information.

2 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

3 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

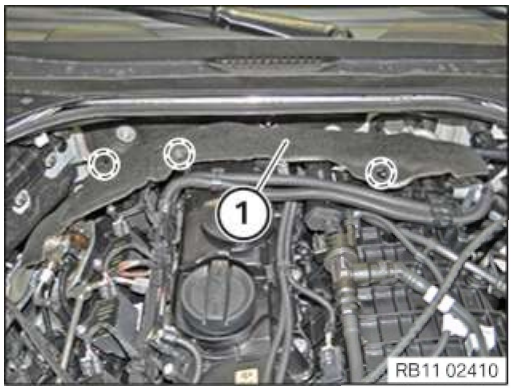
- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

4 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

5 – Removing the DME control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

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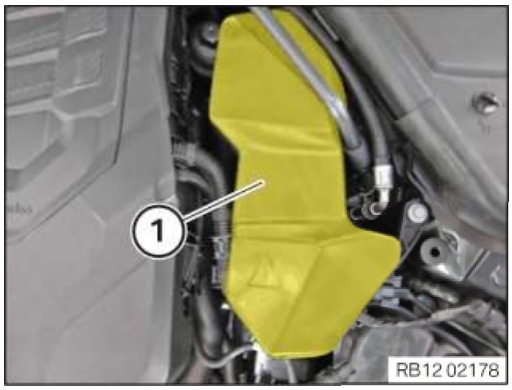
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

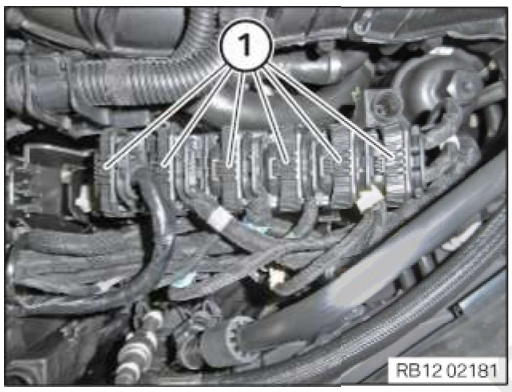
For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

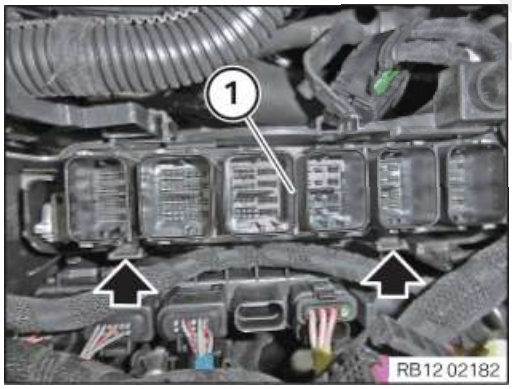
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.



- Pull the cover (1) towards the top and feed out.



- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

6 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

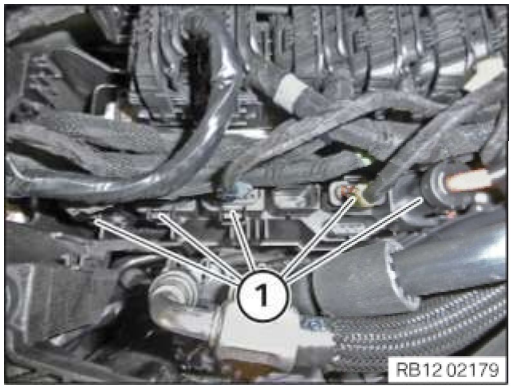
- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

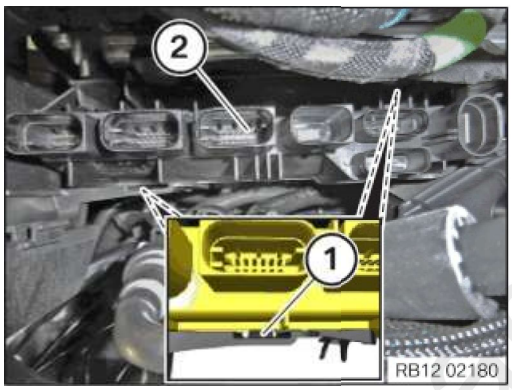
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

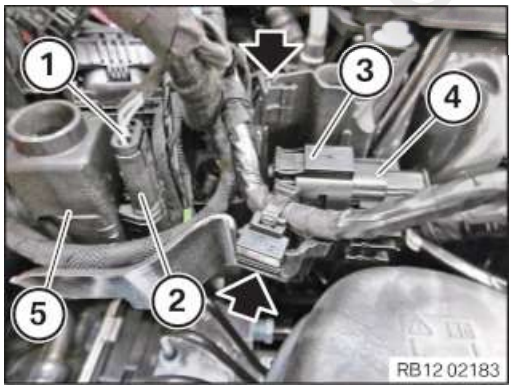


- Unlock and disconnect plug connections (1).



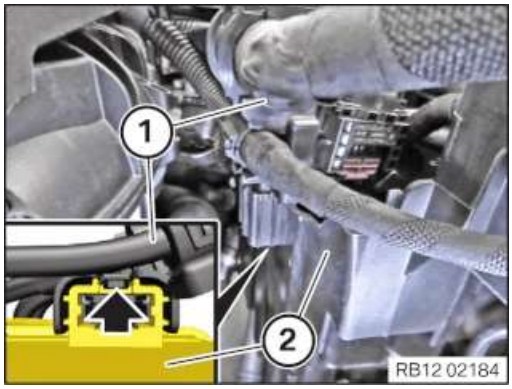
- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

7 – Removing the control unit holder

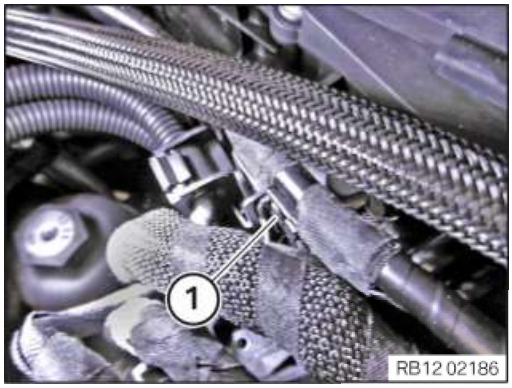


- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).

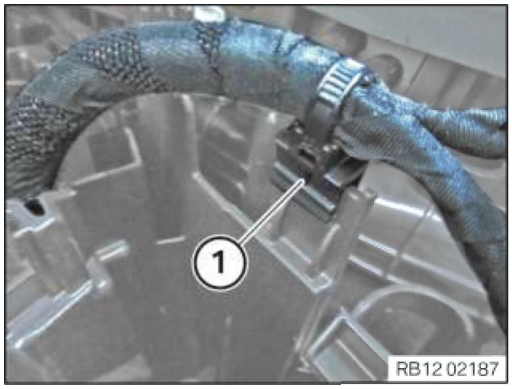
cardiagn.com



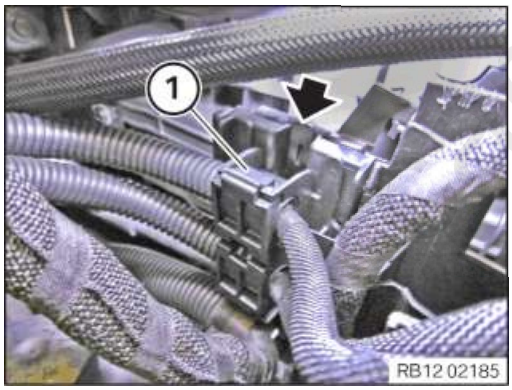
- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).



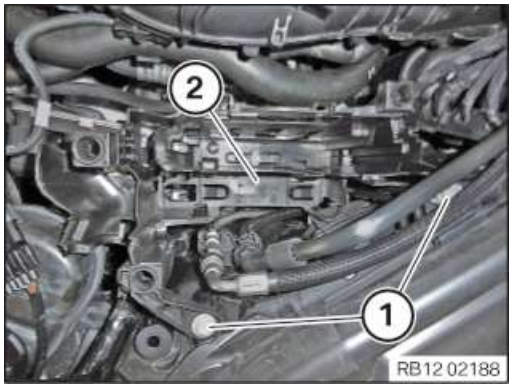
- Loosen clamp (1).



- Loosen clamp (1).



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

8 – Removing the clean air pipe with the resonator

rdiagn.com

WARNING

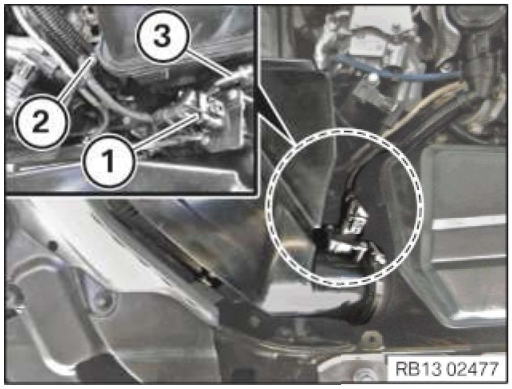
Hot surfaces.

Risk of burning!

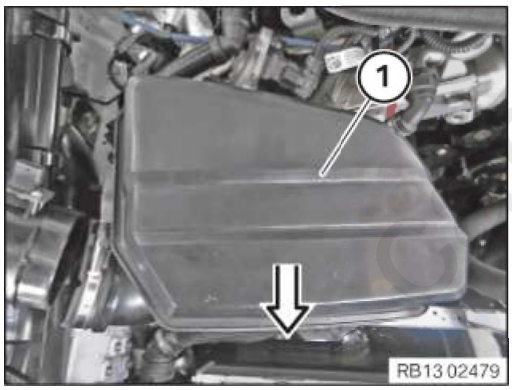
- Perform all work only on components that have cooled down.



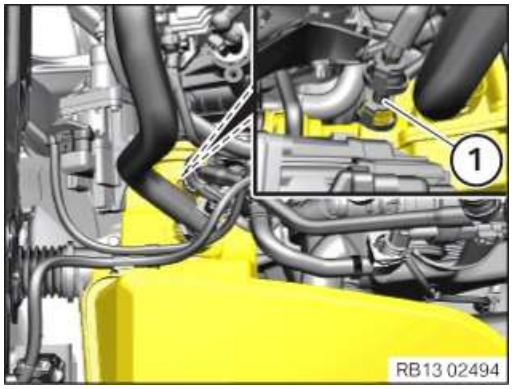
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



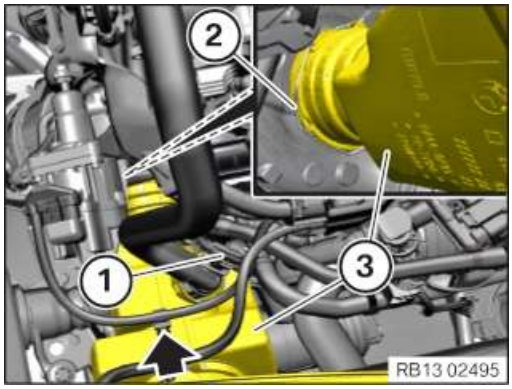
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

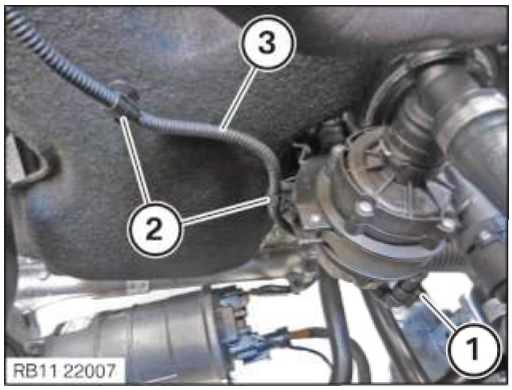


- Unlock and disconnect the tank ventilation line (1).

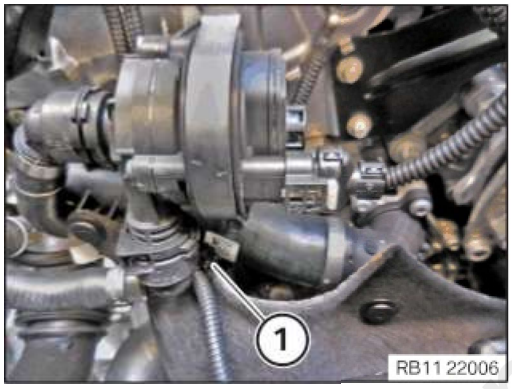


- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

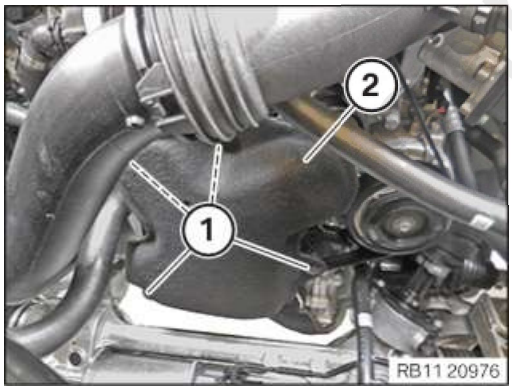
9 – Removing the acoustic cover for the engine at the front



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

10 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

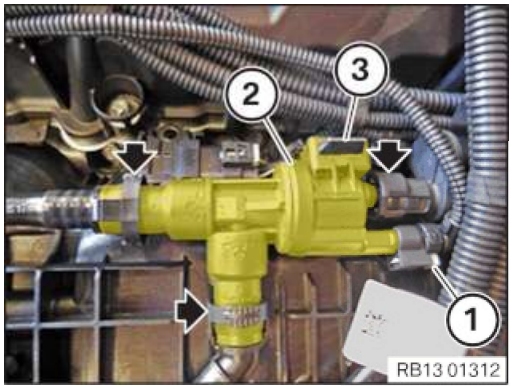
mdiagn.com

RISK OF DAMAGE

Electrostatic discharge.

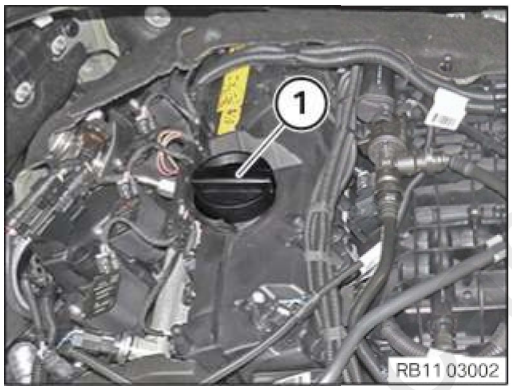
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

11 – Removing the oil filler cap



- Open oil filler cap (1).

12 – Removing the oil filter element

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

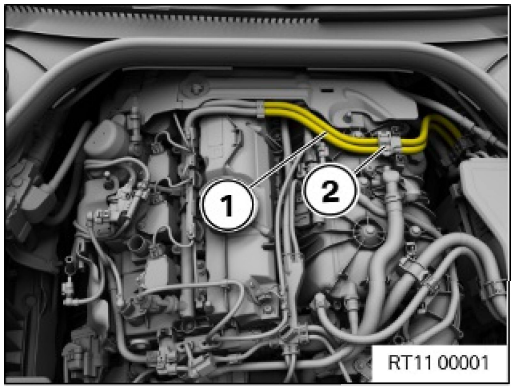
carsdiagn.com

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

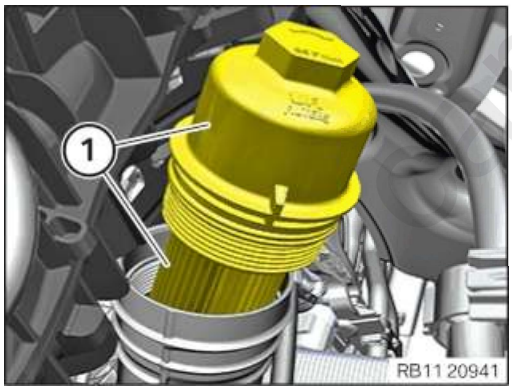
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Unclip engine wiring harness (1) from holder (2) and place it aside.



- Loosen the oil filter cover (1).



TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Guide out and remove the oil filter cover in the upward direction with oil filter element (1).

13 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

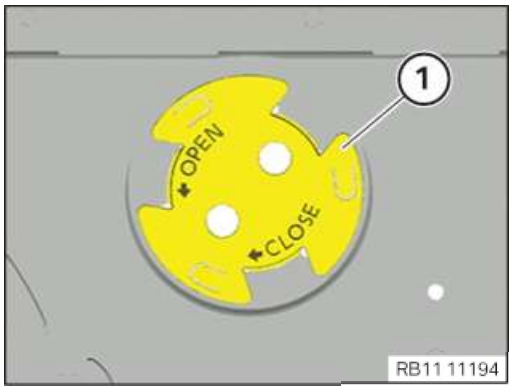
autodiagn.com

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).



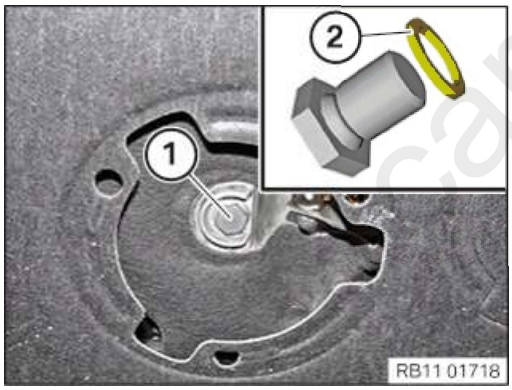
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

14 – Tightening the oil drain plug



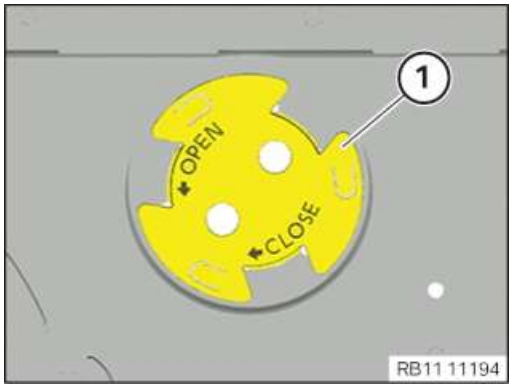
- Renew sealing ring (2).

  Parts: Sealing ring

- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

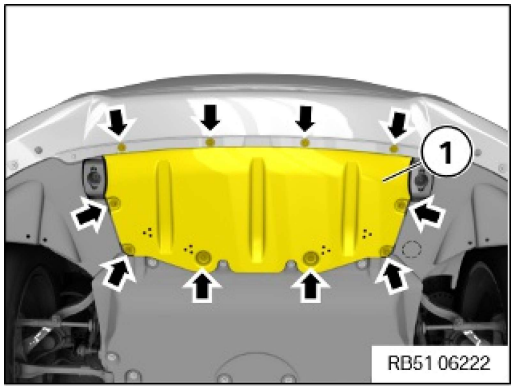
M12x16	Renew the sealing ring.	Tightening torque	25 Nm



- Install service cap (1).

15 – Removing the front underbody protection

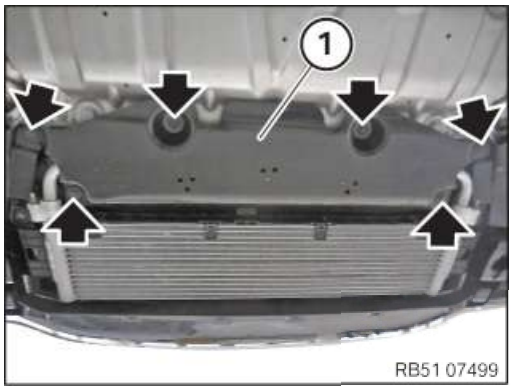
cardiagn.com



- **Version 1:**

  Remove screws (arrows).

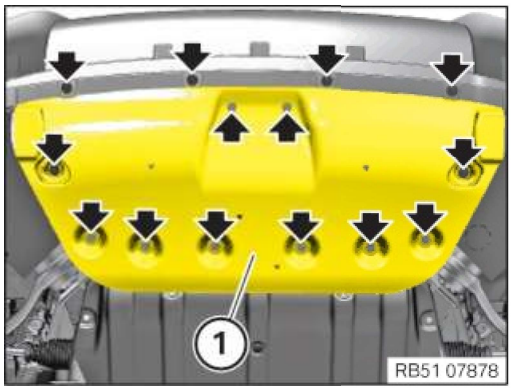
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

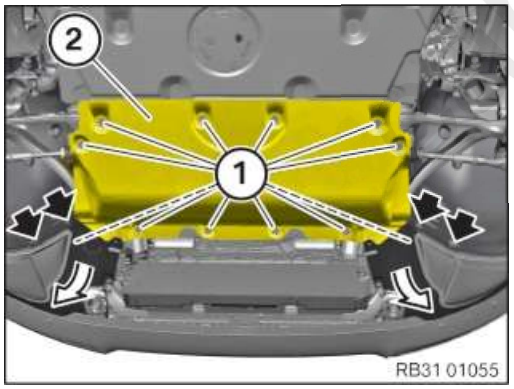


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

16 – Remove the underbody protection of the steering gear



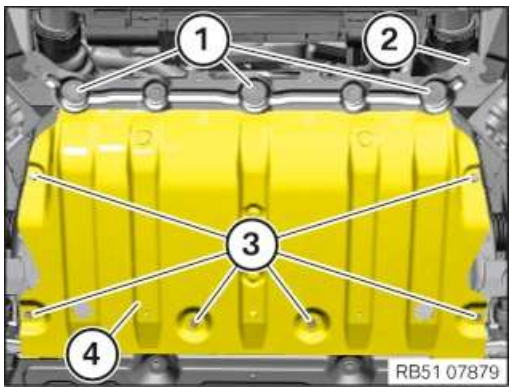
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

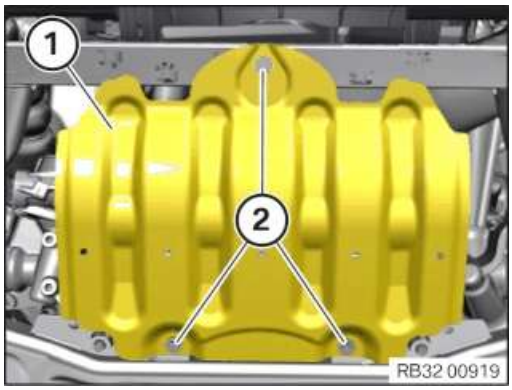
  Slide the steering gear underbody protection (4) out and remove.

17 – If installed: Removing the steering start protection

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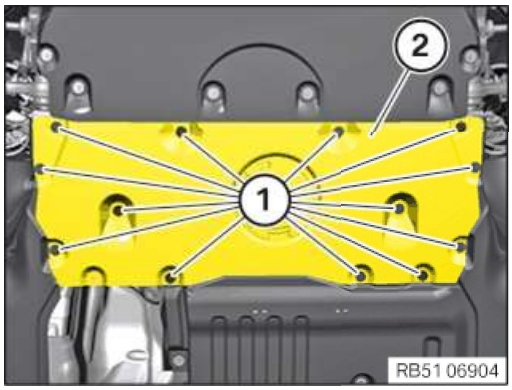
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

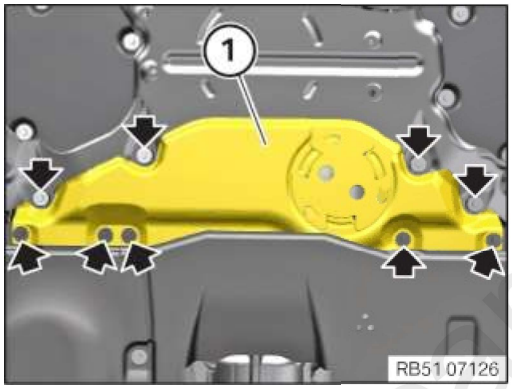
18 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

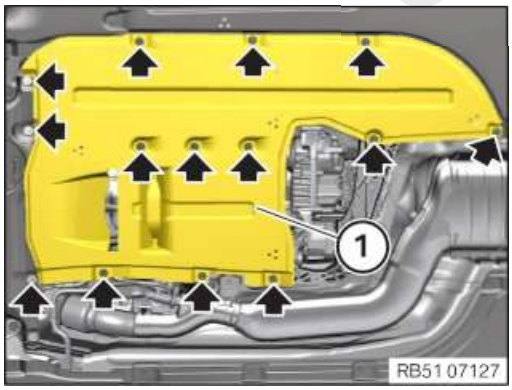


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

19 – Remove rear underbody protection

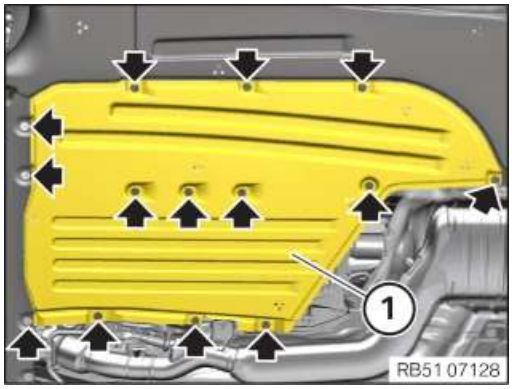


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

20 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

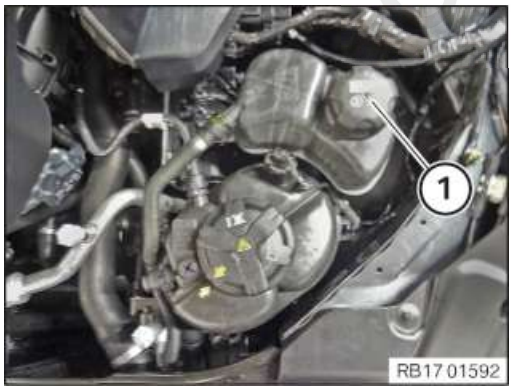
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

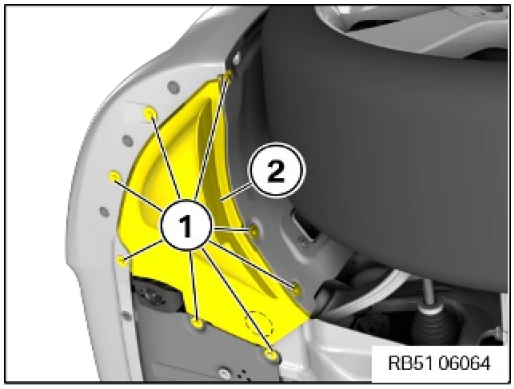
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

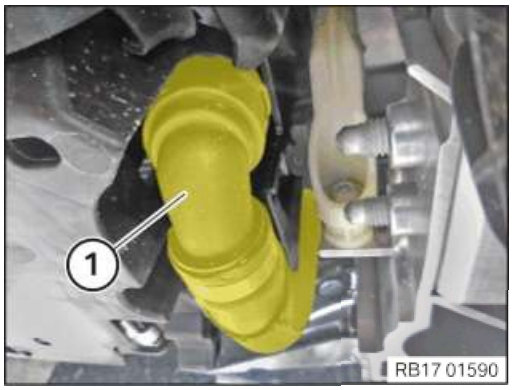


- Loosen sealing cap (1).

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- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

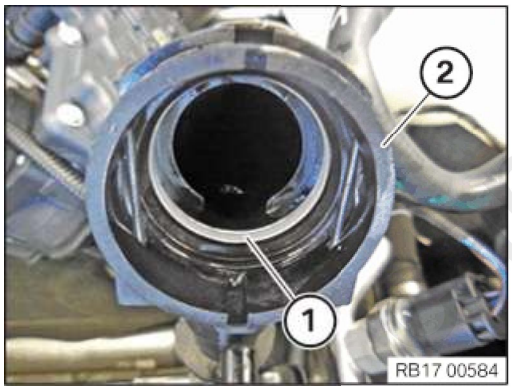


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

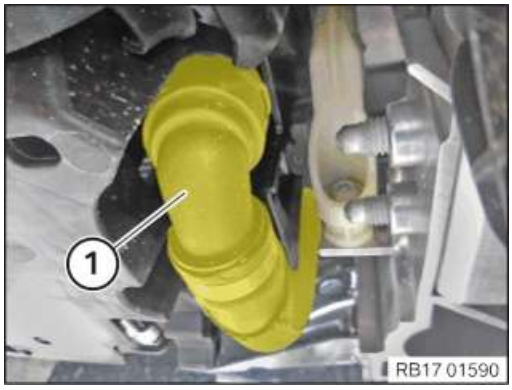
21 – Connecting the coolant lines for the low-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



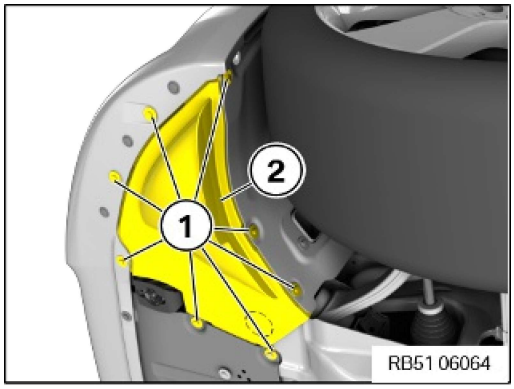
- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.

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- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

22 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

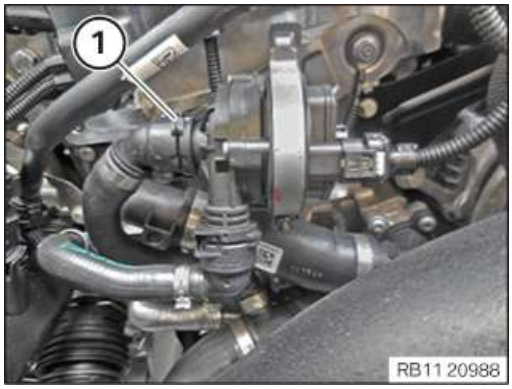
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

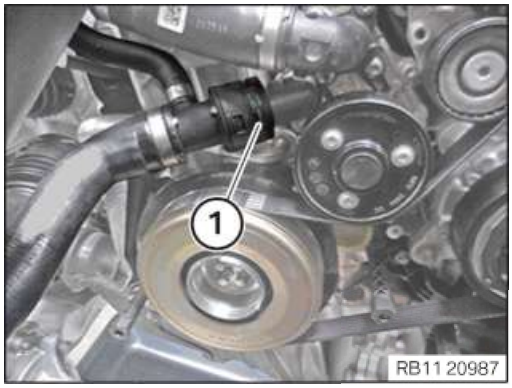


- Loosen sealing cap (1).

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- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

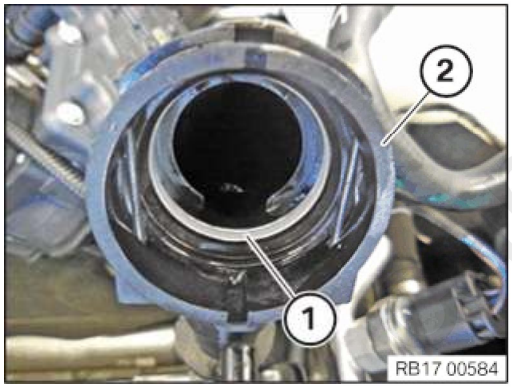


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

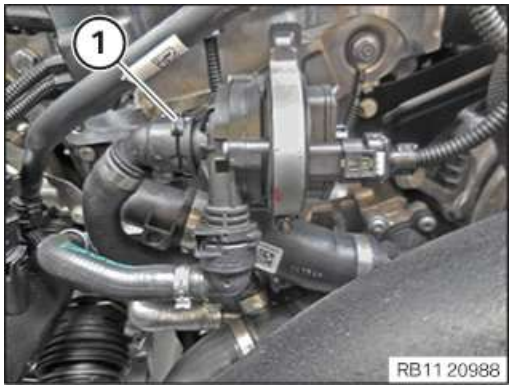
23 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

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- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

24 – Removing the intake plenum

RISK OF DAMAGE

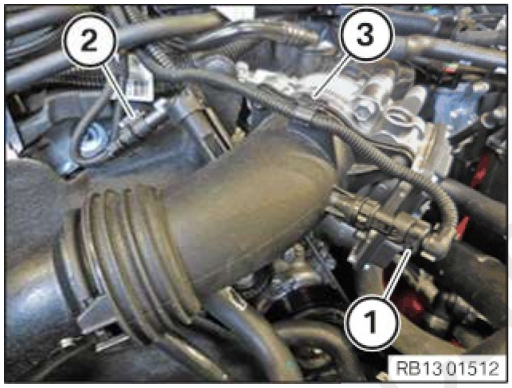
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

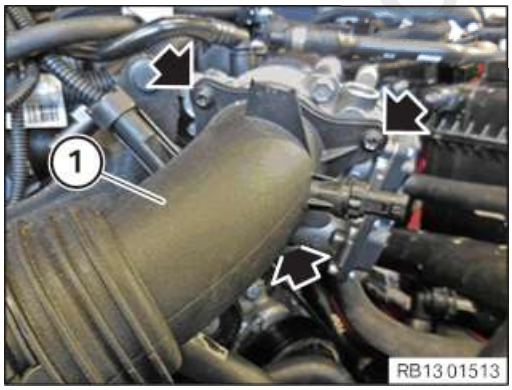
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

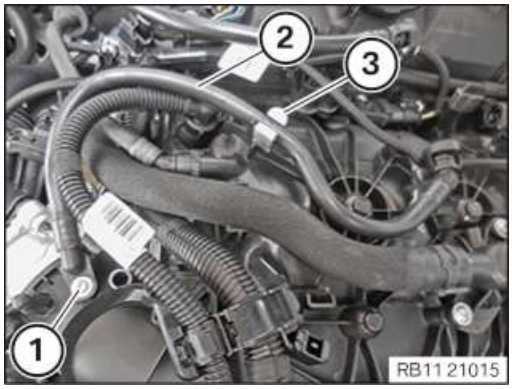
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



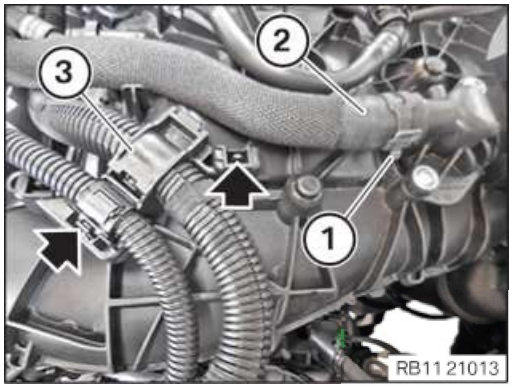
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).



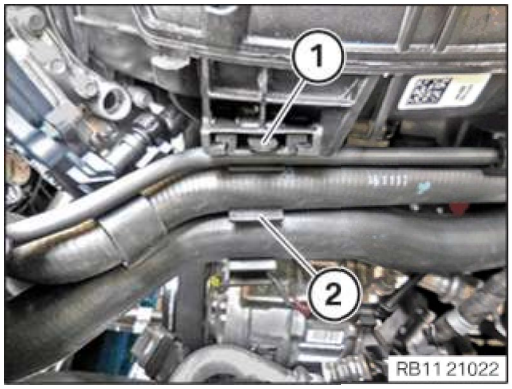
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



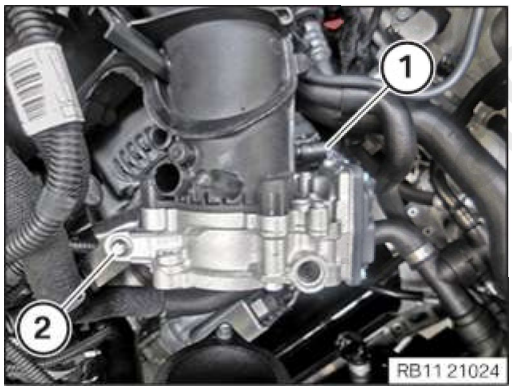
- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



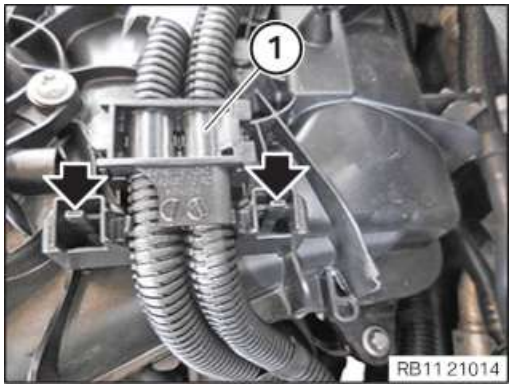
- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.



- Unlock the lock (1).
- Thread out holder (2) and set aside.

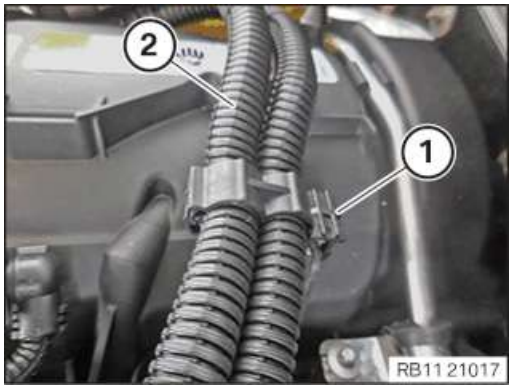


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).



- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.

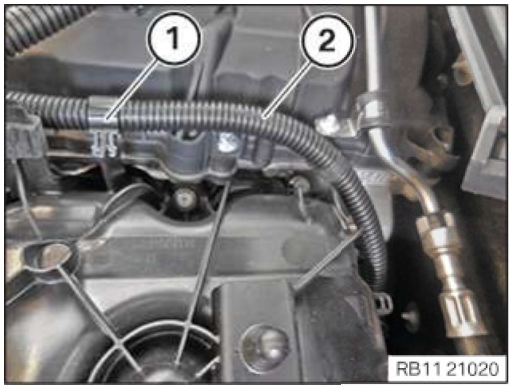
mdiagn.com



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



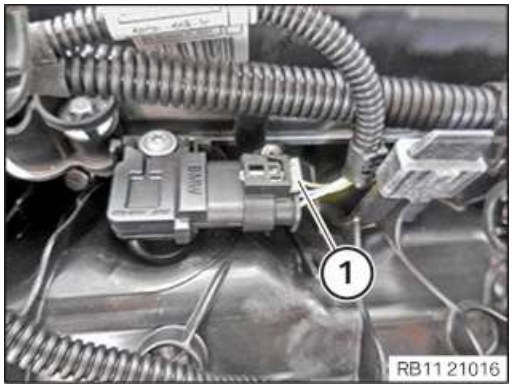
- Guide tank ventilation line (1) out of clamp (2) and place it aside.



- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

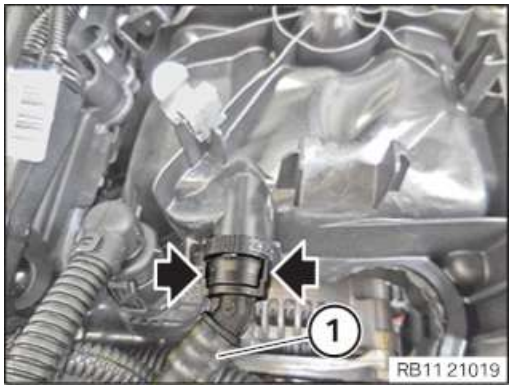


- Loosen screw (1).



- Unlock plug connection (1) and disconnect.

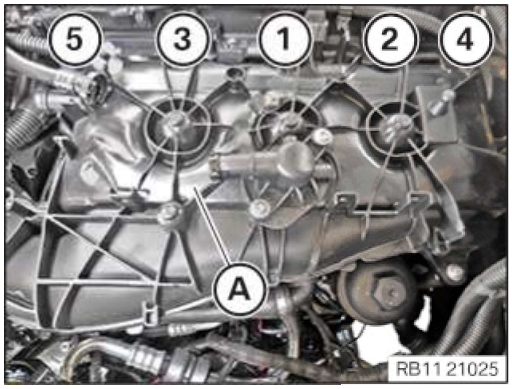
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- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

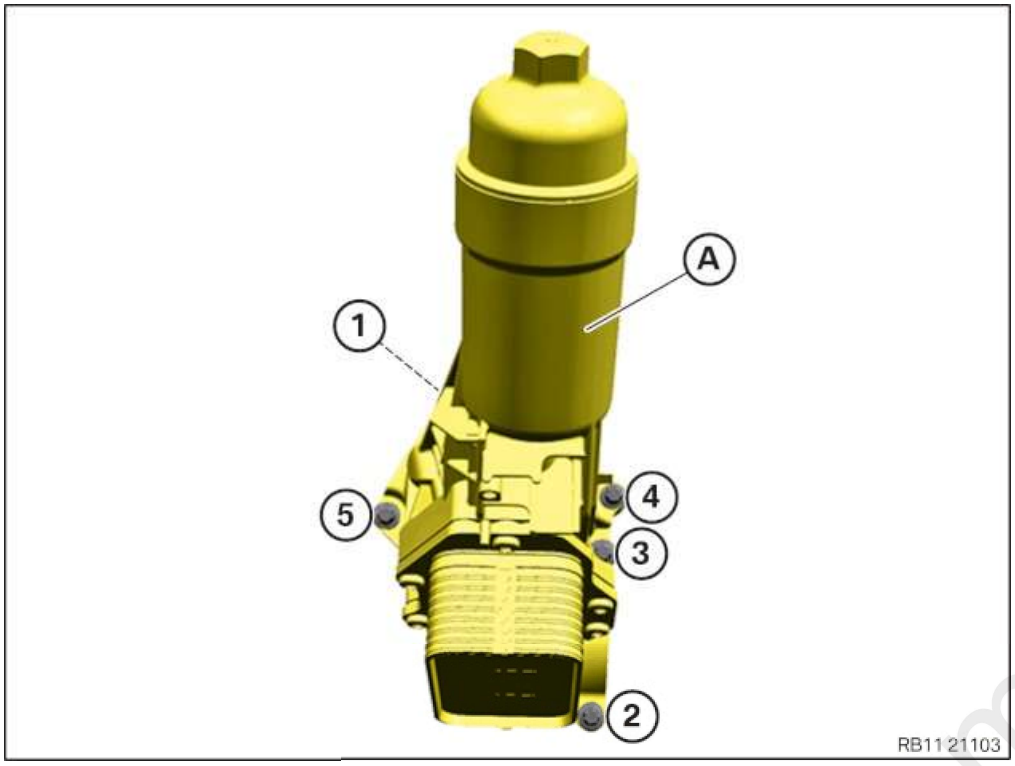
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

25 – Remove the complete full-flow oil filter

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Full-flow oil filter



A Full-flow oil filter

1 to 5 Bolts

Prerequisite

Disconnect all batteries.

RISK OF DAMAGE

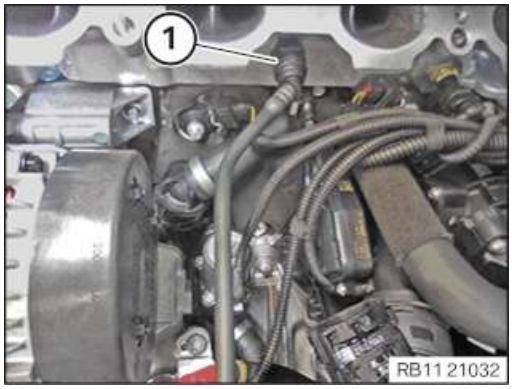
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

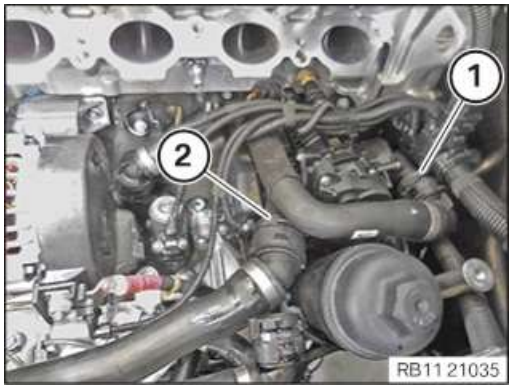
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

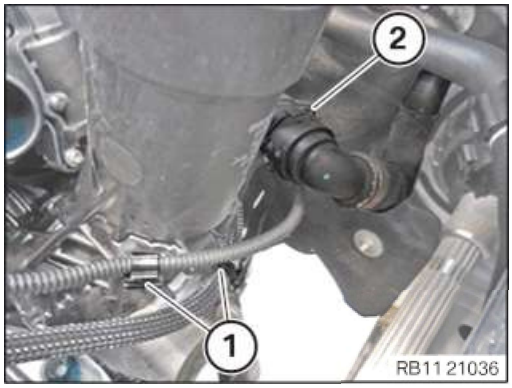


- Unlock and loosen coolant line (1).

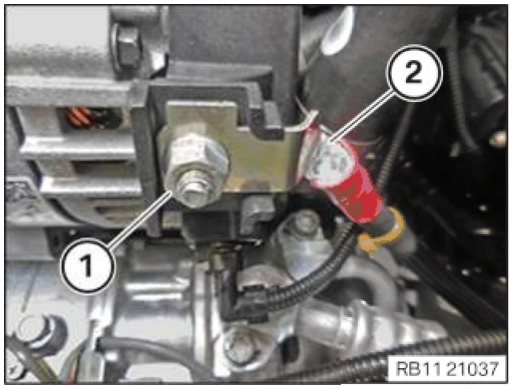
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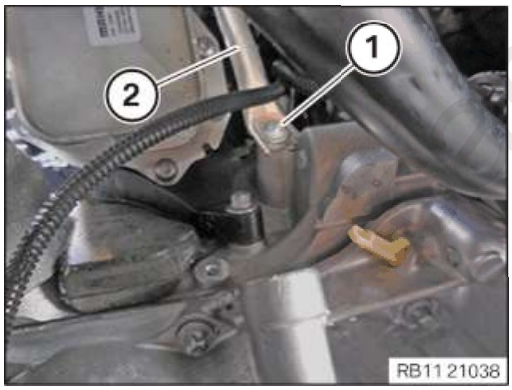
- Unlock and loosen coolant line (1).
- Unlock and loosen coolant line (2).
- Catch and dispose of escaping coolant.



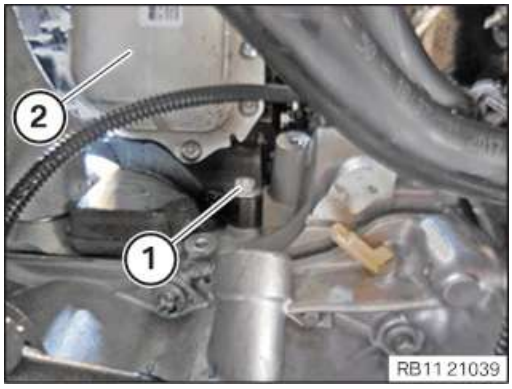
- Loosen clamps (1).
- Unlock and loosen coolant line (2).
- Catch and dispose of escaping coolant.



- Unfasten nut (1).
- Thread out positive battery cable (2) and set it aside.

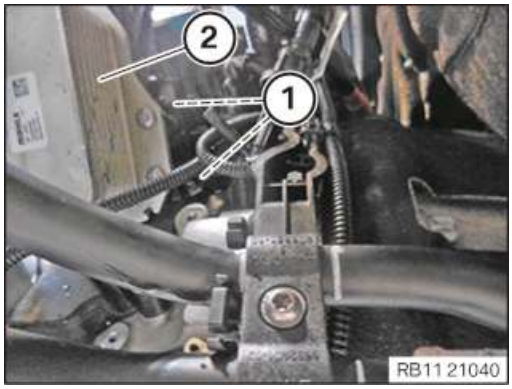


- Loosen screw (1).
- Guide out and remove manifold support (2).

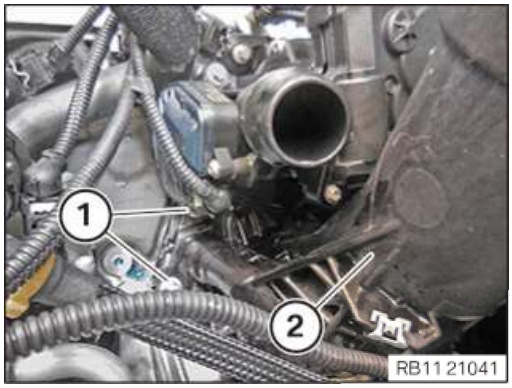


- Release screw (1) on full-flow oil filter (2).

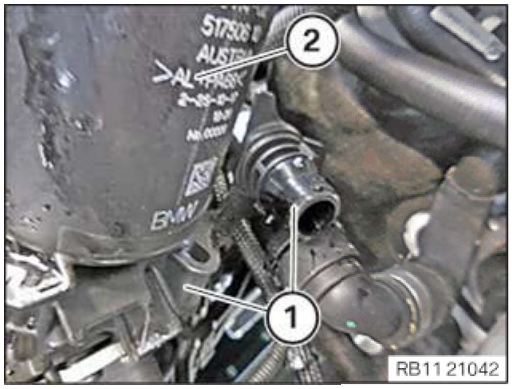
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- Loosen the screws (1) on the full-flow oil filter (2).



- Loosen the screws (1) on the full-flow oil filter (2).



- Guide out coolant line (1) on full-flow oil filter (2) and place it aside.
- Guide out and remove the full-flow oil filter (2).

MAIN WORK

26 – Remove heat management module

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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RISK OF DAMAGE

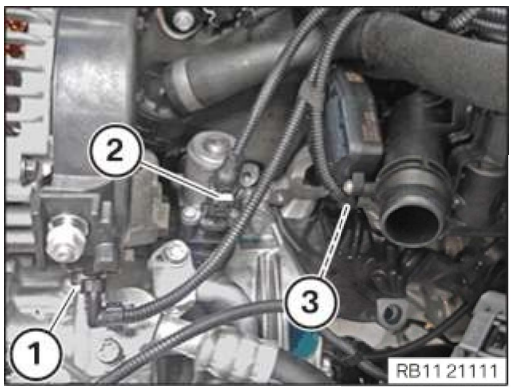
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

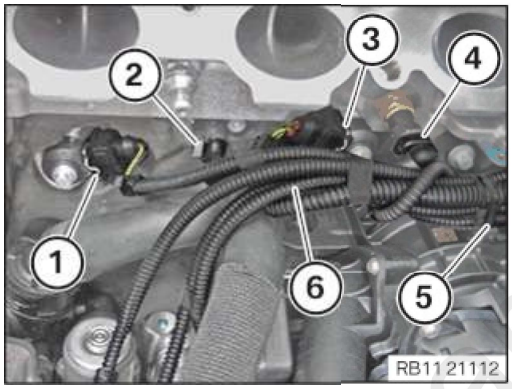
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

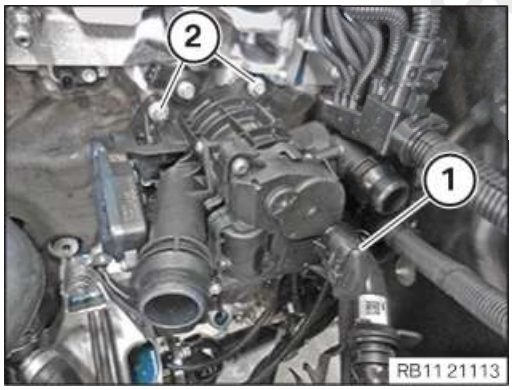
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Unlock and disconnect plug connections (1) to (3).



- Unlock and disconnect plug connections (1) to (4).
- Loosen clamp (5).
- Guide out the wiring harness section (6) for sensor system 1 and place to one side.



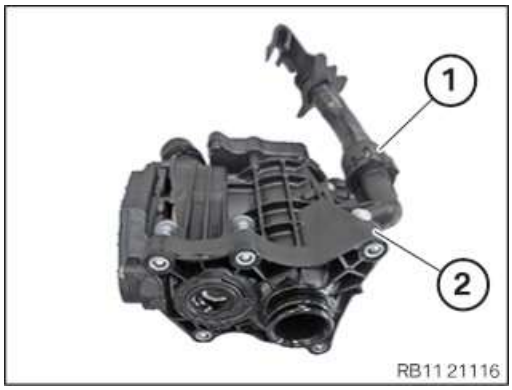
- Unlock plug connection (1) and disconnect.
- Loosen screws (2).



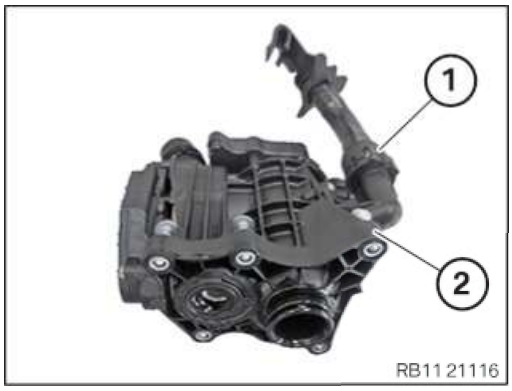
- Loosen screws (1).
- Feed out and remove the heat management module .
- Catch and dispose of escaping coolant.

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27 – Replacing the heat management module



- Unlock coolant line (1) on heat management (2) and release it.

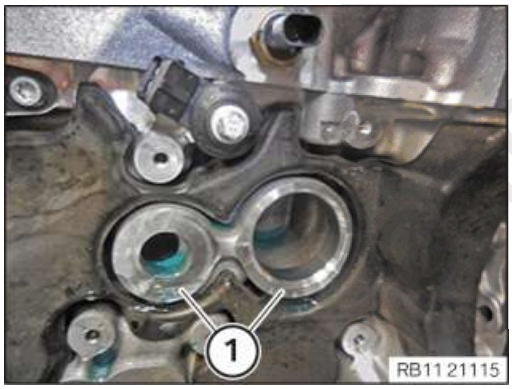


- Guide in coolant line (1) on heat management (2) and install it.
- Make sure that the cooling line (1) engages audibly.

28 – Install heat management module

TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.



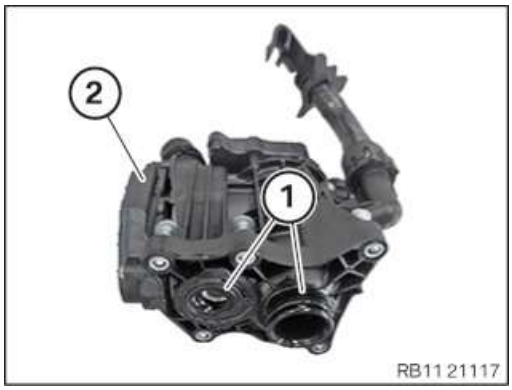
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

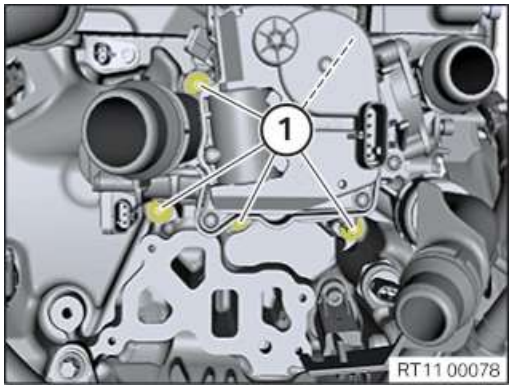
- Clean sealing surfaces (1) on the crankcase with the special tool 0 495 102 (11 4 470).



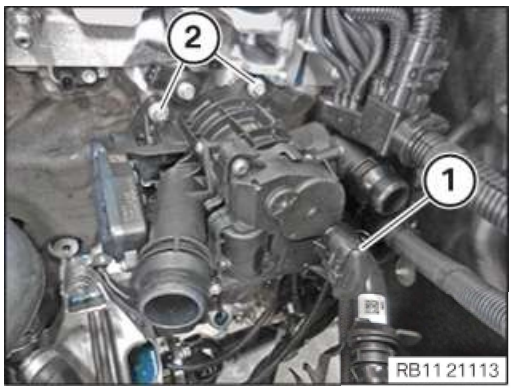
- Renew the sealing rings (1).

  Parts: Sealing ring

- Guide in and install sealing rings (1) on heat management module (2).



- Position the heat management module correctly.
- Hand-tighten the bolts (1).

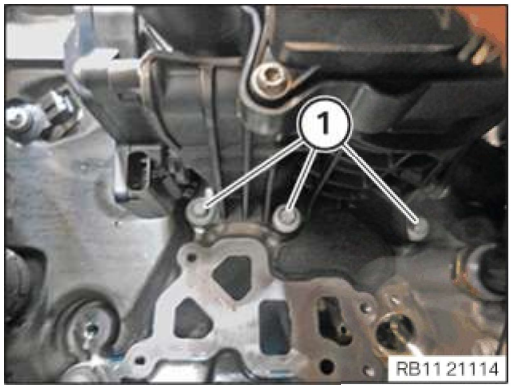


- Tighten the screws (2).

Heat exchange module to crankcase

M6		Tightening torque	9 Nm

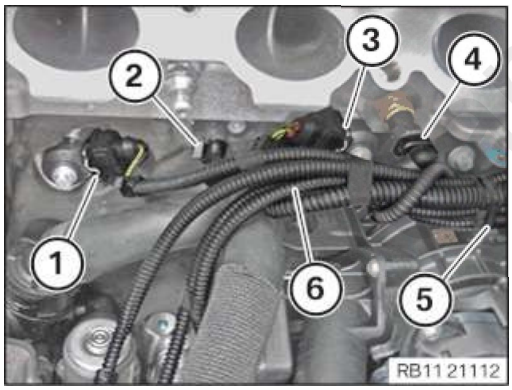
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Tighten the screws (1).

Heat exchange module to crankcase

M6		Tightening torque	9 Nm



RISK OF DAMAGE

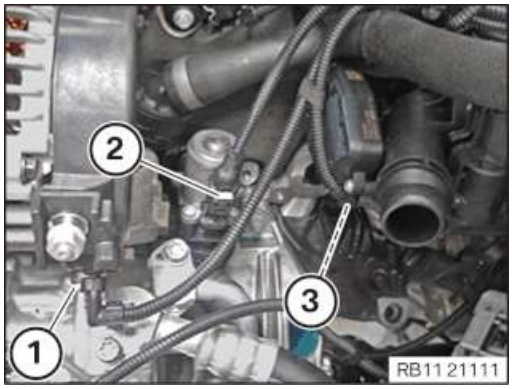
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

- Guide in and position wiring harness section (6) for sensor system 1.
- Secure clamps (5).
- Connect and lock connectors (1) to (4).
- Ensure that connectors (1) to (4) engage audibly.

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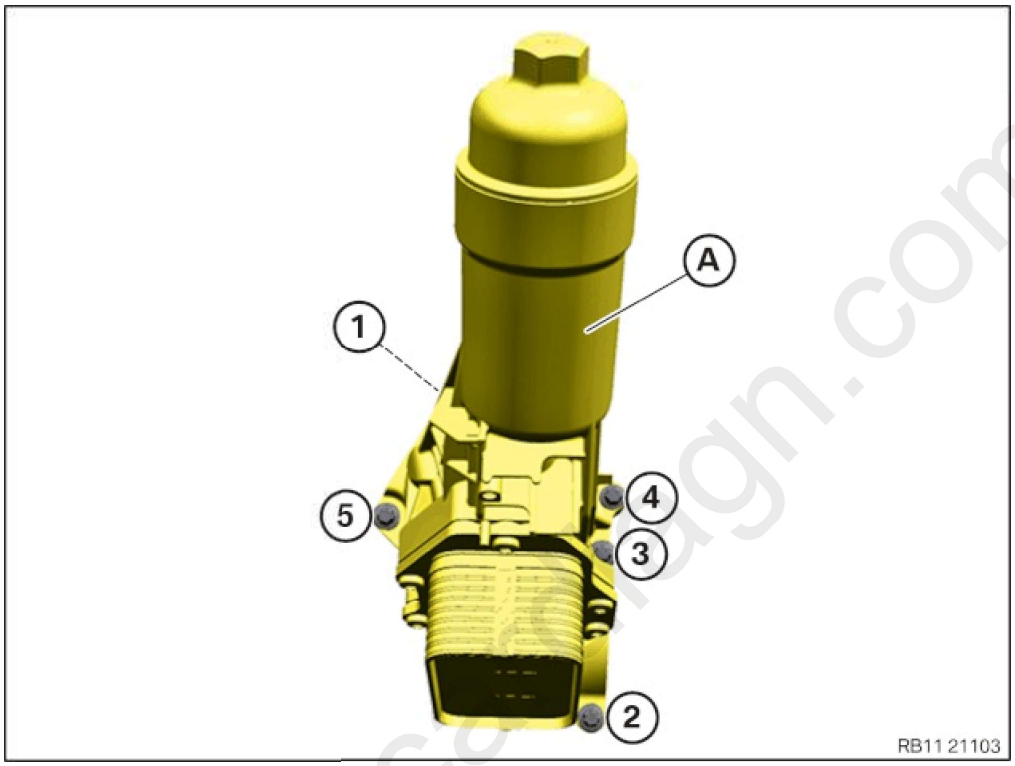


- Connect and lock connectors (1) to (3).
- Ensure that connectors (1) to (3) engage audibly.

POSTPROCESSES

29 – Install the complete full-flow oil filter

Full-flow oil filter

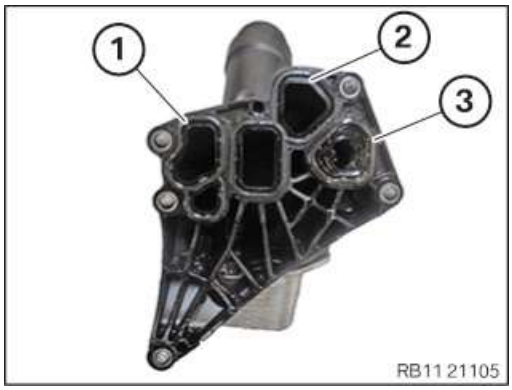


A Full-flow oil filter

1 to 5 Bolts

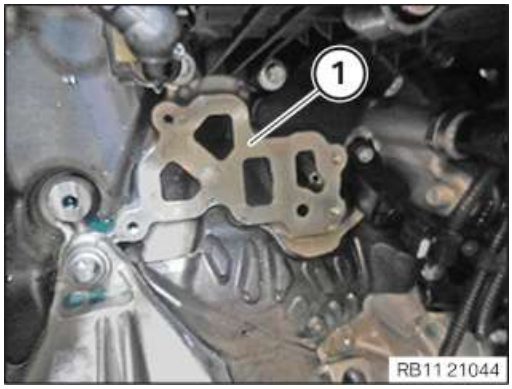
TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.



- Renew the gaskets (1), (2) and (3) on the full-flow oil filter.

  Parts: Seals



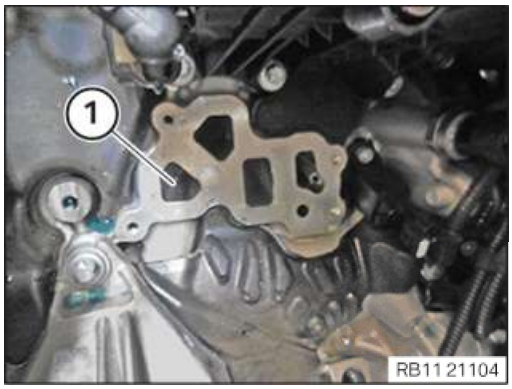
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean any sealing residue on sealing surface (1) on the crankcase with the special tool 0 495 102 (11 4 470).



- Have a cleaning cloth ready.

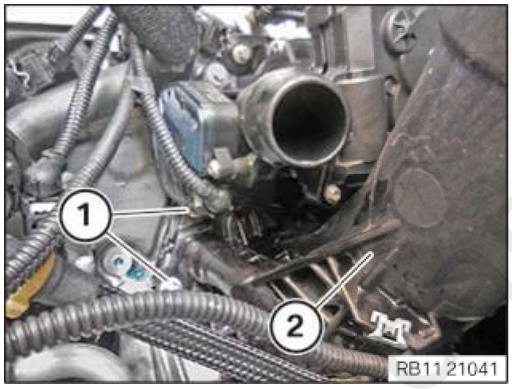
RISK OF DAMAGE

Damage to the engine.

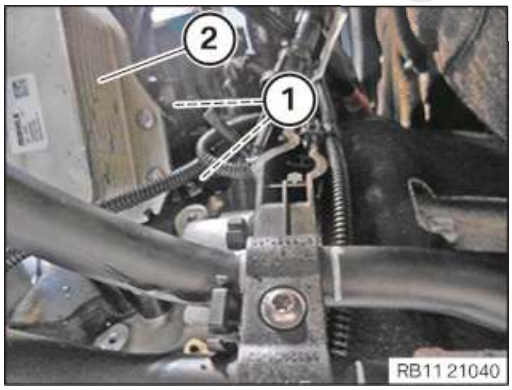
The engine may be damaged if it is manually rotated in the wrong direction.

- Always rotate the engine in the correct direction of rotation by hand: a) Clockwise, facing the vibration damper or b) Counter-clockwise, facing the chain drive. (b) only applies when the rear timing chain is installed.

- Crank the engine with the special tool 0 493 380 (11 6 480) until the engine oil flows in the area of oil duct (1).

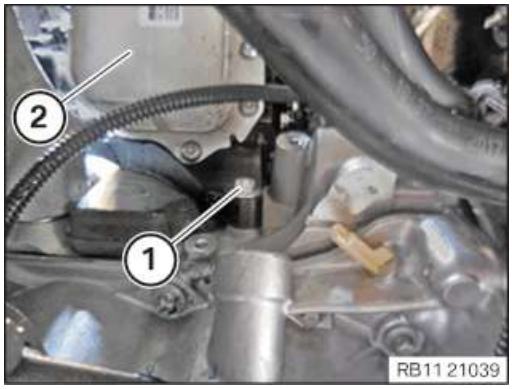


- Install full-flow oil filter (2) from the top and position it.
- Hand-tighten the bolts (1).

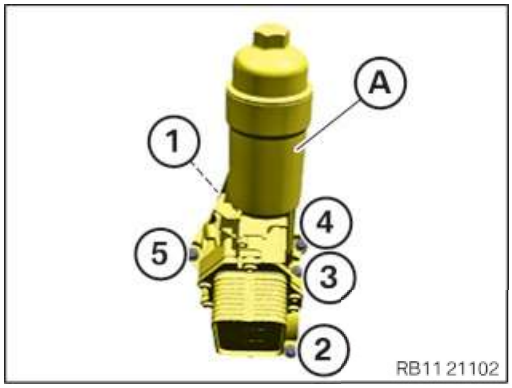


- Apply the screws (1) on the full-flow oil filter (2) hand-tight.

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- Apply the screws (1) on the full-flow oil filter (2) hand-tight.



TECHNICAL INFORMATION

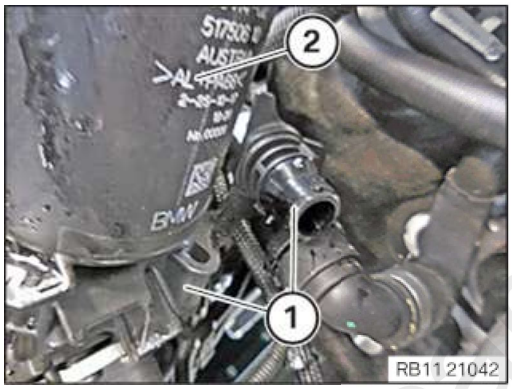
When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

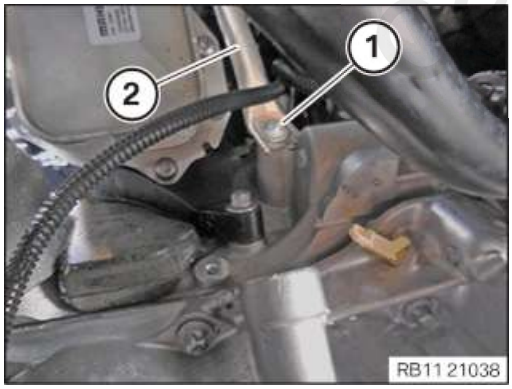
- Tighten the screw on full-flow oil filter (A) in the (1) to (5) order.

Full-flow oil filter to crankcase

M6	Observe tightening sequence.	Jointing torque Tightening torque	4 Nm 10 Nm



- Guide in and install coolant line (1) on full-flow oil filter (2).

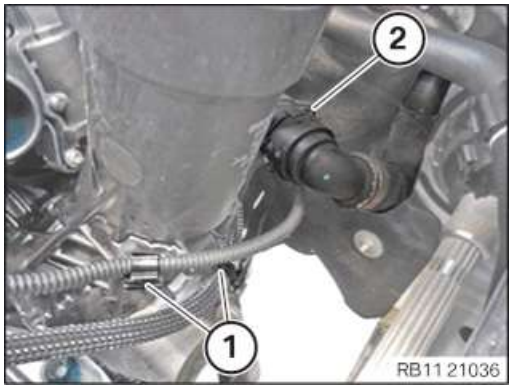


- Guide in and install manifold support (2).
- Tighten down screw (1).

Manifold support to crankcase

M6x16		Tightening torque	8 Nm

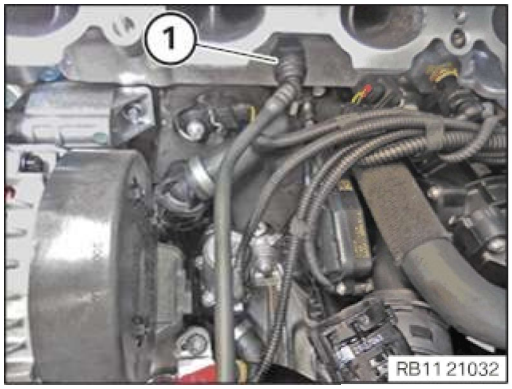
carsdiagn.com



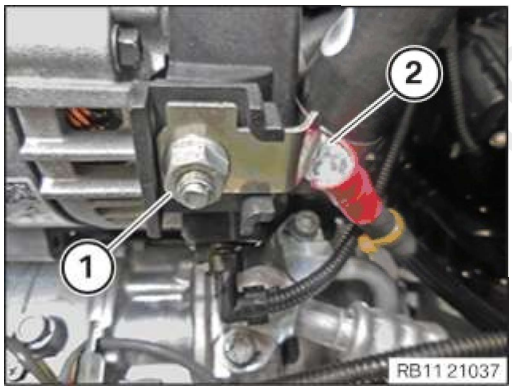
- Secure clamps (1).
- Connect and lock coolant line (2).
- Make sure that the cooling line (2) engages audibly.



- Connect and lock coolant line (1).
- Connect and lock coolant line (2).
- Make sure that you can hear coolant lines (1) and (2) engage.



- Feed in and install coolant line (1).
- Make sure that the cooling line (1) engages audibly.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

- Insert and install the positive battery cable (2).
- Tighten nut (1).

Positive battery cable to the alternator

M8		Tightening torque	19 Nm

30 – Installing the oil filter element

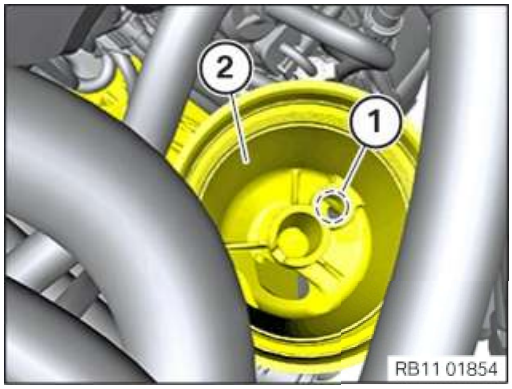
mdiagn.com

RISK OF DAMAGE

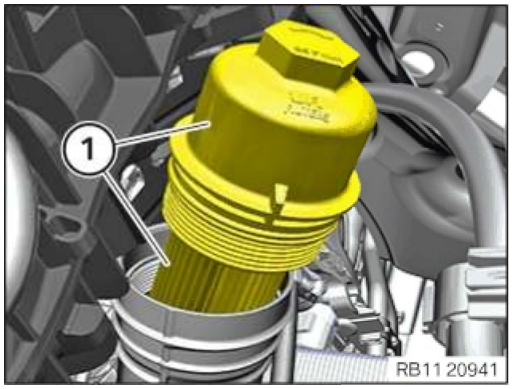
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



- Position the oil filter cover with the oil filter element in guide bore hole (1) in oil filter housing (2).



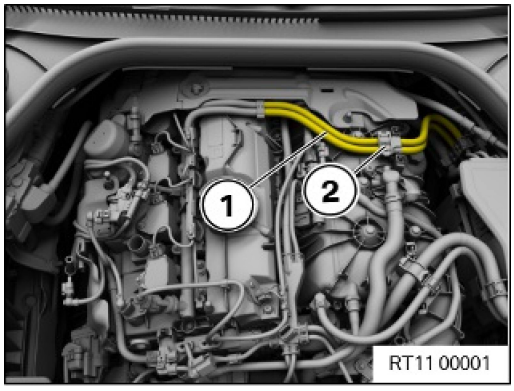
- Install the oil filter cover (1) including oil filter element.



- Tighten the oil filter cover (1).

Oil filter cover to oil filter module

O-ring lightly oiled.	Tightening torque	25 Nm



- Clip in the engine wiring harness (1) in the holder (2).

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RISK OF DAMAGE

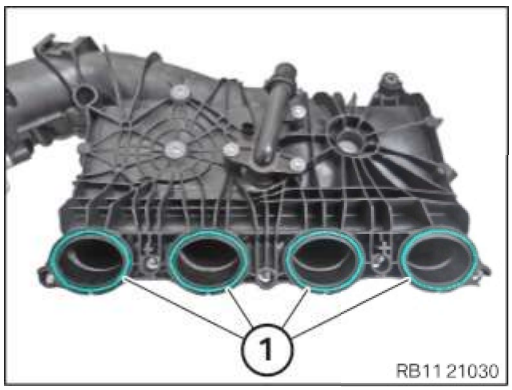
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

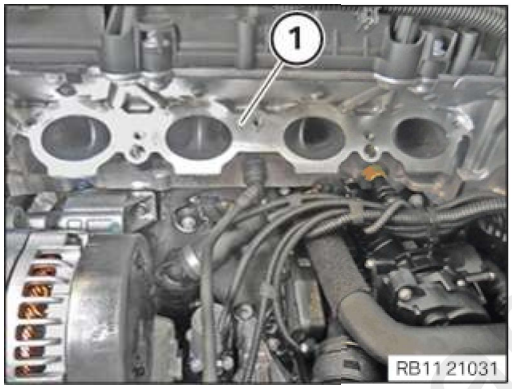
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

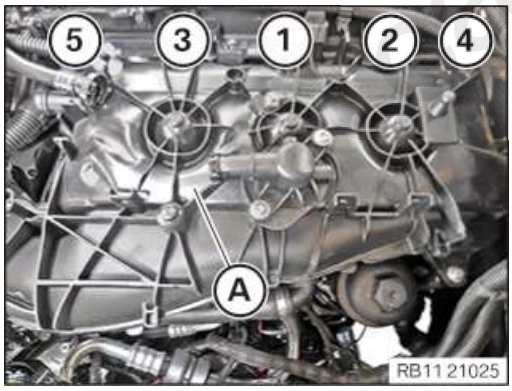


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm

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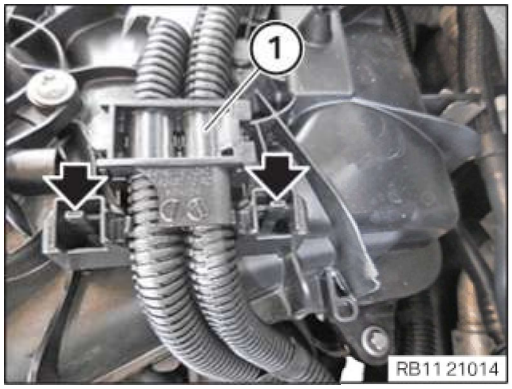
- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.



- Tighten down screw (1).

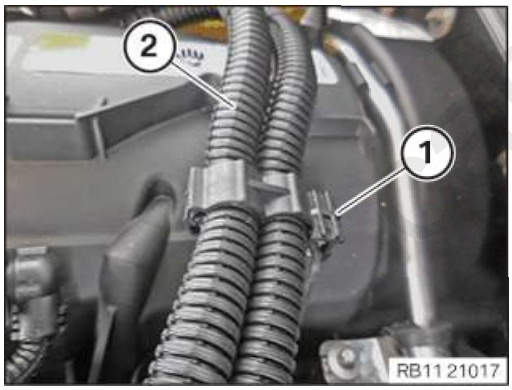
Intake plenum to support

M6X25		Tightening torque	8 Nm

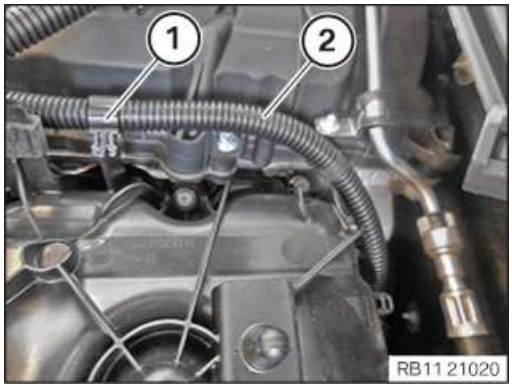


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).

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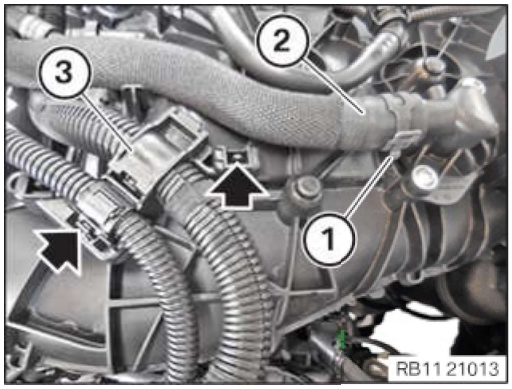
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



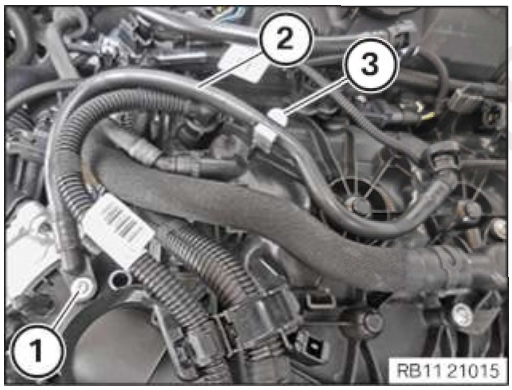
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



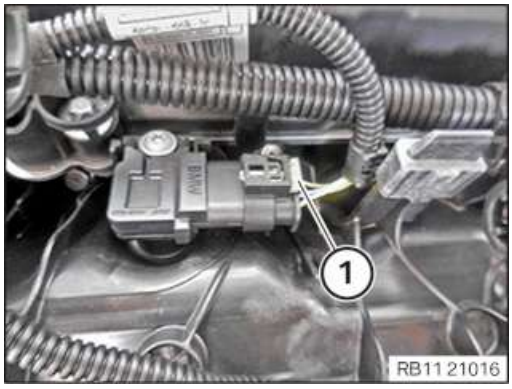
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

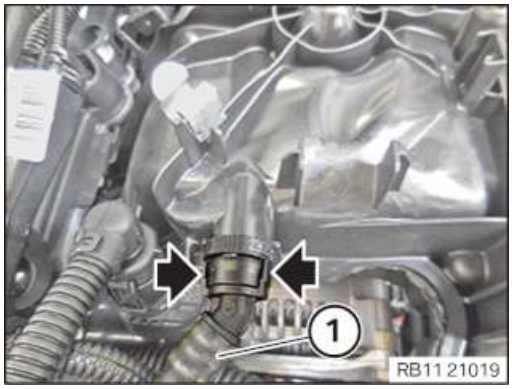
Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

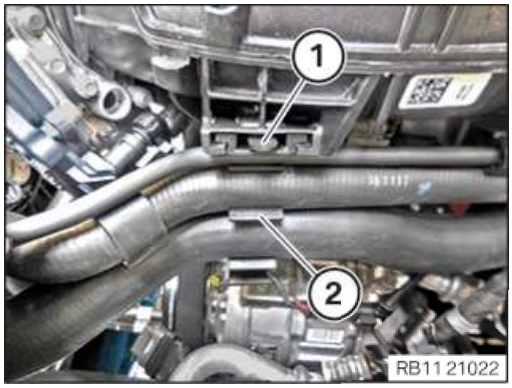
  The connector (1) must engage audibly.

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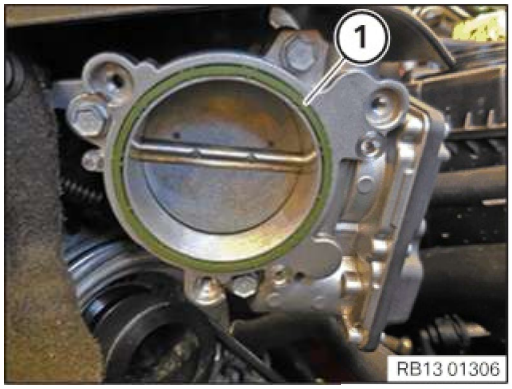


- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

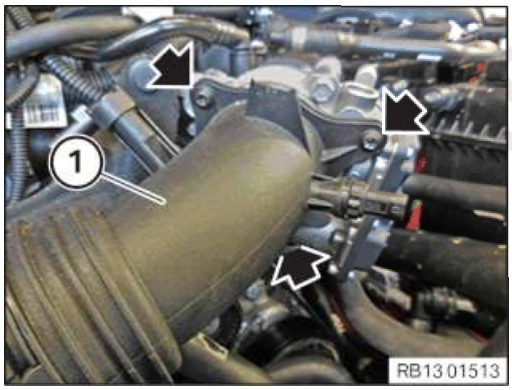


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

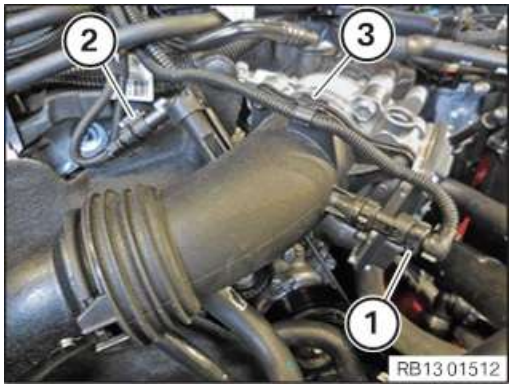
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

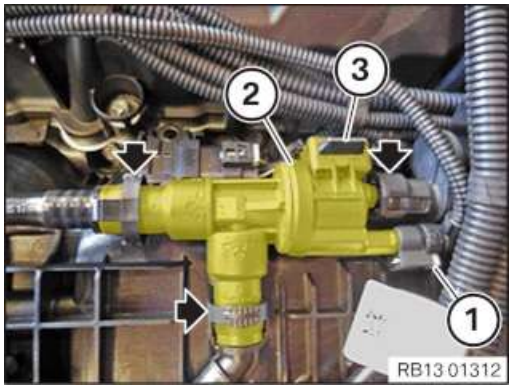
Charge air line to throttle body

M6		Tightening torque	8 Nm



- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

32 – Installing the tank vent valve

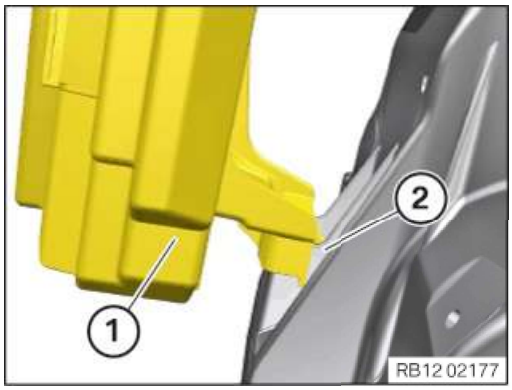


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

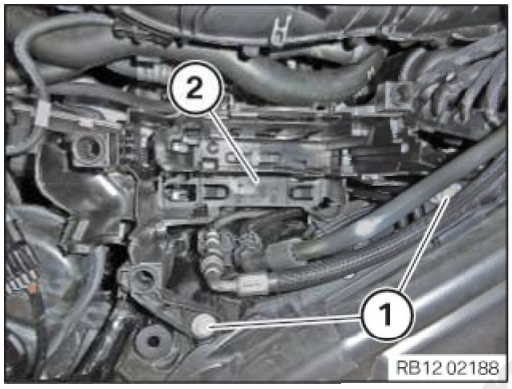
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

33 – Installing the control unit holder



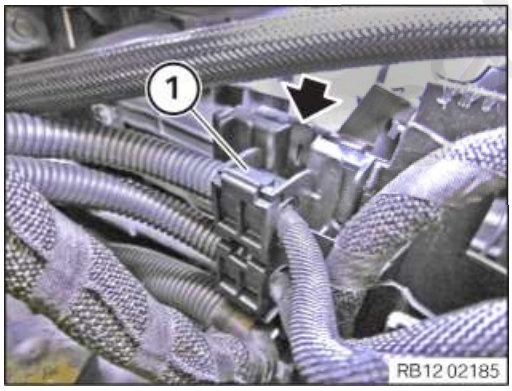
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

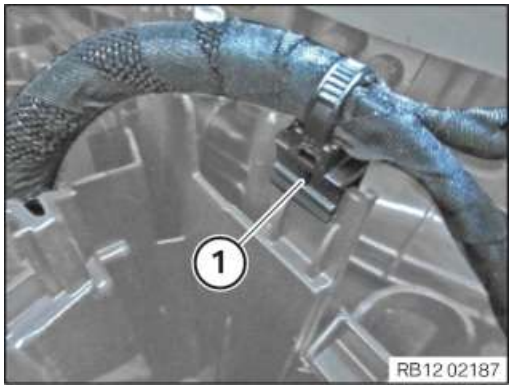
Control unit holder on spring strut dome

Hexagon screw	Tightening torque	8 Nm



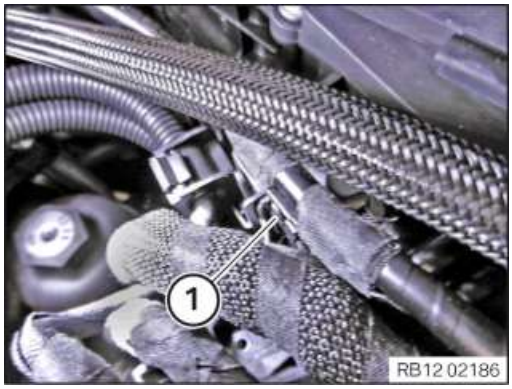
- Feed in and install the cable clip (1).

  Lock (arrow) must audibly engage.

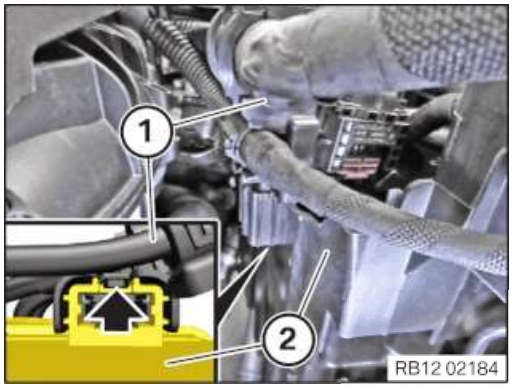


- Secure clamps (1).

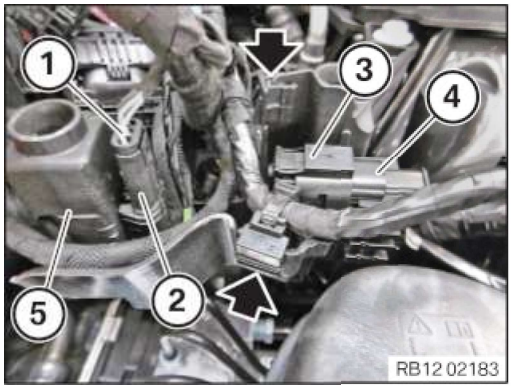
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- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

34 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

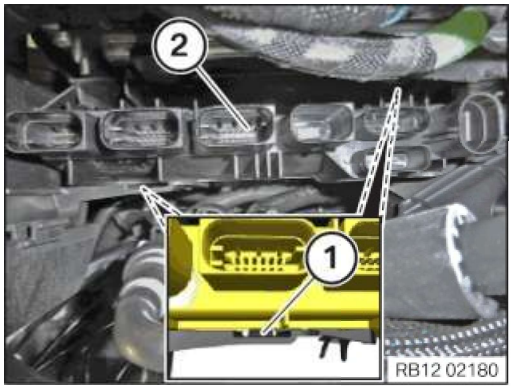
cardiagn.com

RISK OF DAMAGE

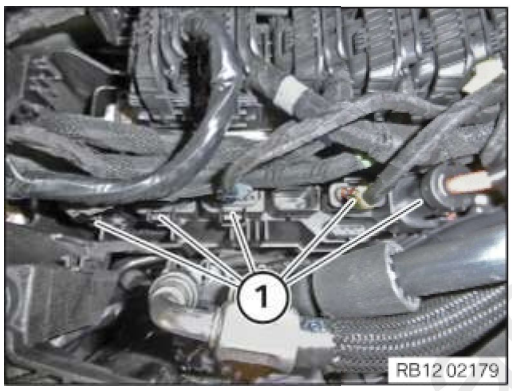
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

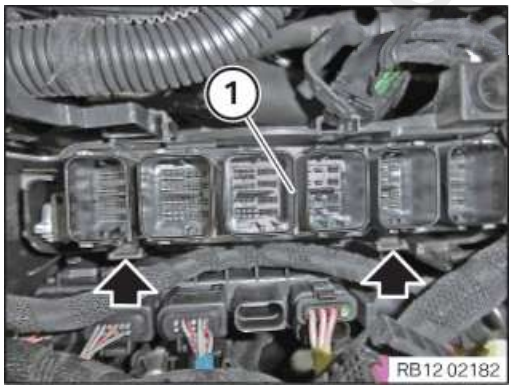


- Insert and install the integrated supply module (PDM) (2).
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



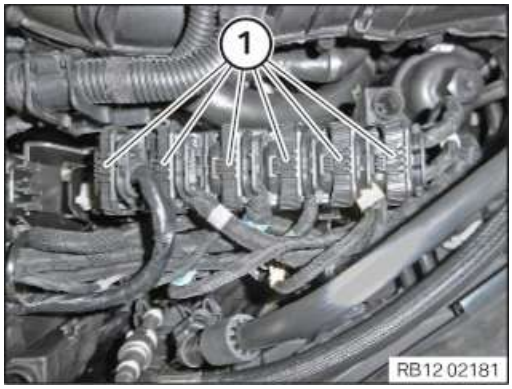
- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

35 – Installing the DME control unit



- Feed in and install DME control unit (1).
  The locks (arrows) must engage audibly.

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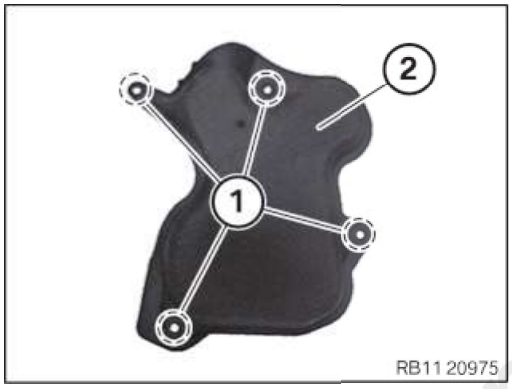
- Connect connectors (1) and lock.

  All connectors (1) must engage audibly.



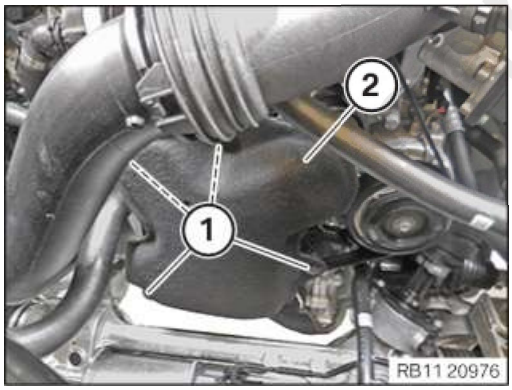
- Insert and install cover (1) into guides.

36 – Install the acoustic cover for the engine at the front

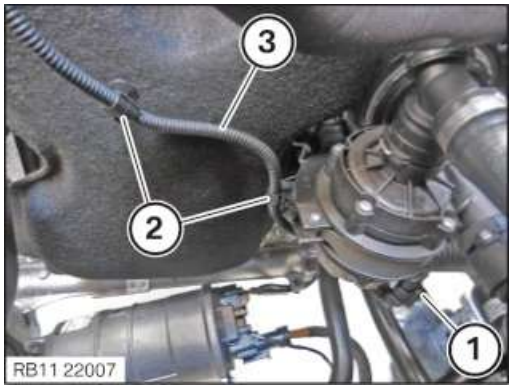


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



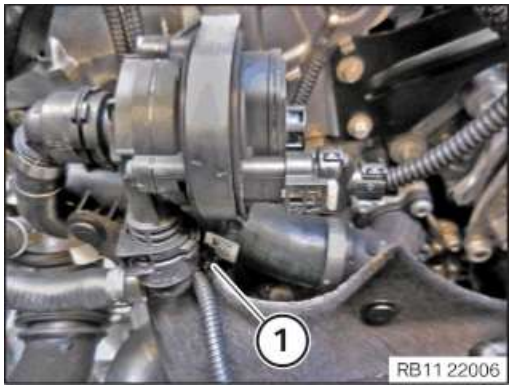
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

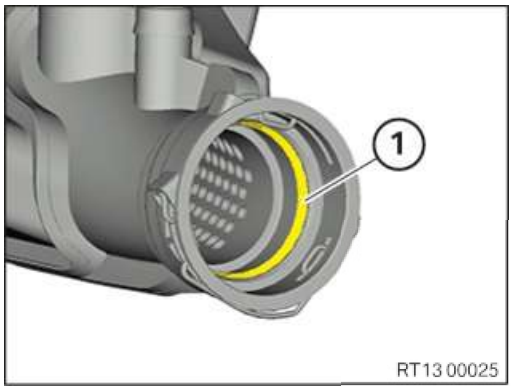
  The connector (1) must engage audibly.

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- Secure clamps (1).

37 – Installing the clean air pipe with resonator

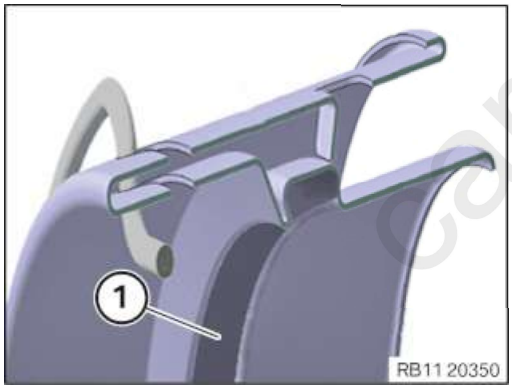


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

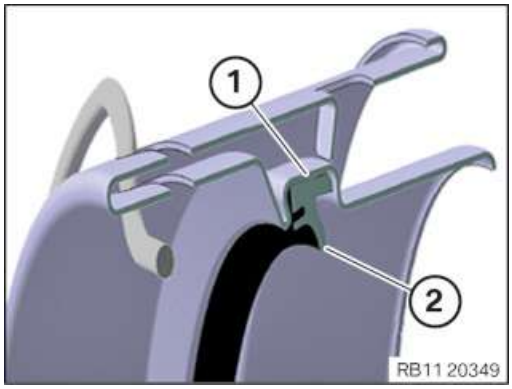
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



- Renew gasket.

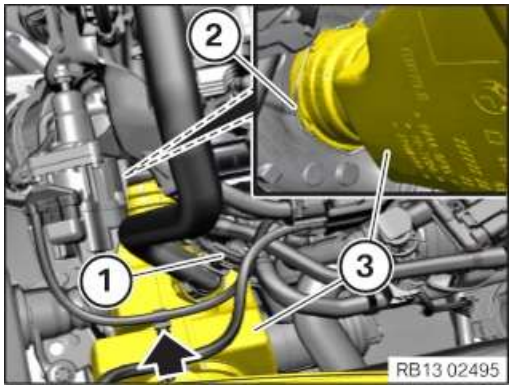
  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).

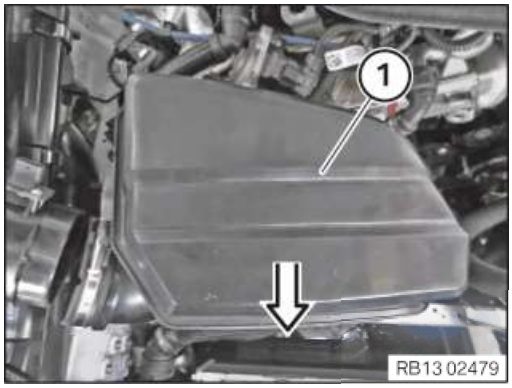
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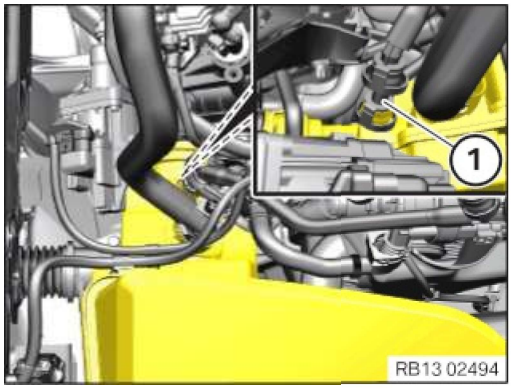
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

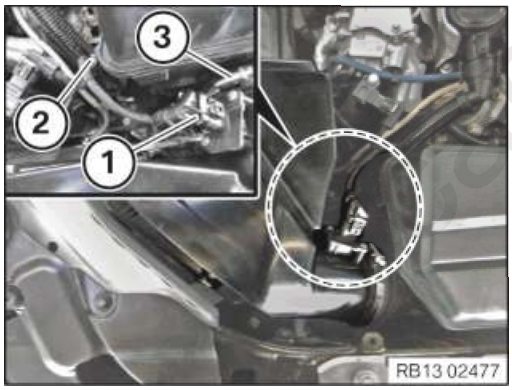
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

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38 – Topping up the engine oil

RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Drain the engine oil.

- Pour in engine oil.

Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l

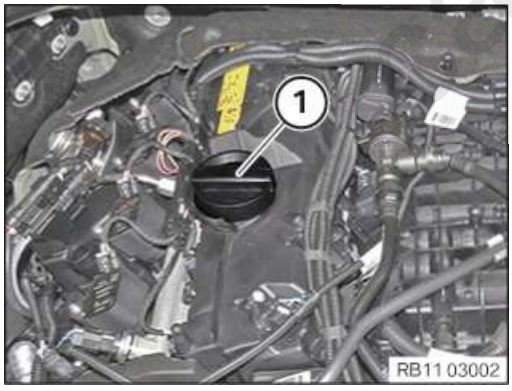
Engine oil: Technically suitable engine oils for BMW Group engines

Engine oil

Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

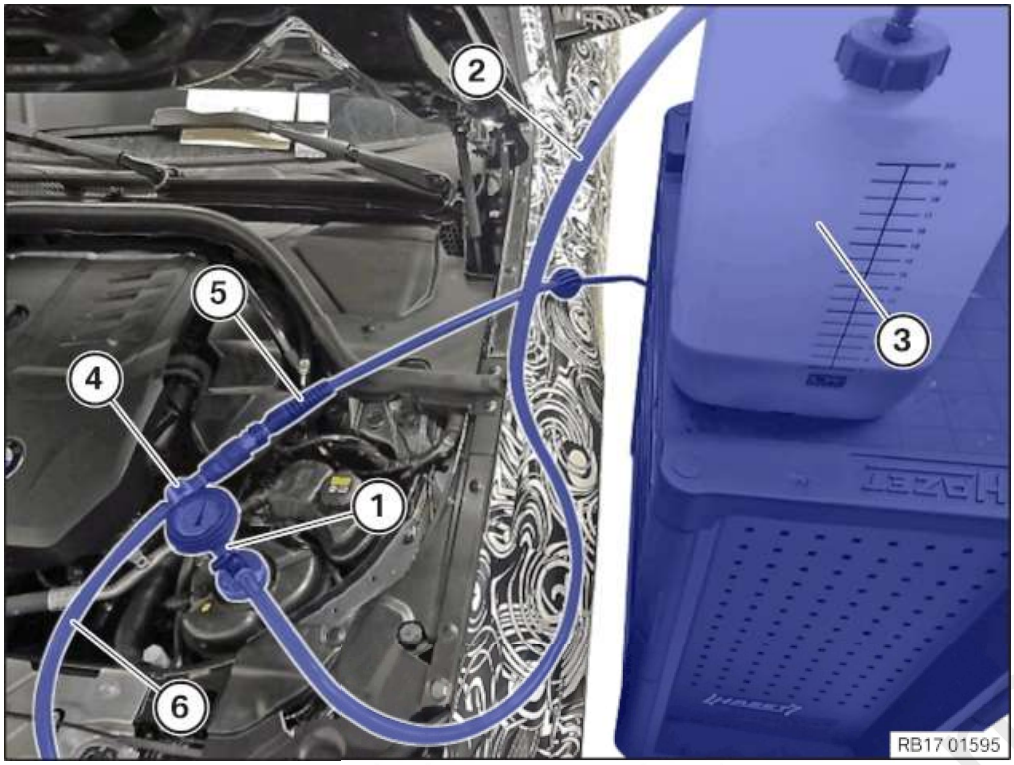
39 – Installing the oil filler cap



- Close oil filler cap (1).

40 – Fill the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

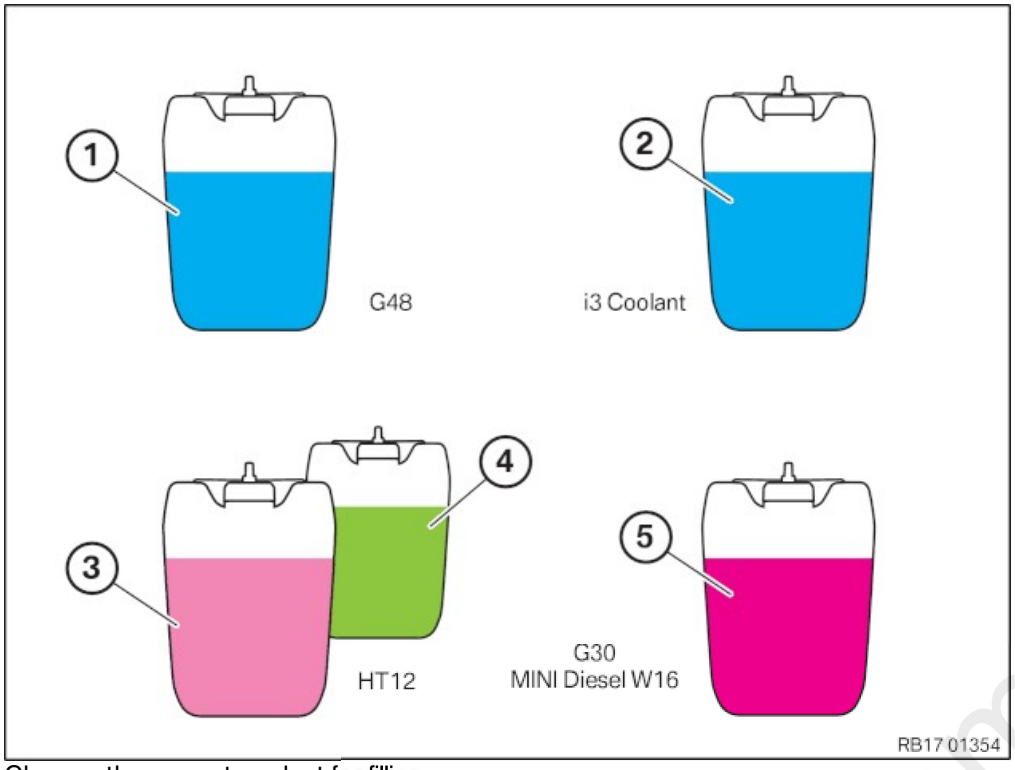
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

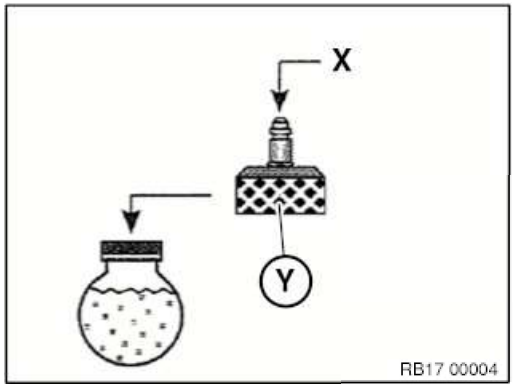
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

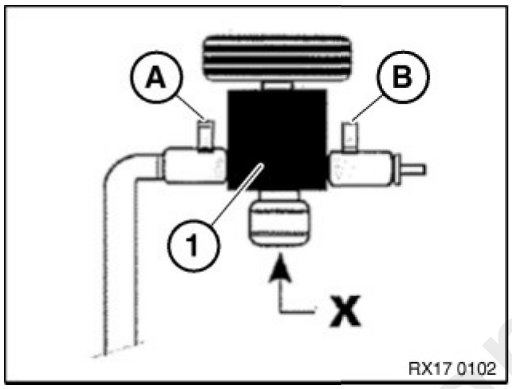
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

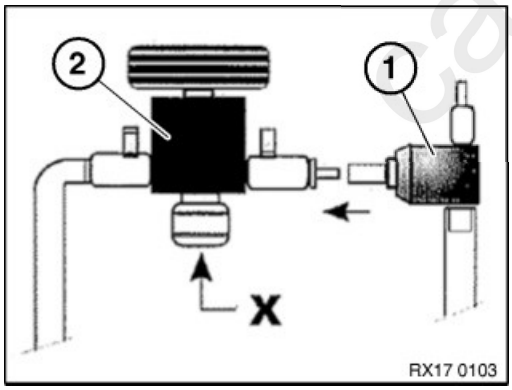
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

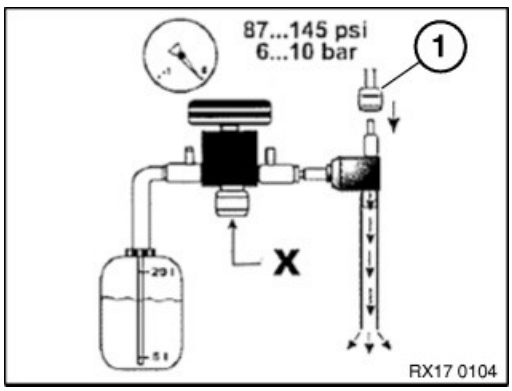


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

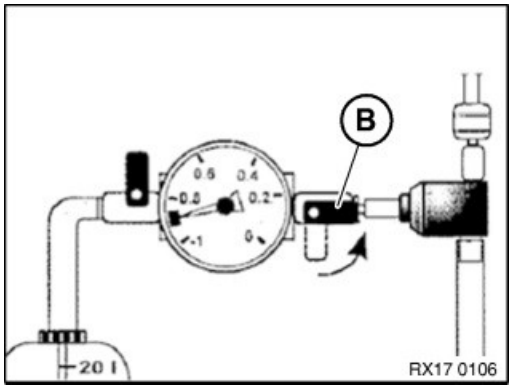
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

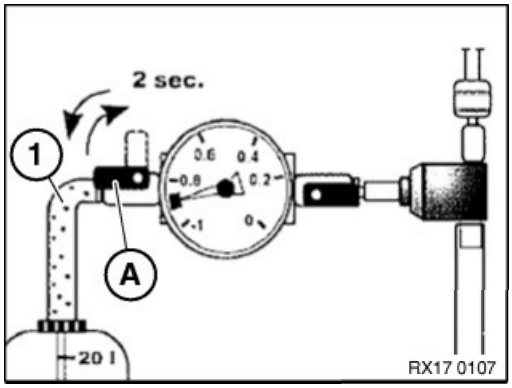
  (X)is the connection on the coolant expansion tank.

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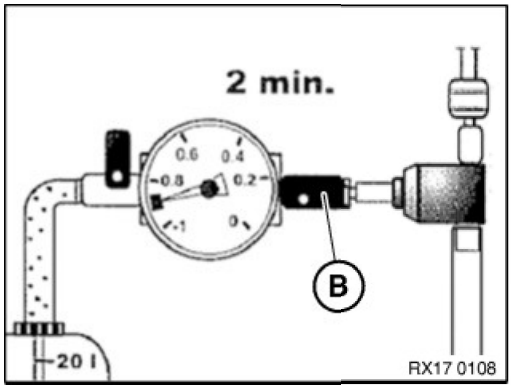
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

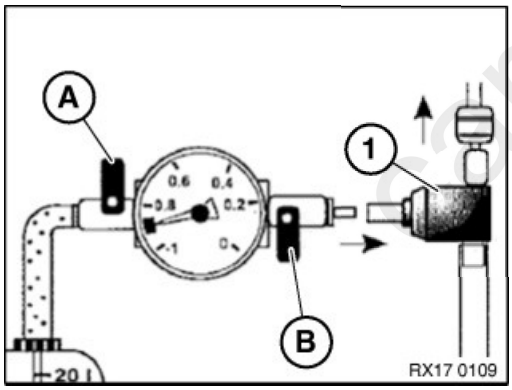


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

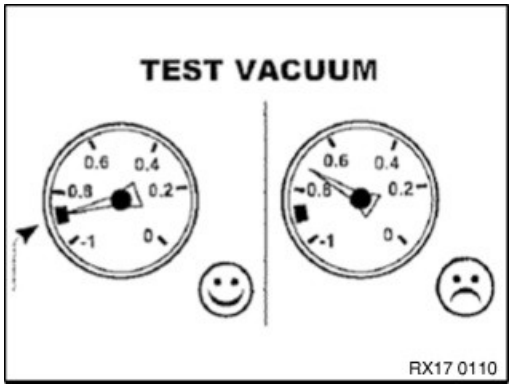
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

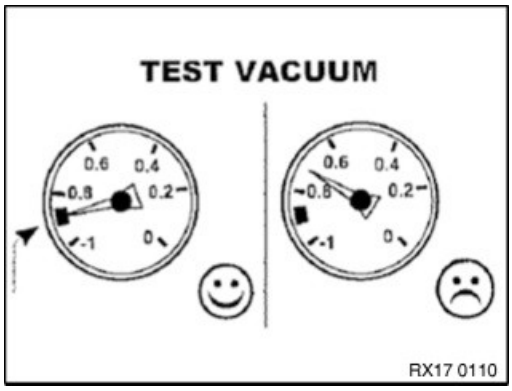
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



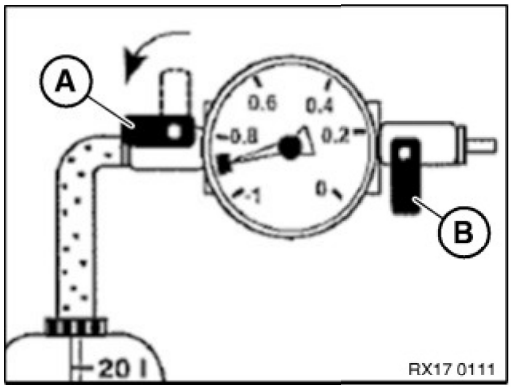
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

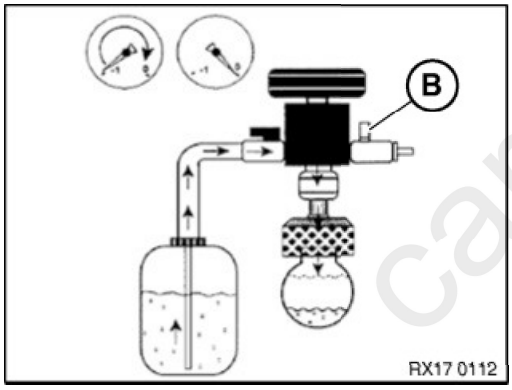
» Vacuum remains constant.

Measure

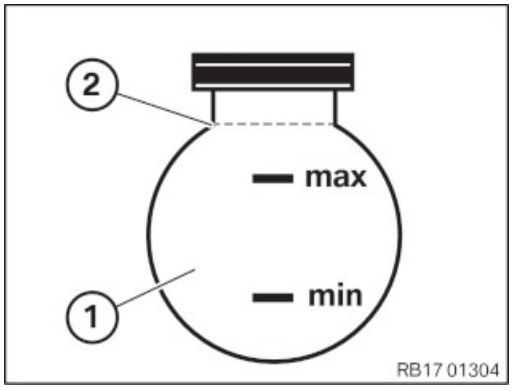
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).

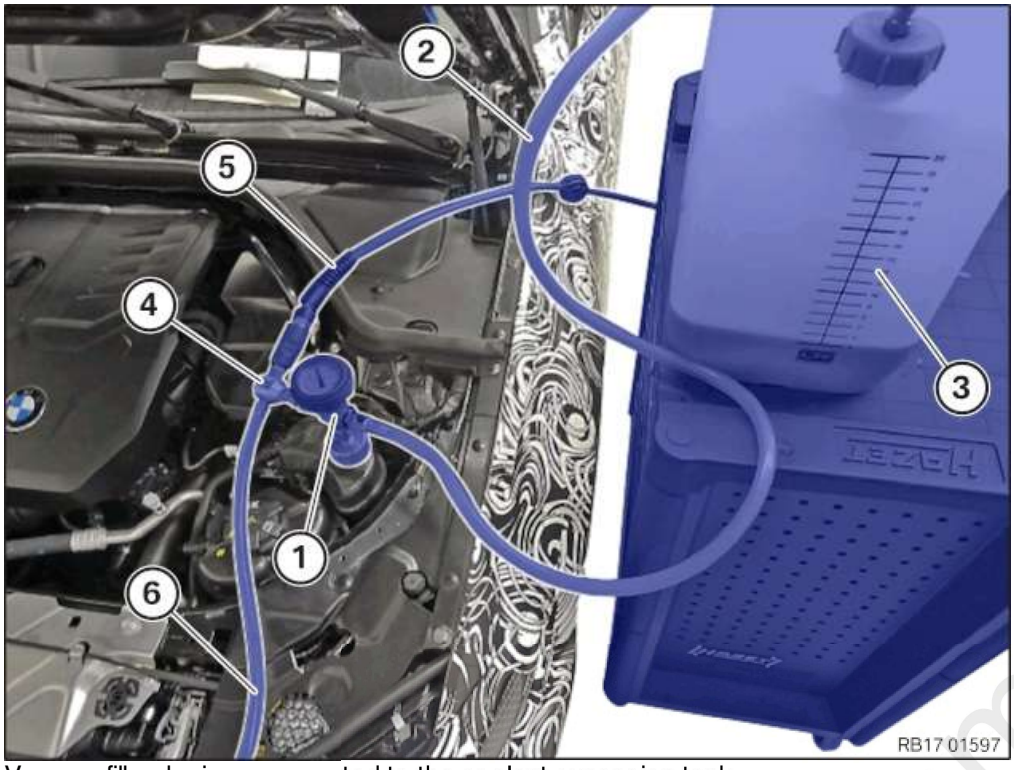


- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

41 – Filling the low-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

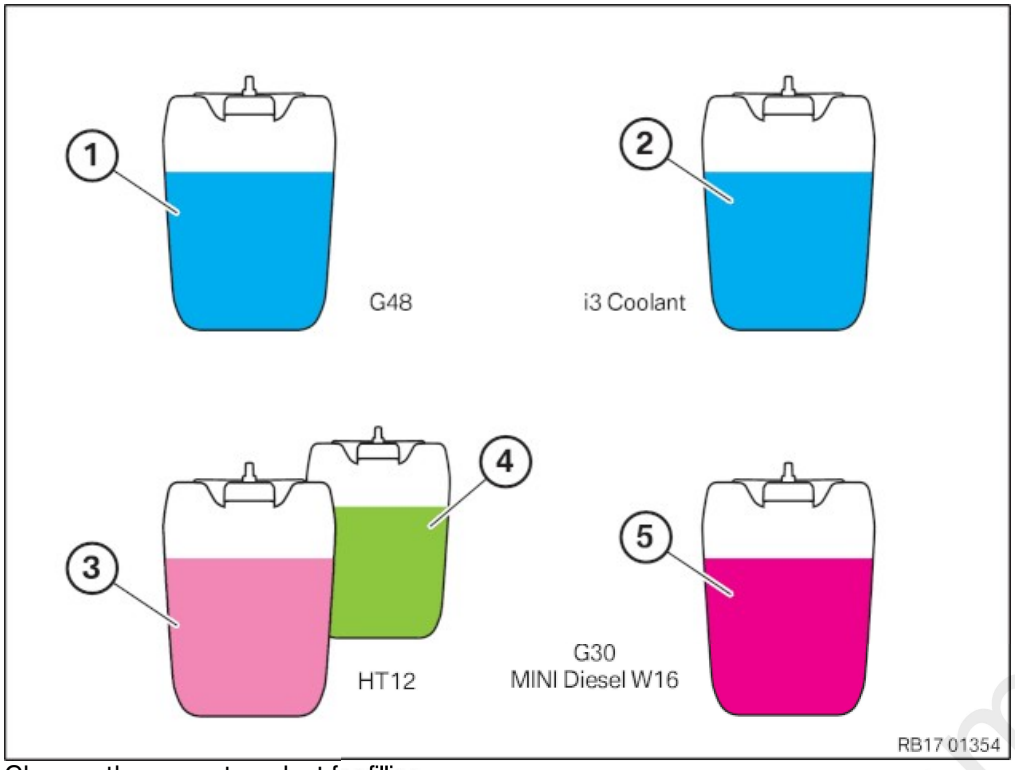
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

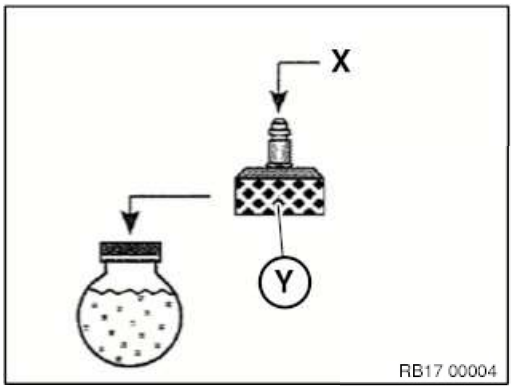
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

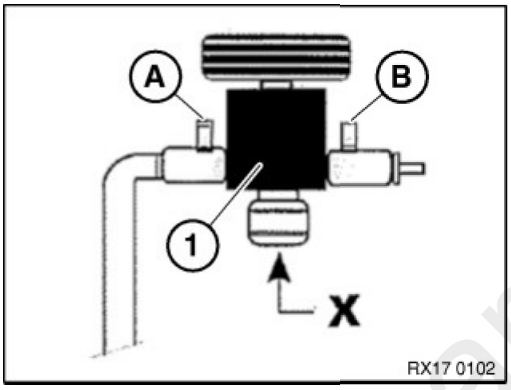
Capacity of low-temperature coolant circuit G20

B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

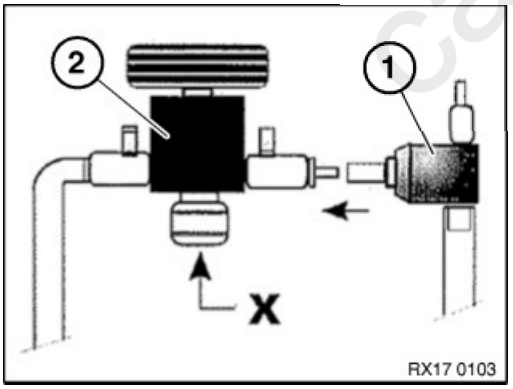
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

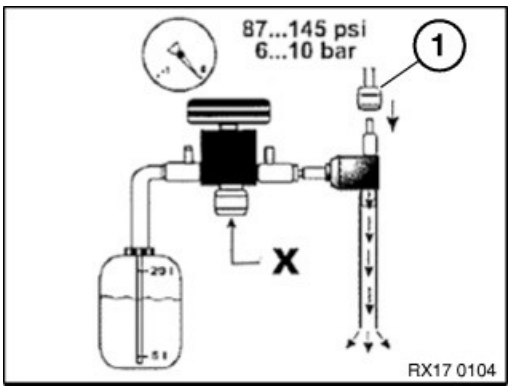


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

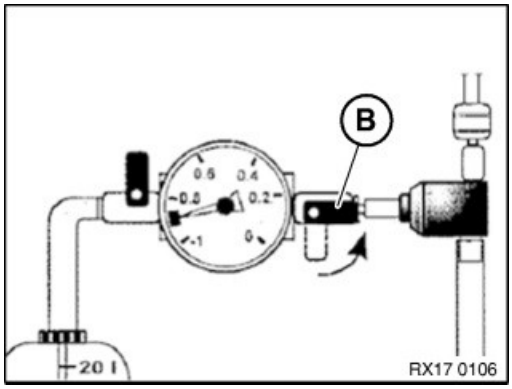
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

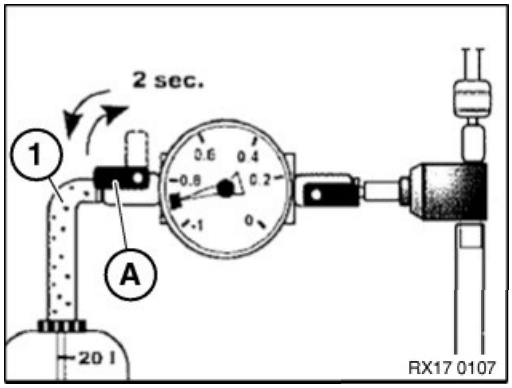
  (X)is the connection on the coolant expansion tank.

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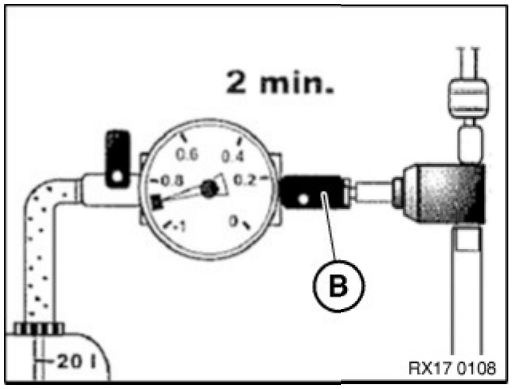
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

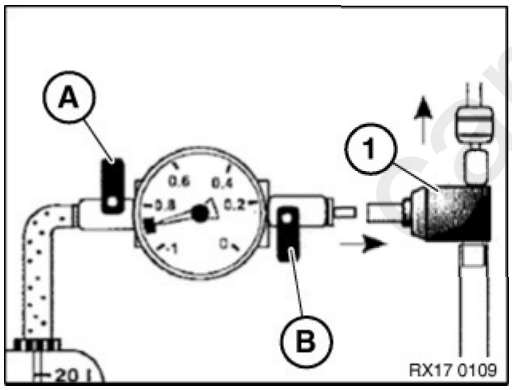


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

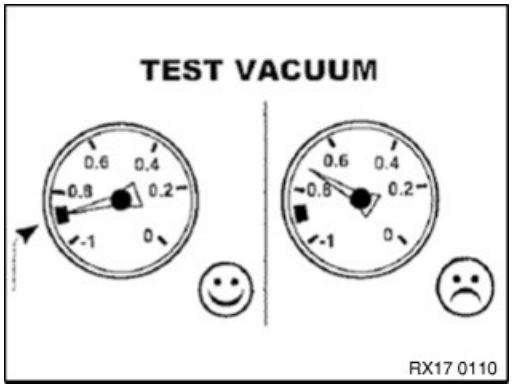
The coolant hoses contract during vacuum build-up.

- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

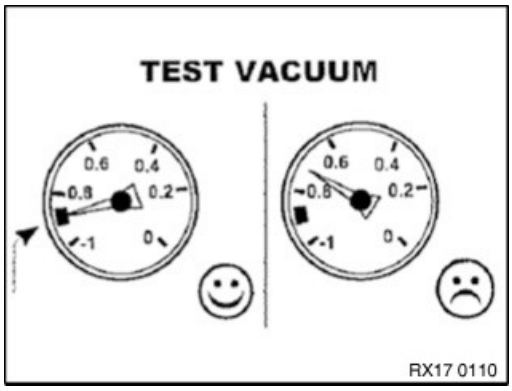
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



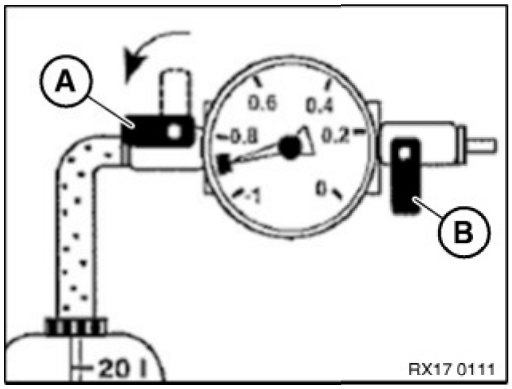
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

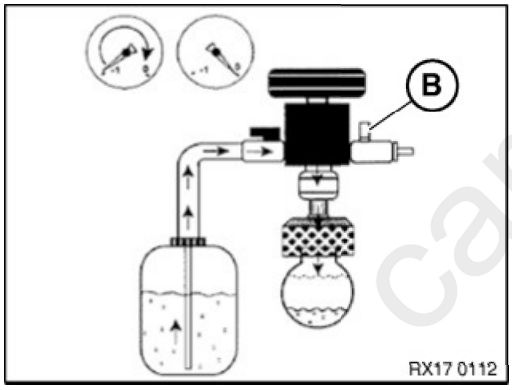
» Vacuum remains constant.

Measure

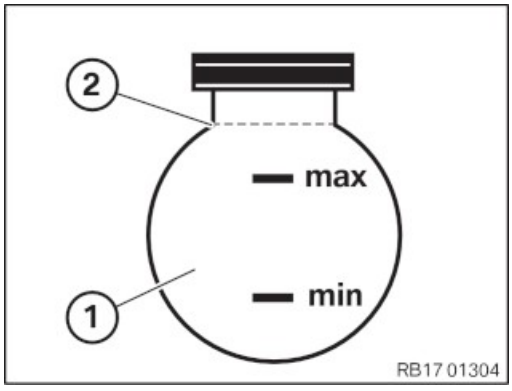
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

42 – Disconnecting all battery earth leads

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- See additional information.

43 – Bleed the high-temperature coolant circuit

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

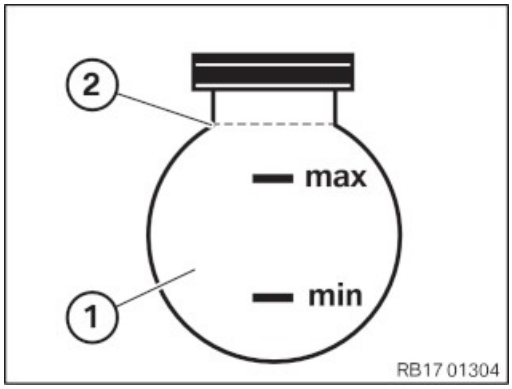
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

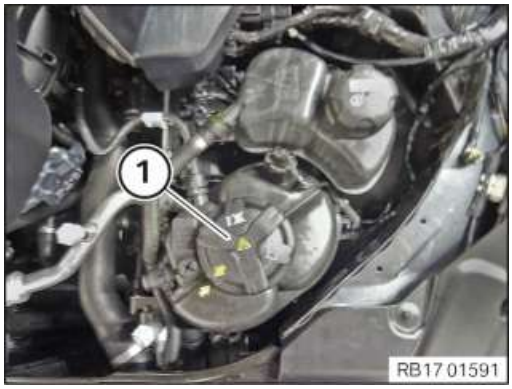
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

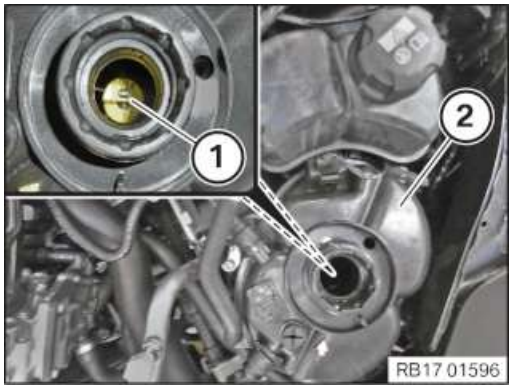
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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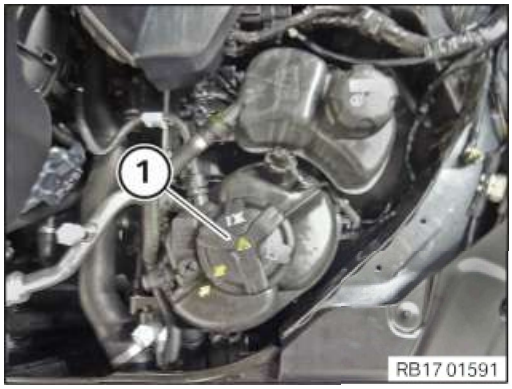
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

44 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

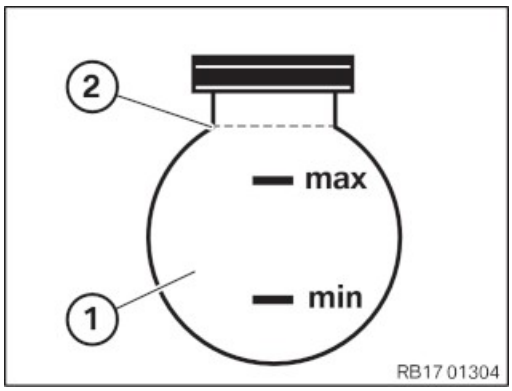
Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

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TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.



- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

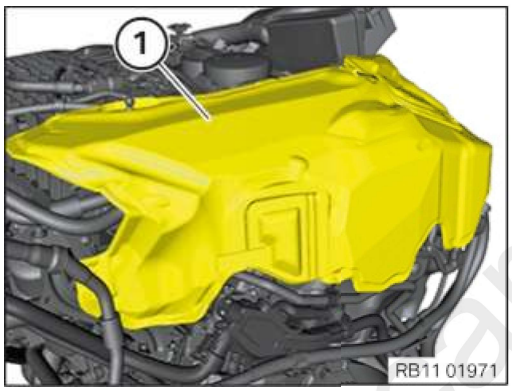
The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

45 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

46 – Installing acoustic cover at rear



- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

47 – Install acoustic cover

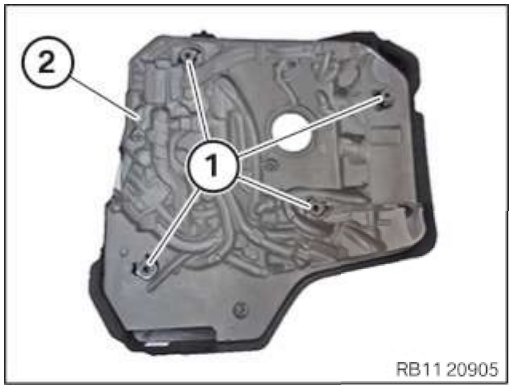
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RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



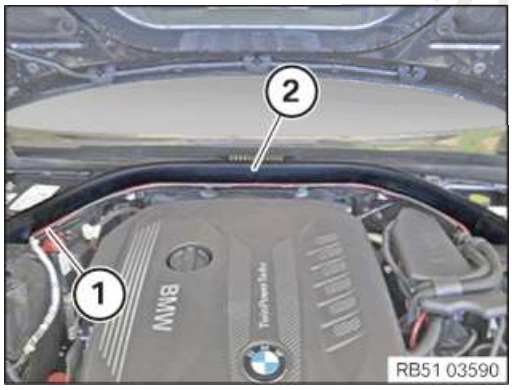
- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

48 – Install the seal for the bonnet



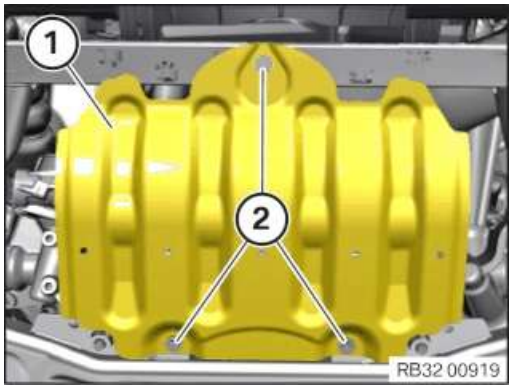
- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

49 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

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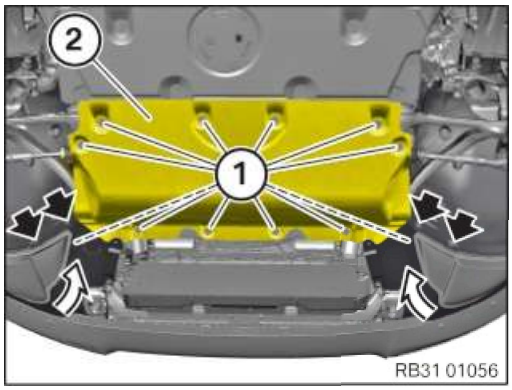


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

50 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

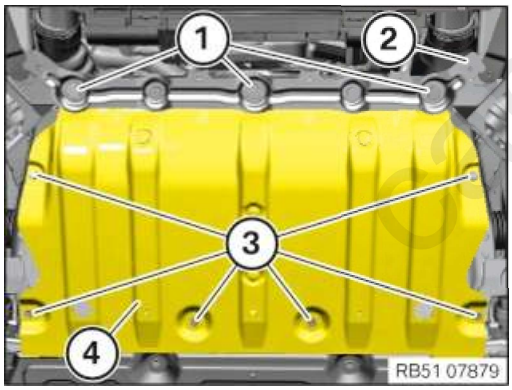
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

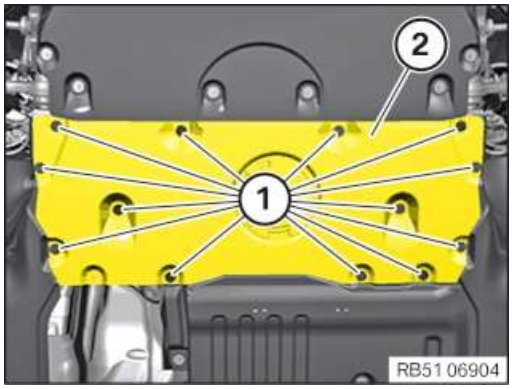
- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

51 – Installing the centre underbody protection

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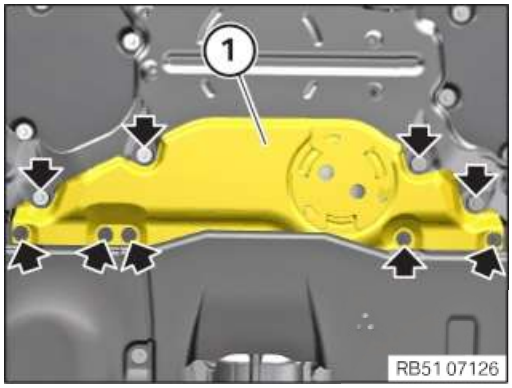
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

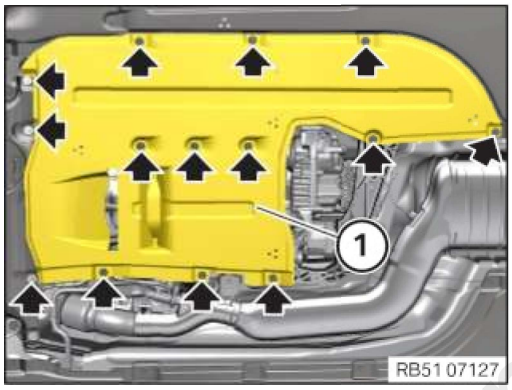
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

52 – Installing underbody protection at rear



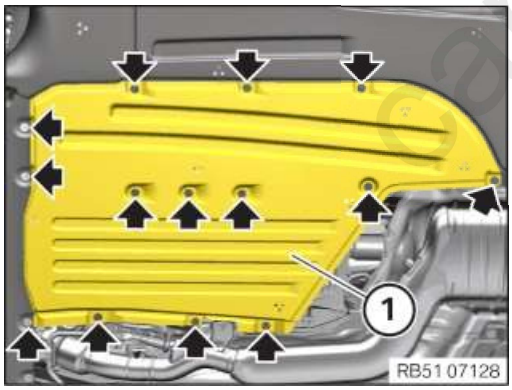
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

  Insert and install the rear underbody protection (1).

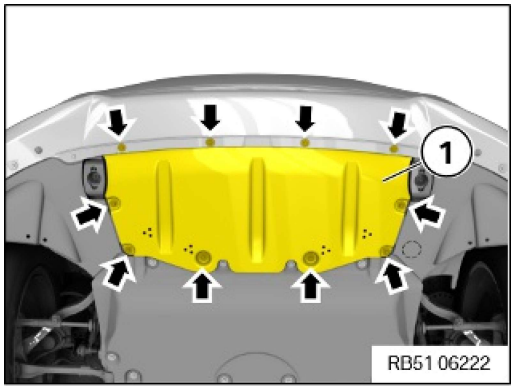
  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

53 – Installing the front underbody protection

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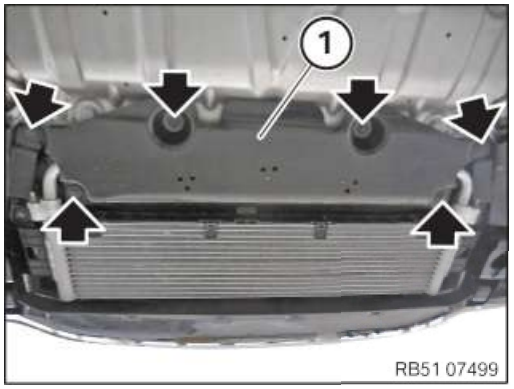
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



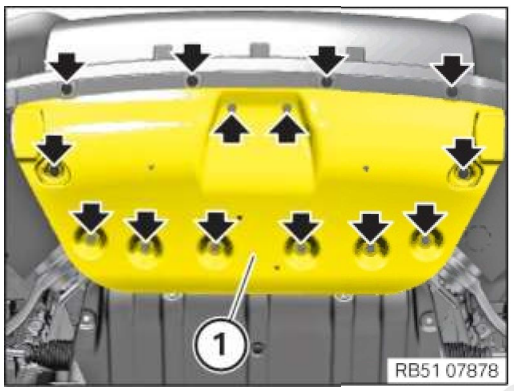
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Oil drain plug — Used in step 14

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Cover, front bottom on side — Used in step 21

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Heat exchange module to crankcase — Used in step 28

M6		Tightening torque	9 Nm

Full-flow oil filter to crankcase — Used in step 29

M6	Observe tightening sequence.	Jointing torque	4 Nm
		Tightening torque	10 Nm

Manifold support to crankcase — Used in step 29

M6x16		Tightening torque	8 Nm

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Positive battery cable to the alternator			Used in step 29
M8		Tightening torque	19 Nm

Oil filter cover to oil filter module			Used in step 30
O-ring lightly oiled.		Tightening torque	25 Nm

Intake plenum to cylinder head			Used in step 31
M6		Tightening torque	10 Nm

Intake plenum to support			Used in step 31
M6X25		Tightening torque	8 Nm

Throttle body to holder			Used in step 31
M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum			Used in step 31
Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body			Used in step 31
M6		Tightening torque	8 Nm

Control unit holder on spring strut dome			Used in step 33
Hexagon screw		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 37
Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support			Used in step 49
M10		Tightening torque	56 Nm

Underbody protection of the steering gear			Used in step 50
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 50
Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support			Used in step 50
M10		Tightening torque	56 Nm

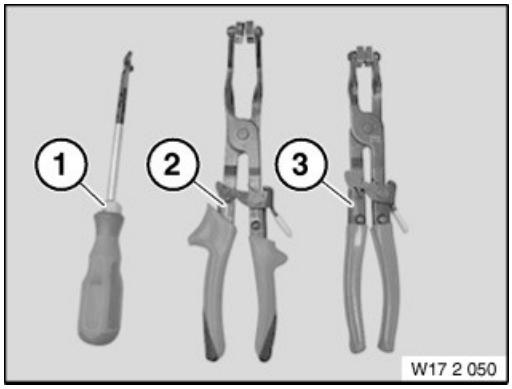
Underbody protection			Used in step 5152
Hexagon screw		Tightening torque	3 Nm

Underbody protection front			Used in step 53
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

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0 495 794 (17 2 050) Pliers



Common Used in step 2431

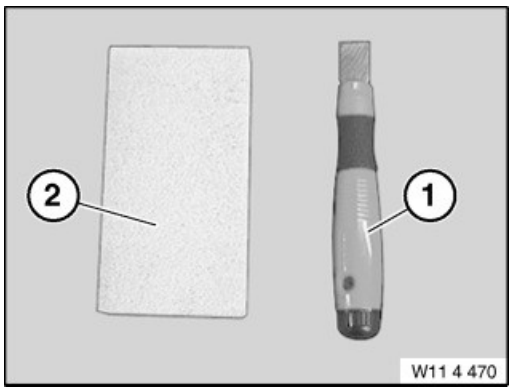
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 495 102 (11 4 470) Tool



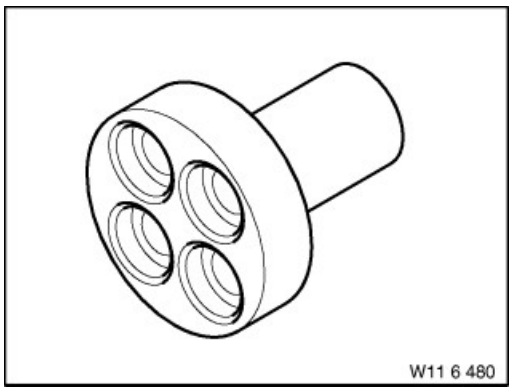
Common	Used in step 2829
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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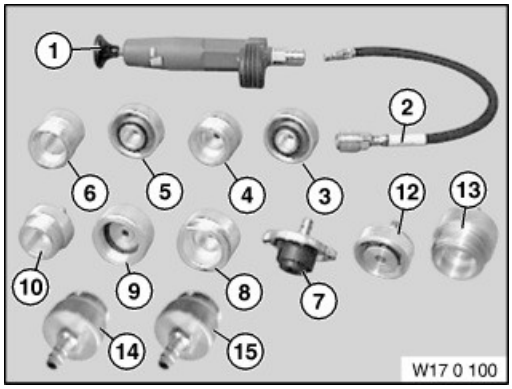
0 493 380 (11 6 480) Connector



Common	Used in step 29
Usage	For turning over engine at crankshaft hub (vibration absorber) when adjusting valve timing
Included in the tool or work	
Storage location	B2
Replaced by	
In connection with	
SI-Number	01 11 98 (338)

0 494 417 (17 0 100) Tester

Common	Used in step 4041
Usage	For checking engine cooling system on watertightness. For checking radiator cap.



Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	

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14	0 495 889 (17 0 115)	**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Engine oil B48B20O1/B46B20O1	Used in step 38
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil	Used in step 38
Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Capacity of high-temperature coolant circuit G20	Used in step 40
B48B20O1/B46B20O1	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Capacity of low-temperature coolant circuit G20	Used in step 41
B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Links

General repair instructions	**Used in step**
12 00 ... Instructions for removal and replacement of control units	535

Repair instructions	**Used in step**
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	142
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	142
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
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61 20 900 Disconnecting and connecting battery earth lead	142

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61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 20 900 Disconnecting and connecting battery earth lead	142
61 35 ... Notes on ESD protection (Electro Static Discharge)	56102634
61 35 ... Notes on ESD protection (Electro Static Discharge)	10
61 00 730 Encode/program control unit(s) (after vehicle test)	35
17 00 ... Notes for working on cooling system.	4041

Operating materials	Used in step
3.0 Technically appropriate engine oils for BMW Group engines	38

Operating materials	Used in step
Main group 17	4041

Parts

Parts required

Designation	Used in step
Seals, oil filter element to full-flow oil filter and to oil filter cover	30
Seal, oil filter cover to full-flow oil filter	30

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11 53 082 Removing and installing/replacing the coolant feed line for the exhaust turbocharger

WARNING

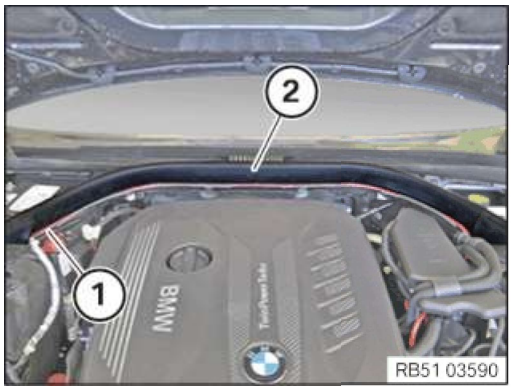
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

PRELIMINARY WORK

1 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

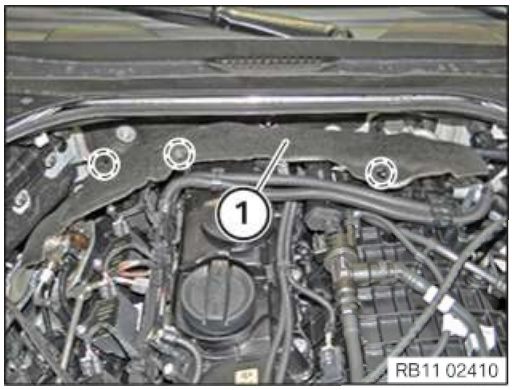
- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

4 – Removing the clean air pipe with the resonator

WARNING

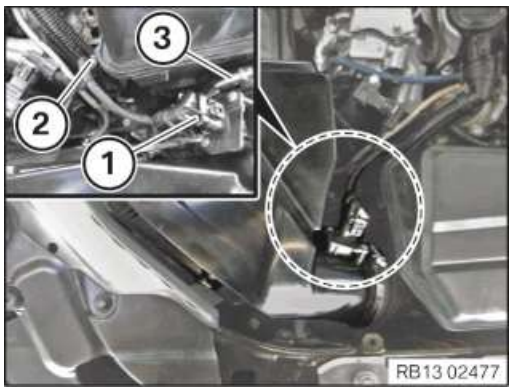
Hot surfaces.

Risk of burning!

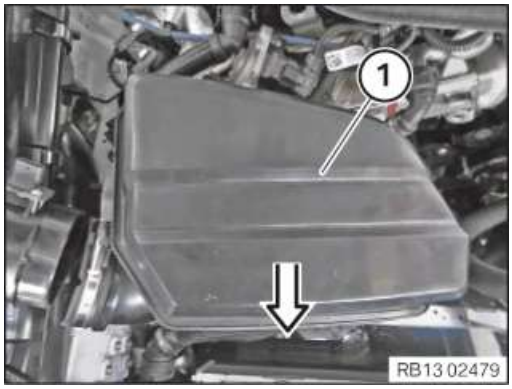
- Perform all work only on components that have cooled down.



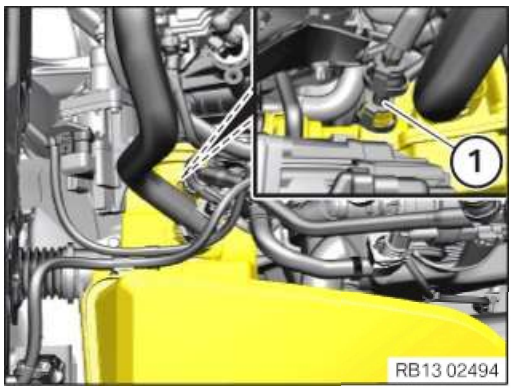
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



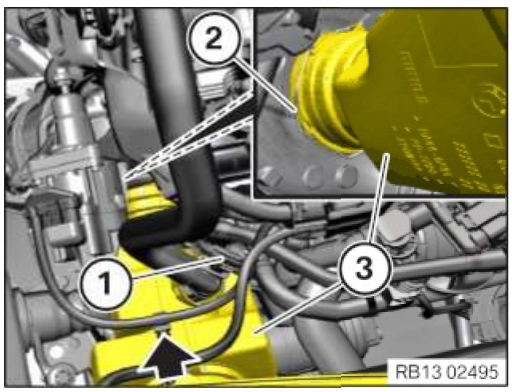
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

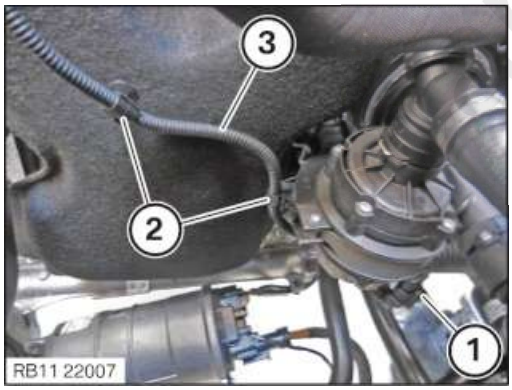


- Unlock and disconnect the tank ventilation line (1).

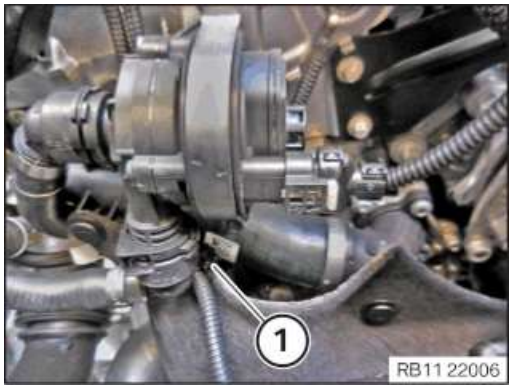


- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

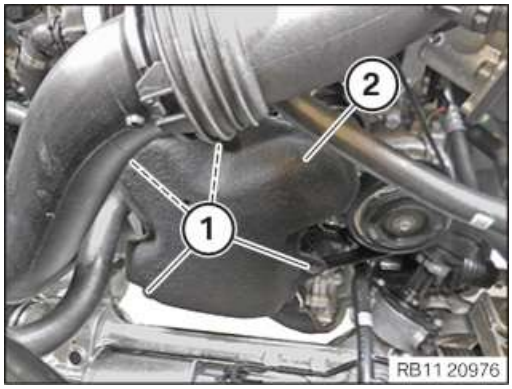
5 – Removing the acoustic cover for the engine at the front



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

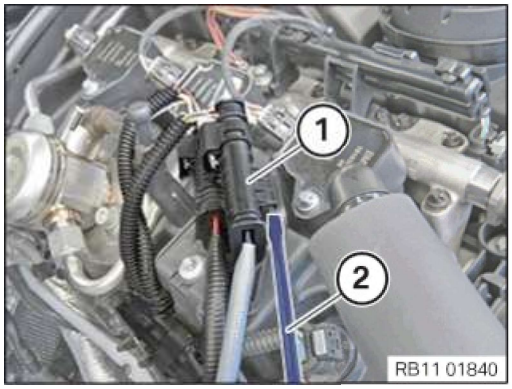
6 – Remove the control sensor

WARNING

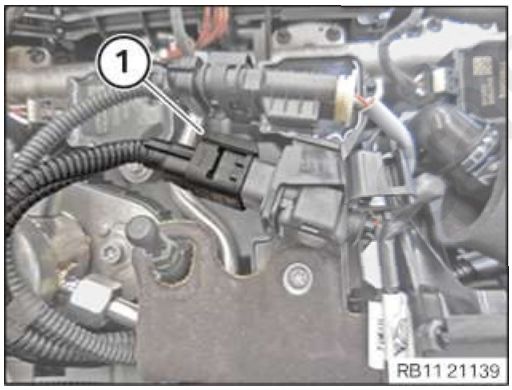
Hot surfaces.

Risk of burning!

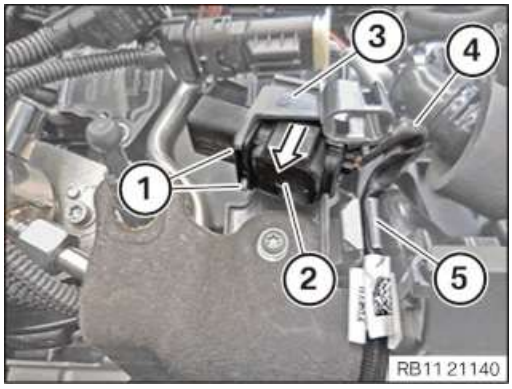
- Perform all work only on components that have cooled down.



- Unlock connector (1) with screwdriver (2) and remove from the carrier plate.
- Unlock and loosen connector (1).

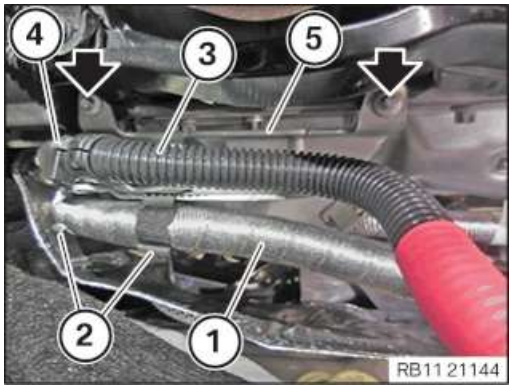


- Unlock and loosen connector (1).

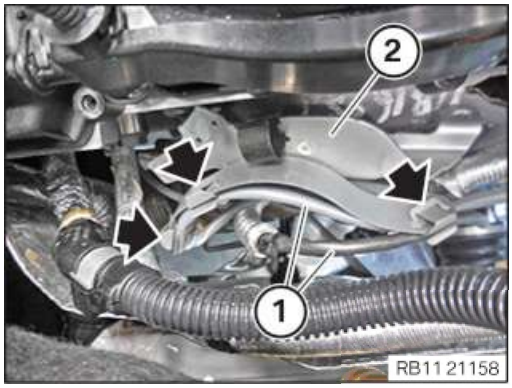


- Unlock the locks (1).
- Guide the connector (2) out of the bracket (3)in the **direction of the arrow** and set it aside.
- Release the cable (4) from the clamp (5).

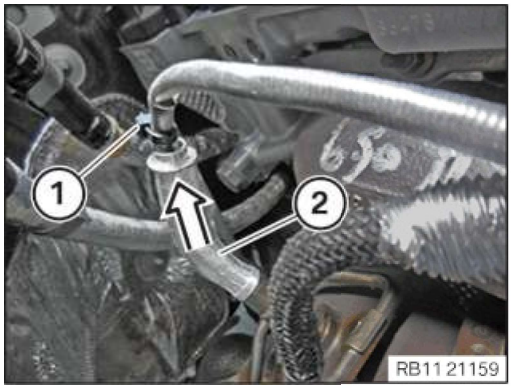
rdiagn.com



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

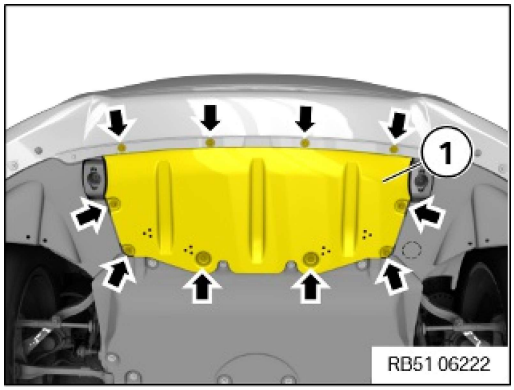


- Unfasten cable strap (1).
- Feed out the heat shield (2) **in direction of arrow** and set it aside.



- Release and remove the control sensor (1) with the special tool 0 491 074 (11 7 020).

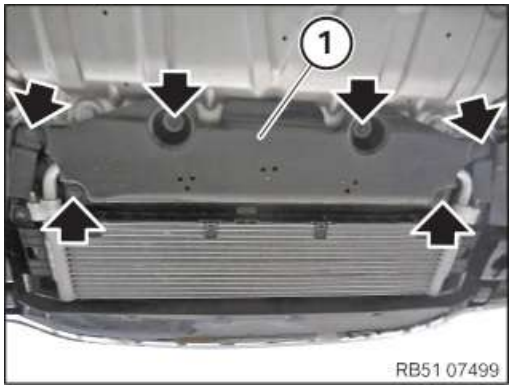
7 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

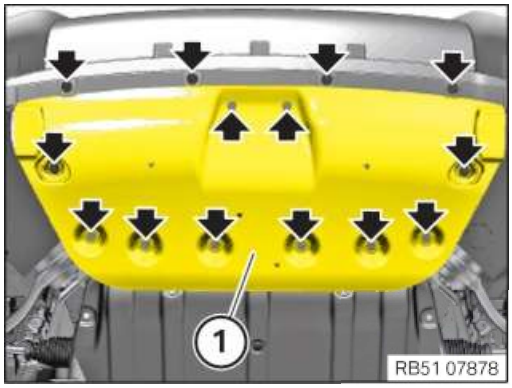
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

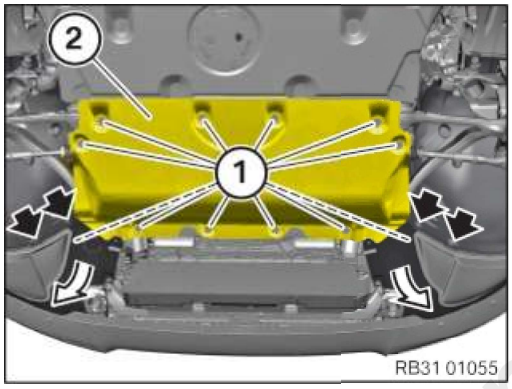


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

8 – Remove the underbody protection of the steering gear



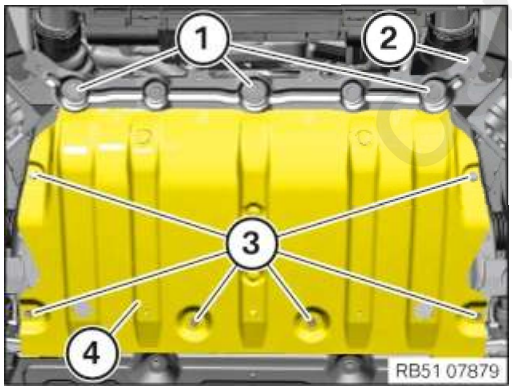
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

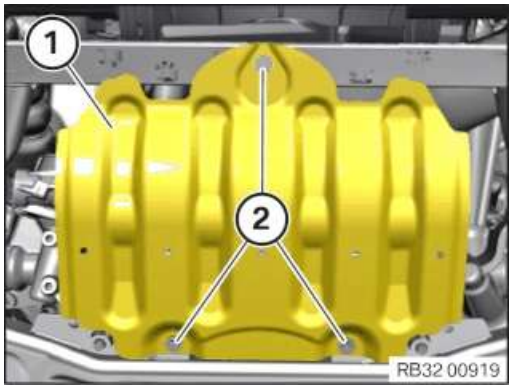
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

9 – If installed: Removing the steering start protection

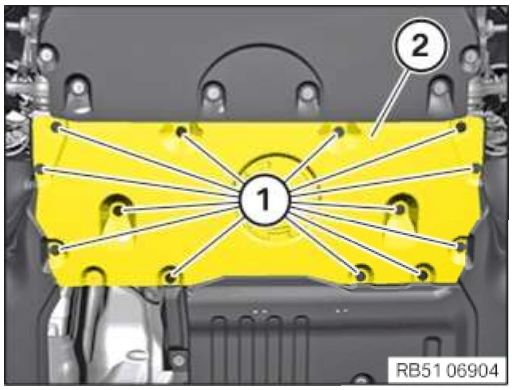
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

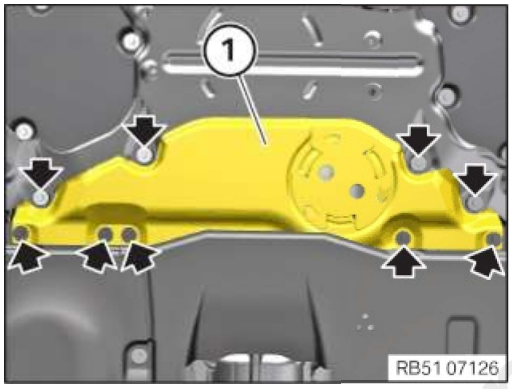
10 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

11 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

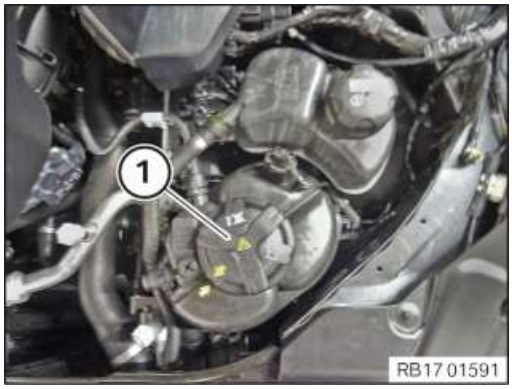
When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

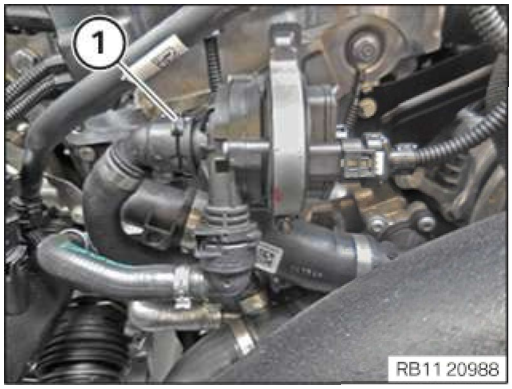
cardiagn.com

TECHNICAL INFORMATION

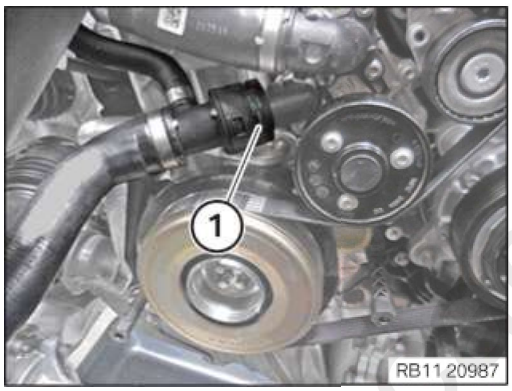
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

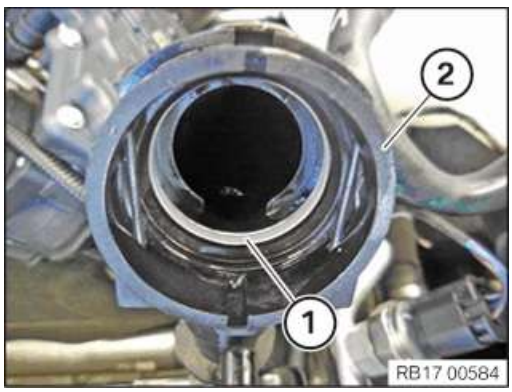


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

12 – Connecting the coolant lines for the high-temperature coolant circuit

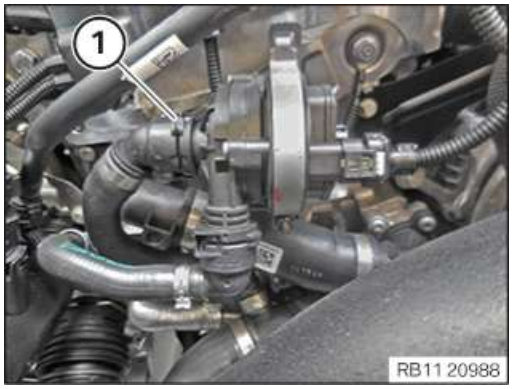
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

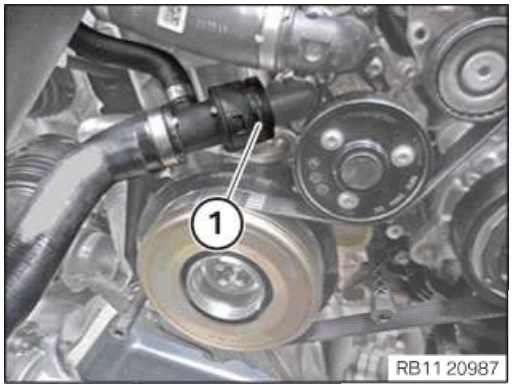


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.

carfdiag.com

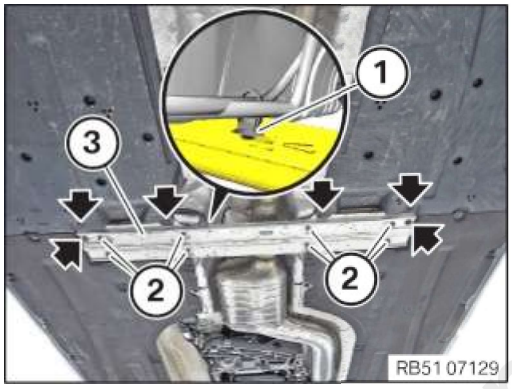


- Connect and lock coolant line (1).
  Coolant line (1) must audibly engage.



- Connect and lock coolant line (1).
  Coolant line (1) must audibly engage.

13 – Remove the connecting support from the tunnel



- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

14 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

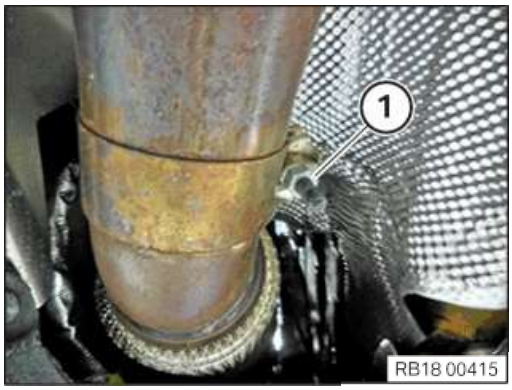
cardiagn.com

CAUTION

Heavy component.

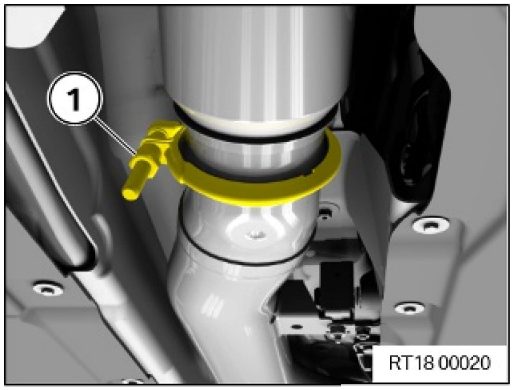
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



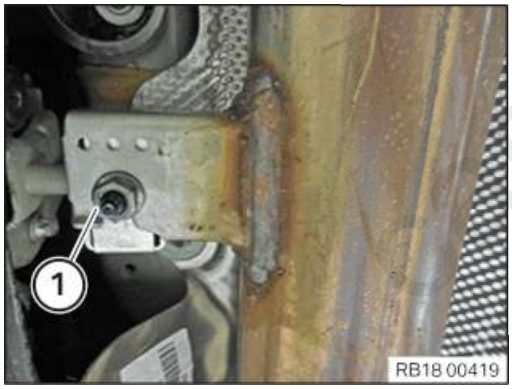
- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).

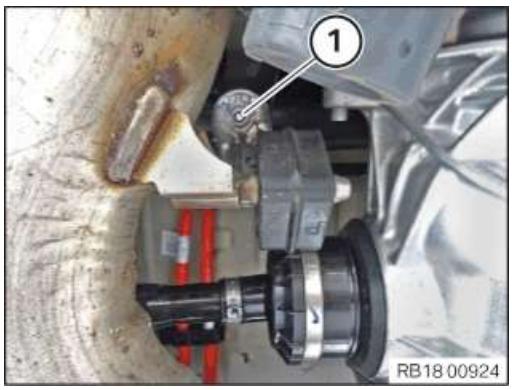


- **Equipment specification 2 (V-clips)**

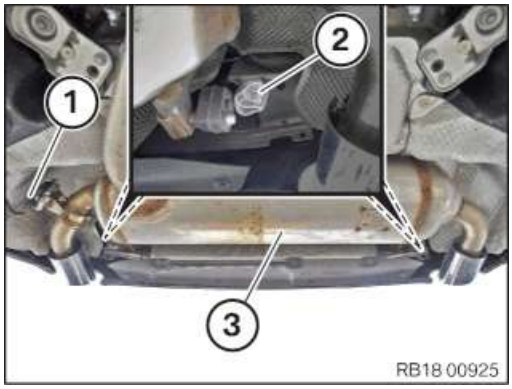
  Unfasten clamp (1).



- Loosen nut (1).



- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

15 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

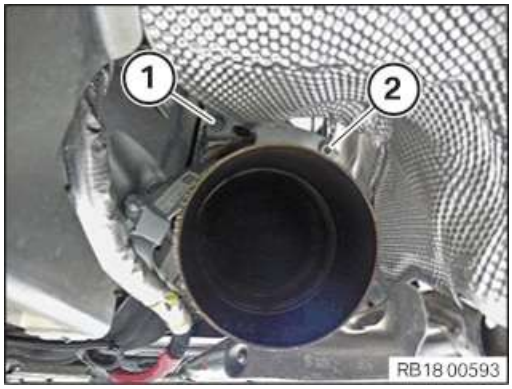
- Remove and install heavy components with the aid of another person/other persons.

CAUTION

Component with heavy weight.

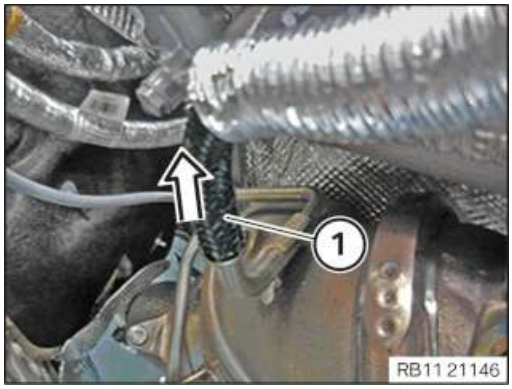
Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

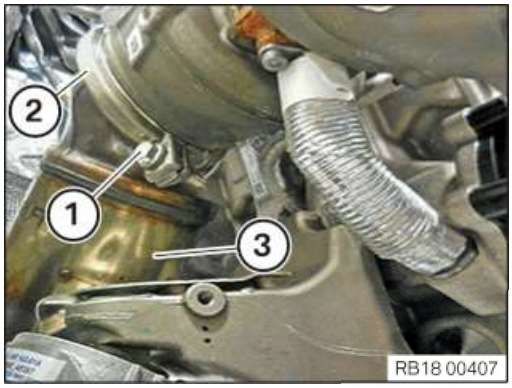


- Loosen screw (1).
- Loosen nut (2).

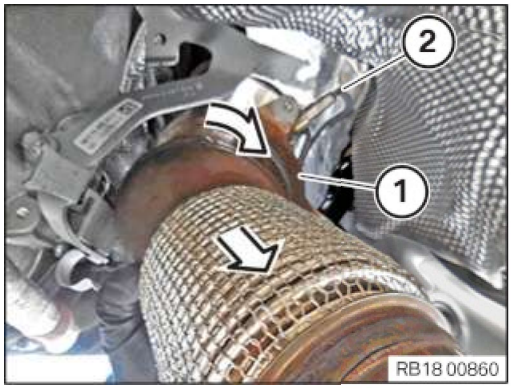
cardiagn.com



- Pull off pressure hose (1) in direction of arrow and set it aside.



- Loosen screw (1).
- Feed out V-clip (2) on catalytic converter (3) and remove.



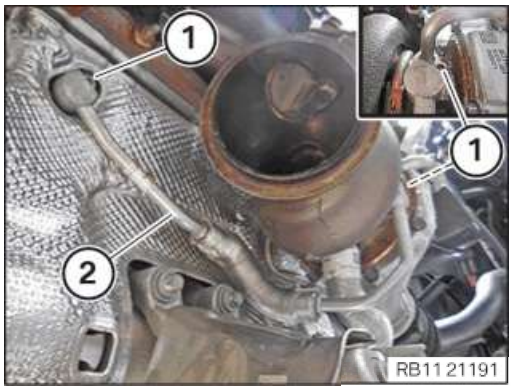
- Guide out catalytic converter (1) in direction of arrow and remove.
- Ensure that monitoring oxygen sensor (2) is **not** damaged.

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16 – Remove the coolant feed line for the exhaust turbocharger

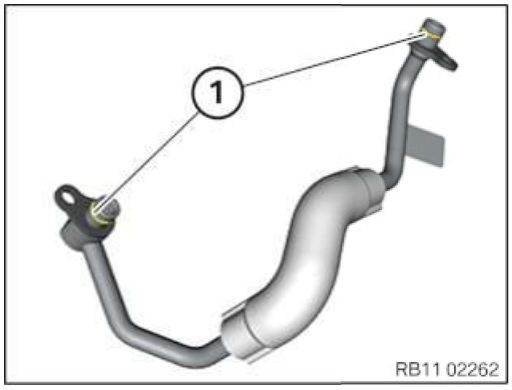
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



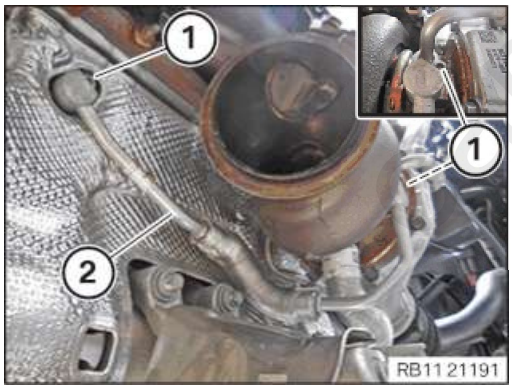
- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

17 – Install the coolant feed line for the exhaust turbocharger



- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

mandiag.com

POSTPROCESSES

18 – Install catalytic converter



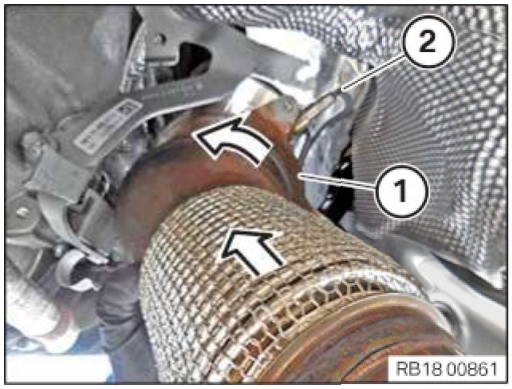
- Renew the V-clip (1).

  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket



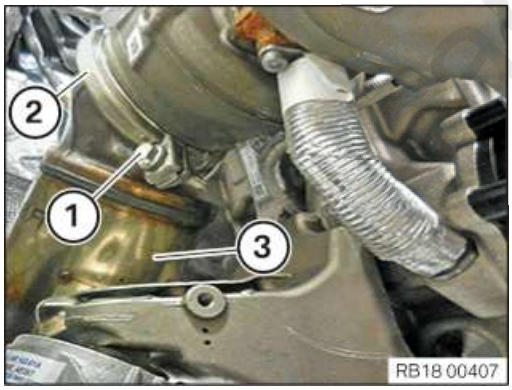
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

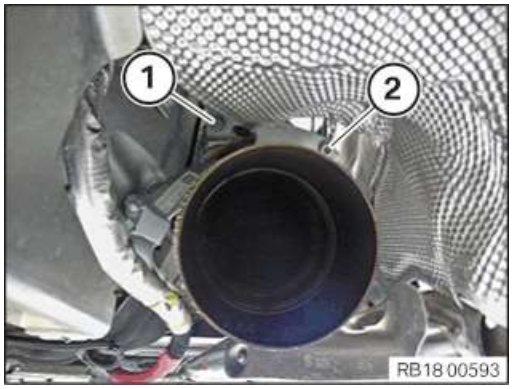
- Guide in and install the catalytic converter (1) in the direction of arrow.
- Make sure that the monitoring oxygen sensor (2) **is not damaged.**



- Renew the V-clip (2).

  Parts: V-band clamp

- Feed in and install V-clip (2) on the catalytic converter (3).
- Position the bolt (1).



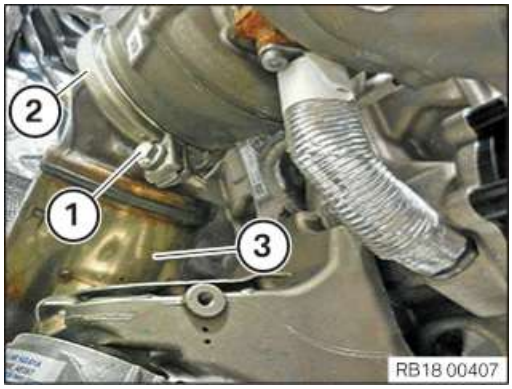
- Renew the screw (1).

  Parts: Screw

- Position the bolt (1).
- Renew nut (2).

  Parts: Nut

- Position the nut (2).



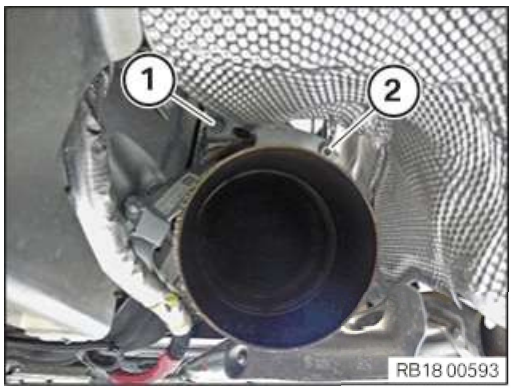
- Position the catalytic converter (3).
- Position V-clip (2).

Note: Ensure correct mounting orientation of the V-clip.

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm



- Tighten down screw (1).

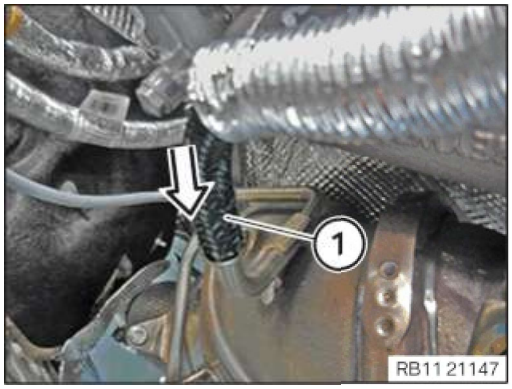
Catalytic converter to holder

M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm



- Check the pressure hose (1) for damage and renew hardened pressure hose (1) if necessary.
- Connect the pressure hose (1) in direction of arrow to the limit position.

19 – Installing the complete exhaust system

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

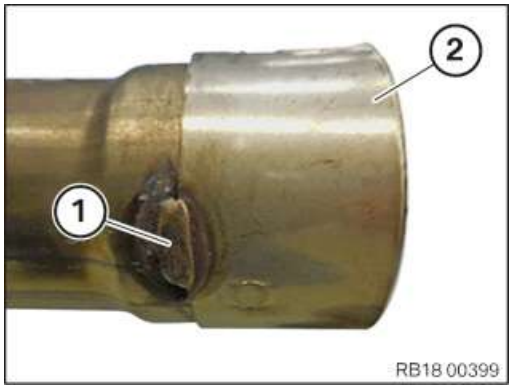
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

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CAUTION

Swarf resulting from sawing or grinding components.

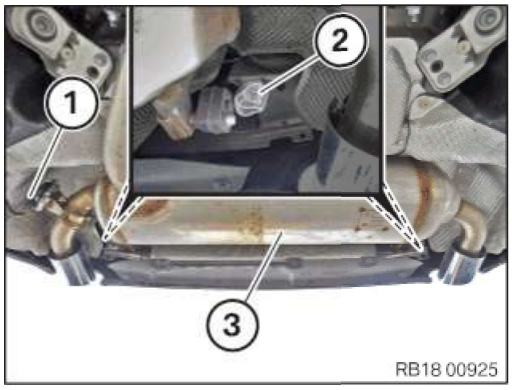
Danger of injury!

- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp



- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

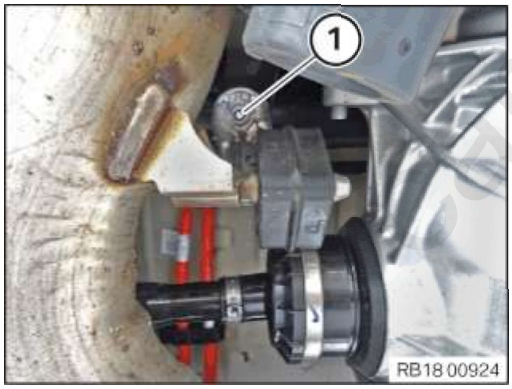
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm



- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

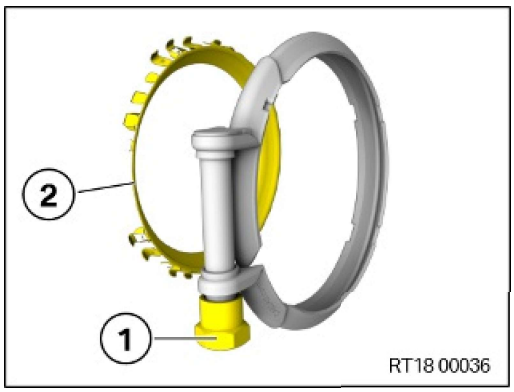
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

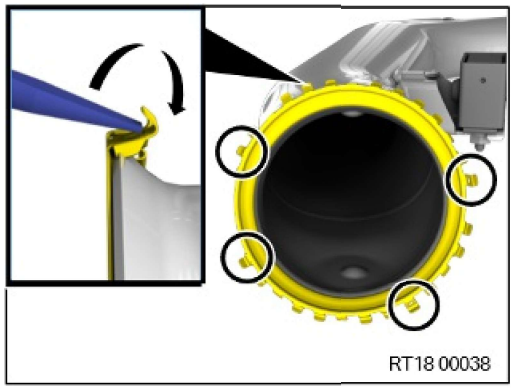


- **Equipment specification 2 (V-clips)**

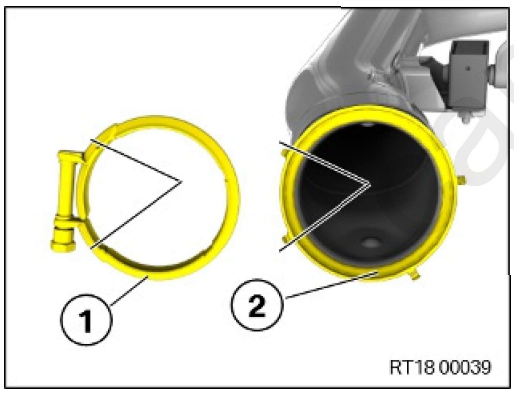
  Renew V-band clamp.

  Parts: V-band clamp

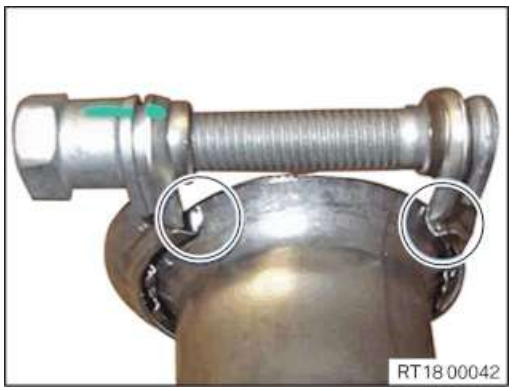
  Unscrew the nut (1) and remove the sealing ring (2).



- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.

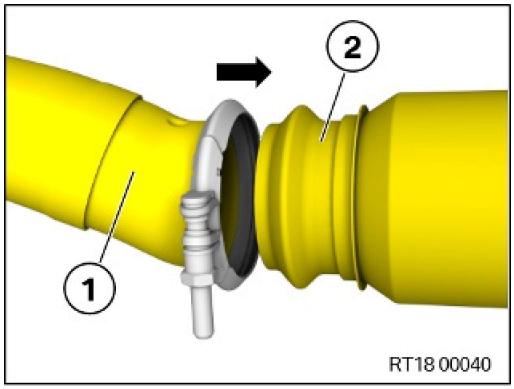


- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).

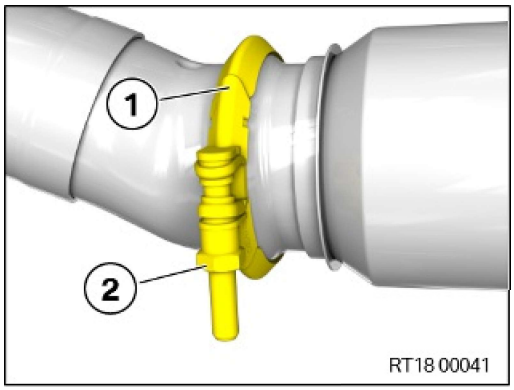


- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.

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- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).

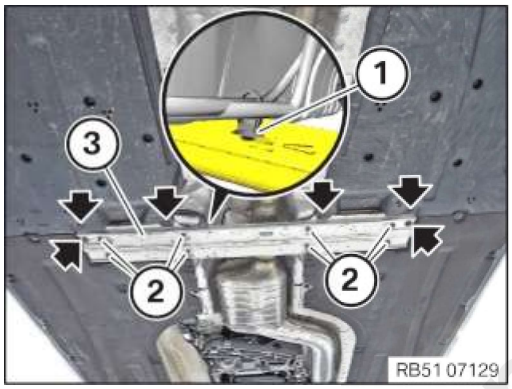


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

20 – Install the connecting supports on the tunnel



- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- Tighten screws (arrows).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

21 – Install the control sensor

TECHNICAL INFORMATION

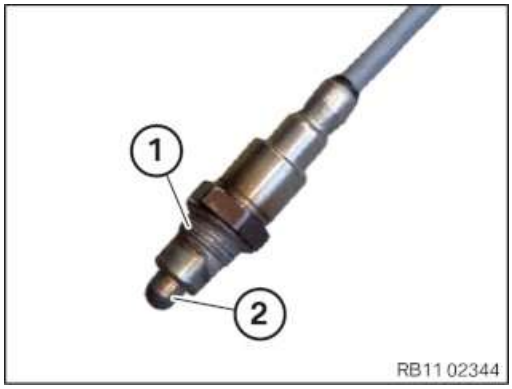
New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

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TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

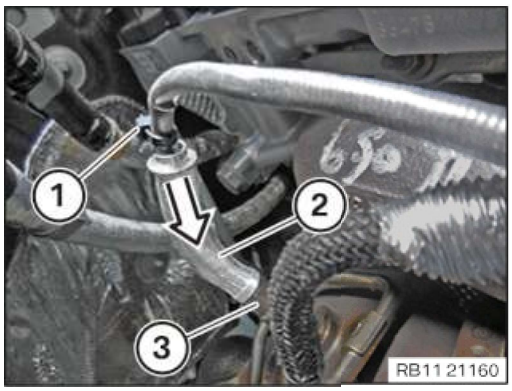
  (2) = Sensor ceramics



- Screw the control sensor (1) in and tighten it with the special tool 0 491 074 (11 7 020).

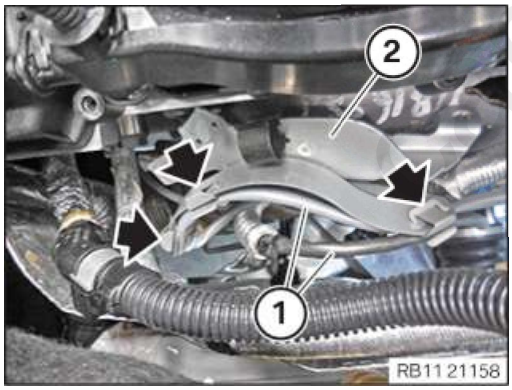
Control sensor

M18x1.5		Tightening torque	50 Nm



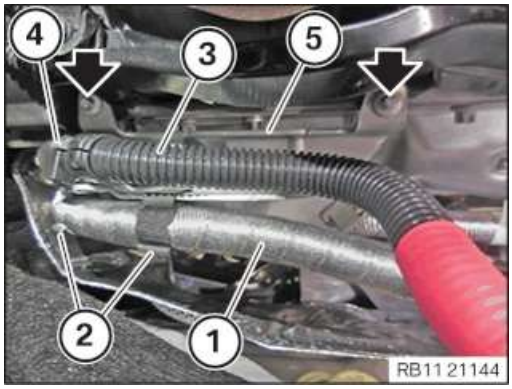
- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

  Parts: Cable strap
- Guide in and install the cable strap (1).



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).

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CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

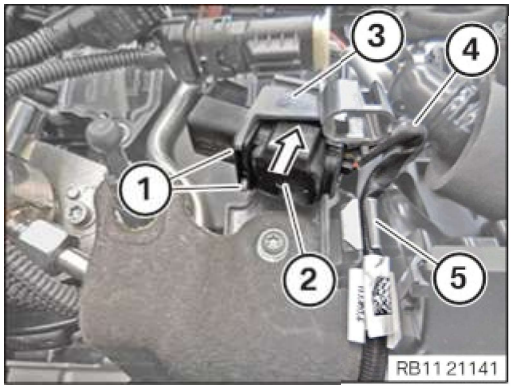
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

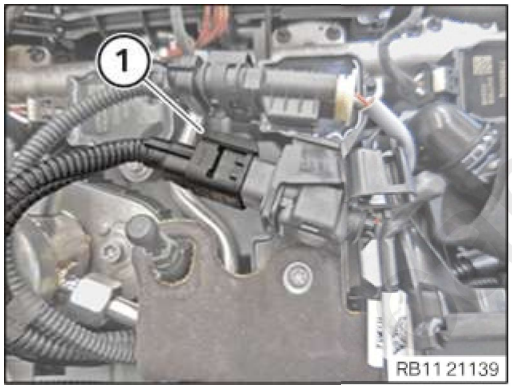
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).



- Guide in the connector (2) in the direction of arrow at the carrier plate (3) and install.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).



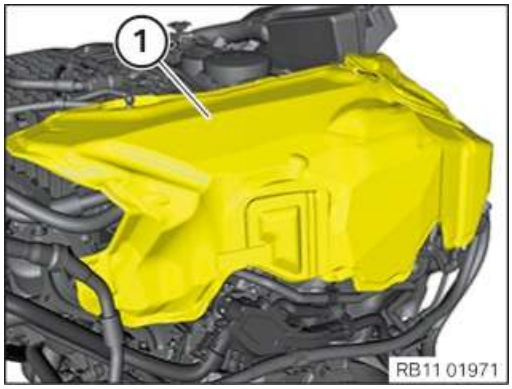
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Connect and lock the connector (1).
- Guide the connector (1) into the carrier plate in the direction of arrow.
- Ensure the connector (1) audibly engages with the carrier plate.

22 – Installing acoustic cover at rear

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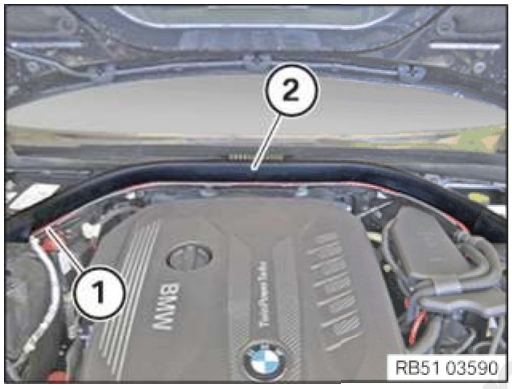


- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



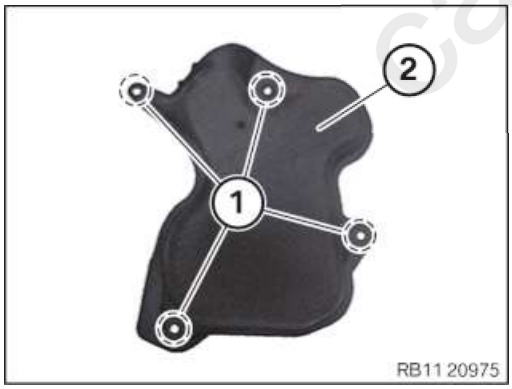
- Install the acoustic cover (1) from the top and clip it in into the marked areas.

23 – Install the seal for the bonnet



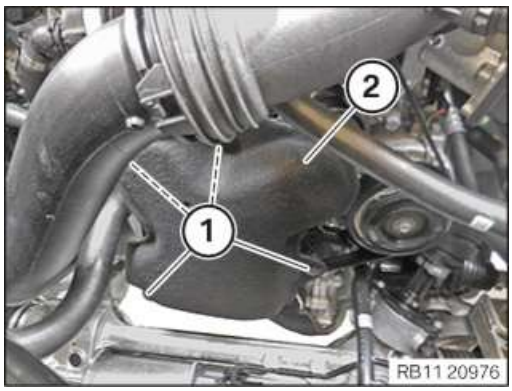
- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

24 – Install the acoustic cover for the engine at the front



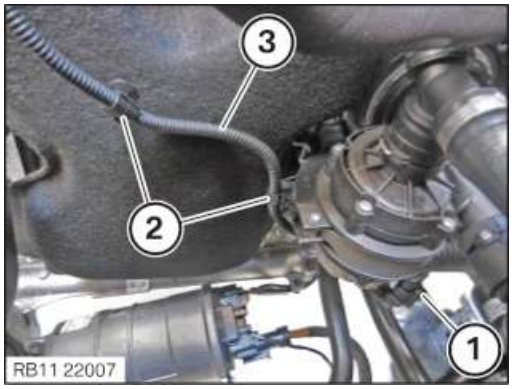
- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover



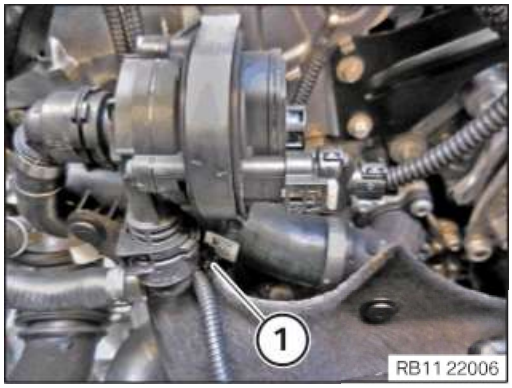
- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).

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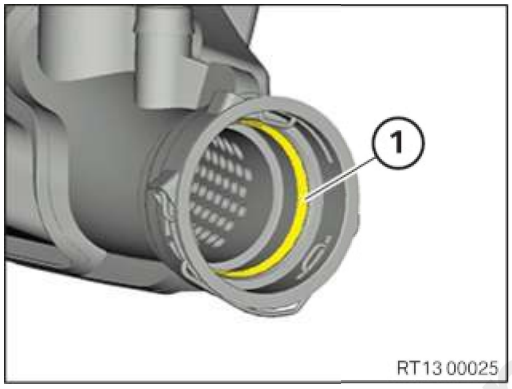
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

25 – Installing the clean air pipe with resonator

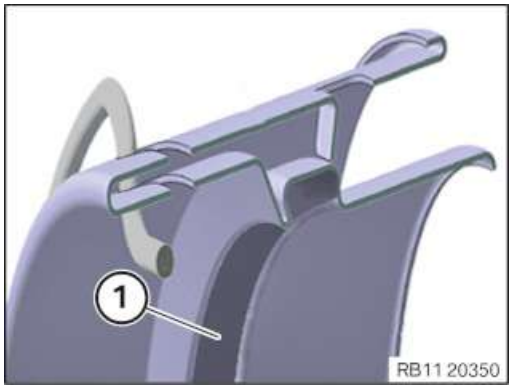


- Check the seal (1) for damages, replace if necessary.

▶ **Replace damaged gasket**

TECHNICAL INFORMATION

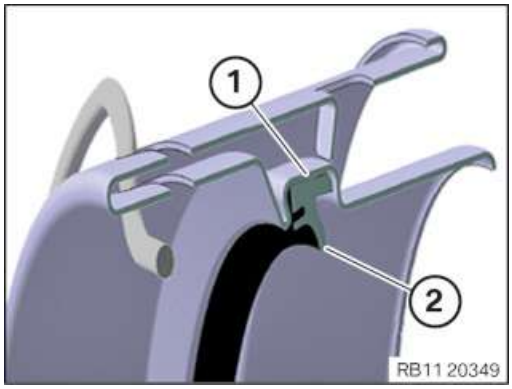
Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.

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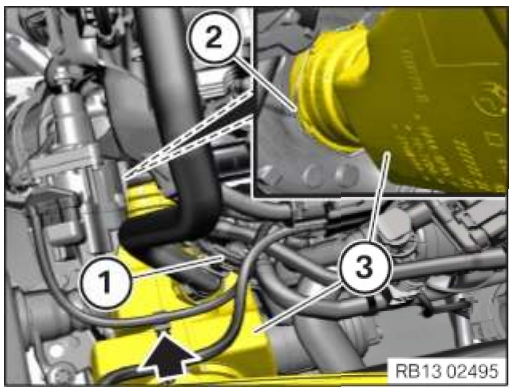
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

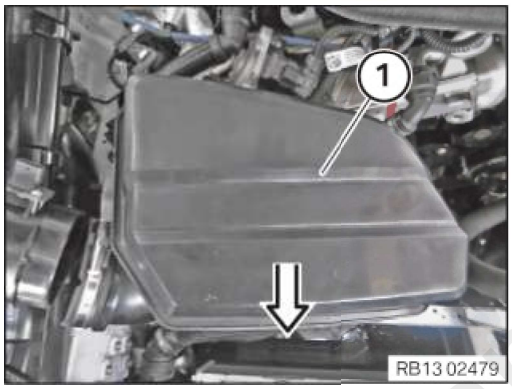
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



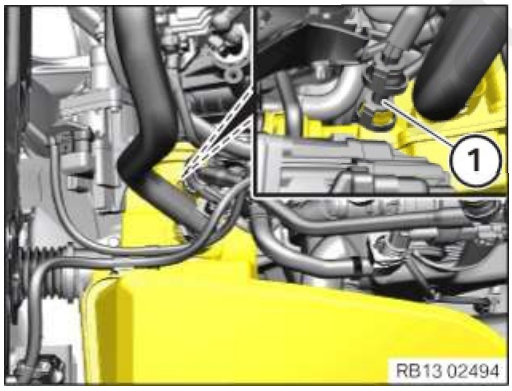
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

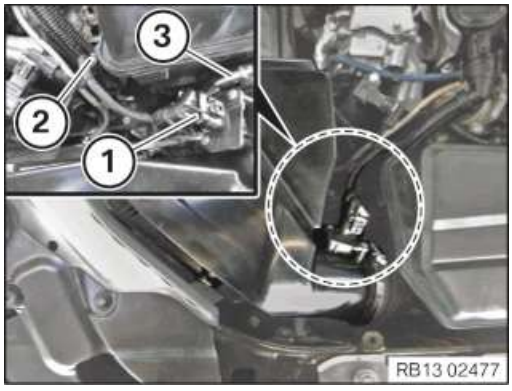
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

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- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

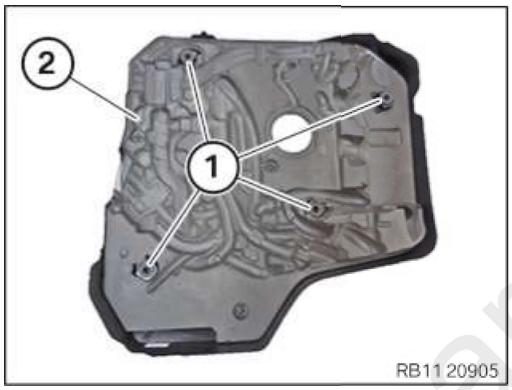
26 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



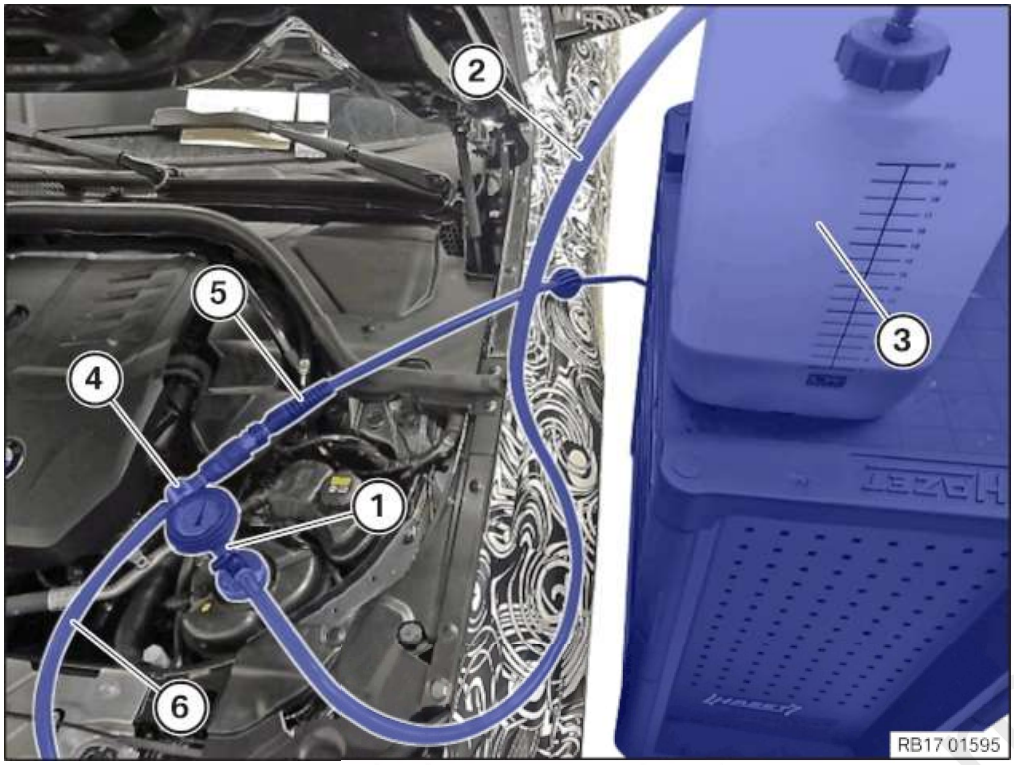
- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

27 – Fill the high-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

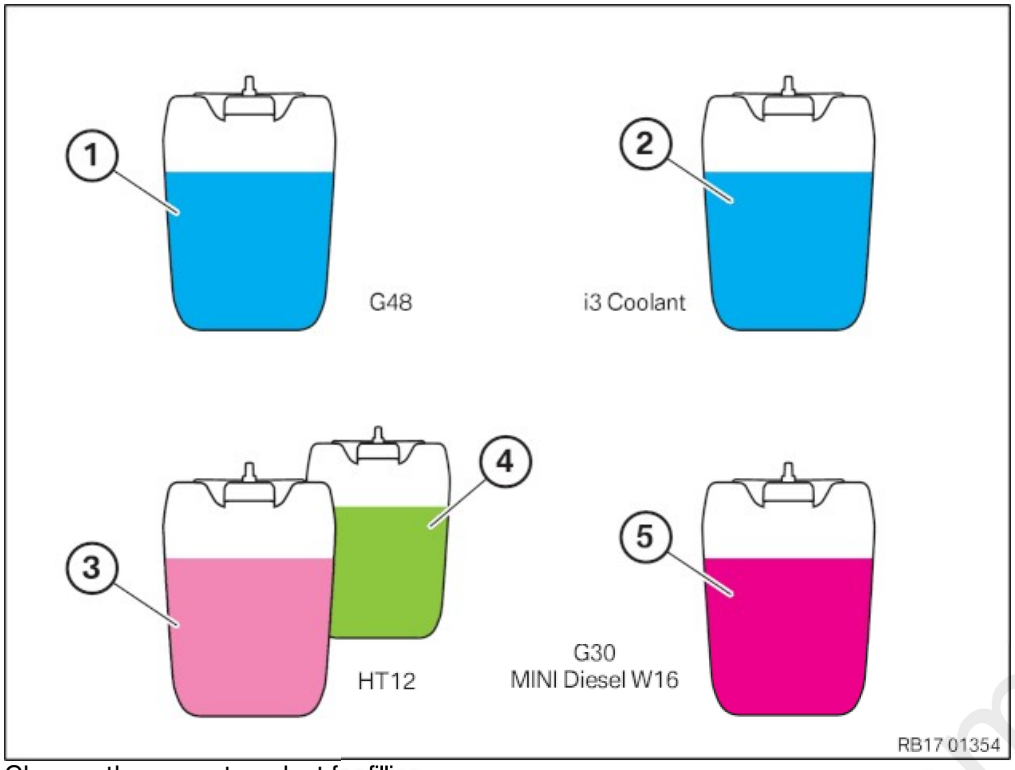
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

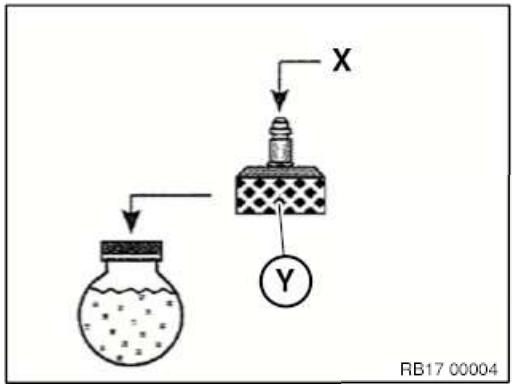
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

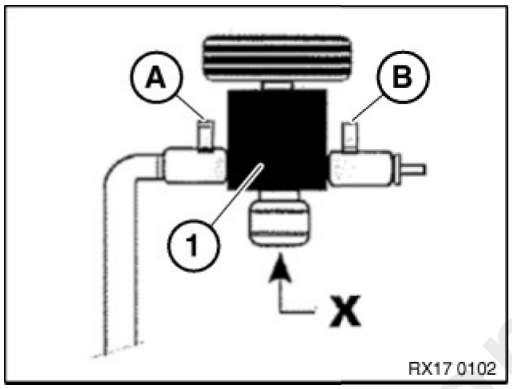
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

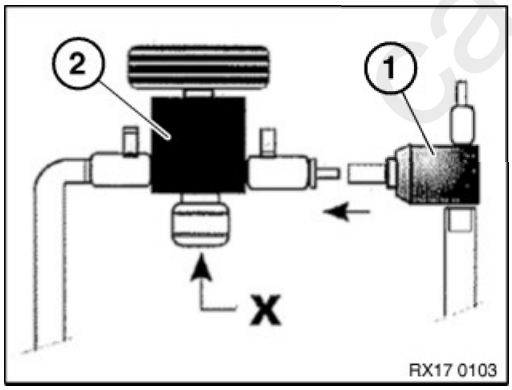
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

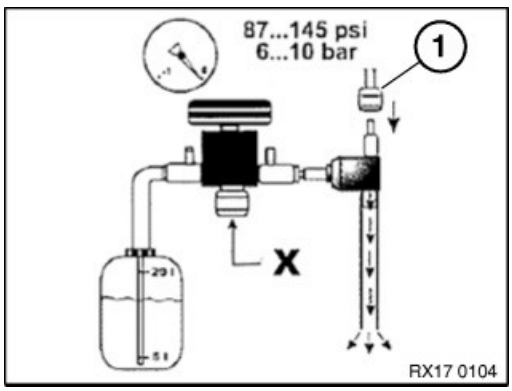


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

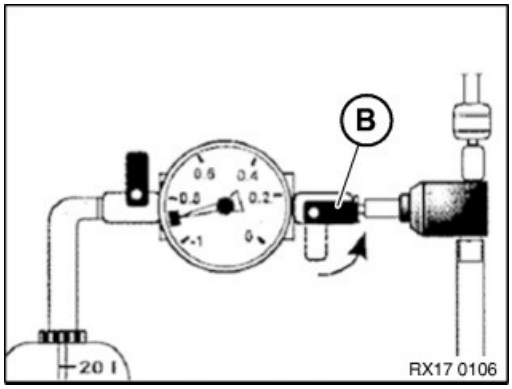
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

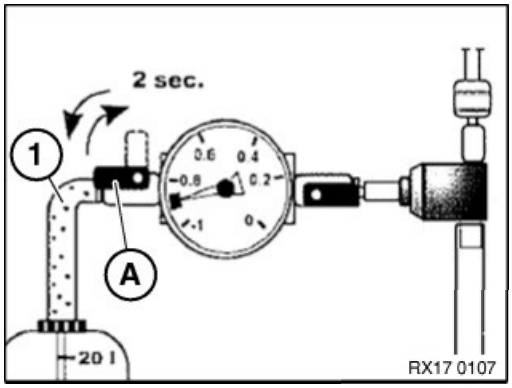
  (X)is the connection on the coolant expansion tank.

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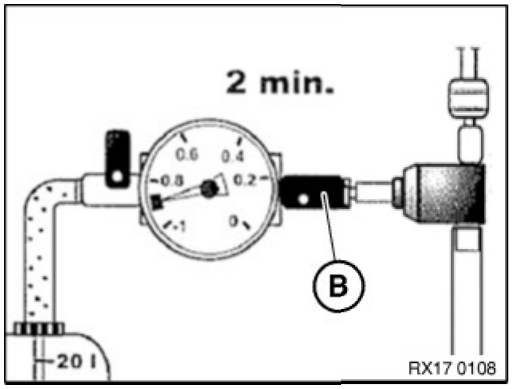
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

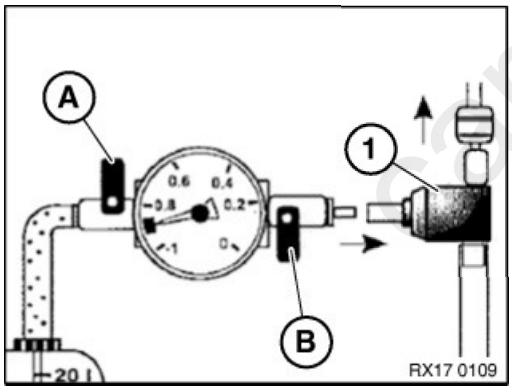


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

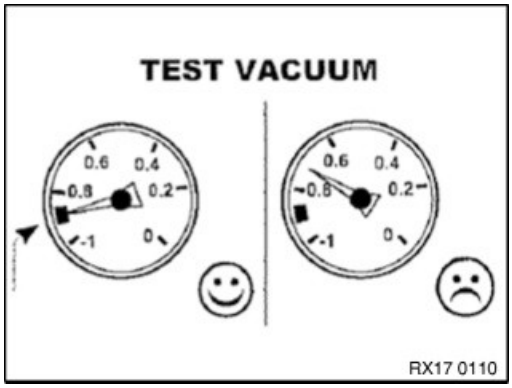
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

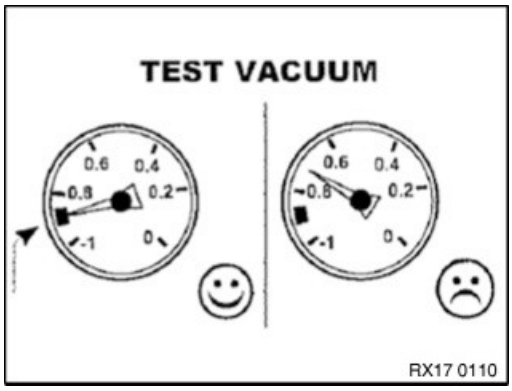
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



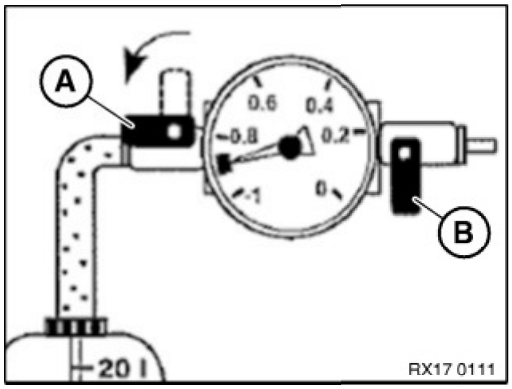
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

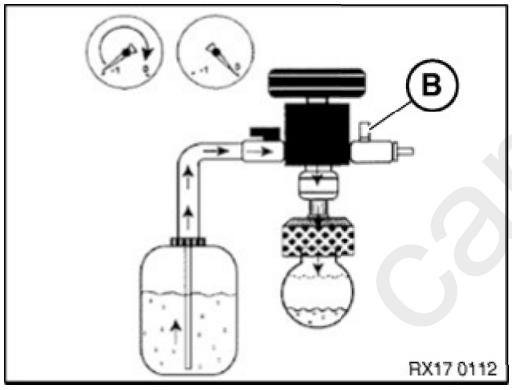
» Vacuum remains constant.

Measure

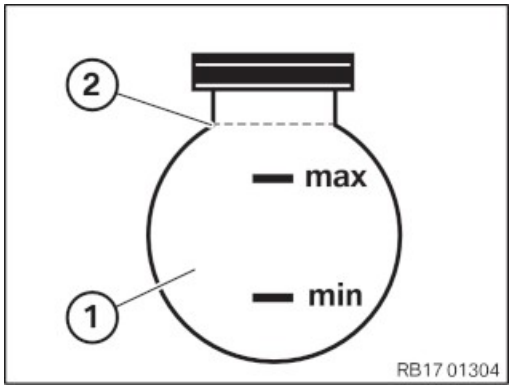
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

28 – Bleed the high-temperature coolant circuit

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

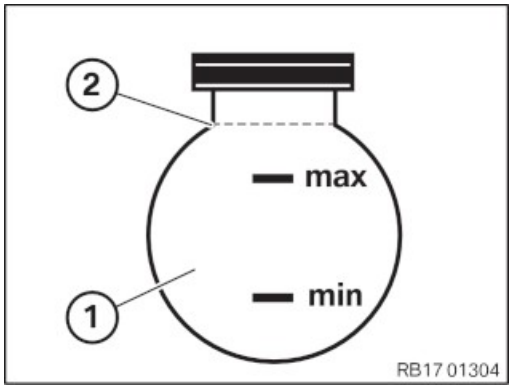
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

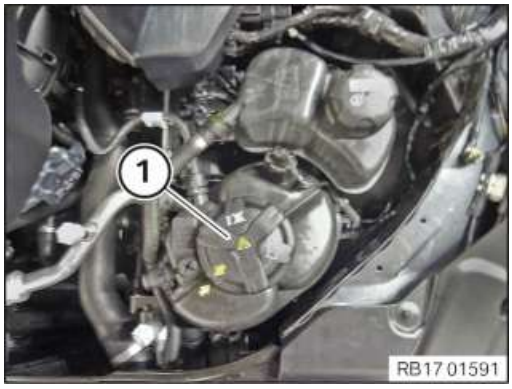
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

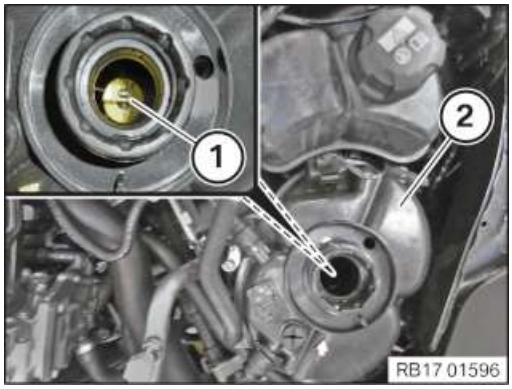
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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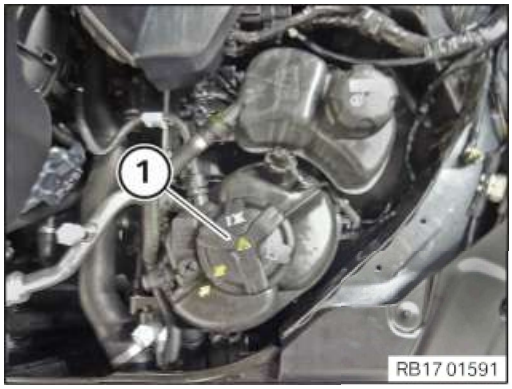
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .

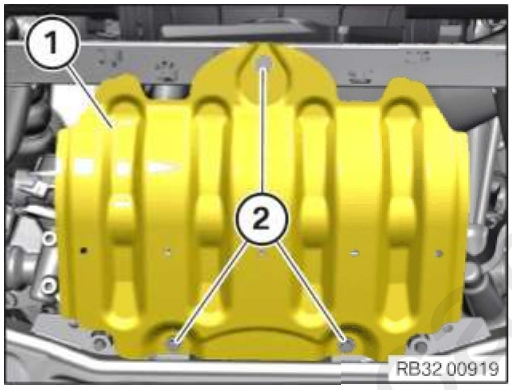


- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

29 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



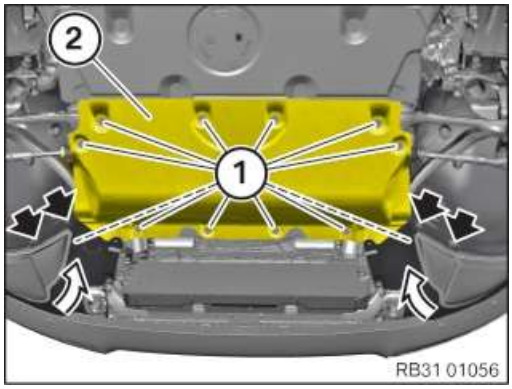
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

30 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

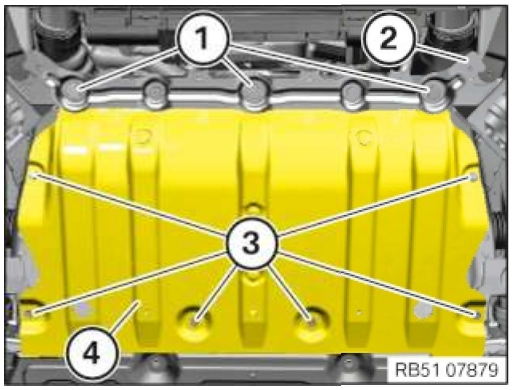
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

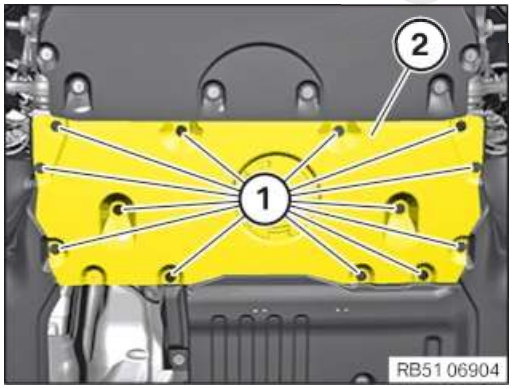
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

31 – Installing the centre underbody protection



- **Version with rear-wheel drive:**

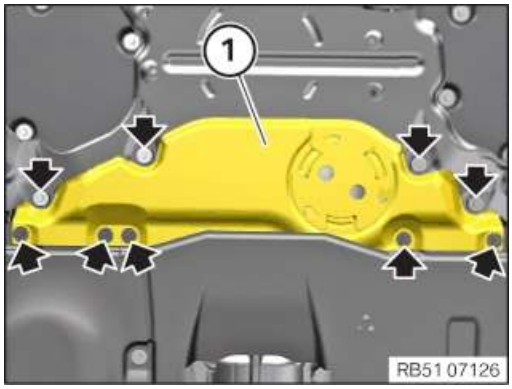
  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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- **Version with all-wheel drive:**

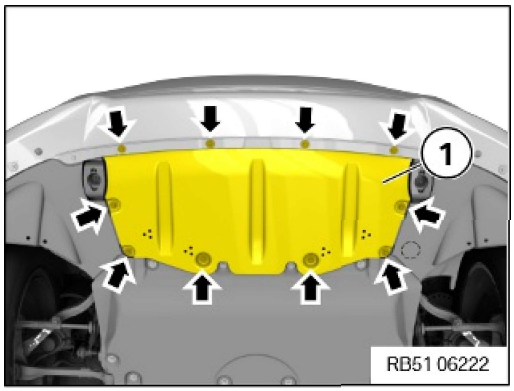
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

32 – Installing the front underbody protection



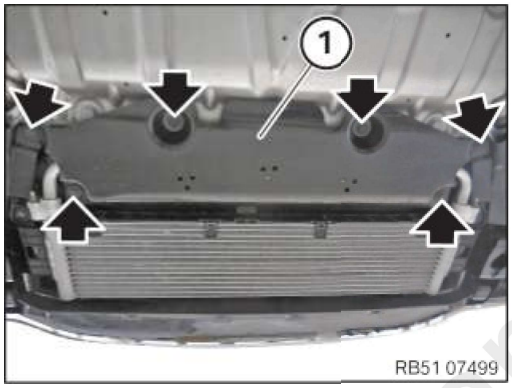
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



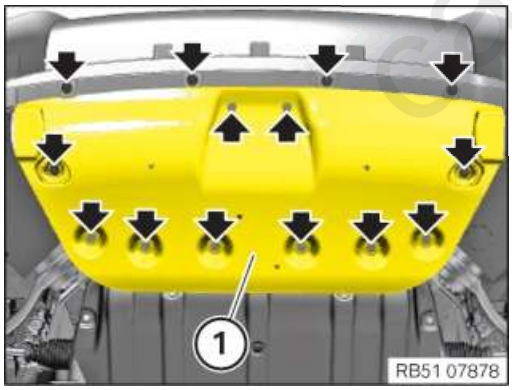
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Coolant feed line to crankcase Used in step 17

M6 x 12		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger Used in step 17

M6 x 12		Tightening torque	8 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger — Used in step 18

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Catalytic converter to holder — Used in step 18

M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder — Used in step 18

M8	Renew nut.	Tightening torque	19 Nm

Rear silencer to body / bumper support — Used in step 19

M8	Replace nuts.	Tightening torque	19 Nm

Exhaust system to rear axle carrier — Used in step 19

Nut M8	Renew nut.	Tightening torque	19 Nm

Front silencer / petrol particulate filter on transmission bracket — Used in step 19

M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter — Used in step 19

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter — Used in step 19

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

Connecting support to tunnel — Used in step 20

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Control sensor — Used in step 21

M18x1.5		Tightening torque	50 Nm

Holder, positive battery cable to cylinder head cover — Used in step 21

6X18		Tightening torque	6 Nm

Clean air pipe to upper section of intake filter housing — Used in step 25

Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 29

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 30

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 30

Thermoplastic hexagon screw		Tightening torque	3 Nm

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Holder underride guard to front axle support — Used in step 30

M10		Tightening torque	56 Nm

Underbody protection — Used in step 31

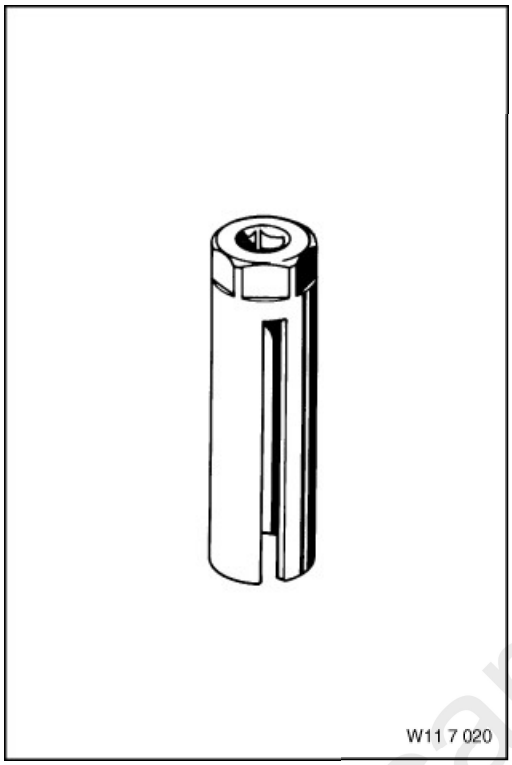
Hexagon screw		Tightening torque	3 Nm

Underbody protection front — Used in step 32

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

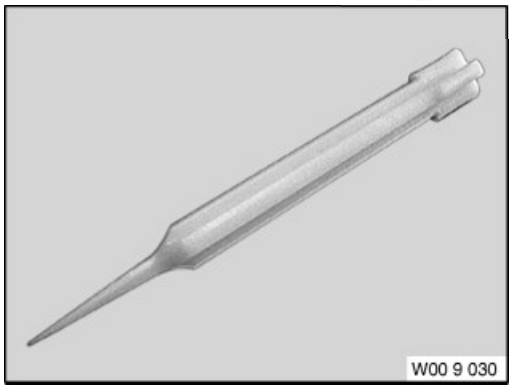
0 491 074 (11 7 020) Socket wrench insert



Common — Used in step 621

Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

0 496 714 (00 9 030) Wedge



Common — Used in step 17

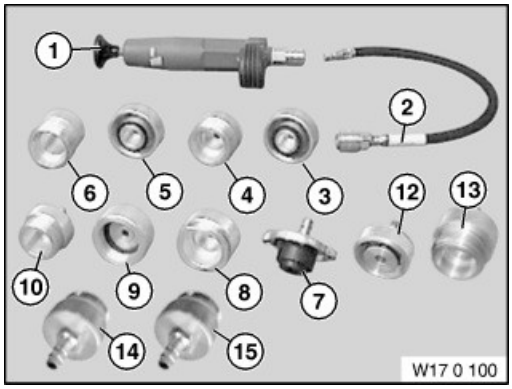
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

0 494 417 (17 0 100) Tester

Common — Used in step 27

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	

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Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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Overview Technical Data

Capacity of high-temperature coolant circuit G20	Used in step 27
B48B20O1/B46B20O1	9.8 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

General repair instructions	Used in step
11 00 ... Overview of consumables (Electronic Parts Catalogue)	21

Repair instructions	Used in step
17 00 ... Notes for working on cooling system.	27

Operating materials	Used in step
Main group 17	27

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11 53 116 Removing and installing/replacing the coolant line between cylinder head and coolant pump

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

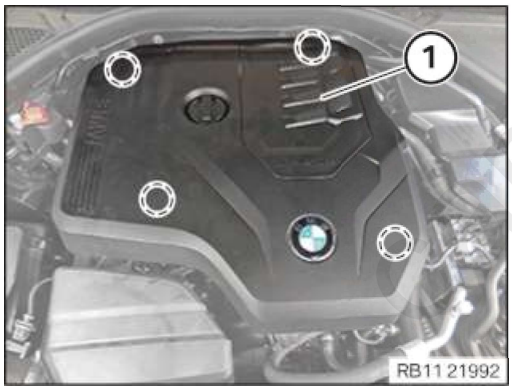
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Removing the clean air pipe with the resonator

WARNING

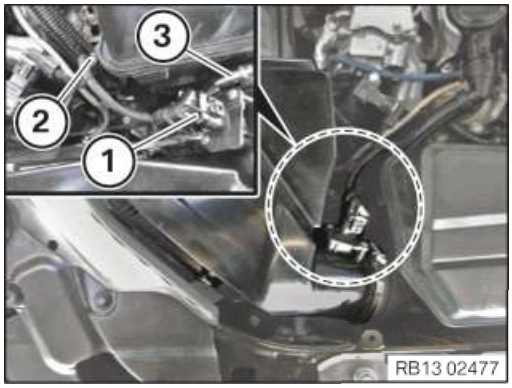
Hot surfaces.

Risk of burning!

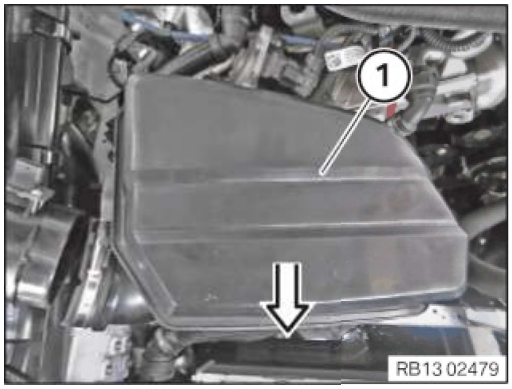
- Perform all work only on components that have cooled down.



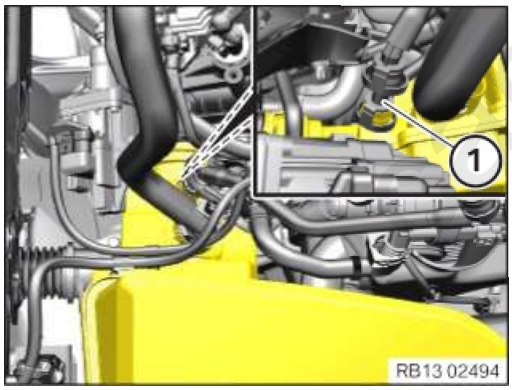
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



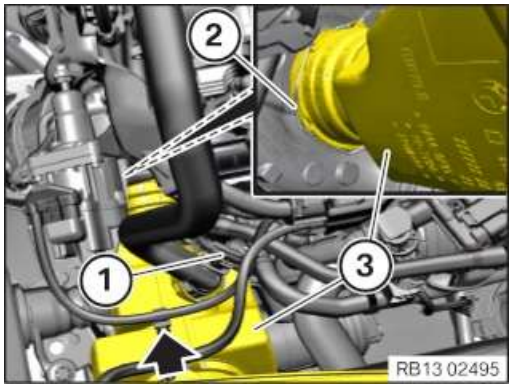
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



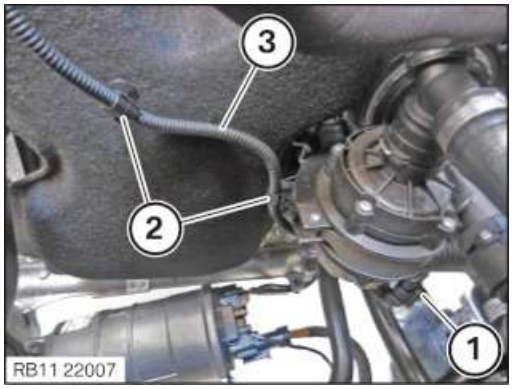
- Unlock and disconnect the tank ventilation line (1).



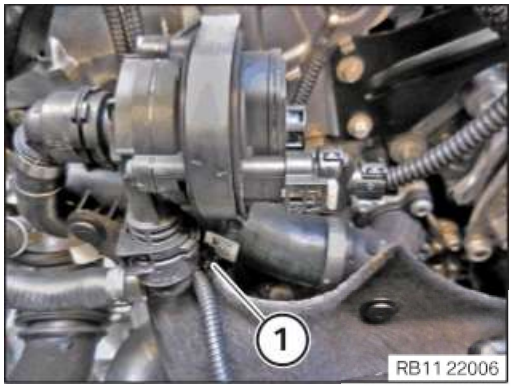
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

3 – Removing the acoustic cover for the engine at the front

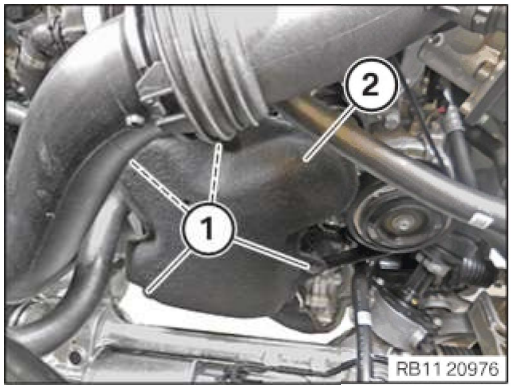
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

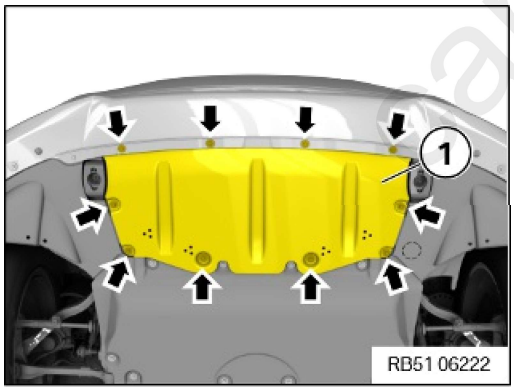


- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

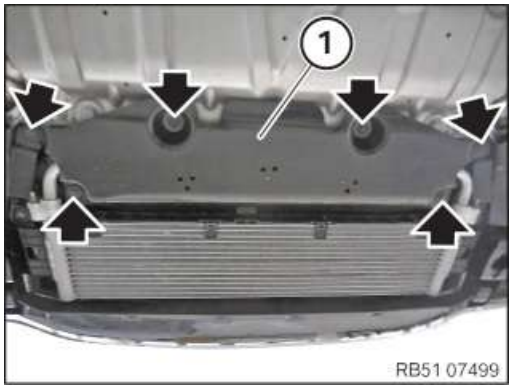
4 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed front underbody protection (1) backwards out of the bumper panel.

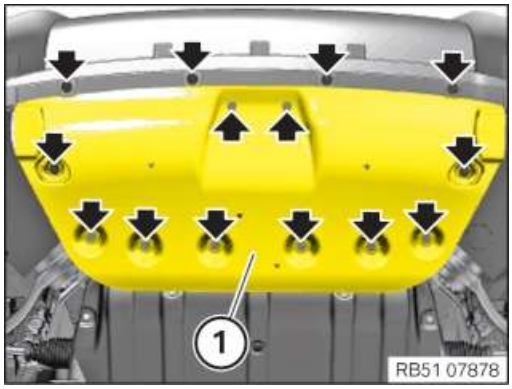


- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

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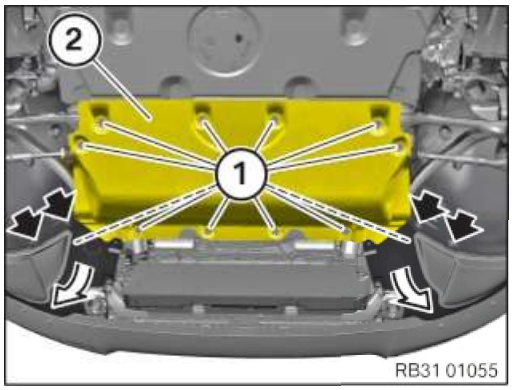


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

5 – Remove the underbody protection of the steering gear



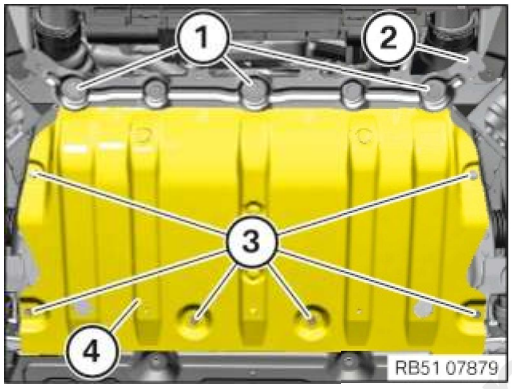
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

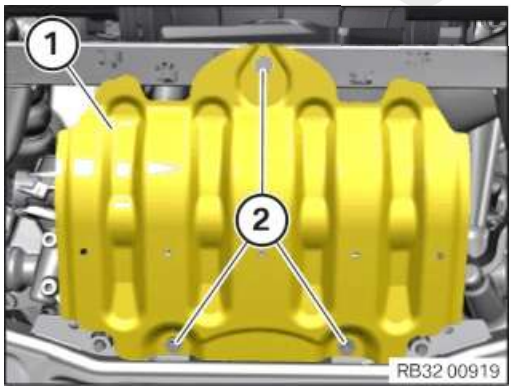
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

6 – If installed: Removing the steering start protection

Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

7 – Draining the coolant from the high-temperature cooling system

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

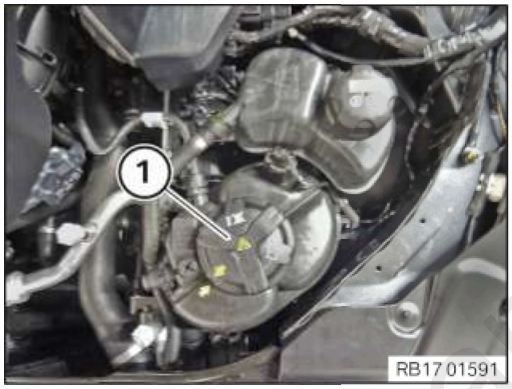
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

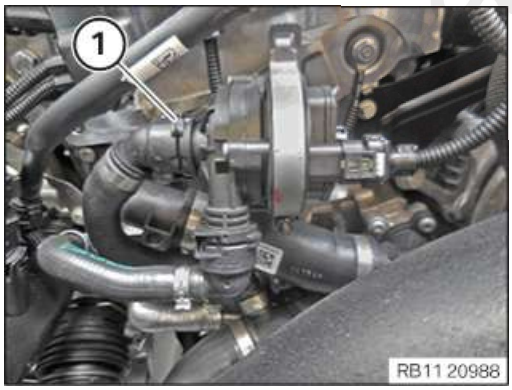
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

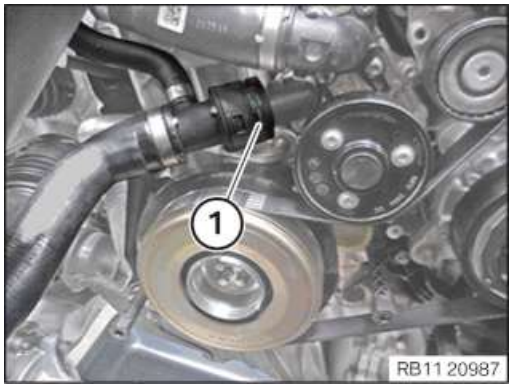
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



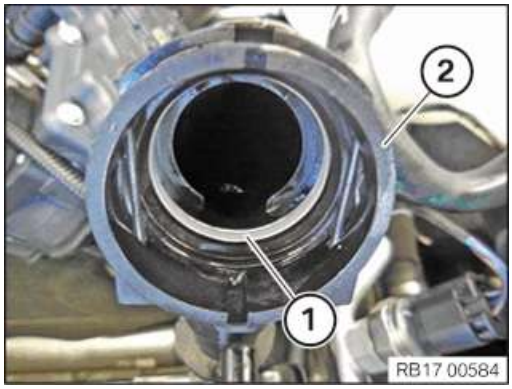
- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

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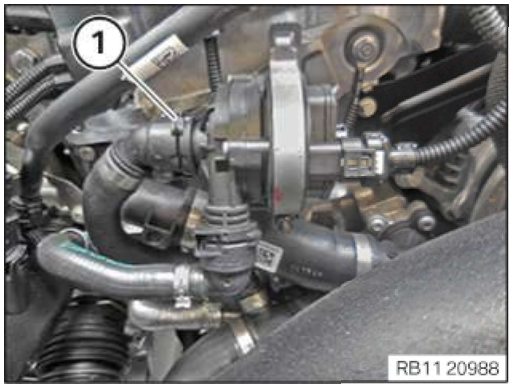
8 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

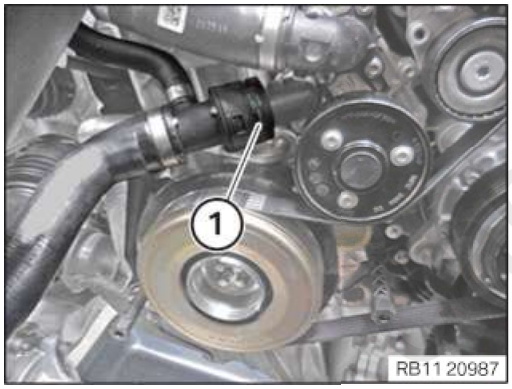


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

MAIN WORK

9 – Remove the coolant line between the coolant pump and the cylinder head

WARNING

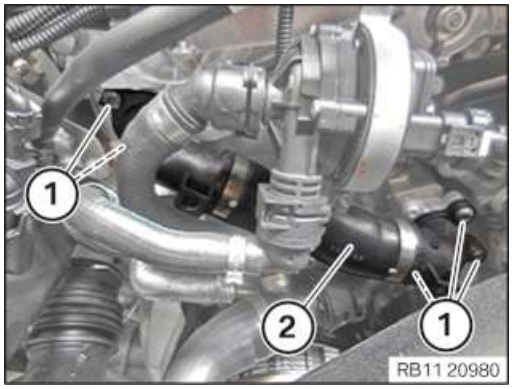
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

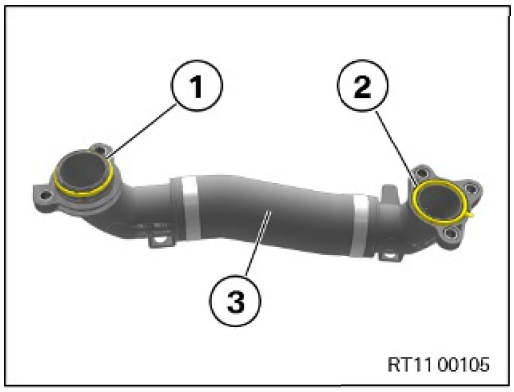
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



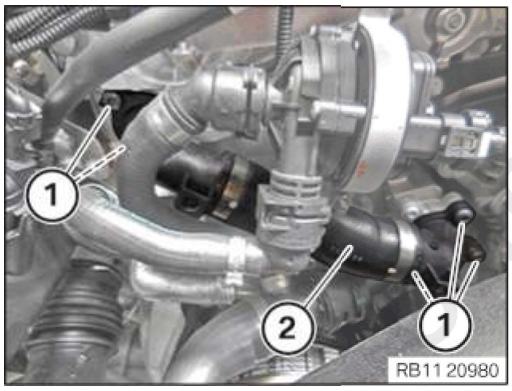
- Loosen screws (1).
- Remove the coolant line (2).
- Catch and dispose of escaping coolant.

10 – Install the coolant line between the coolant pump and the cylinder head



- Check the sealing rings (1) and (2) for damage and if necessary, renew the coolant line (3).

  Parts: Sealing ring



TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

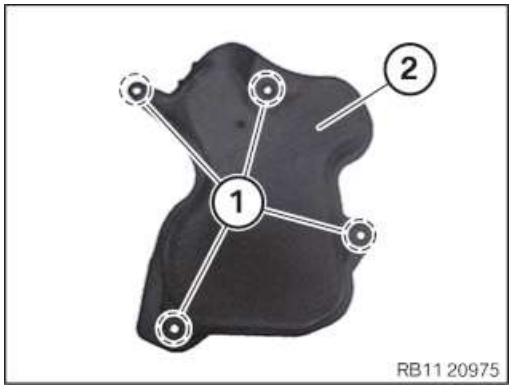
- Feed in and install coolant line (2).
- Hand-tighten the bolts (1).
- Tighten the screws (1).

Coolant line to coolant pump/cylinder head

M6x20		Tightening torque	8 Nm

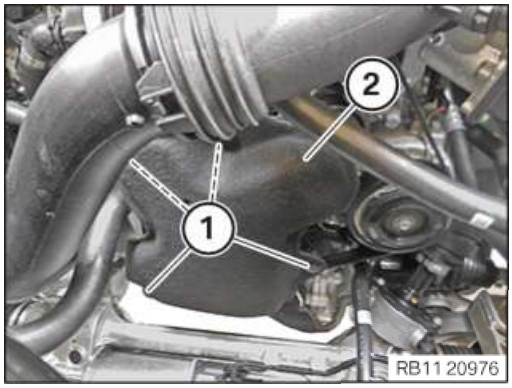
POSTPROCESSES

11 – Install the acoustic cover for the engine at the front

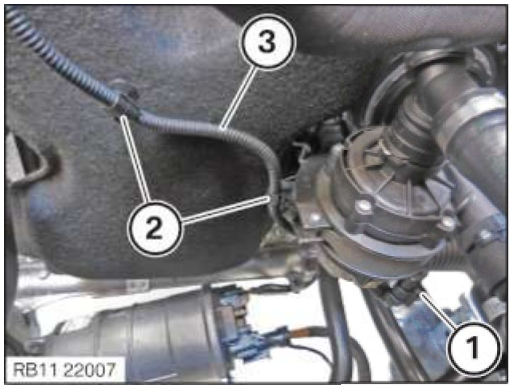


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

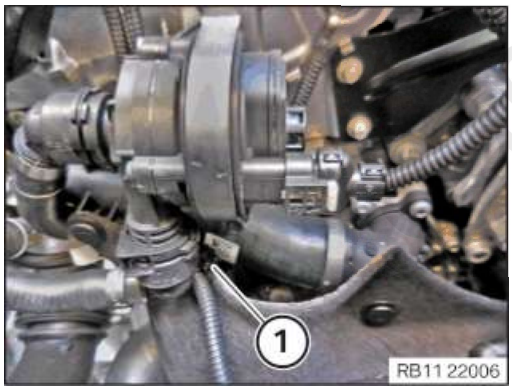


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



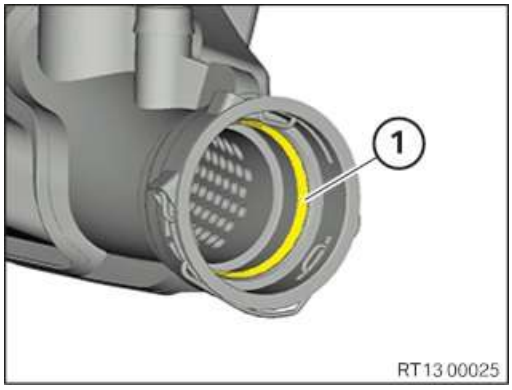
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

12 – Installing the clean air pipe with resonator



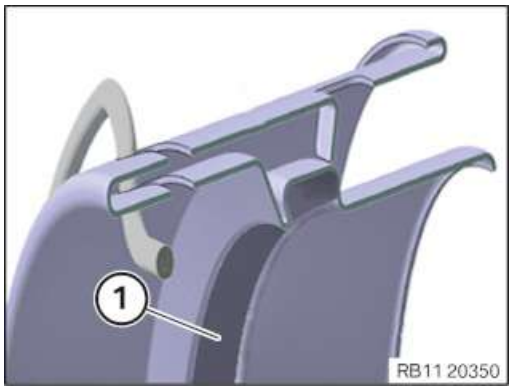
- Check the seal (1) for damages, replace if necessary.

► **Replace damaged gasket**

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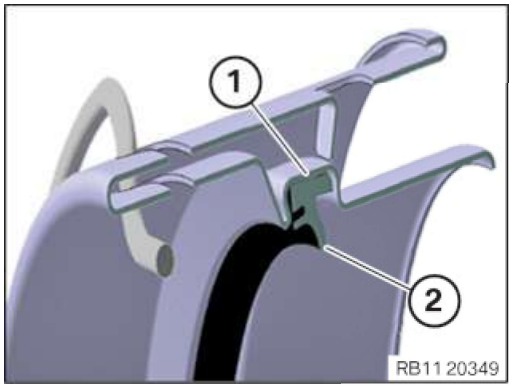
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



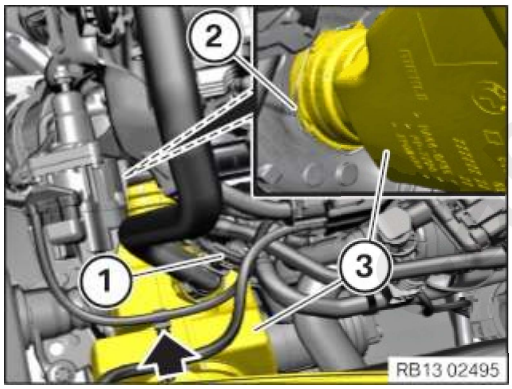
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

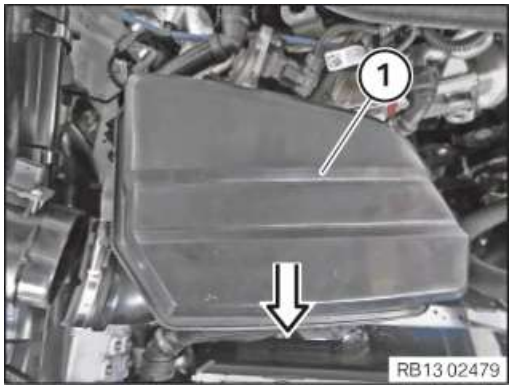
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



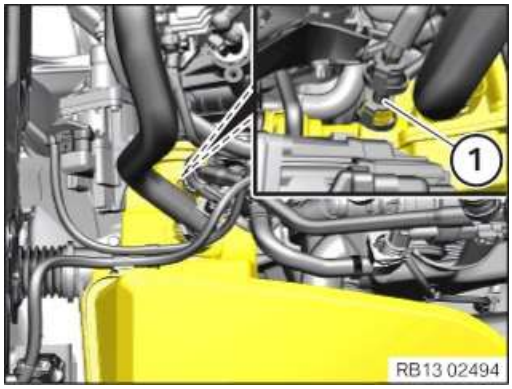
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

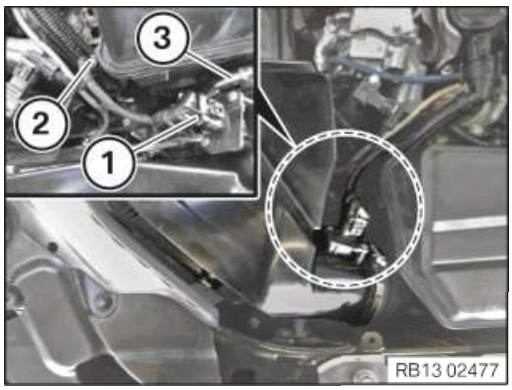
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

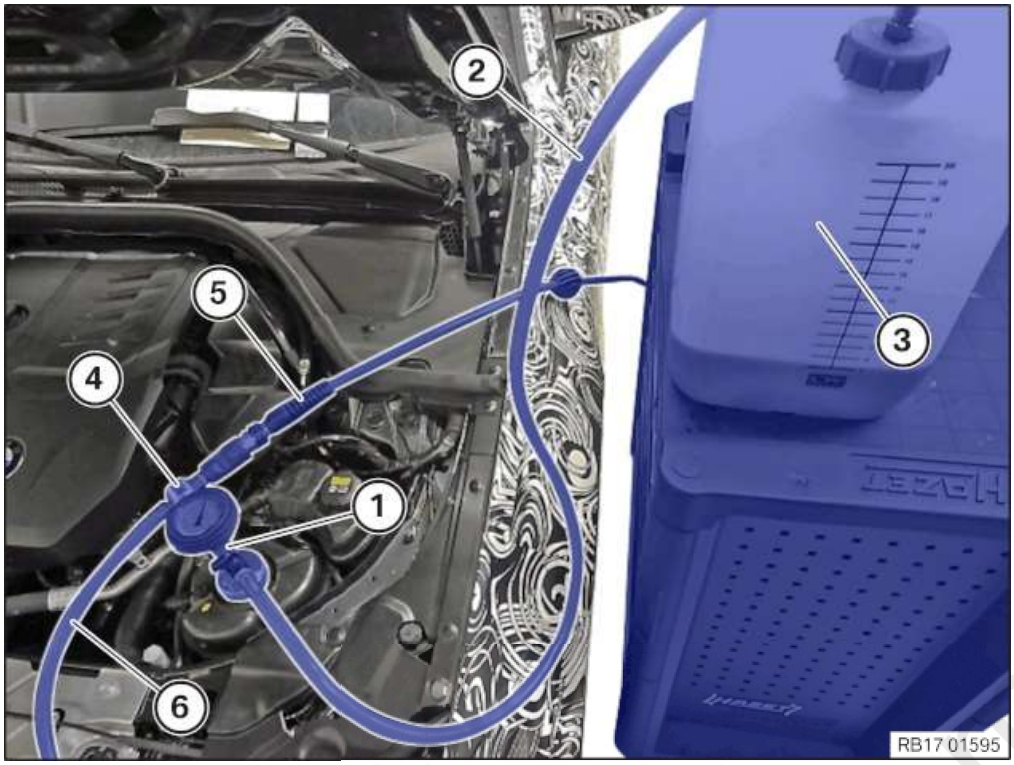


- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

13 – Fill the high-temperature cooling system with the vacuum filler device

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Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

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TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

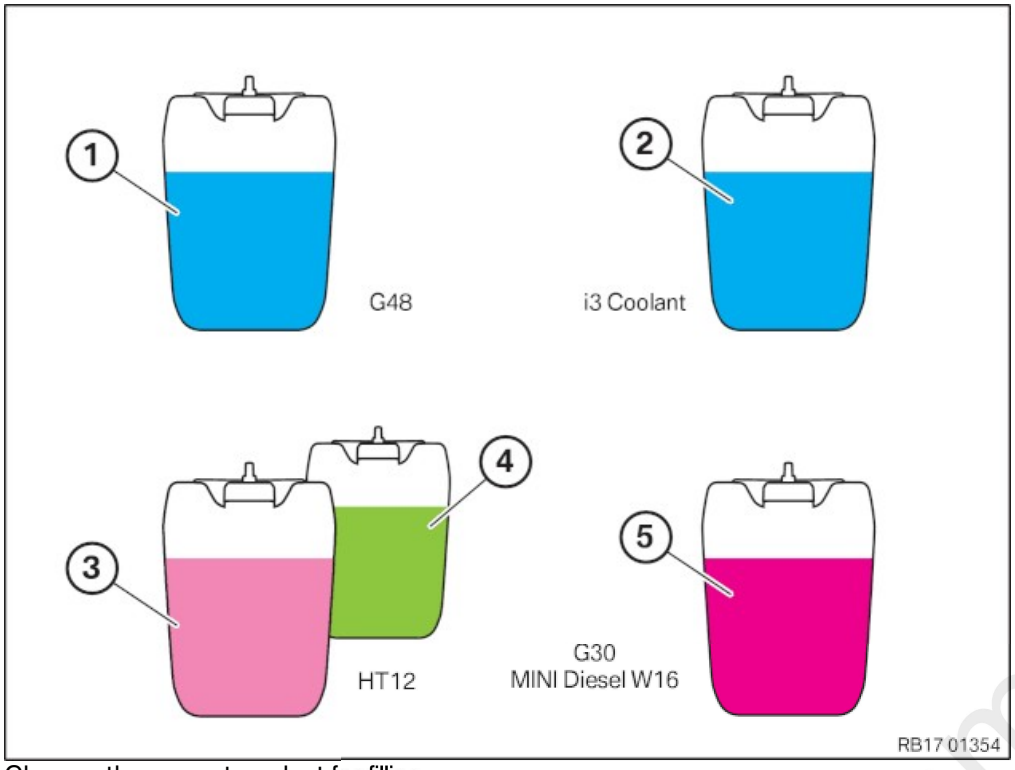
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

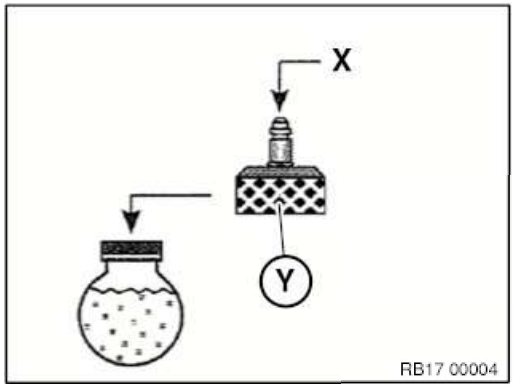
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

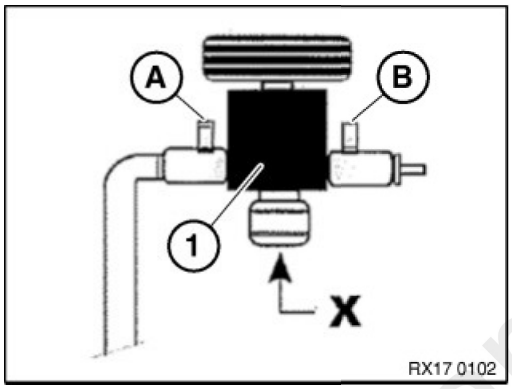
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

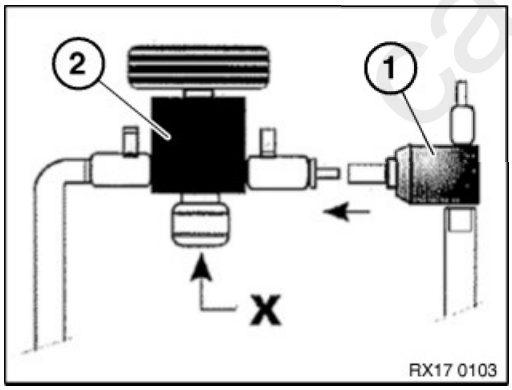
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

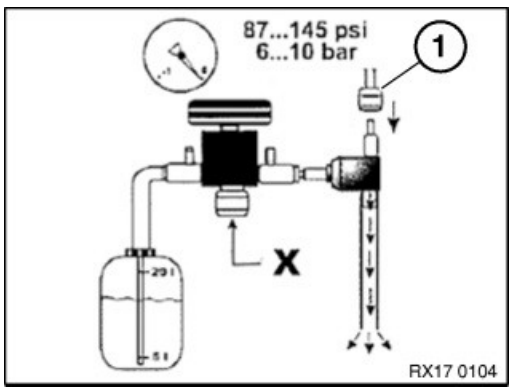


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

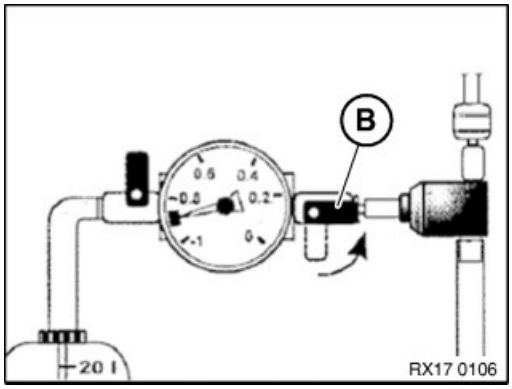
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

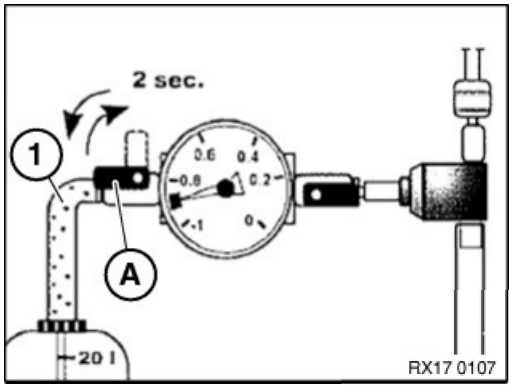
  (X)is the connection on the coolant expansion tank.

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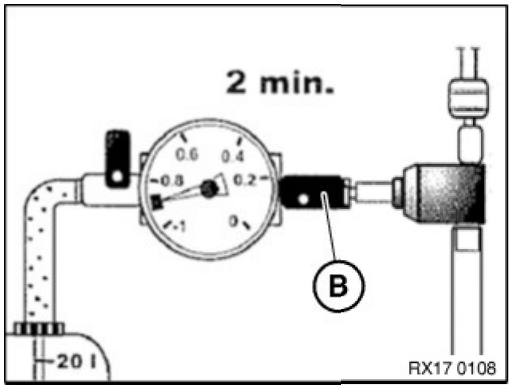
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

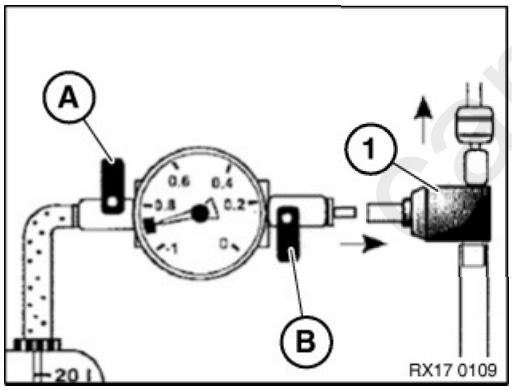


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

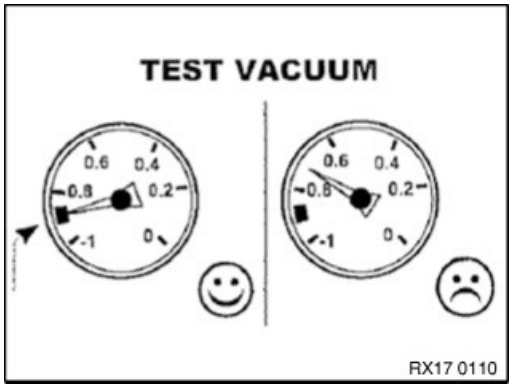
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

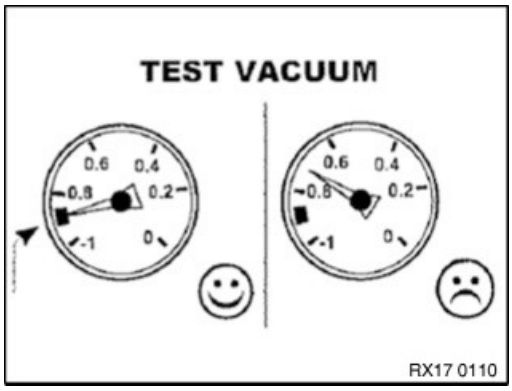
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



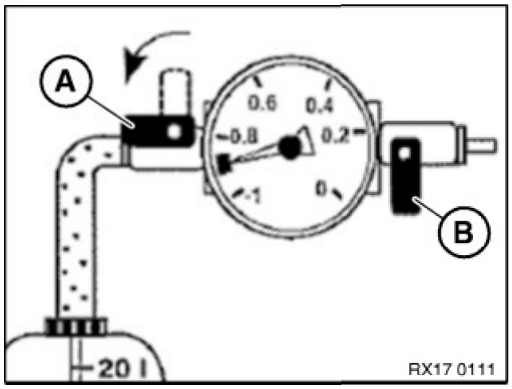
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

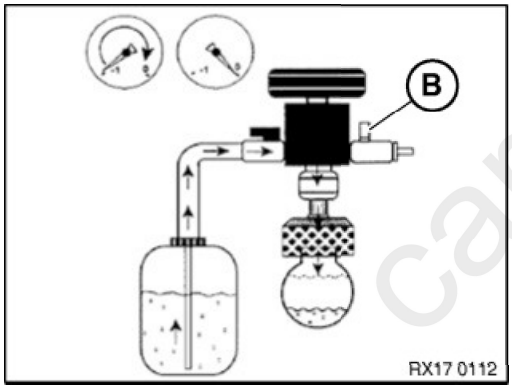
» Vacuum remains constant.

Measure

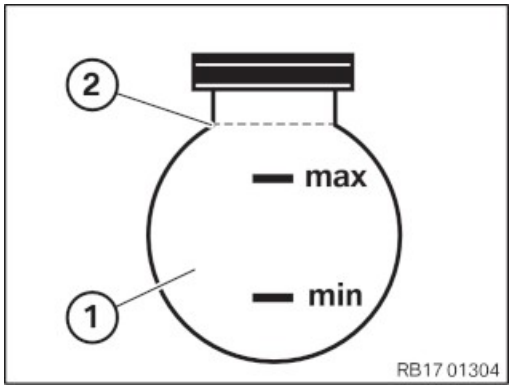
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

14 – Bleed the high-temperature coolant circuit

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

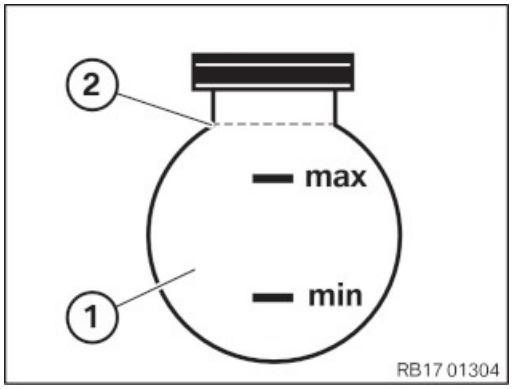
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

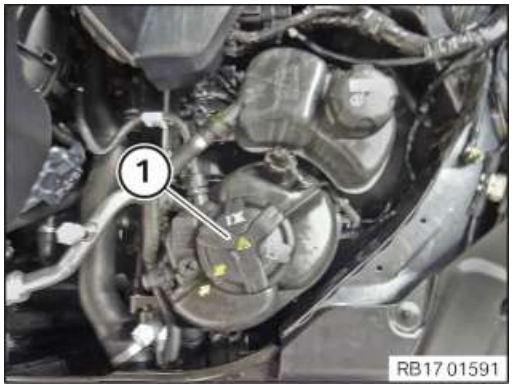
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

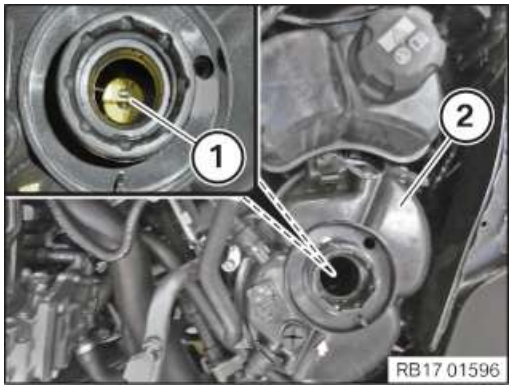
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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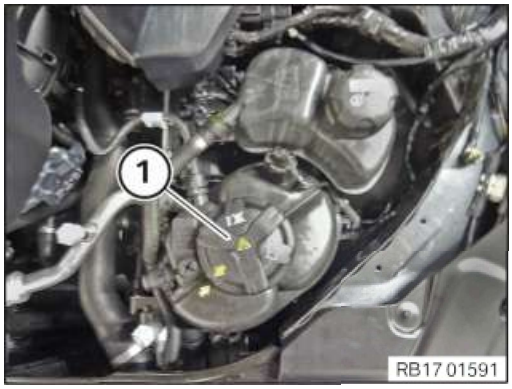
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .



- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

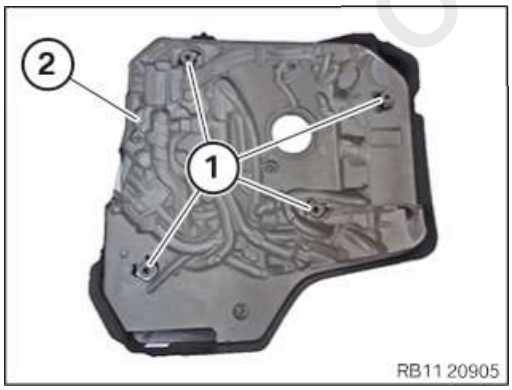
15 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

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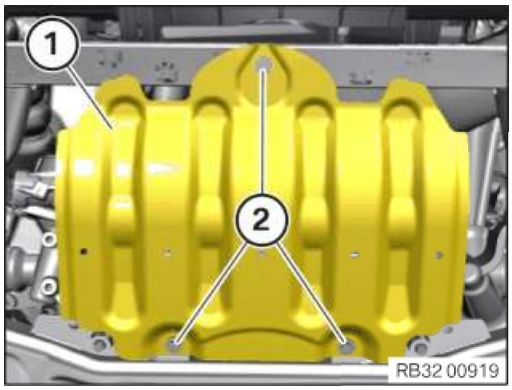
- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

16 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

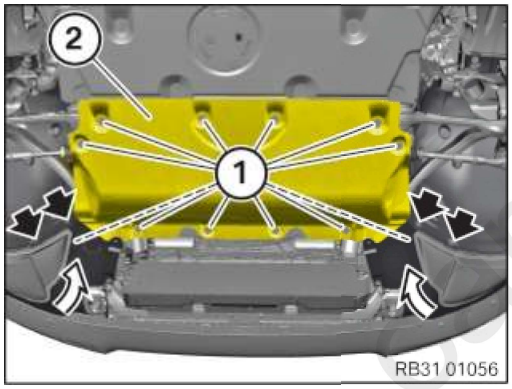


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

17 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

Underbody protection of the steering gear

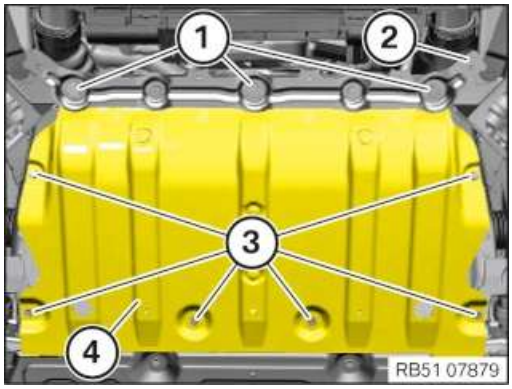
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm

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- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

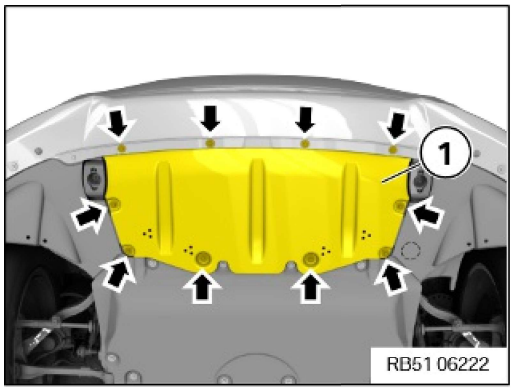
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

18 – Installing the front underbody protection



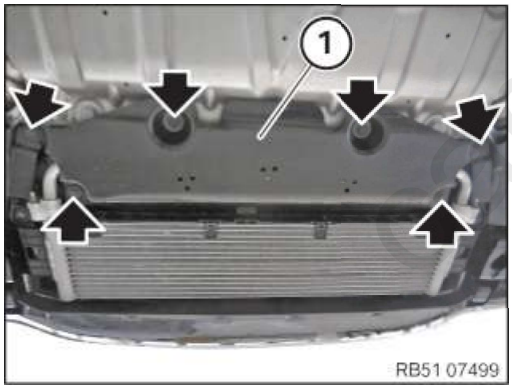
- **Version 1:**

Feed in the front underbody protection (1) towards the front under the bumper panel and position.

Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



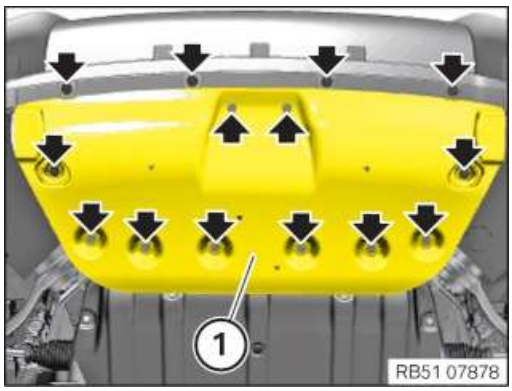
- **Version 2:**

Feed in and position the front underbody protection (1).

Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

Feed in and install front underbody protection (1).

Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Overview of Tightening Torques

Coolant line to coolant pump/cylinder head — Used in step 10

M6x20		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 12

Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 16

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 17

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 17

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 17

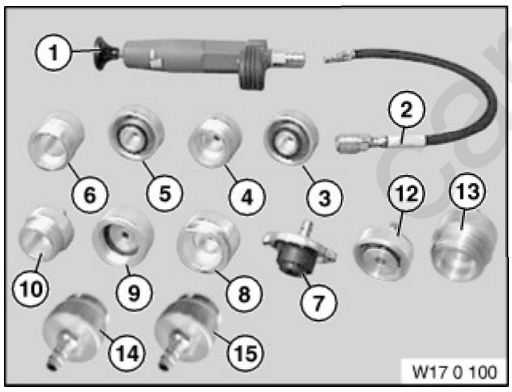
M10		Tightening torque	56 Nm

Underbody protection front — Used in step 18

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

0 494 417 (17 0 100) Tester



Common — Used in step 13

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	

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1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Capacity of high-temperature coolant circuit G20	Used in step 13
B48B20O1/B46B20O1	9.8 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

Repair instructions	**Used in step**
17 00 ... Notes for working on cooling system.	13

Operating materials	**Used in step**
Main group 17	13

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11 53 086 Removing and installing/replacing the coolant return line for the exhaust turbocharger

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

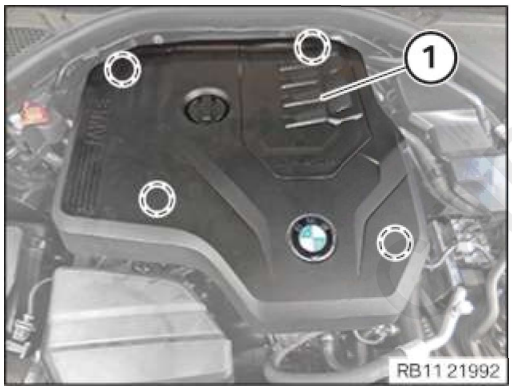
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Removing the clean air pipe with the resonator

WARNING

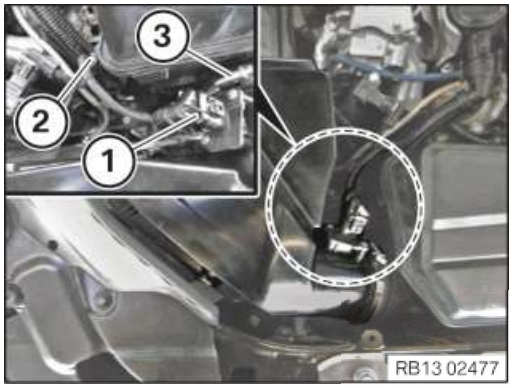
Hot surfaces.

Risk of burning!

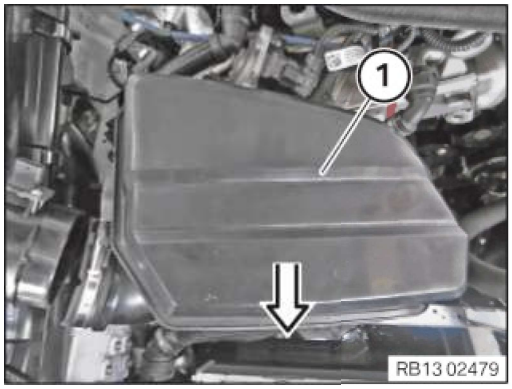
- Perform all work only on components that have cooled down.



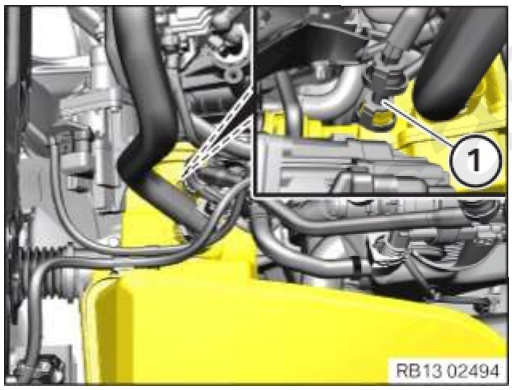
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



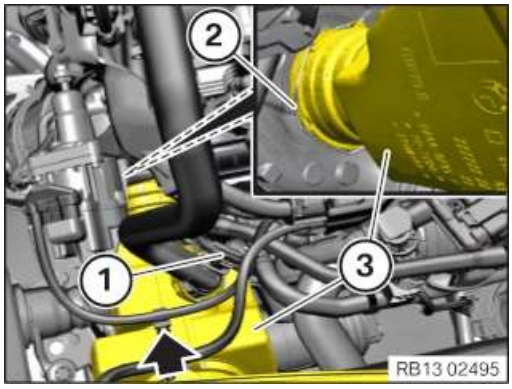
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



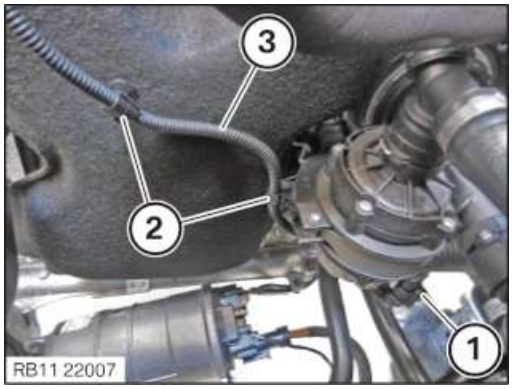
- Unlock and disconnect the tank ventilation line (1).



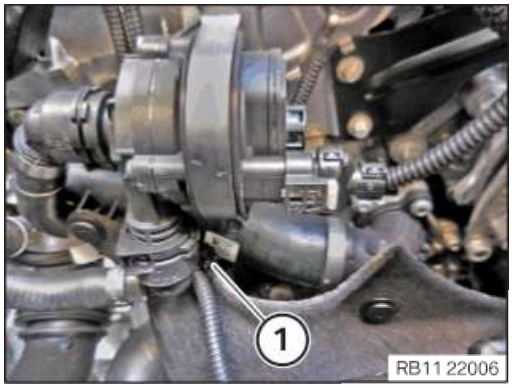
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

3 – Removing the acoustic cover for the engine at the front

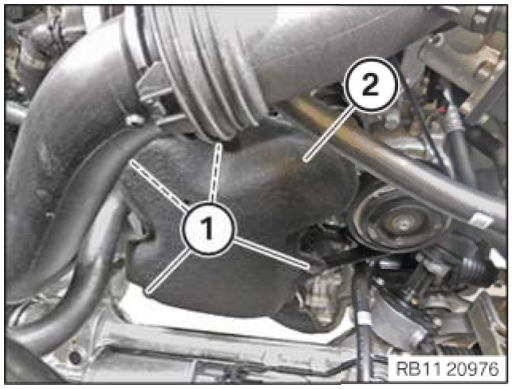
rdiagn.com



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.

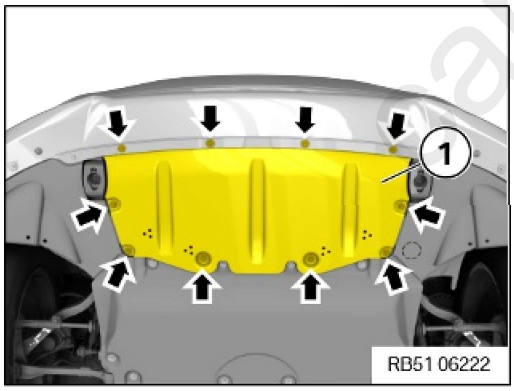


- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

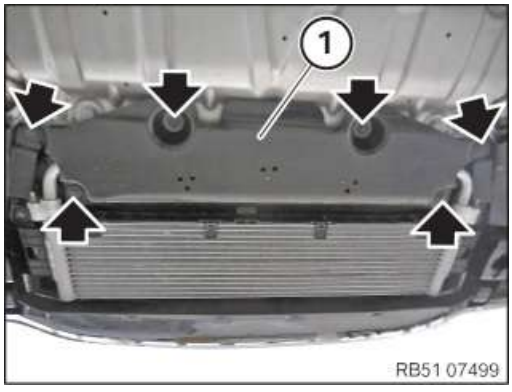
4 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed front underbody protection (1) backwards out of the bumper panel.

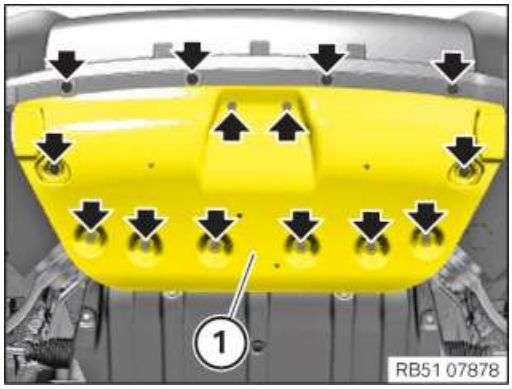


- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

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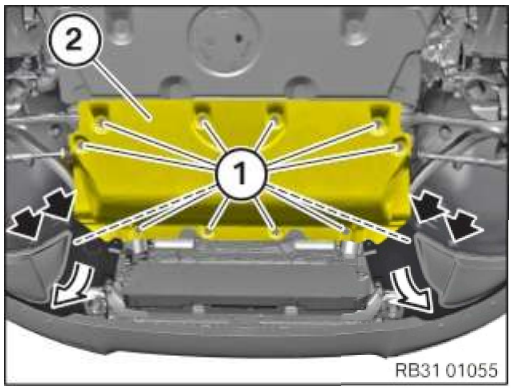


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

5 – Remove the underbody protection of the steering gear



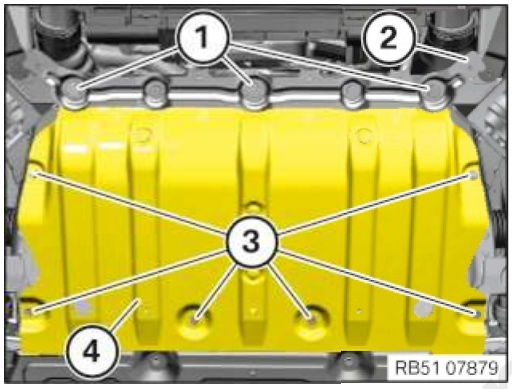
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

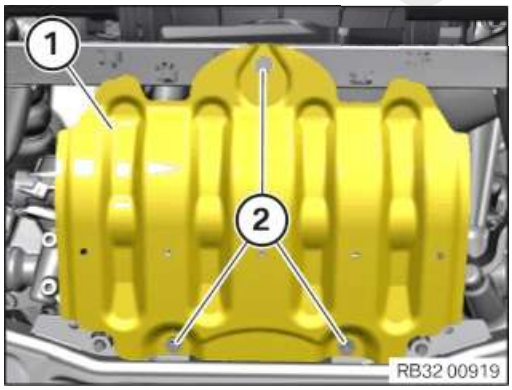
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

6 – If installed: Removing the steering start protection

Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

7 – Draining the coolant from the high-temperature cooling system

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

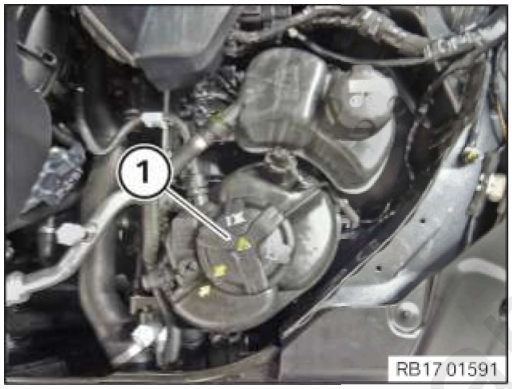
Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

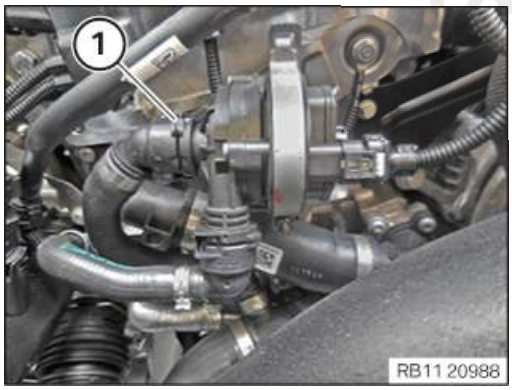
In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

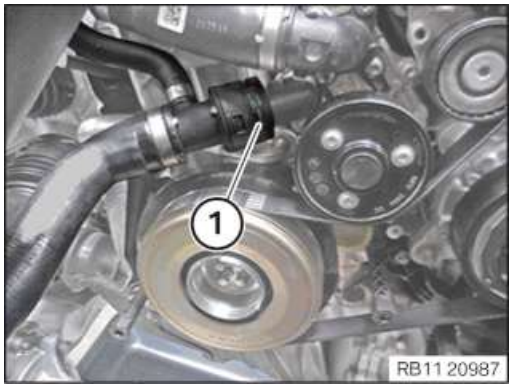
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.



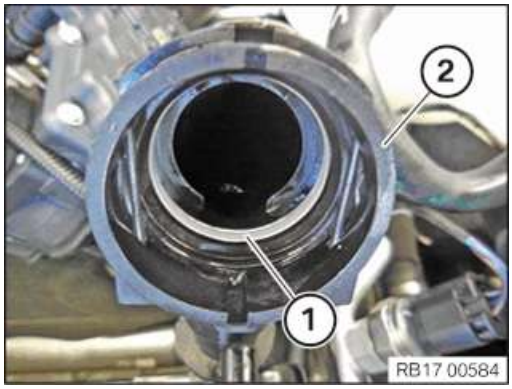
- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

partdiagn.com

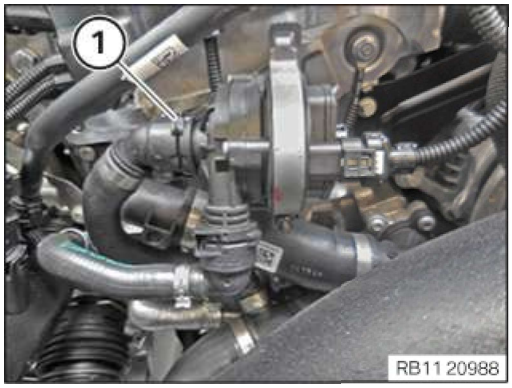
8 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

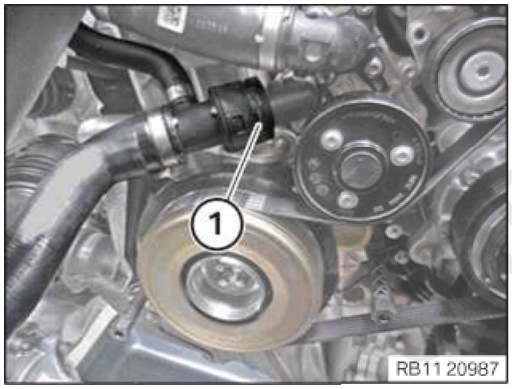


- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

MAIN WORK

9 – Remove the coolant return line for the exhaust turbocharger

WARNING

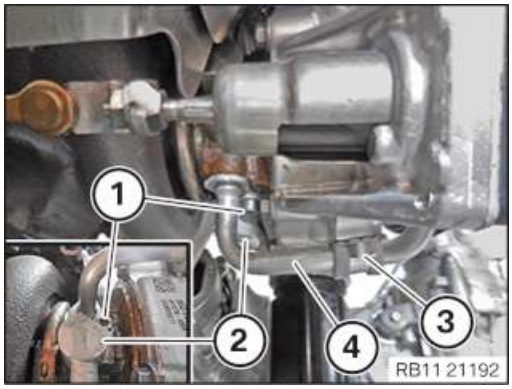
Hot fluids.

Risk of scalding!

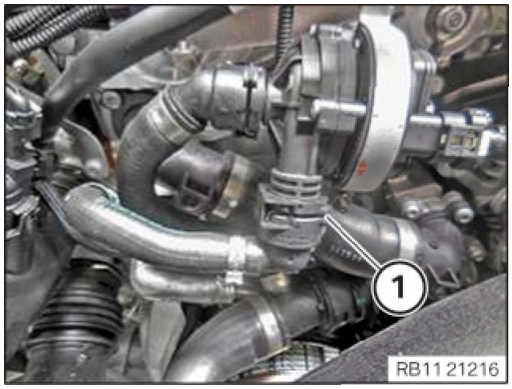
- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

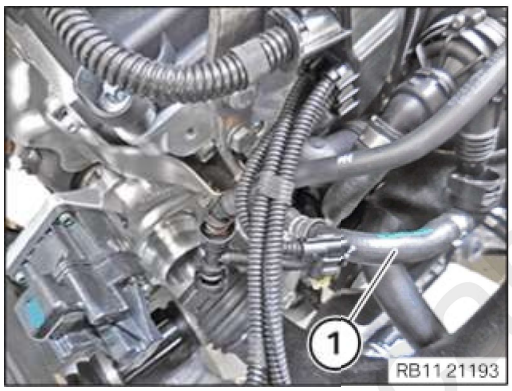
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

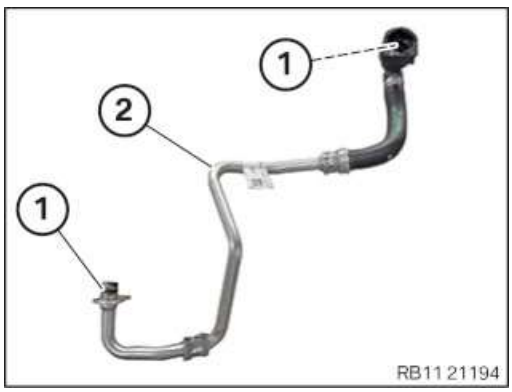


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

10 – Install the coolant return line for the exhaust turbocharger

TECHNICAL INFORMATION

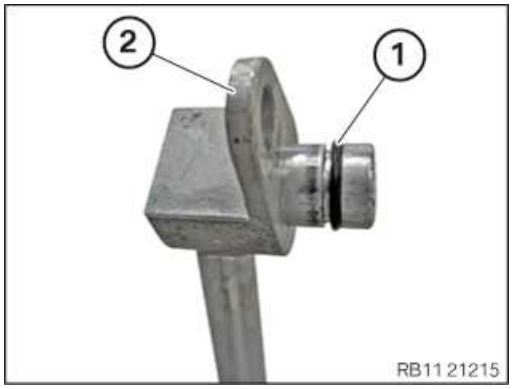
Make sure that the connections are locked correctly. The locks must engage audibly.



- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

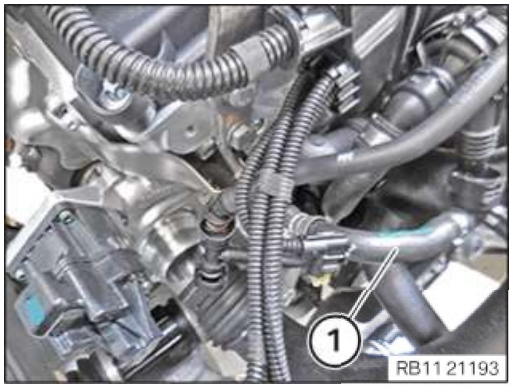
  Parts: O-rings

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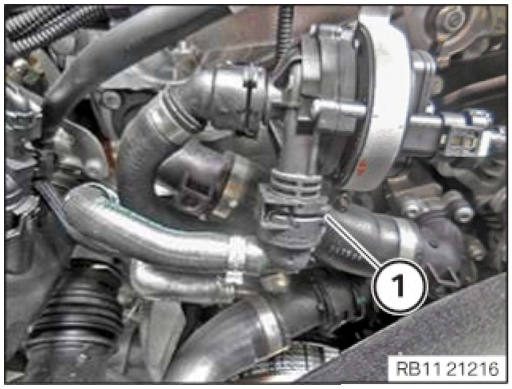


- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

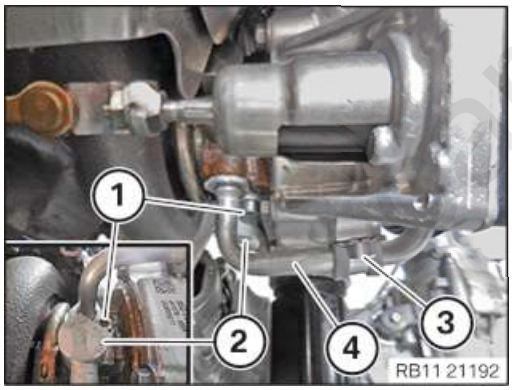
  Parts: O-ring



- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

- Tighten down screw (3).

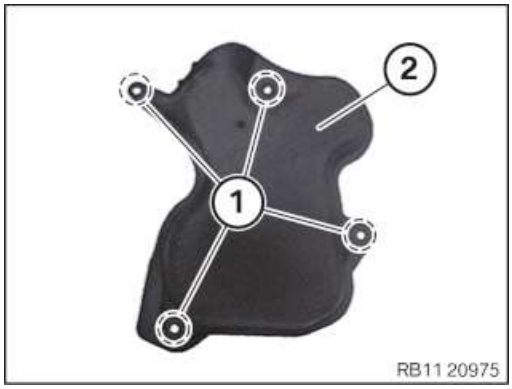
Coolant return line holder to exhaust turbocharger

M6		Tightening torque	8 Nm

POSTPROCESSES

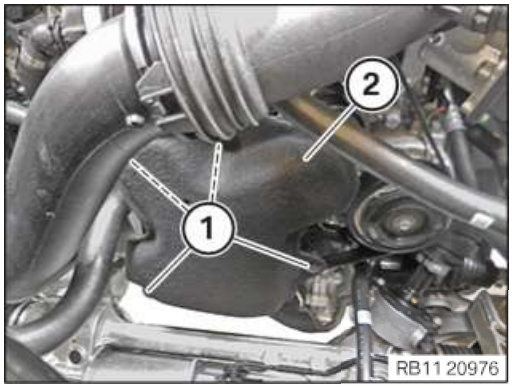
11 – Install the acoustic cover for the engine at the front

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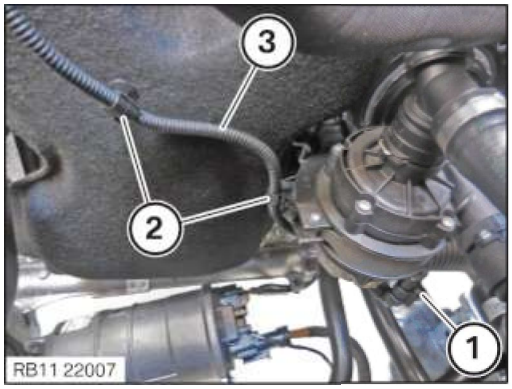


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

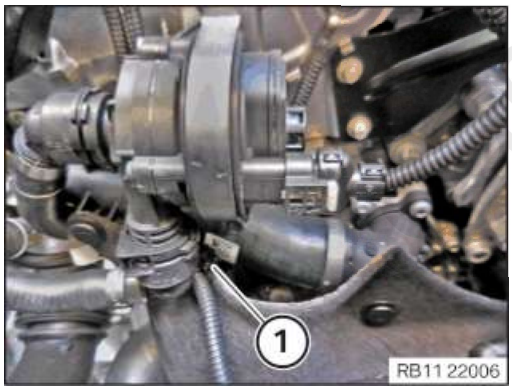


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



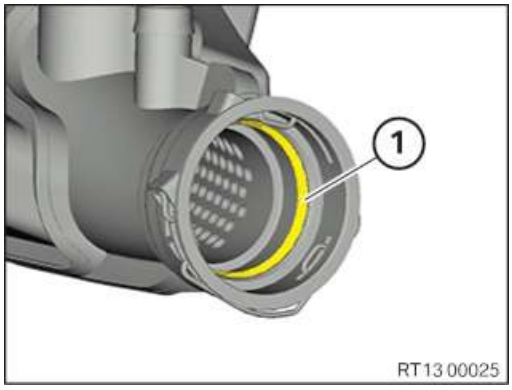
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

12 – Installing the clean air pipe with resonator



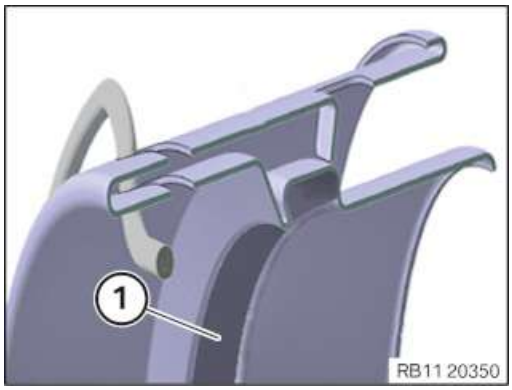
- Check the seal (1) for damages, replace if necessary.

► **Replace damaged gasket**

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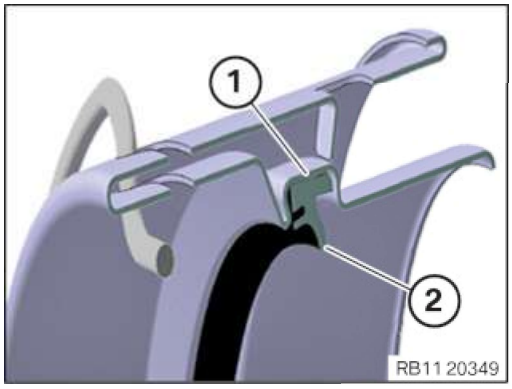
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



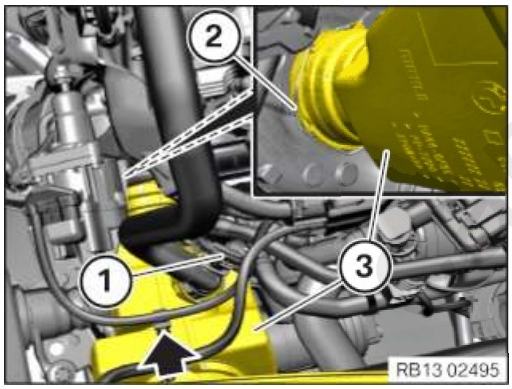
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

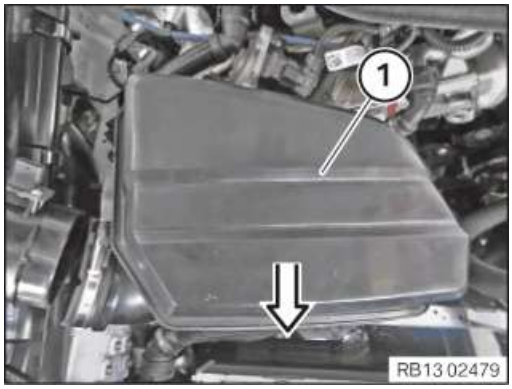
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



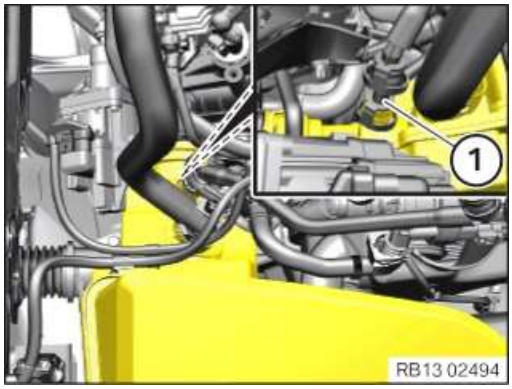
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

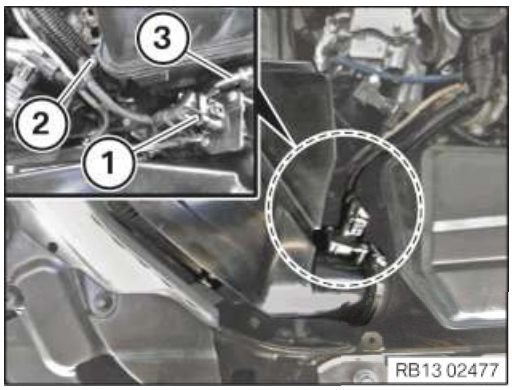
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

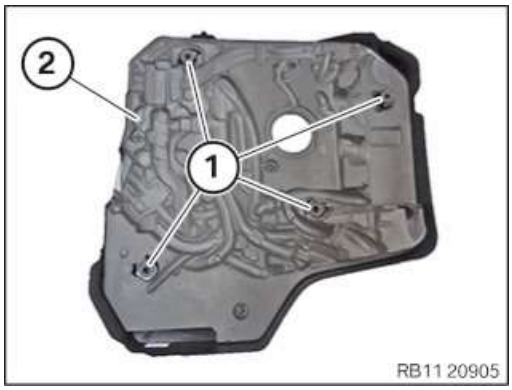
13 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

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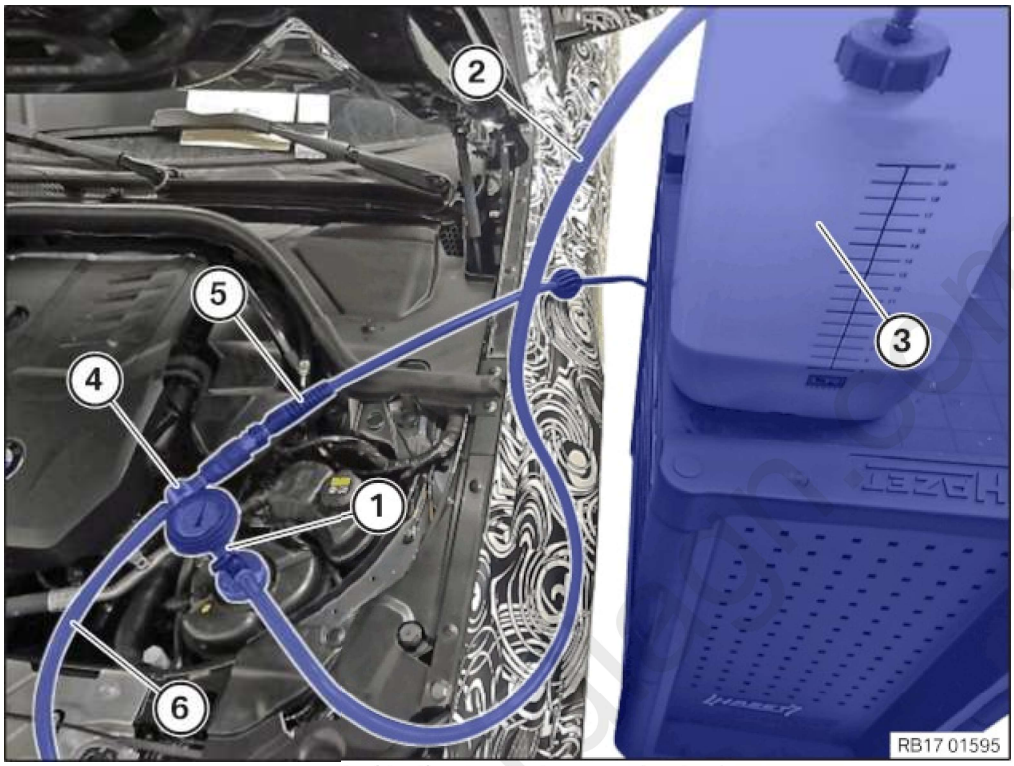


- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

14 – Fill the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

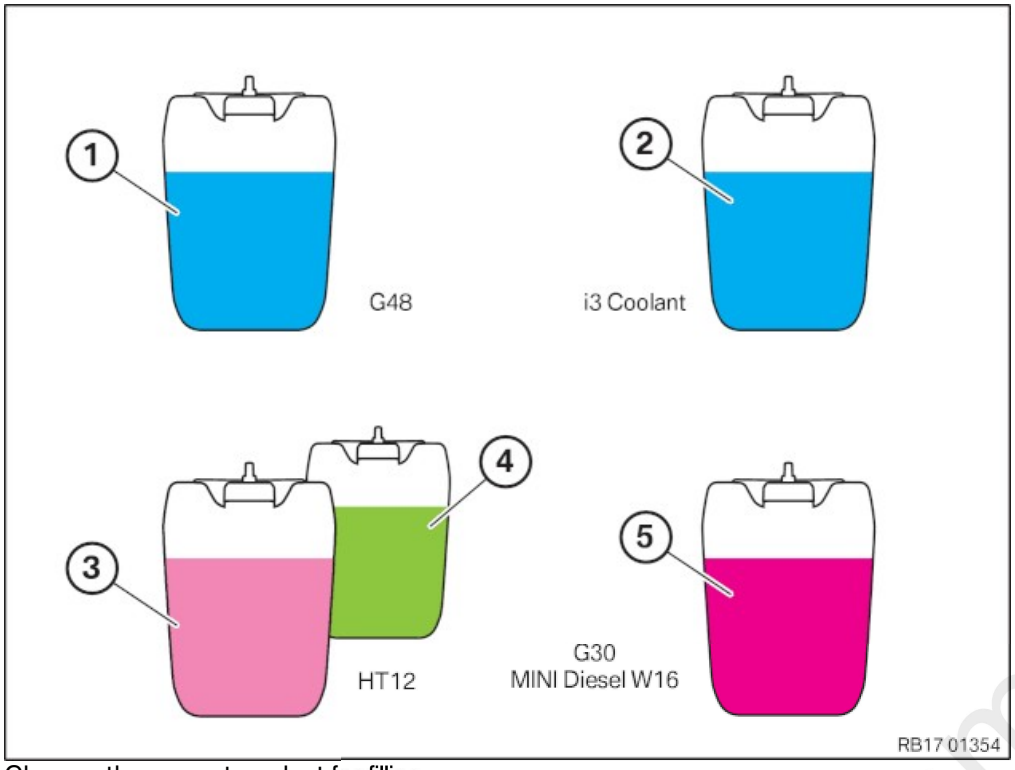
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

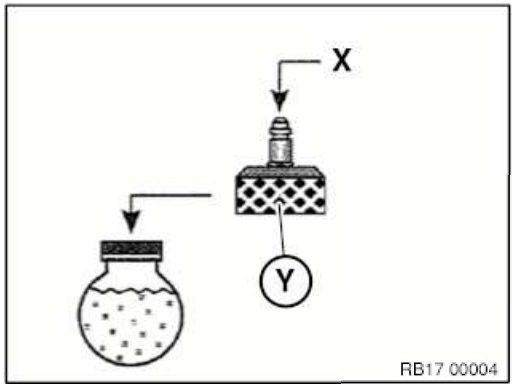
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

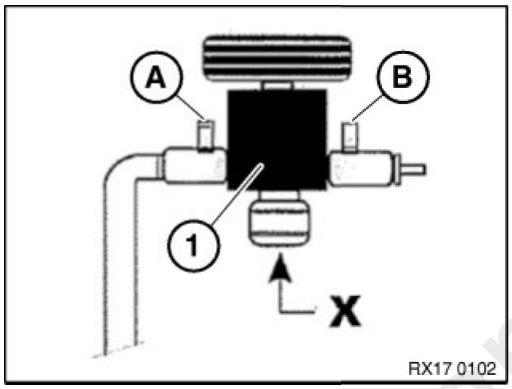
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

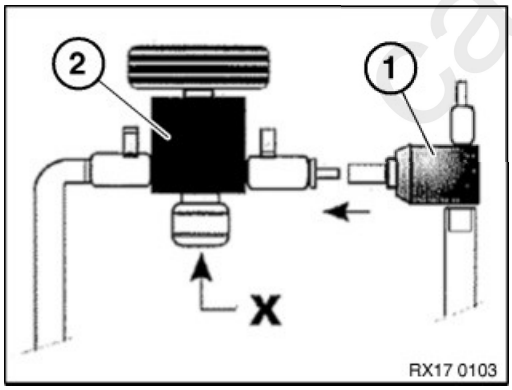
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

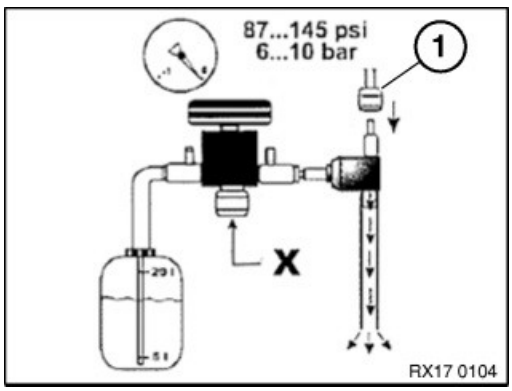


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

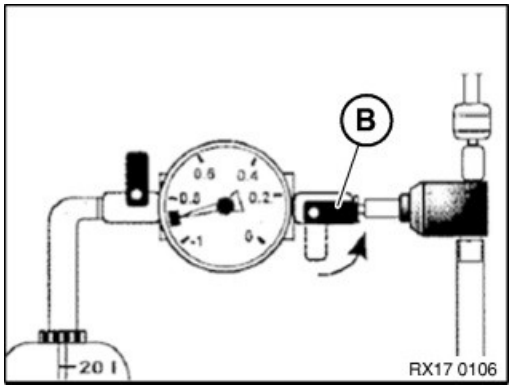
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

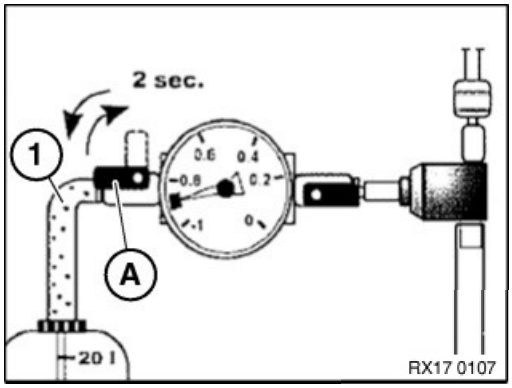
  (X)is the connection on the coolant expansion tank.

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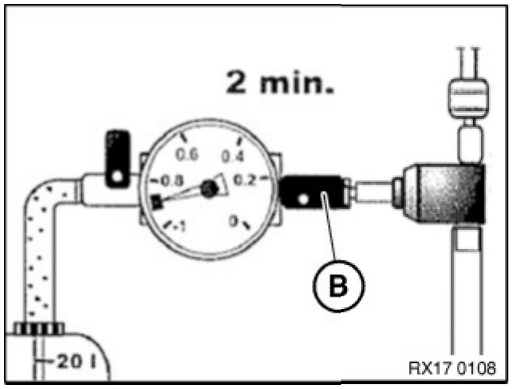
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

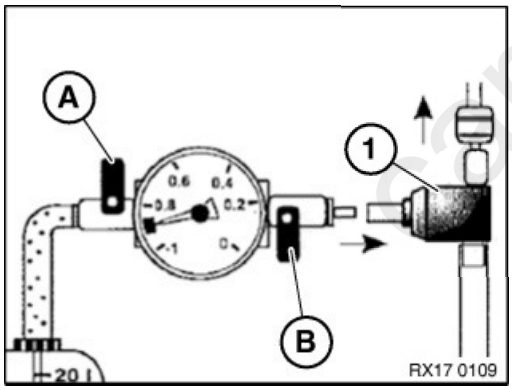


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

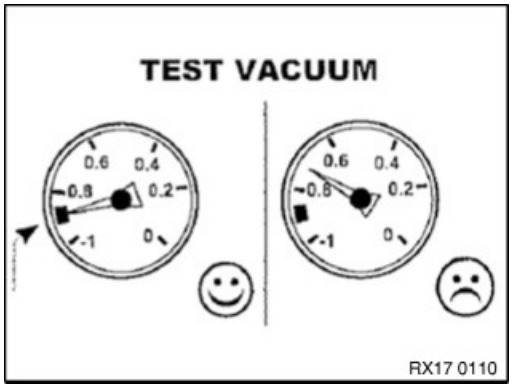
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

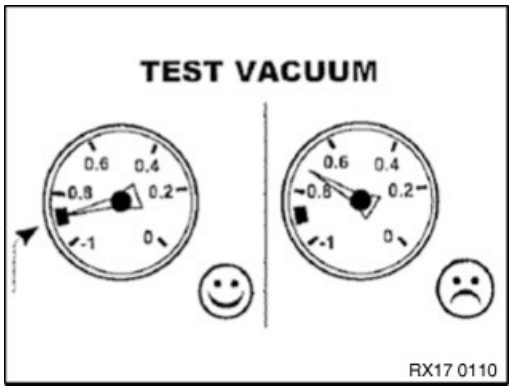
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



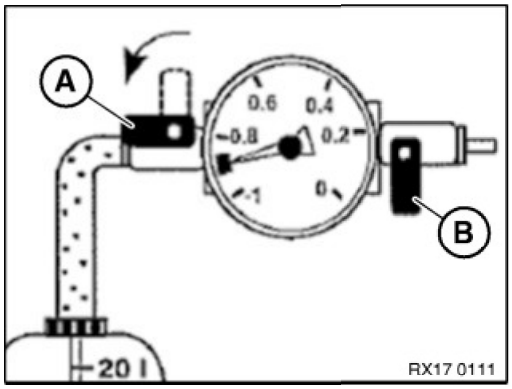
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

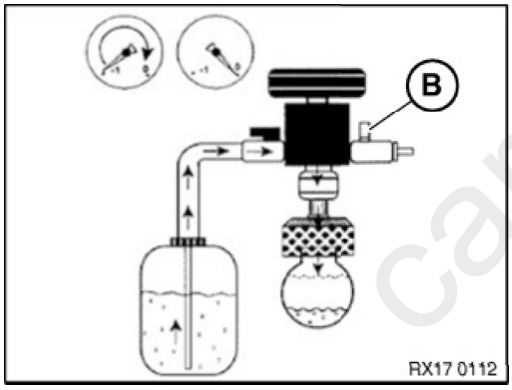
» Vacuum remains constant.

Measure

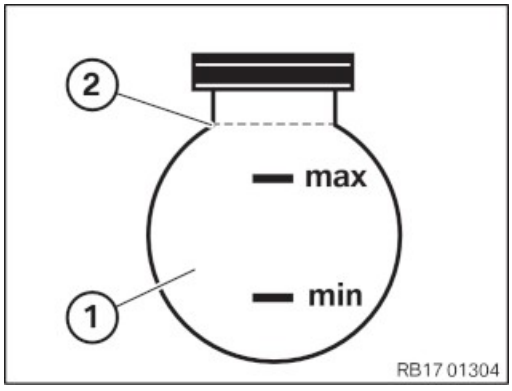
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

15 – Bleed the high-temperature coolant circuit

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

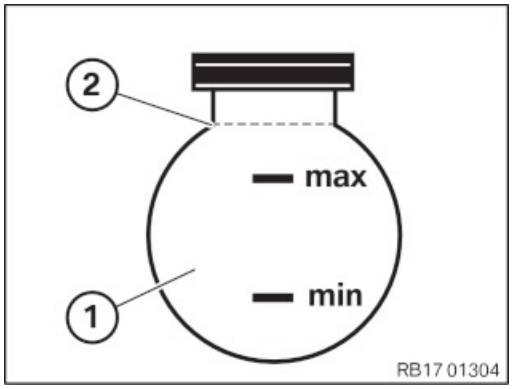
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

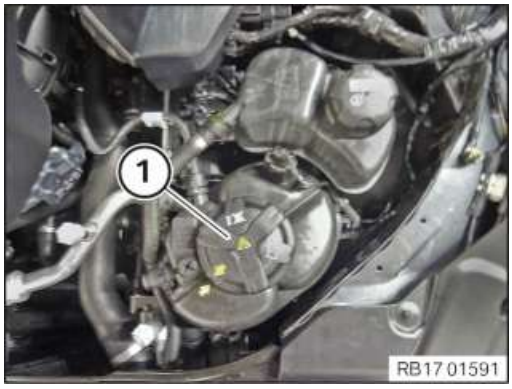
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

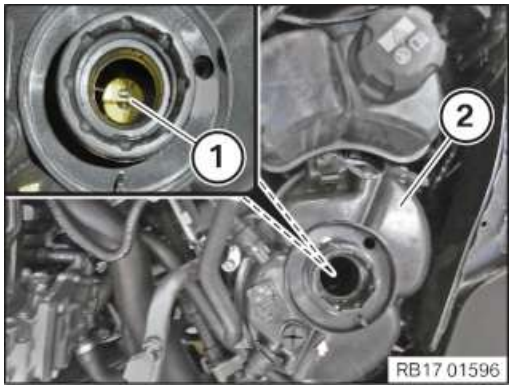
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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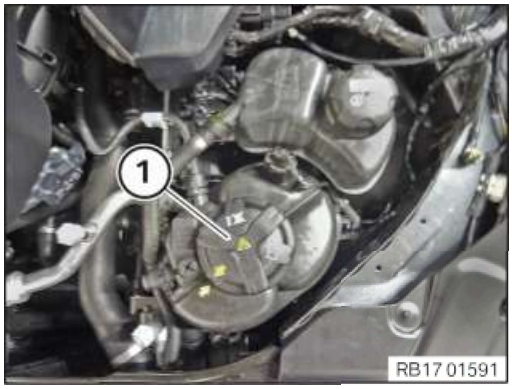
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .

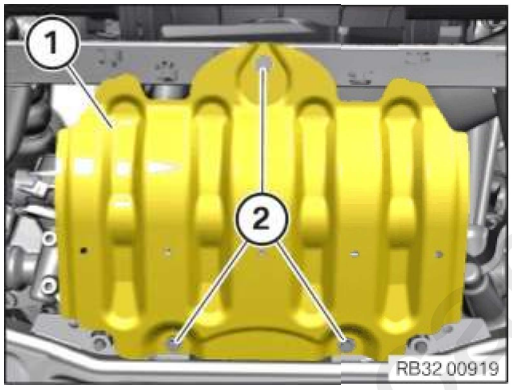


- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

16 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



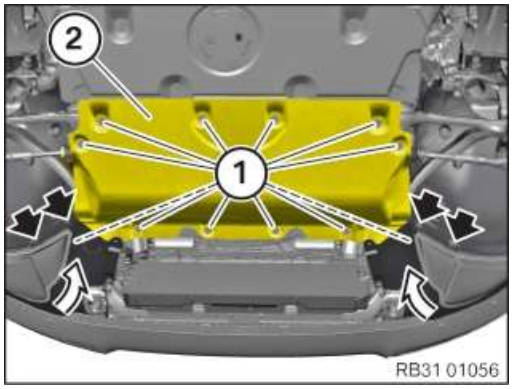
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

17 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

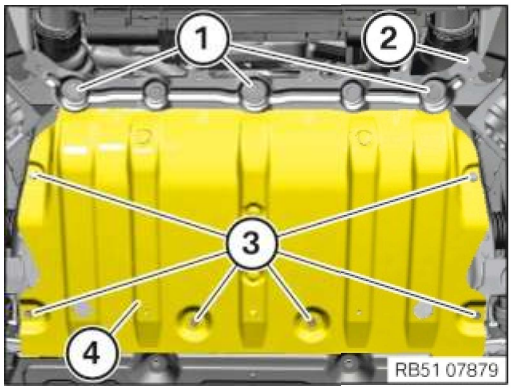
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

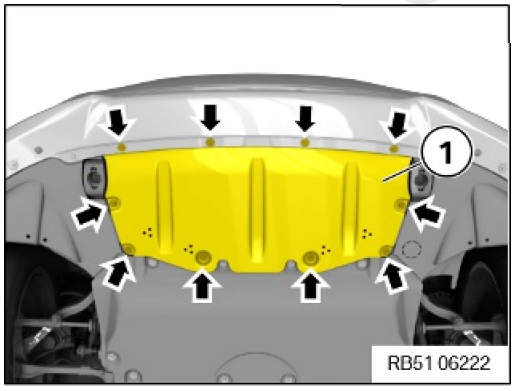
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

18 – Installing the front underbody protection



- **Version 1:**

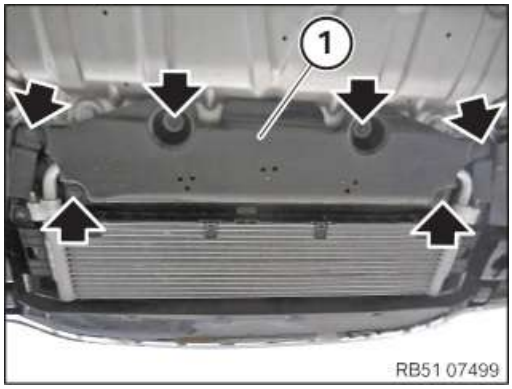
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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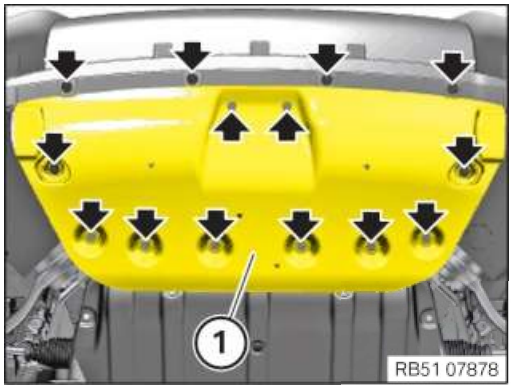
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Coolant feed line/coolant return line to exhaust turbocharger — Used in step 10

M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger — Used in step 10

M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 12

Clamp		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 16

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 17

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 17

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 17

M10		Tightening torque	56 Nm

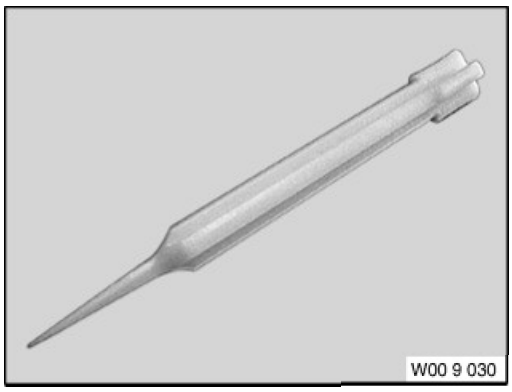
cardiagn.com

Underbody protection front Used in step 18

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

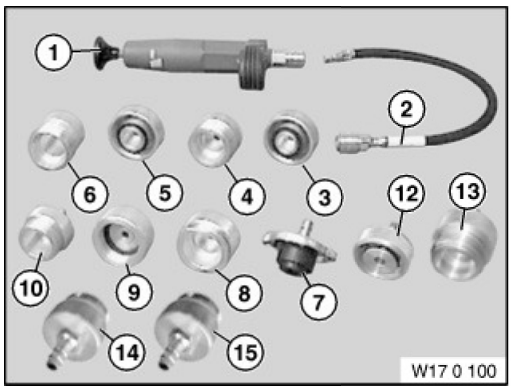
0 496 714 (00 9 030) Wedge



Common Used in step 10

Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

0 494 417 (17 0 100) Tester



Common Used in step 14

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	

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6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Capacity of high-temperature coolant circuit G20	Used in step 14
B48B20O1/B46B20O1	9.8 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

Repair instructions	**Used in step**
17 00 ... Notes for working on cooling system.	14

Operating materials	**Used in step**
Main group 17	14

cardiagn.com

11 61 730 Leakage test for the intake system

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

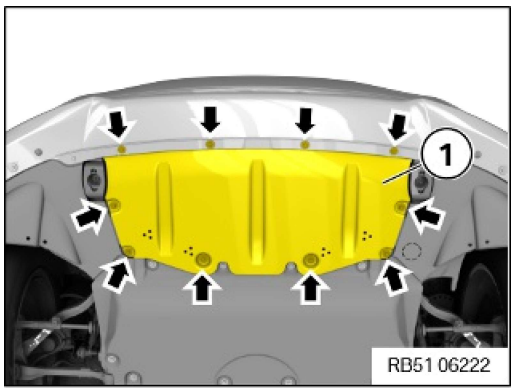
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Removing the front underbody protection

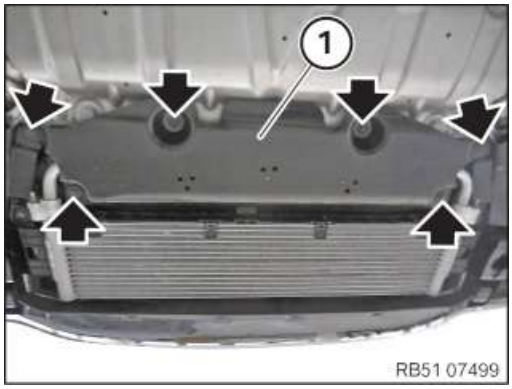


- **Version 1:**

  Remove screws (arrows).

  Feed front underbody protection (1) backwards out of the bumper panel.

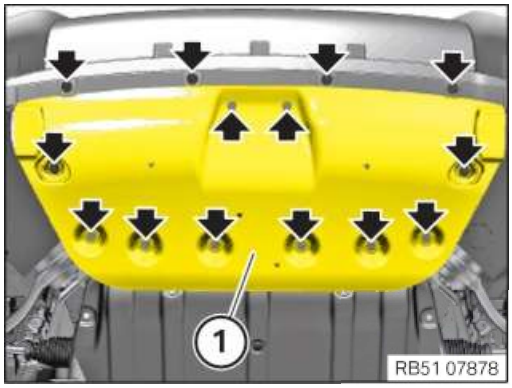
bmwdiagn.com



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

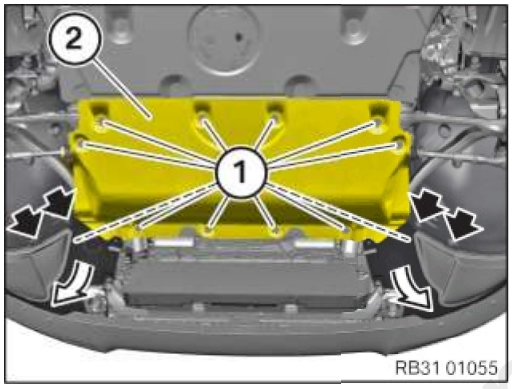


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

3 – Remove the underbody protection of the steering gear



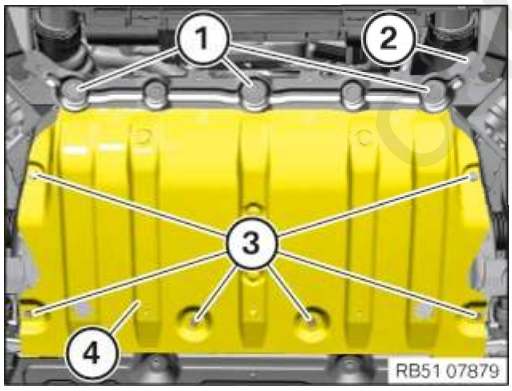
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

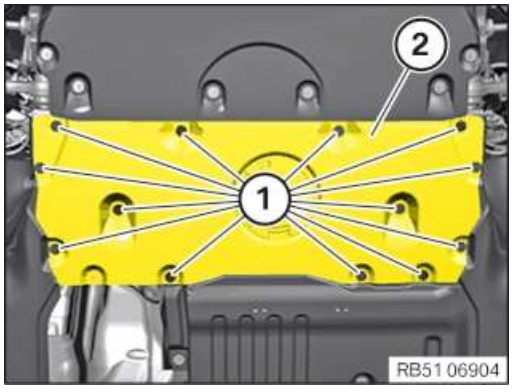
  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

4 – Removing the centre underbody protection

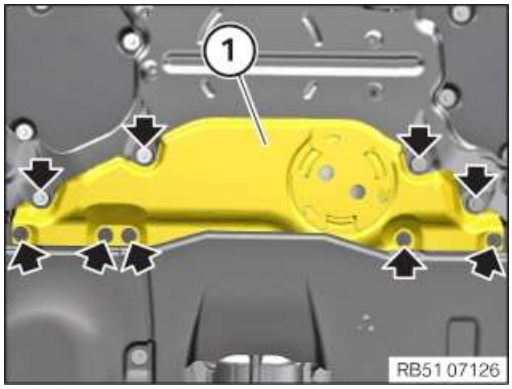


- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

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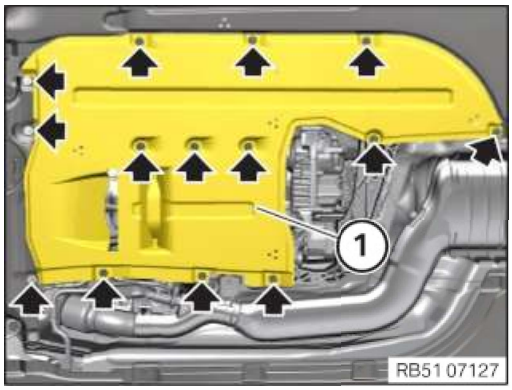


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

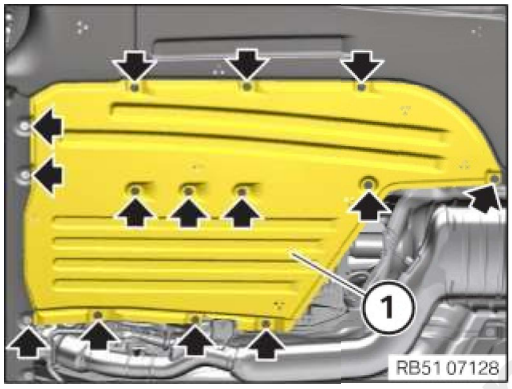
5 – Remove rear underbody protection



- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).



- **Version 2:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

6 – Preparing the diagnosis system



- **Start the diagnosis system.**
  - Power train
  - Digital Diesel Electronics/Engine electronics
  - Air supply
  - Charging pressure control system or perception of lack of power

MAIN WORK

7 – Check air intake system for tightness

Prerequisite

The intake filter housing or the upper section of intake filter housing is removed.

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TECHNICAL INFORMATION

Excess pressure and vacuum lines can be recognised by the size of their fasteners and are colour-coded blue and red respectively.

The overpressure line is marked **blue**.

The vacuum line is marked **red**.

Excess pressure and vacuum lines must not be mixed up. Mixing up the lines will result in engine damage.

TECHNICAL INFORMATION

Ordering information:

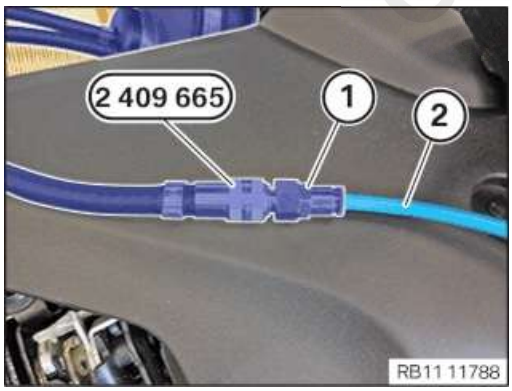
- Workshop equipment - Start BMW
- Workshop equipment catalogue
- Measurement equipment- and testers
- Service and diagnosis
- Order number 81 29 0 426 464
- Order number 81 31 2 353 954

NOTICE

Schematic diagram is for example purposes. Some parts may differ in certain details.

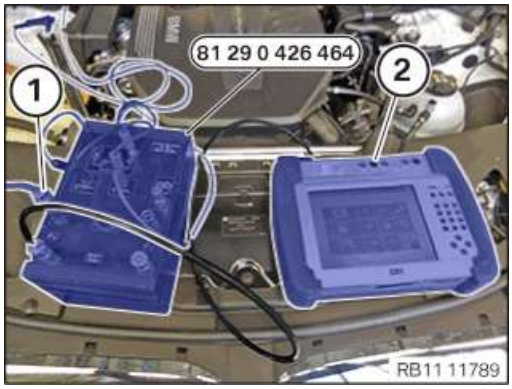


- Slide the special tool 2 409 665 into the clean air pipe and inflate it.
- Seal the clean air pipe airtight using special tool 2 409 665.



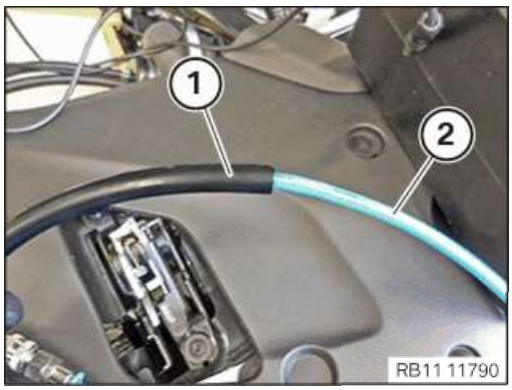
- Insert the blue excess pressure line (2) of the special tool 0 426 464 into the quick-release coupling (1) of the special tool 2 409 665 up to the limit position.

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- Connect the blue excess pressure line on connector (1) with the special tool 0 426 464.
- Connect Integrated Measurement Interface Box (1) with the special tool 0 426 464 using a hose (for example, hose with order number 81 31 2 357 800).

  The hose is secured to the connector of the special tool 0 426 464.
- Follow diagnosis instruction.



- Disconnect the blue excess pressure line (2) from the special tool 0 426 464.

  The quick-release coupling remains connected.
- Connect pressure line (1) of the special tool 2 353 954 to the blue excess pressure line (2).



- Put the special tool 2 353 954 into operation according to the operating instructions.

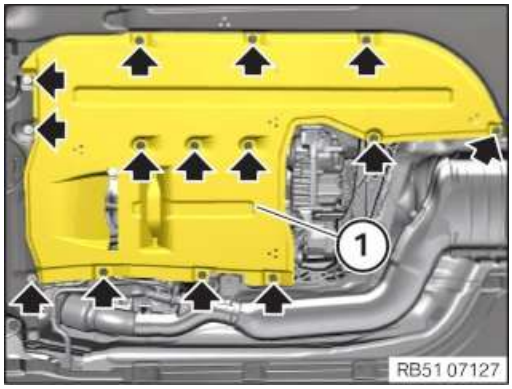


- Follow the instructions of the diagnosis system.
- Search for escaping smoke.

  A leak in the air intake system is detected by means of escaping smoke.

POSTPROCESSES

8 – Installing underbody protection at rear



- **Version 1:**

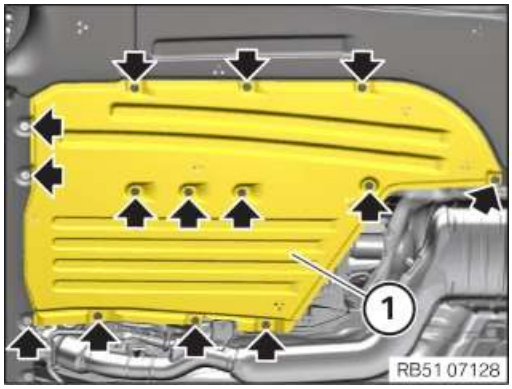
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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- **Version 2:**

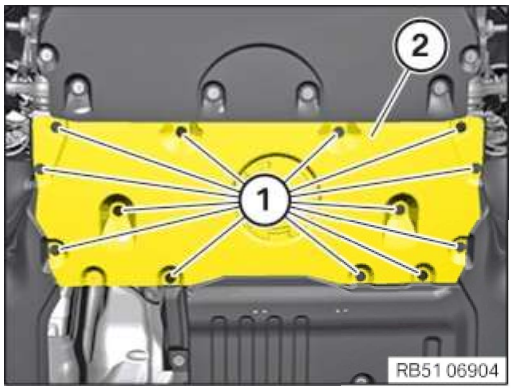
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

9 – Installing the centre underbody protection



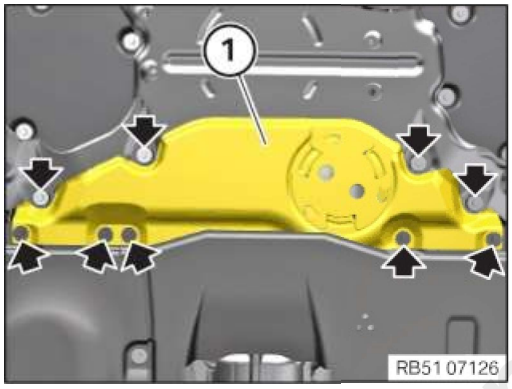
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

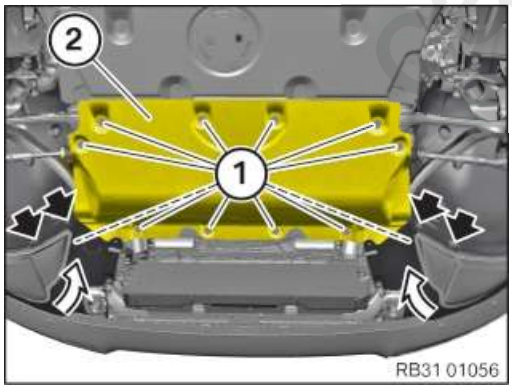
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

10 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

Underbody protection of the steering gear

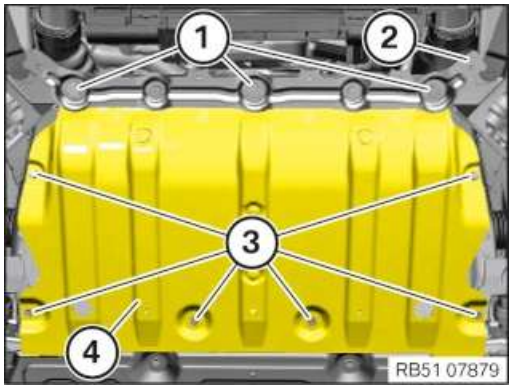
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm

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- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

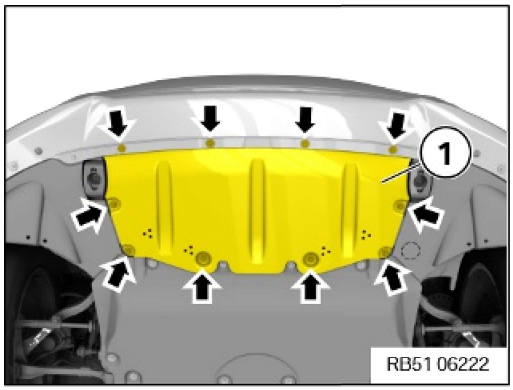
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

11 – Installing the front underbody protection



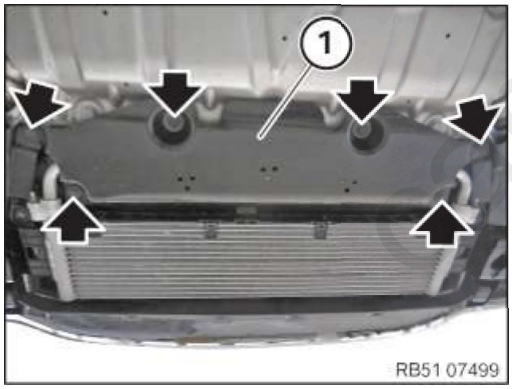
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



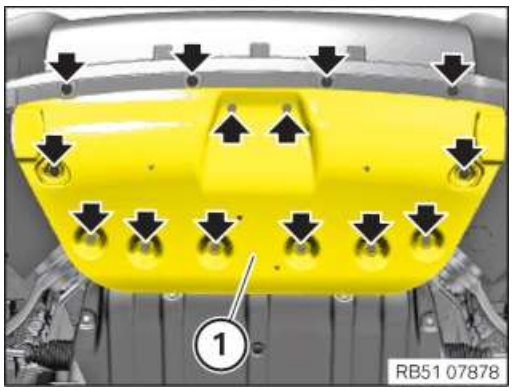
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

12 – Install acoustic cover

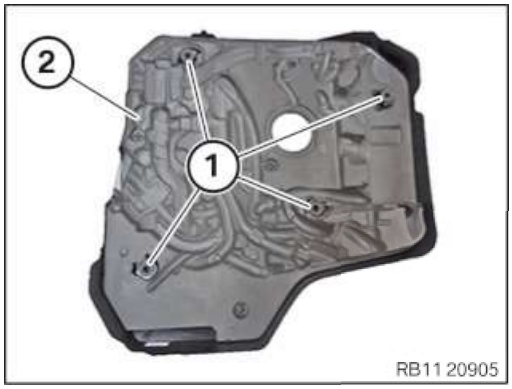
otdiagn.com

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

Additional Information

Overview of Tightening Torques

Underbody protection — Used in step 89

Hexagon screw		Tightening torque	3 Nm

Underbody protection of the steering gear — Used in step 10

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 10

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 10

M10		Tightening torque	56 Nm

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Underbody protection front Used in step 11

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

2 409 665 Gaiter



Common Used in step 7

Usage	Universal bellows for leakage test on the air intake duct.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 35 15 (307)

0 426 464 Tester



Common Used in step 7

Usage	For localization of component defects in the charging system.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	

2 353 954 Leak detector



Common Used in step 7

Usage	"BMW Smoke diagnosis tester" leak detector for the tightness diagnosis of closed systems such as fuel tanks, intake air passages, etc.. (1) "BMW Smoke diagnosis tester", (2) "UltraTracer", (3) cylinder with pressure reducer, (4) diverse adapter, (5) coupling kit for compressed air connection, (6) torch with white and UV light including special glasses, (7) power pack note: (2) "UltraTracer" is currently only available at CSS7@Bosch-Automotive.com under the following order number GLD0712UV.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	02 11 13 (958)

cardiagn.com

11 61 730 Leakage test for the intake system

Prerequisite

- Intake filter housing or upper section of intake filter housing is removed.

1 – Preparing the diagnosis system



- **Start the diagnosis system.**
  - Power train
  - Digital Diesel Electronics/Engine electronics
  - Air supply
  - Charging pressure control system or perception of lack of power

2 – Check air intake system for tightness

Prerequisite

The intake filter housing or the upper section of intake filter housing is removed.

TECHNICAL INFORMATION

Excess pressure and vacuum lines can be recognised by the size of their fasteners and are colour-coded blue and red respectively.

The overpressure line is marked **blue**.

The vacuum line is marked **red**.

Excess pressure and vacuum lines must not be mixed up. Mixing up the lines will result in engine damage.

TECHNICAL INFORMATION

Ordering information:
- Workshop equipment - Start BMW
- Workshop equipment catalogue
- Measurement equipment- and testers
- Service and diagnosis
- Order number 81 29 0 426 464
- Order number 81 31 2 353 954

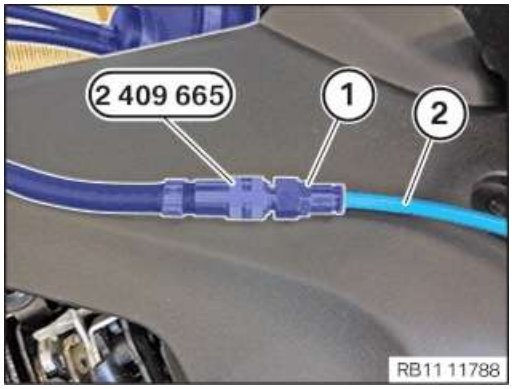
NOTICE

Schematic diagram is for example purposes. Some parts may differ in certain details.

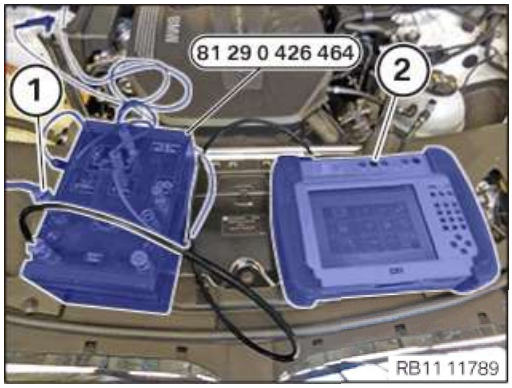


- Slide the special tool 2 409 665 into the clean air pipe and inflate it.
- Seal the clean air pipe airtight using special tool 2 409 665.

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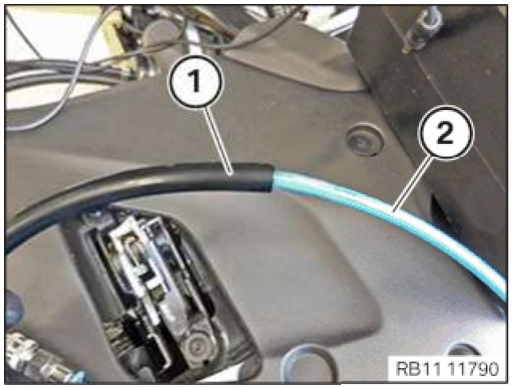


- Insert the blue excess pressure line (2) of the special tool 0 426 464 into the quick-release coupling (1) of the special tool 2 409 665 up to the limit position.



- Connect the blue excess pressure line on connector (1) with the special tool 0 426 464.
- Connect Integrated Measurement Interface Box (1) with the special tool 0 426 464 using a hose (for example, hose with order number 81 31 2 357 800).

  The hose is secured to the connector of the special tool 0 426 464.
- Follow diagnosis instruction.



- Disconnect the blue excess pressure line (2) from the special tool 0 426 464.

  The quick-release coupling remains connected.
- Connect pressure line (1) of the special tool 2 353 954 to the blue excess pressure line (2).



- Put the special tool 2 353 954 into operation according to the operating instructions.



- Follow the instructions of the diagnosis system.
- Search for escaping smoke.

  A leak in the air intake system is detected by means of escaping smoke.

Additional Information

Overview of Special Tools

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2 409 665 Gaiter



Common	Used in step 2
Usage	Universal bellows for leakage test on the air intake duct.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 35 15 (307)

0 426 464 Tester



Common	Used in step 2
Usage	For localization of component defects in the charging system.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	

2 353 954 Leak detector



Common	Used in step 2
Usage	"BMW Smoke diagnosis tester" leak detector for the tightness diagnosis of closed systems such as fuel tanks, intake air passages, etc.. (1) "BMW Smoke diagnosis tester", (2) "UltraTracer", (3) cylinder with pressure reducer, (4) diverse adapter, (5) coupling kit for compressed air connection, (6) torch with white and UV light including special glasses, (7) power pack note: (2) "UltraTracer" is currently only available at CSS7@Bosch-Automotive.com under the following order number GLD0712UV.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	02 11 13 (958)

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11 61 050 Removing and installing the intake plenum.

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

3 – Removing the acoustic cover

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

4 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

5 – Removing the DME control unit

rdiagn.com

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

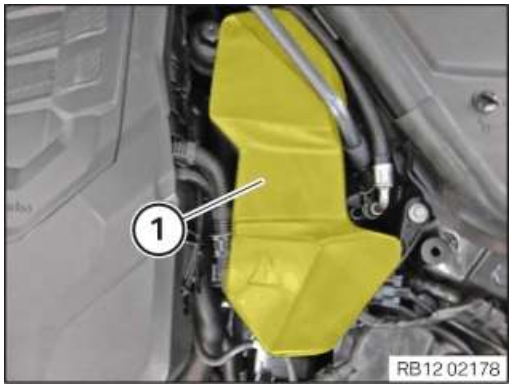
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

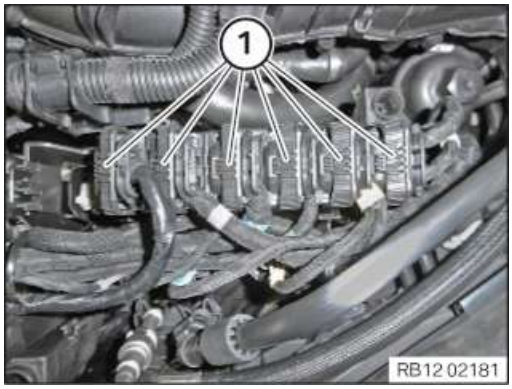
TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

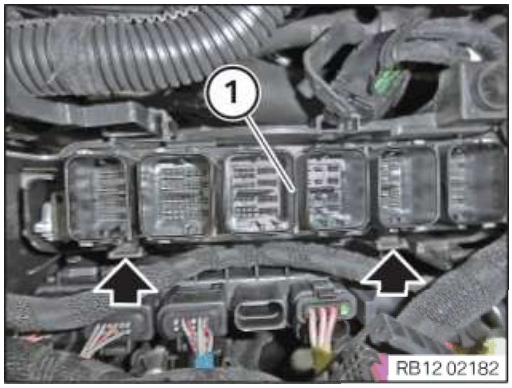


- Pull the cover (1) towards the top and feed out.

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- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

6 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

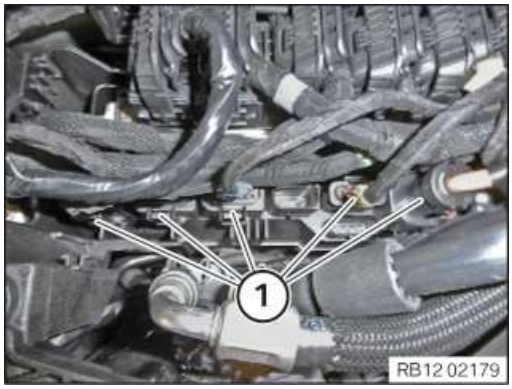
RISK OF DAMAGE

Electrostatic discharge.

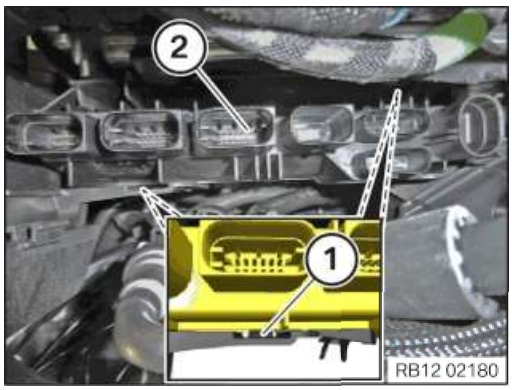
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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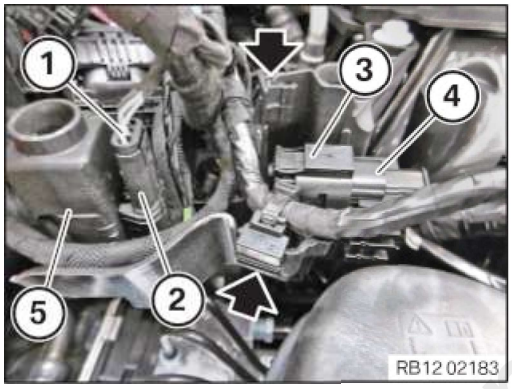


- Unlock and disconnect plug connections (1).

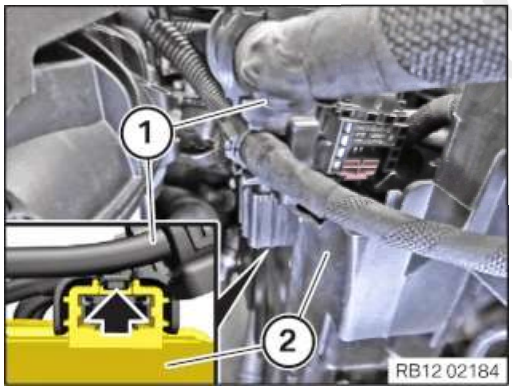


- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

7 – Removing the control unit holder



- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).

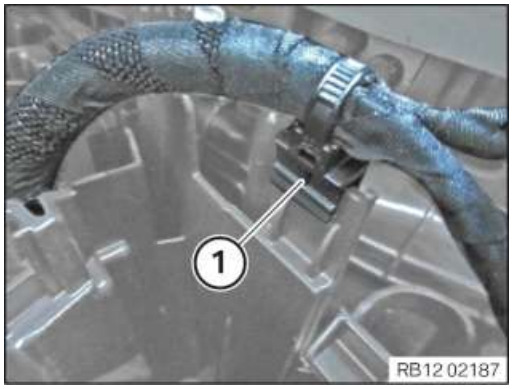


- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).

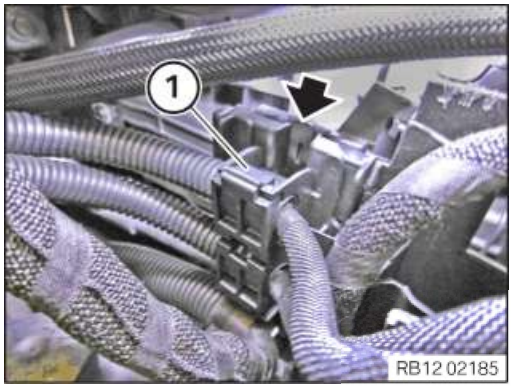


- Loosen clamp (1).

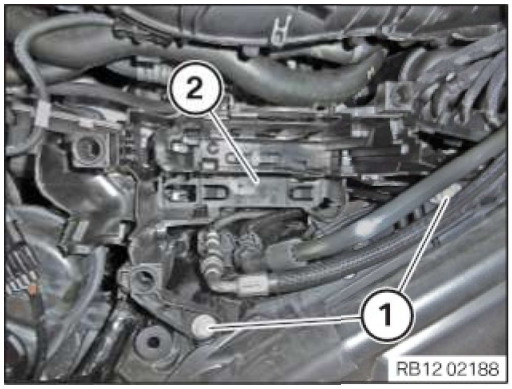
mdiagn.com



- Loosen clamp (1).



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

8 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

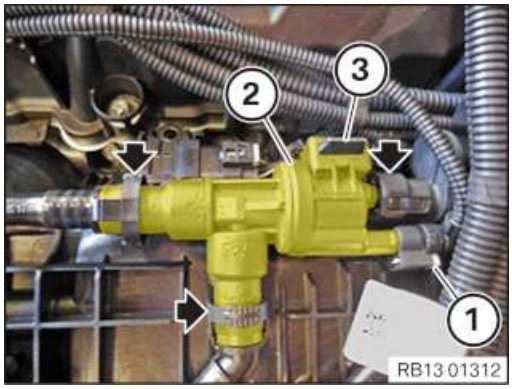
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

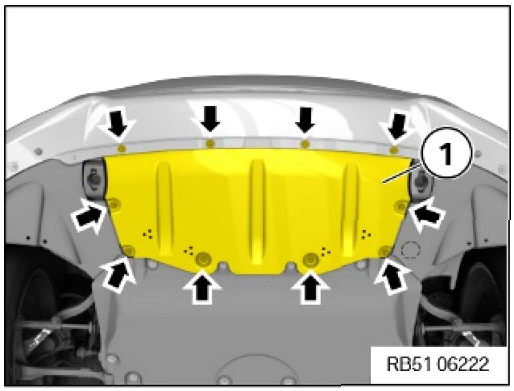
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

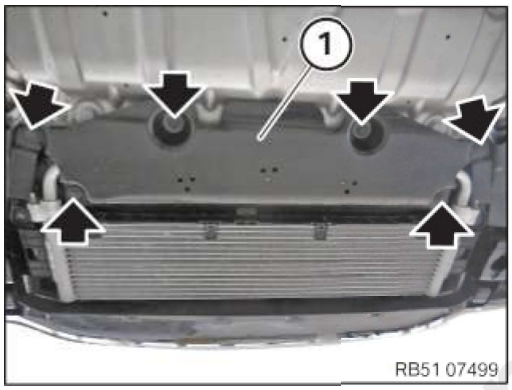
9 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

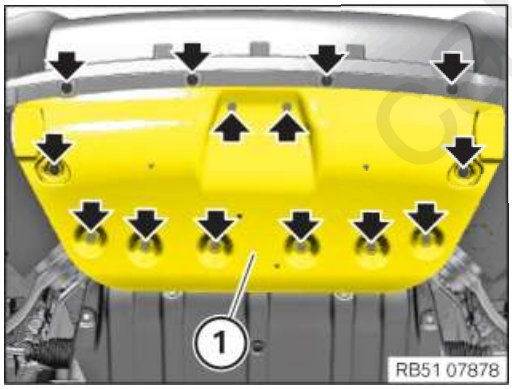
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

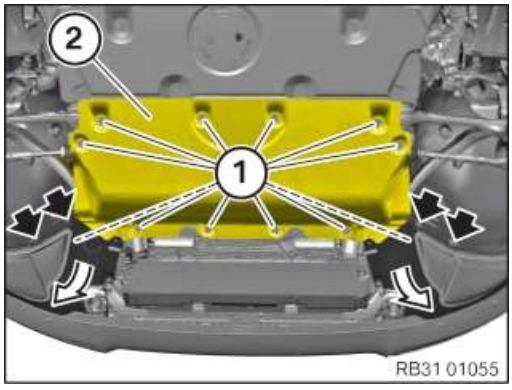


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

10 – Remove the underbody protection of the steering gear



- **Version 1:**

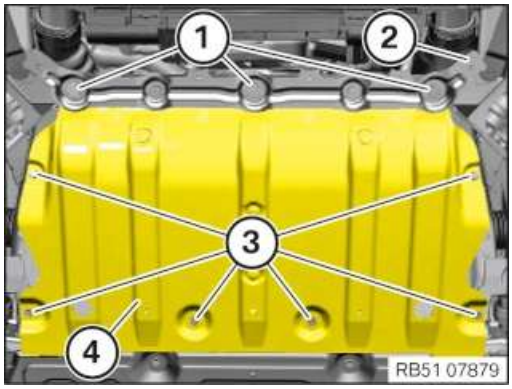
  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).

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- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

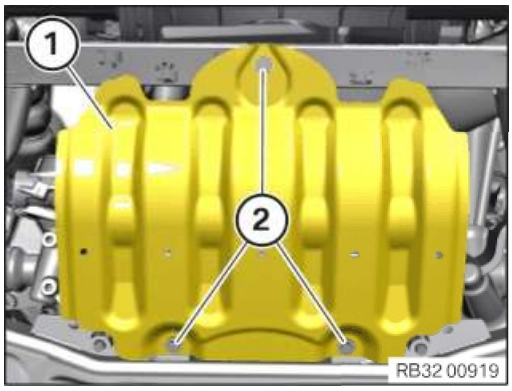
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

11 – If installed: Removing the steering start protection

Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

12 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

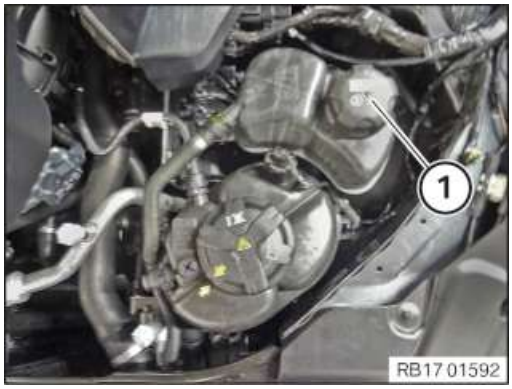
When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

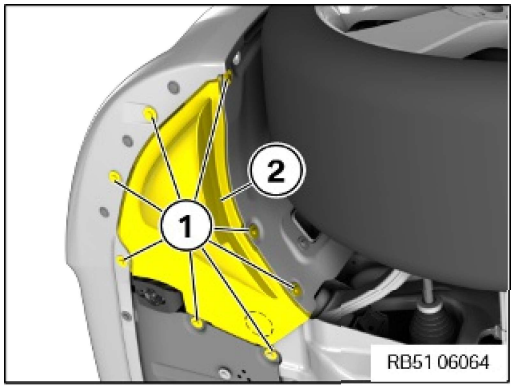
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

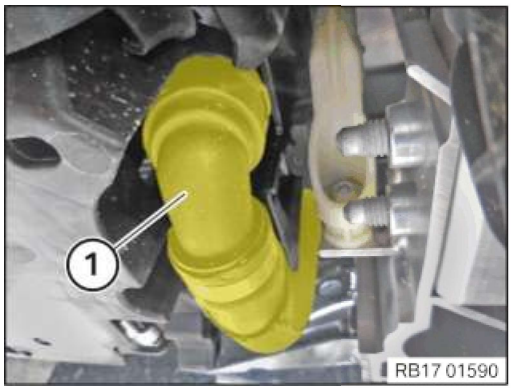
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- Loosen sealing cap (1).



- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

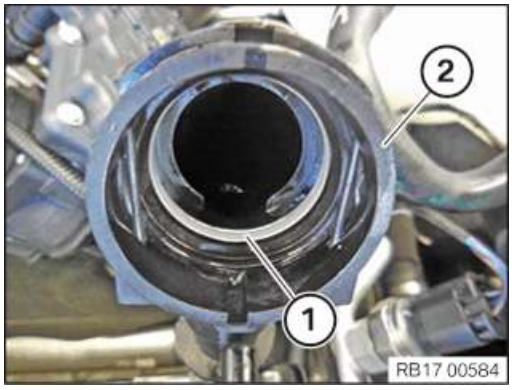


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

13 – Connecting the coolant lines for the low-temperature coolant circuit

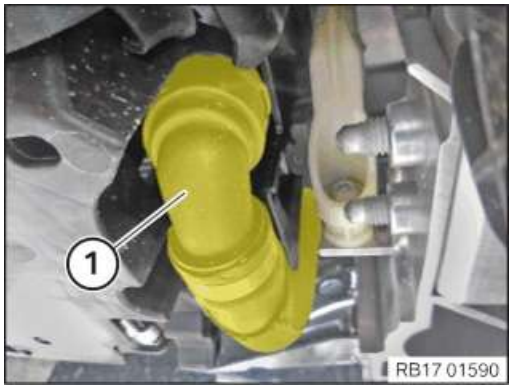
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



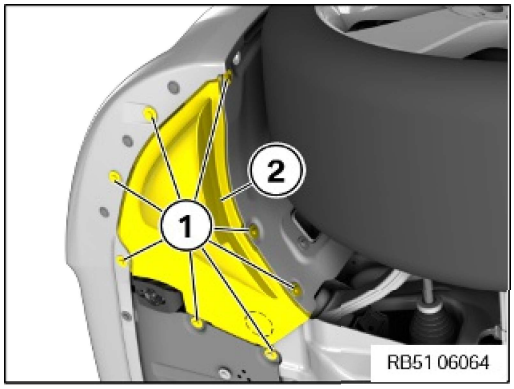
- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.

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- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

MAIN WORK

14 – Removing the intake plenum

RISK OF DAMAGE

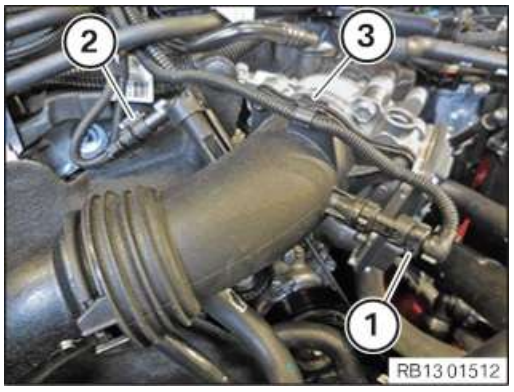
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

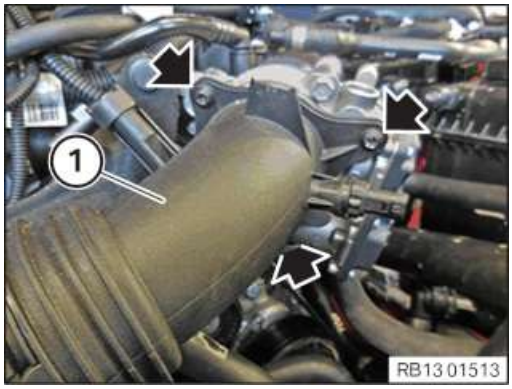
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

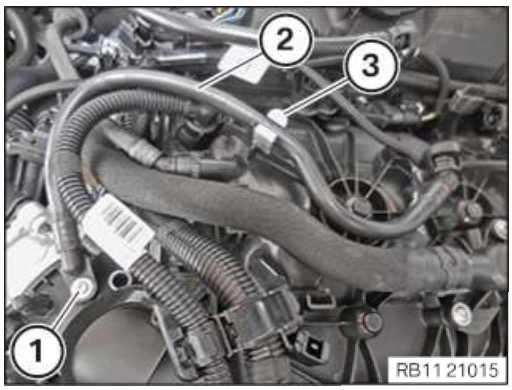


- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).

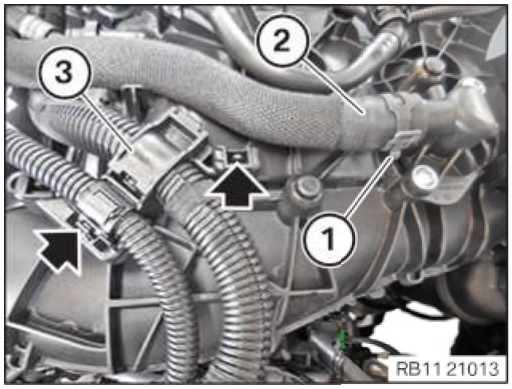
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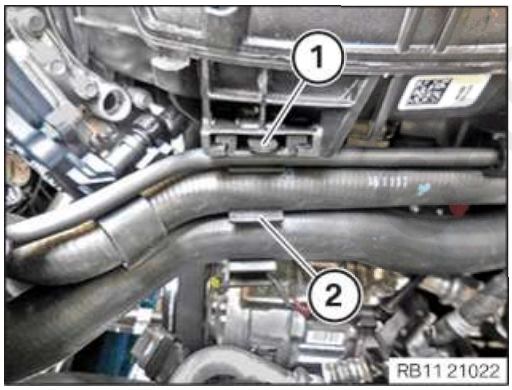
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.

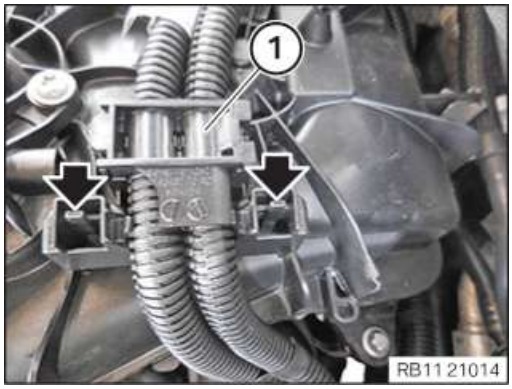


- Unlock the lock (1).
- Thread out holder (2) and set aside.

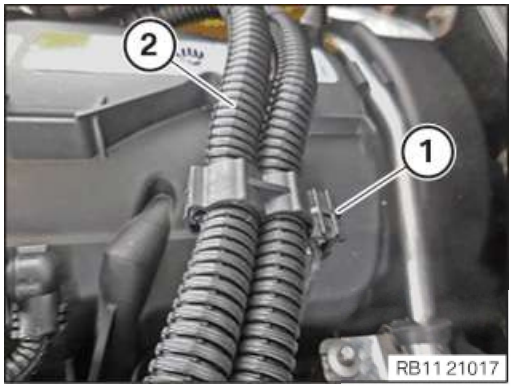


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).

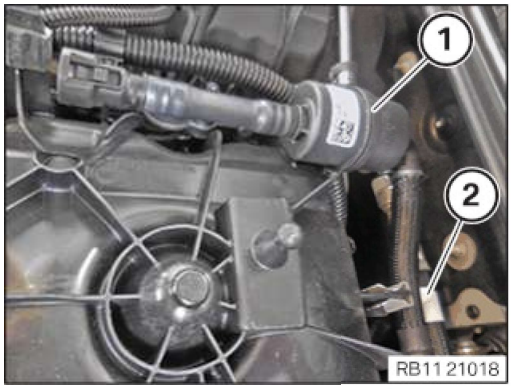
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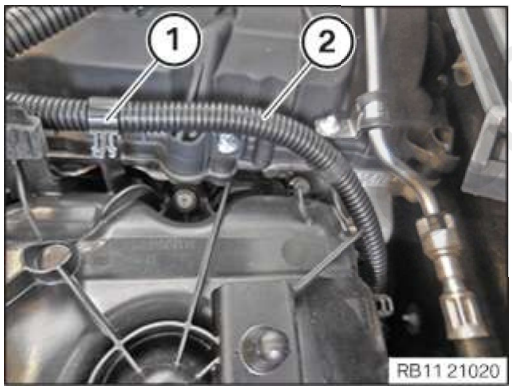
- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Guide tank ventilation line (1) out of clamp (2) and place it aside.

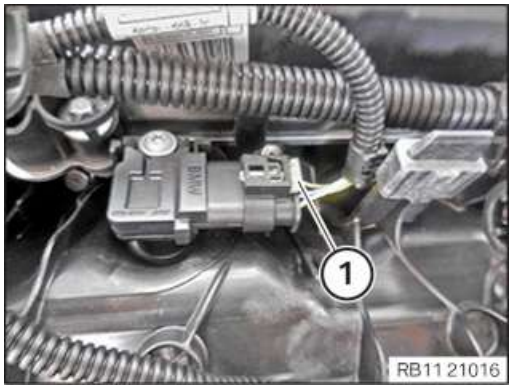


- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

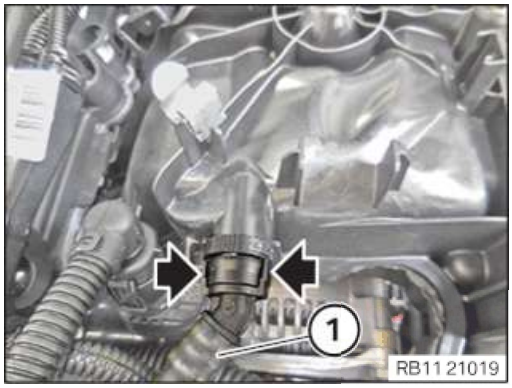


- Loosen screw (1).

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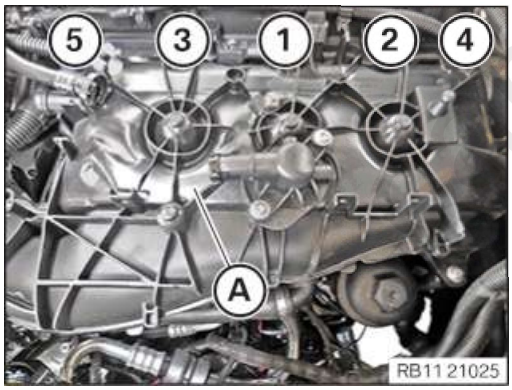
- Unlock plug connection (1) and disconnect.



- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

15 – Installing the intake plenum

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

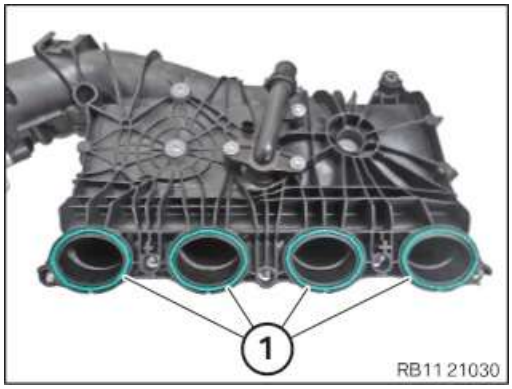
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

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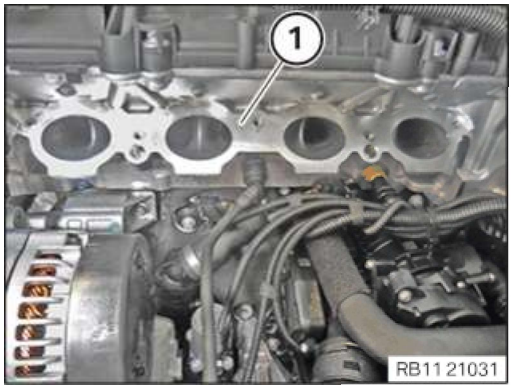
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

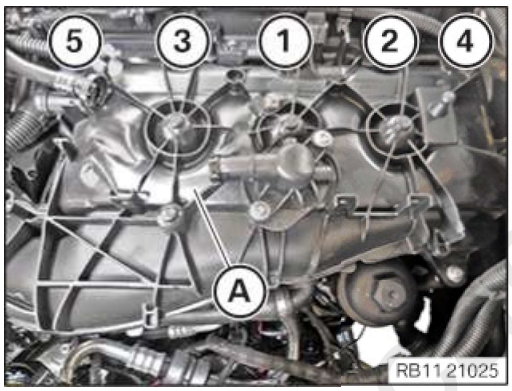


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm



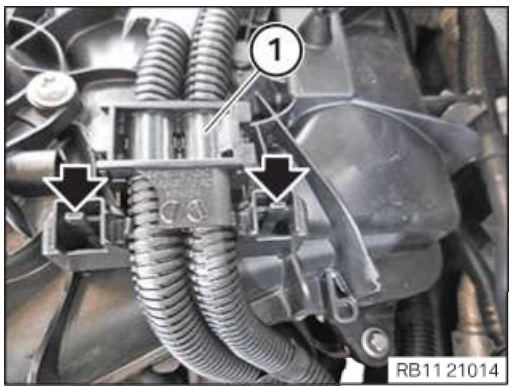
- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.



- Tighten down screw (1).

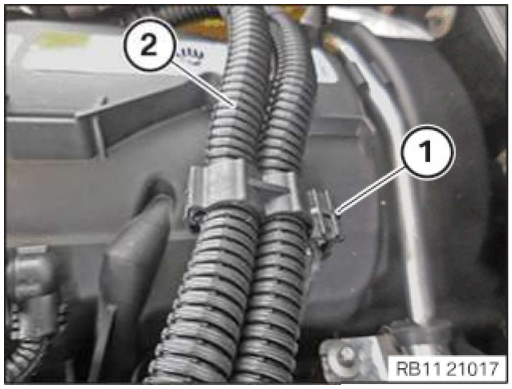
Intake plenum to support

M6X25		Tightening torque	8 Nm

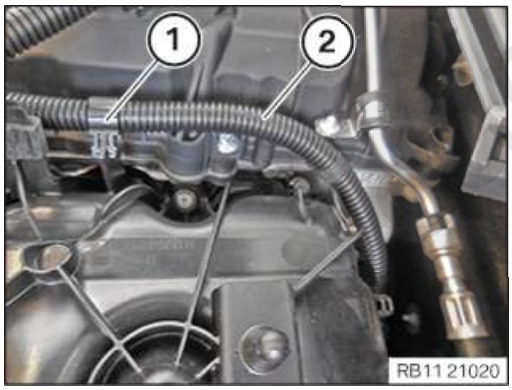


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).



- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).

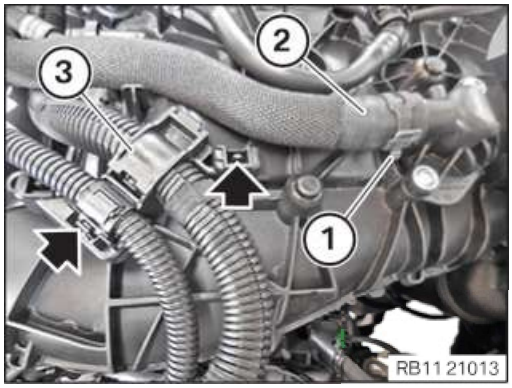
rdiagn.com



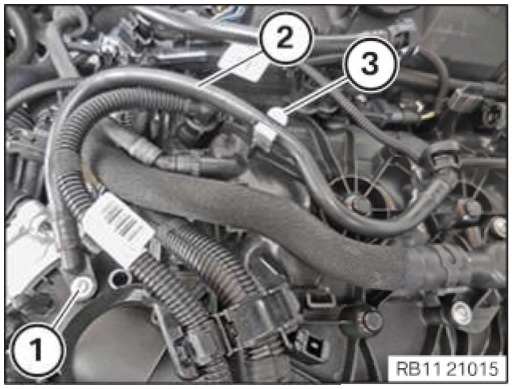
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



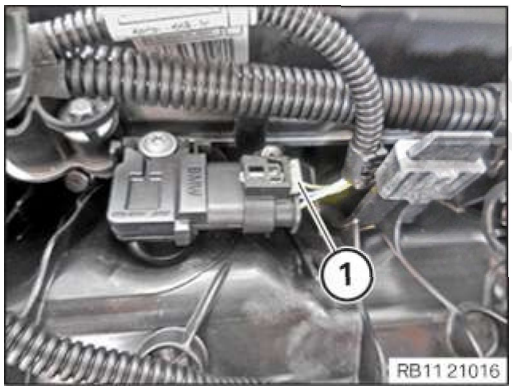
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

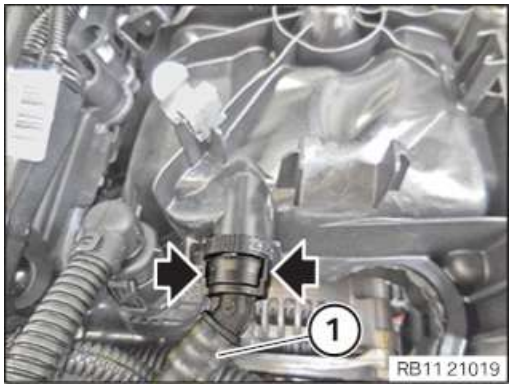
Tank ventilation line to intake plenum

Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

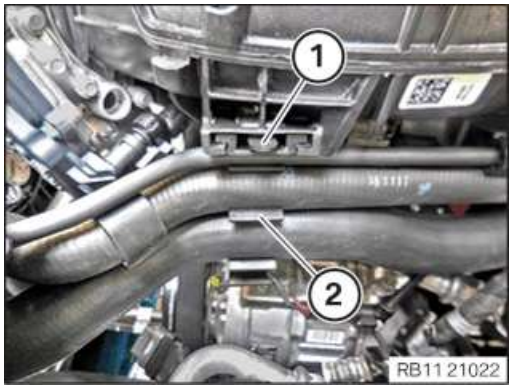
  The connector (1) must engage audibly.



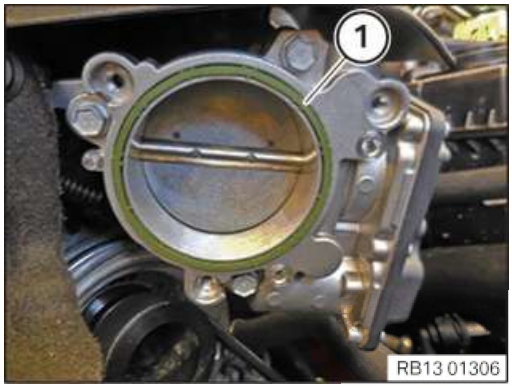
- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

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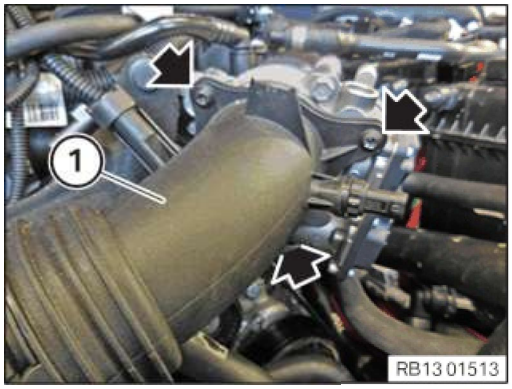


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

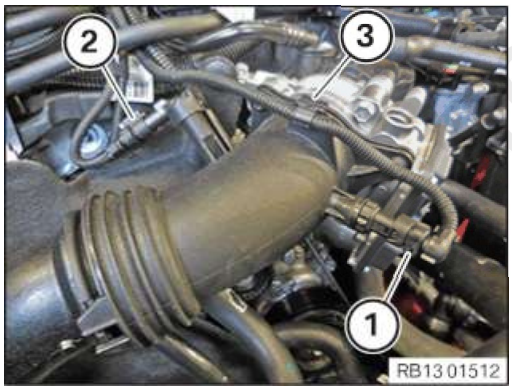
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

Charge air line to throttle body

M6		Tightening torque	8 Nm

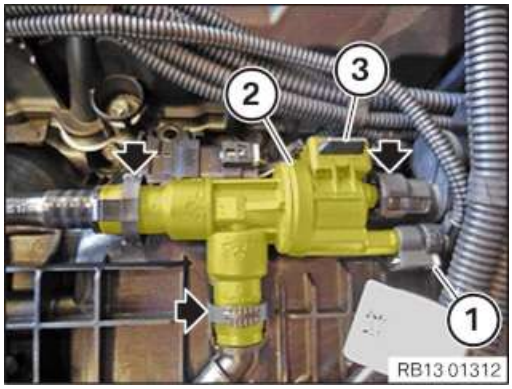


- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

POSTPROCESSES

16 – Installing the tank vent valve

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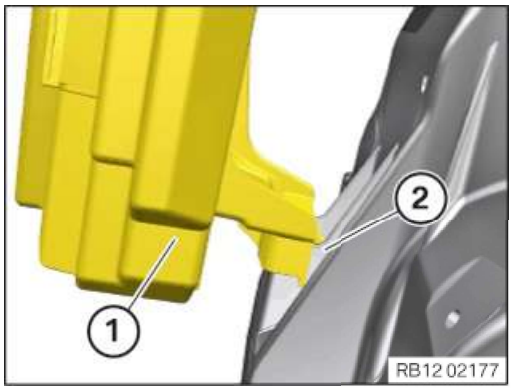


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

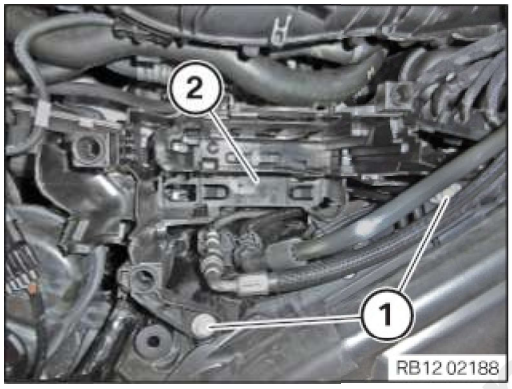
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

17 – Installing the control unit holder



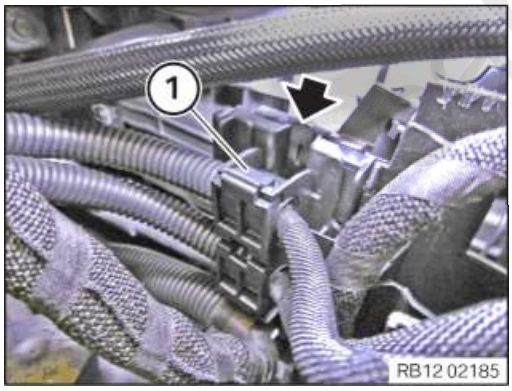
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

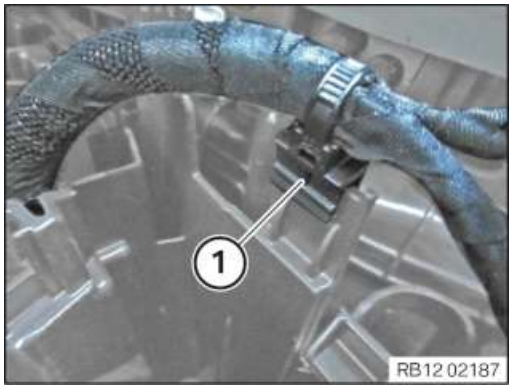
Control unit holder on spring strut dome

Hexagon screw	Tightening torque	8 Nm



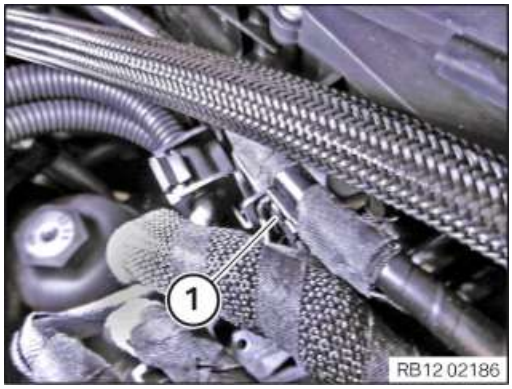
- Feed in and install the cable clip (1).

  Lock (arrow) must audibly engage.

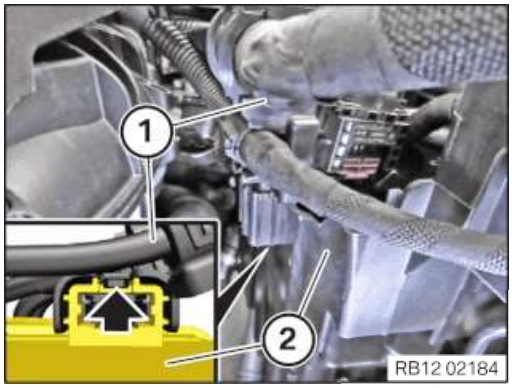


- Secure clamps (1).

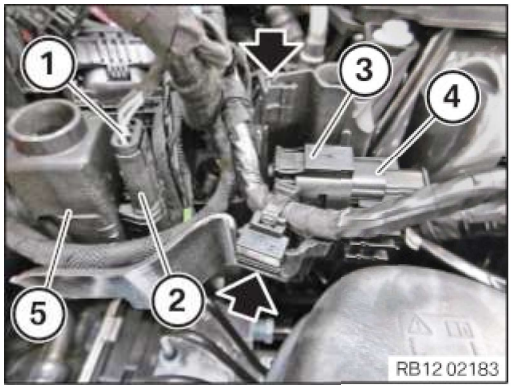
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- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

18 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

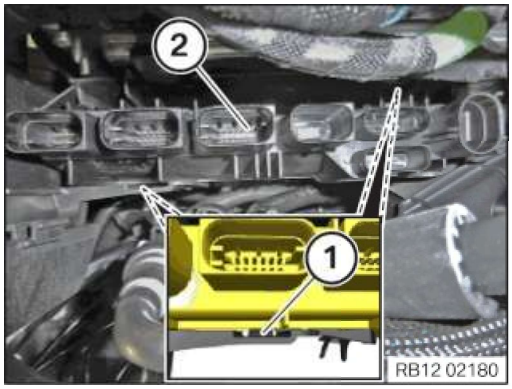
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RISK OF DAMAGE

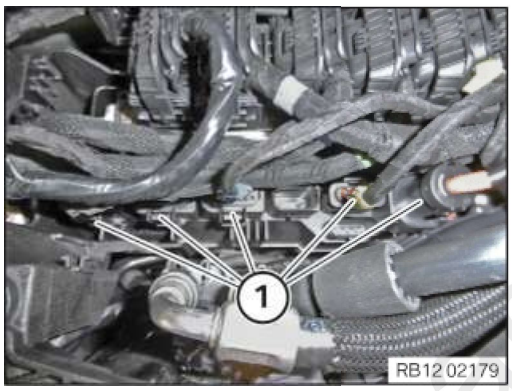
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

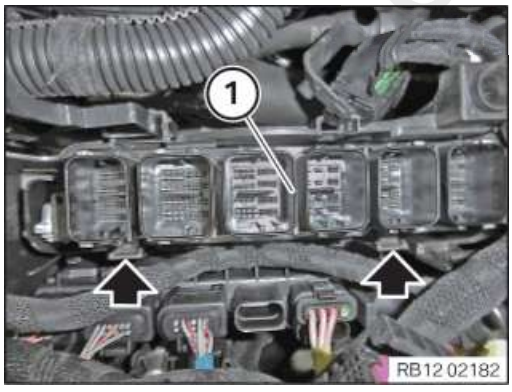


- Insert and install the integrated supply module (PDM) (2).
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



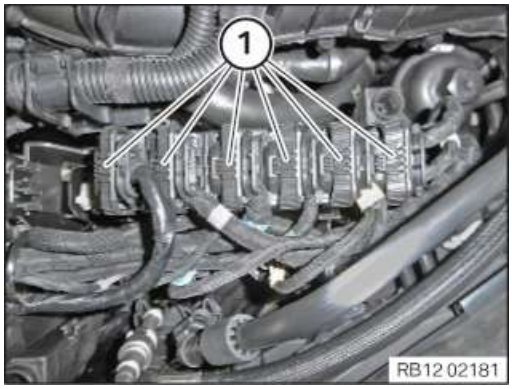
- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

19 – Installing the DME control unit



- Feed in and install DME control unit (1).
  The locks (arrows) must engage audibly.

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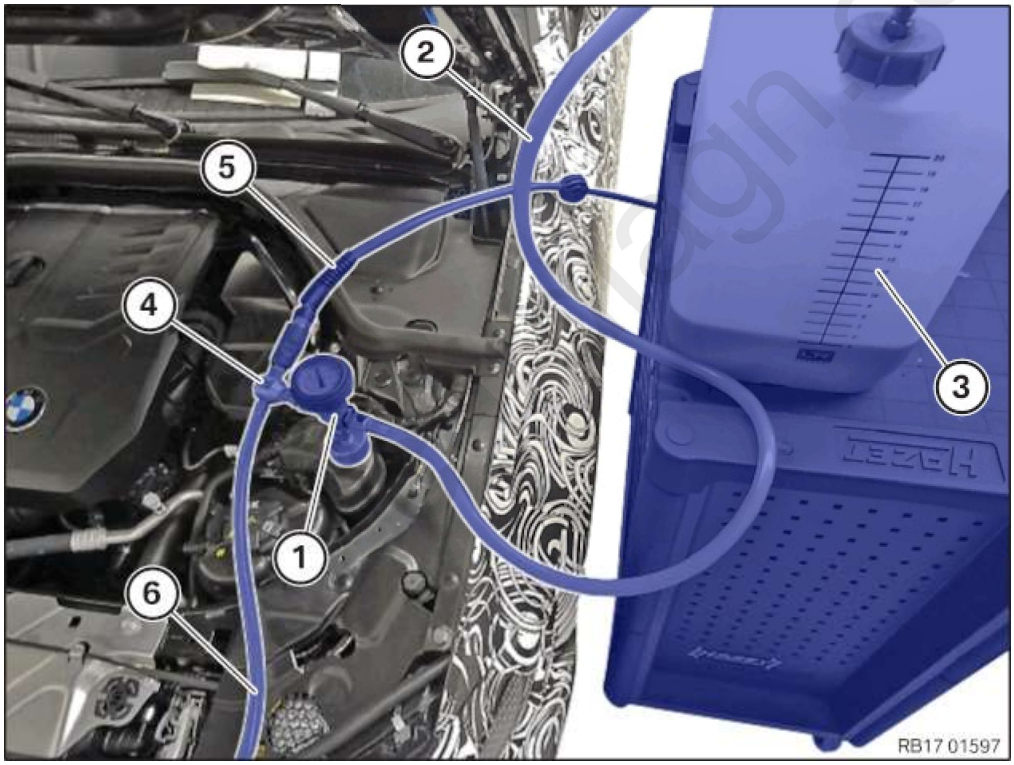
- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.



- Insert and install cover (1) into guides.

20 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

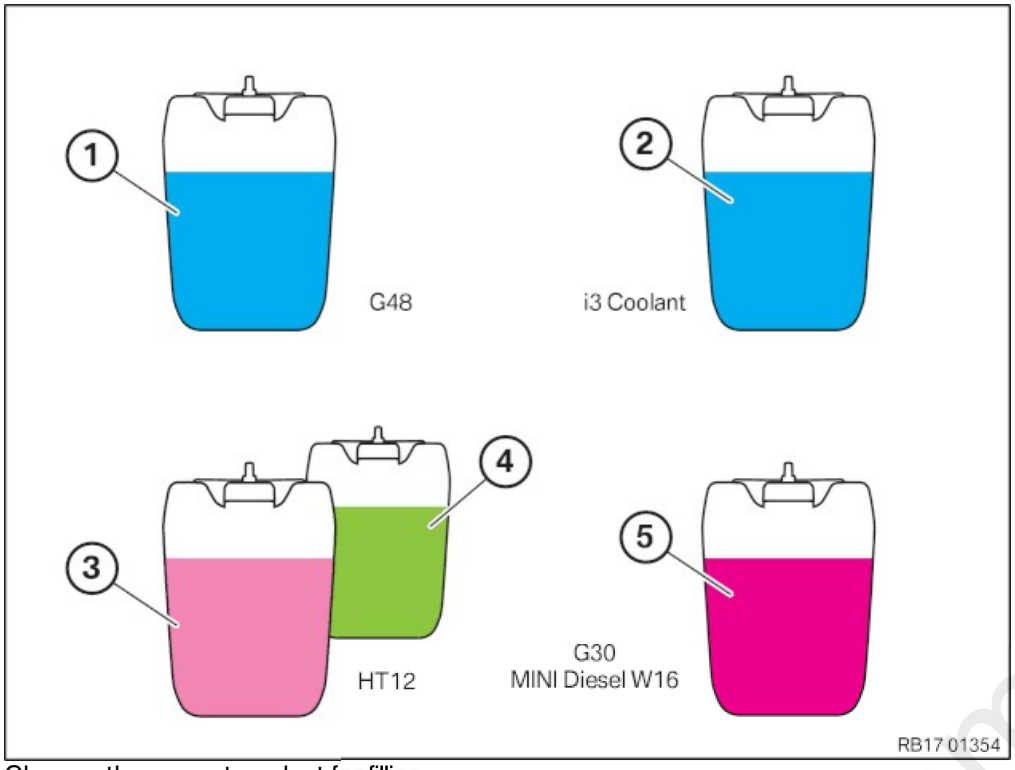
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

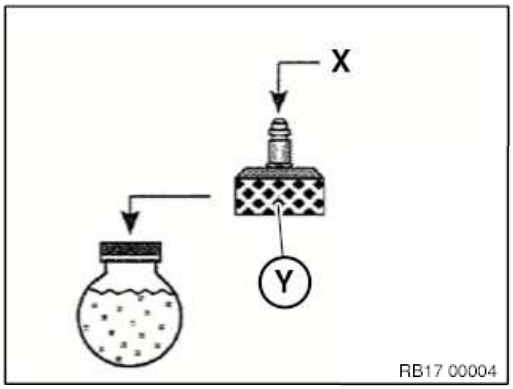
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

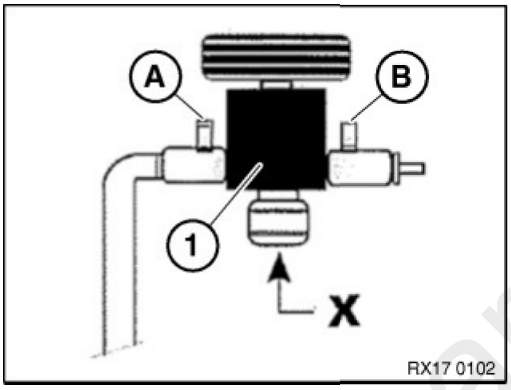
Capacity of low-temperature coolant circuit G20

B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

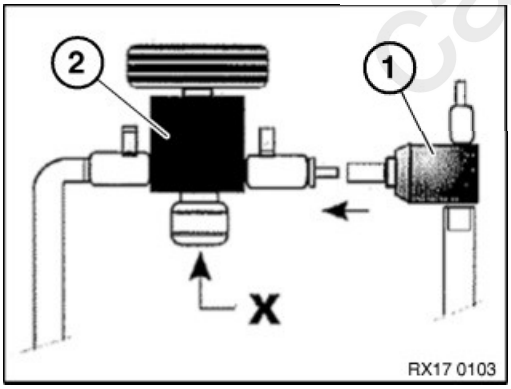
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

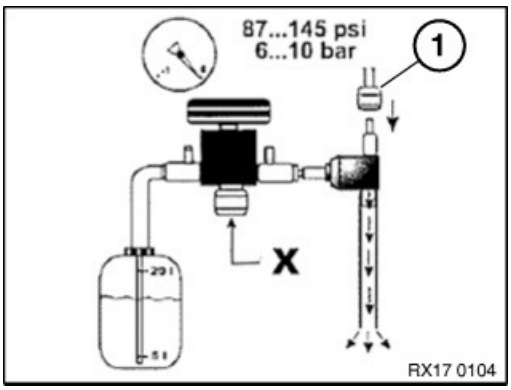


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

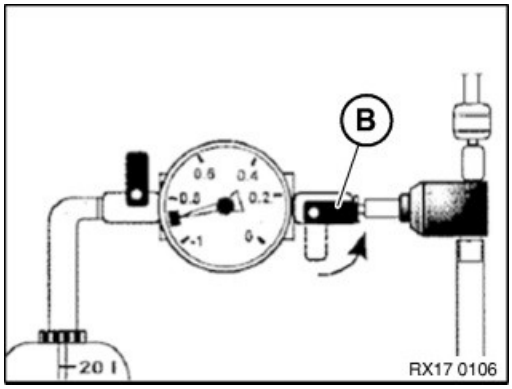
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

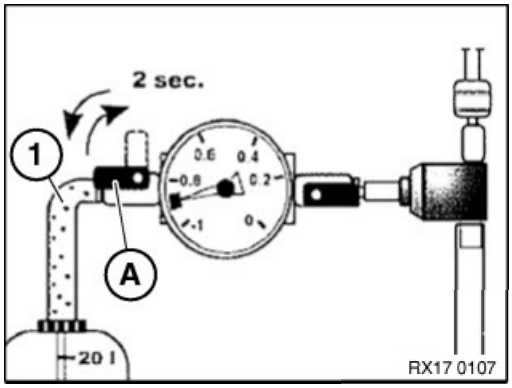
  (X)is the connection on the coolant expansion tank.

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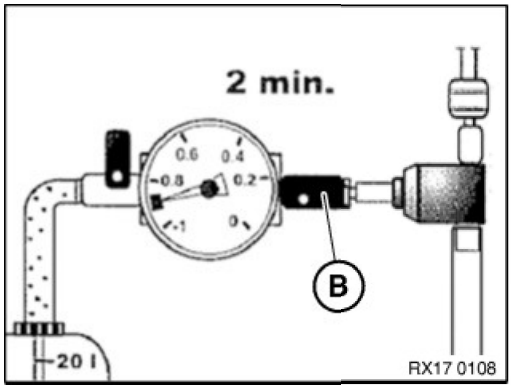
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

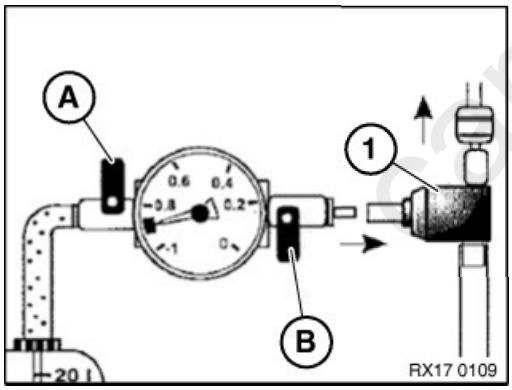


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

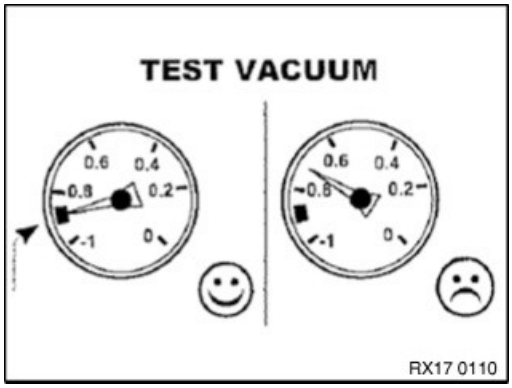
The coolant hoses contract during vacuum build-up.

- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

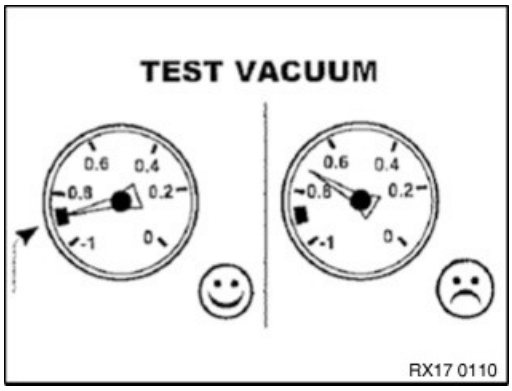
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



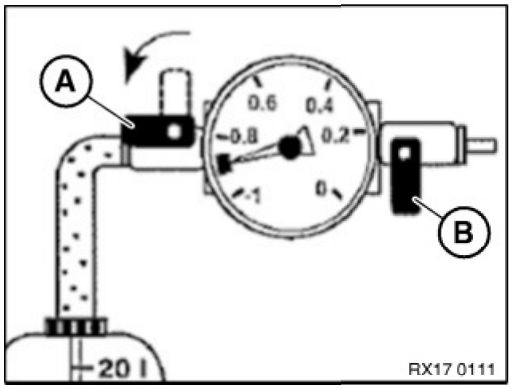
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

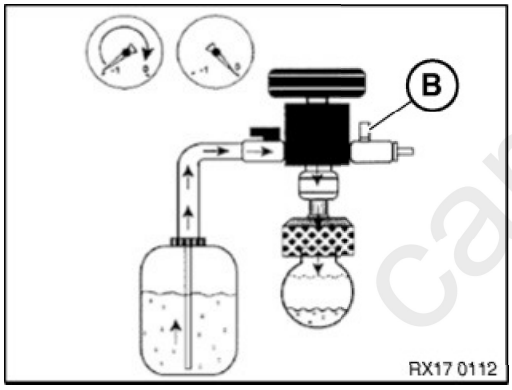
» Vacuum remains constant.

Measure

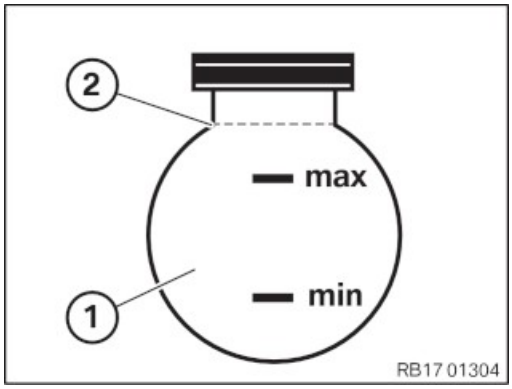
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

21 – Disconnecting all battery earth leads

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- See additional information.

22 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

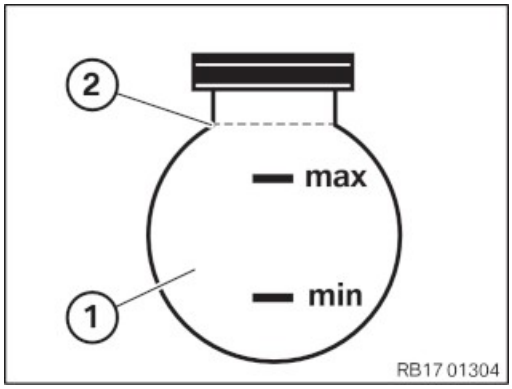
Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

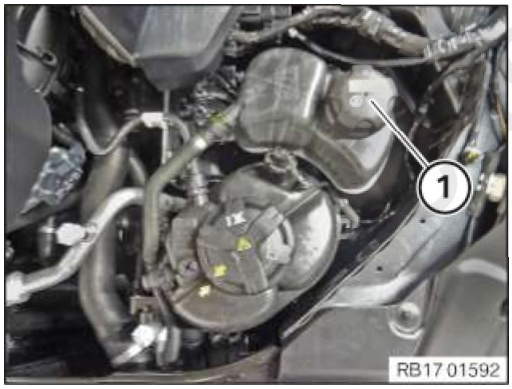
  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).



TECHNICAL INFORMATION

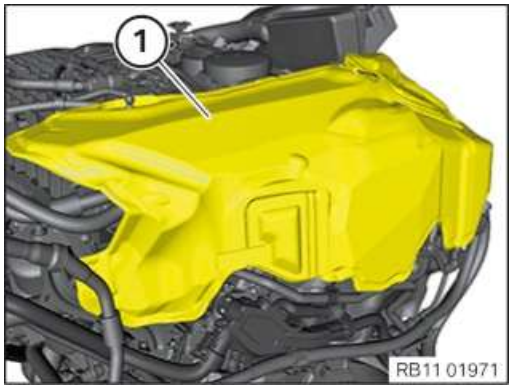
After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

23 – Installing acoustic cover at rear



- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

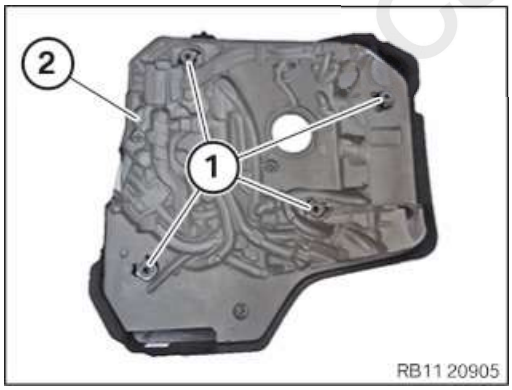
24 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

25 – Install the seal for the bonnet

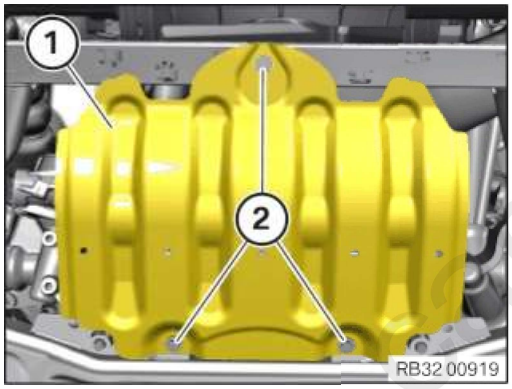


- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

26 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

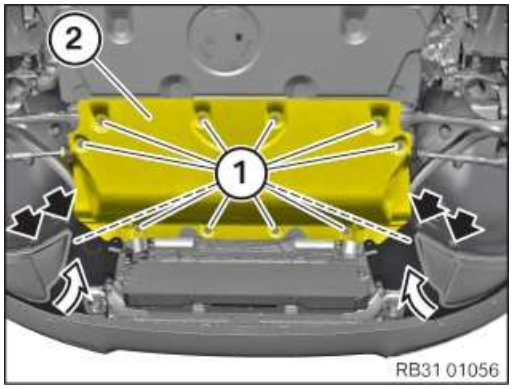


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

27 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

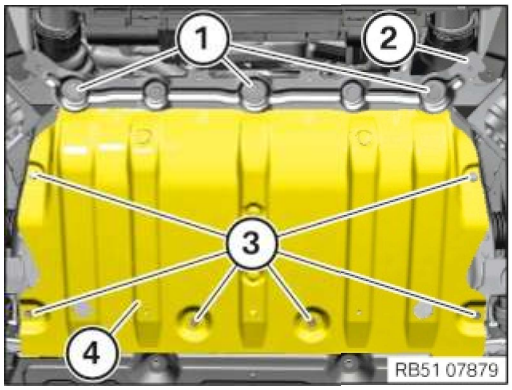
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

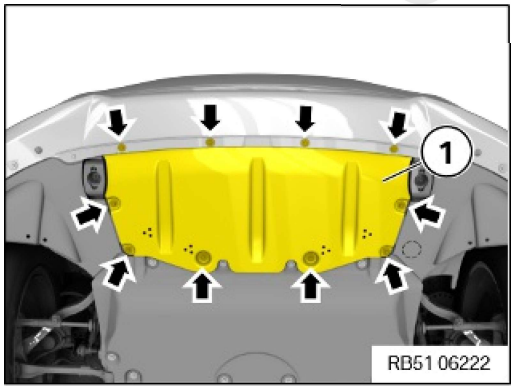
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

28 – Installing the front underbody protection



- **Version 1:**

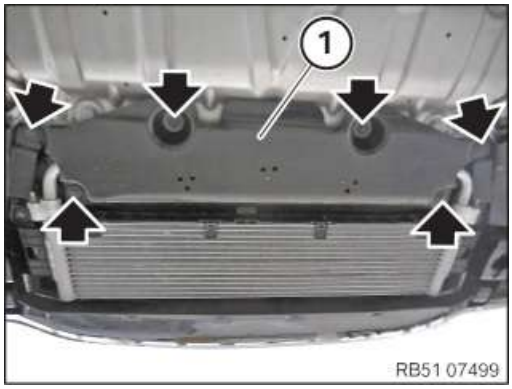
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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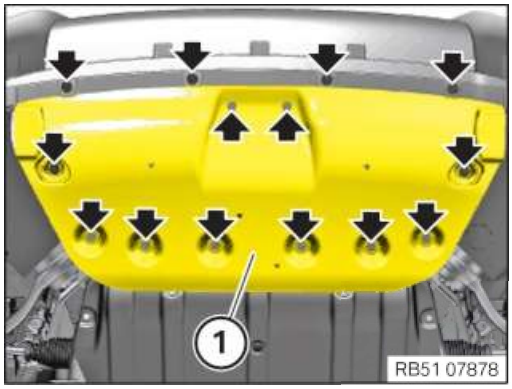
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 13

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Intake plenum to cylinder head — Used in step 15

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 15

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 15

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 15

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 15

M6		Tightening torque	8 Nm

Control unit holder on spring strut dome — Used in step 17

Hexagon screw		Tightening torque	8 Nm

Bumper buffer device steering on front axle support — Used in step 26

M10		Tightening torque	56 Nm

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Underbody protection of the steering gear Used in step 27

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) Used in step 27

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support Used in step 27

M10		Tightening torque	56 Nm

Underbody protection front Used in step 28

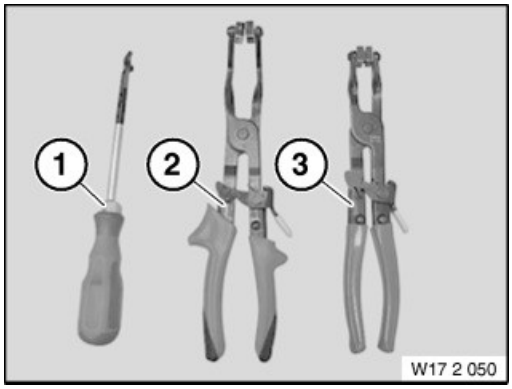
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

0 495 794 (17 2 050) Pliers

Used in step 1415

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Common

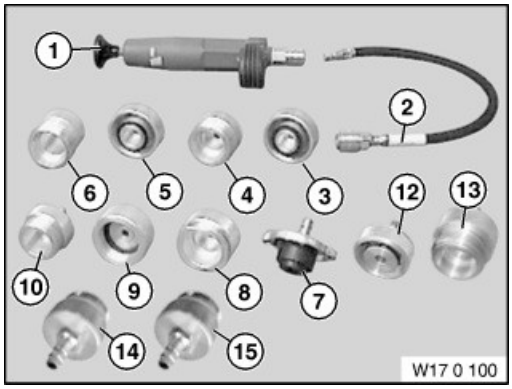
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 494 417 (17 0 100) Tester



Common Used in step 20

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Capacity of low-temperature coolant circuit G20 Used in step 20

B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

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Links

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	519

Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	121
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	121
61 20 900 Disconnect and connect battery earth lead (Plug-in Hybrid Electric Vehicle)	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
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61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 20 900 Disconnecting and connecting battery earth lead	121
61 35 ... Notes on ESD protection (Electro Static Discharge)	56818
61 35 ... Notes on ESD protection (Electro Static Discharge)	8
61 00 730 Encode/program control unit(s) (after vehicle test)	19
17 00 ... Notes for working on cooling system.	20

Operating materials	Used in step
Main group 17	20

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11 61 051 Replace intake plenum

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

3 – Removing the acoustic cover

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

4 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

5 – Removing the DME control unit

rdiagn.com

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

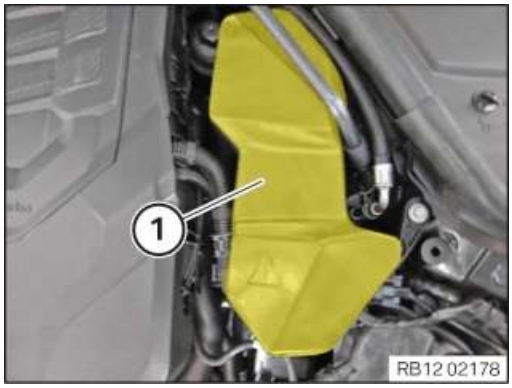
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

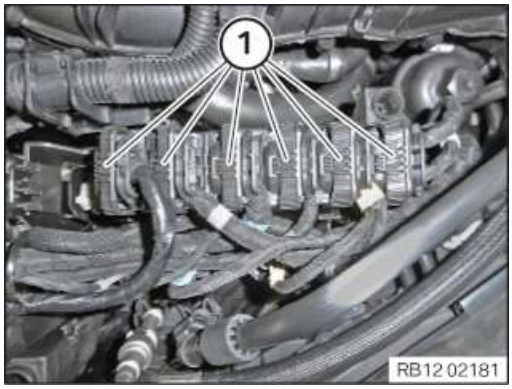
TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

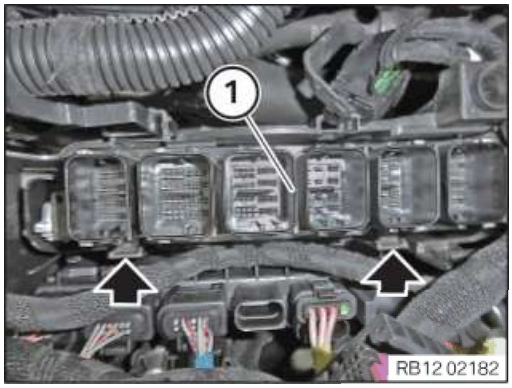


- Pull the cover (1) towards the top and feed out.

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- Unlock and disconnect the plug connection (1).



- Unlock the locks (arrows).
- Guide out and remove DME control unit (1).

6 – Removing integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

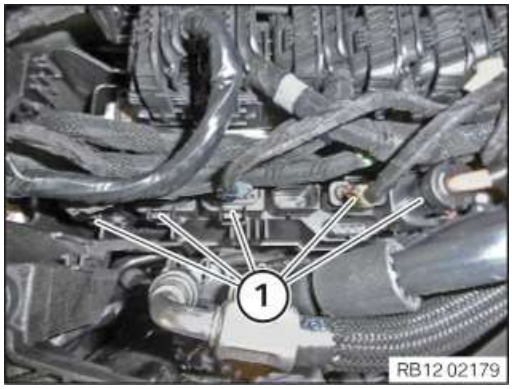
RISK OF DAMAGE

Electrostatic discharge.

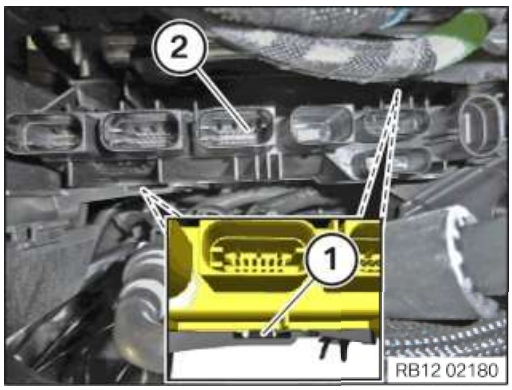
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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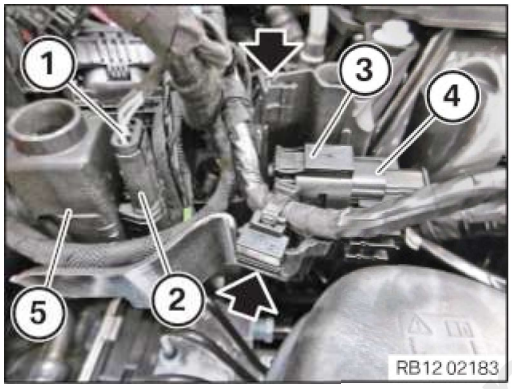


- Unlock and disconnect plug connections (1).

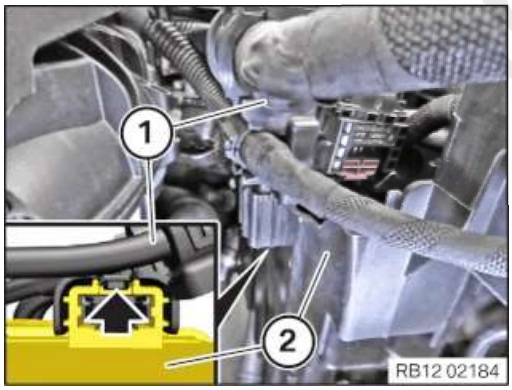


- Unlock the latch mechanisms (1).
- Guide out and remove integrated supply module (PDM) (2) upwards.

7 – Removing the control unit holder



- Unlock plug connection (1) and disconnect.
- Unlock the connector (2) and disconnect from the starter (5).
- Unlock plug connection (3) and disconnect.
- Unlock the connector (4) and disconnect from the starter (5).
- Release the clamps (arrows).

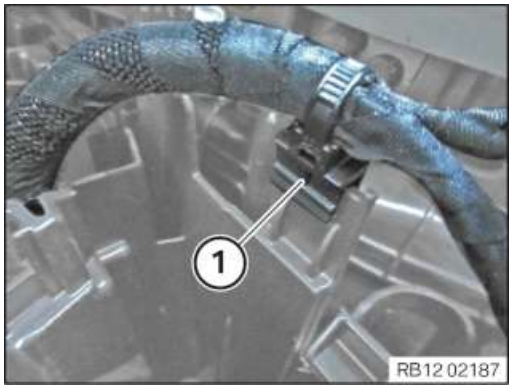


- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).

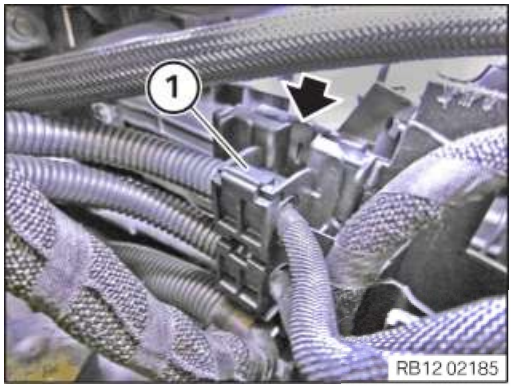


- Loosen clamp (1).

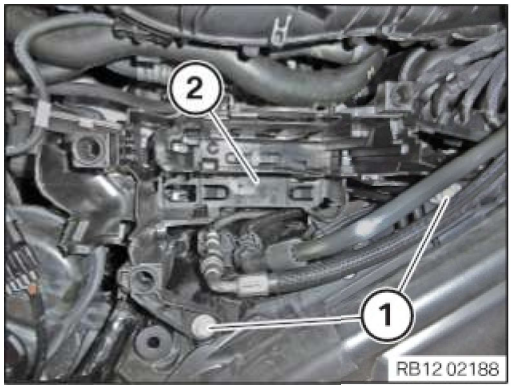
mdiagn.com



- Loosen clamp (1).



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

8 – Remove tank vent valve

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

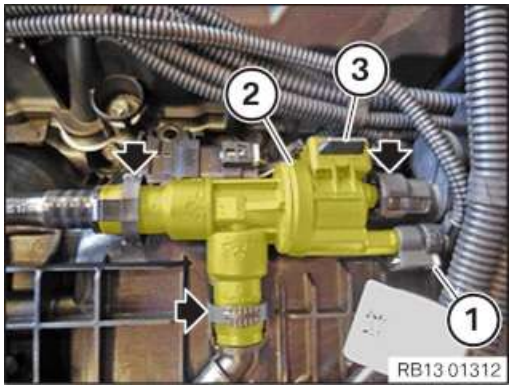
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

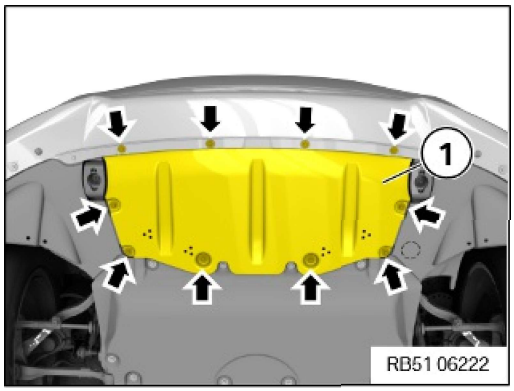
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Unlock and disconnect the tank ventilation lines (arrows).
- Unlock and loosen connector (1).
- Remove the tank vent valve (2) from the holder (3).

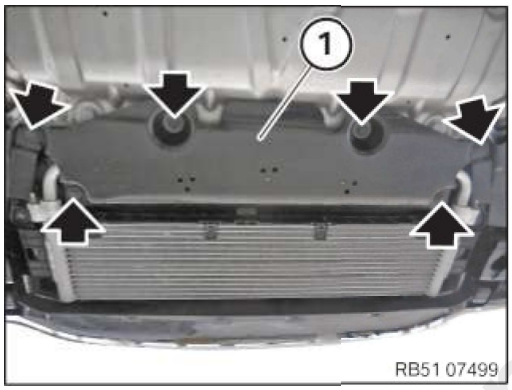
9 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

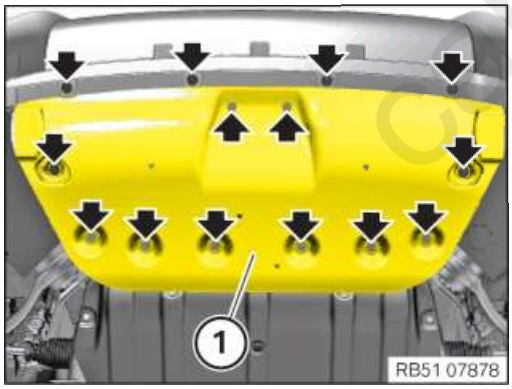
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

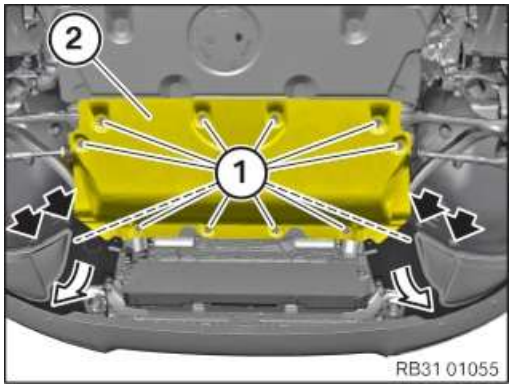


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

10 – Remove the underbody protection of the steering gear



- **Version 1:**

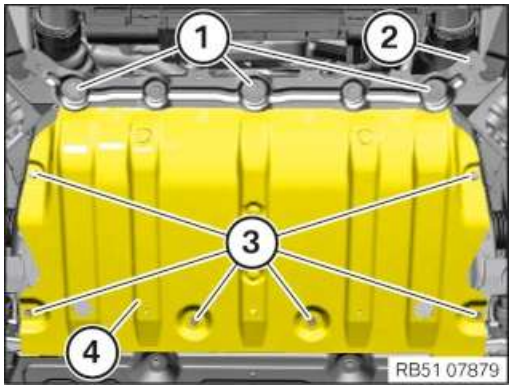
  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).

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- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

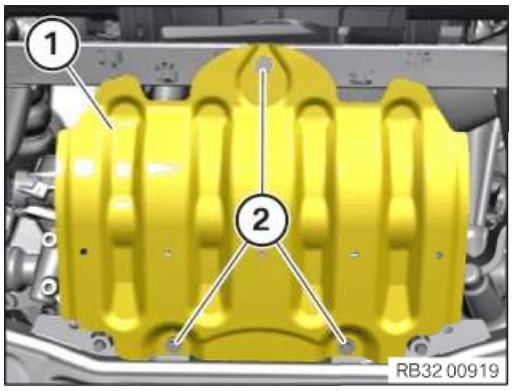
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

11 – If installed: Removing the steering start protection

Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

12 – Draining the coolant from the low-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

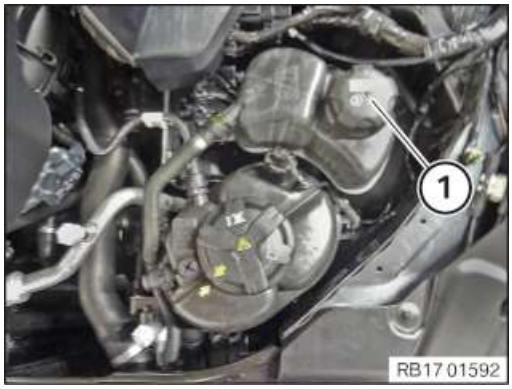
When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

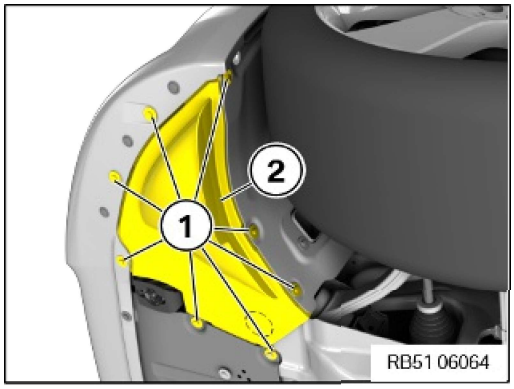
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

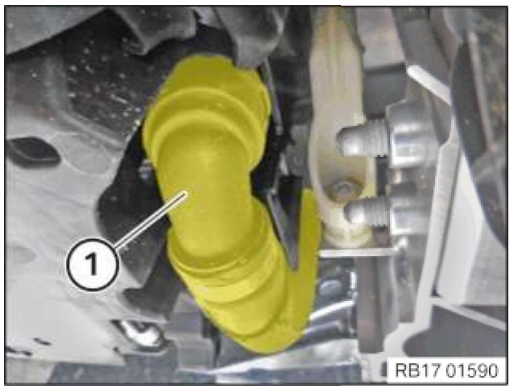
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- Loosen sealing cap (1).



- Loosen screws (1).
- Guide out and remove bottom left cover (2) to the front.

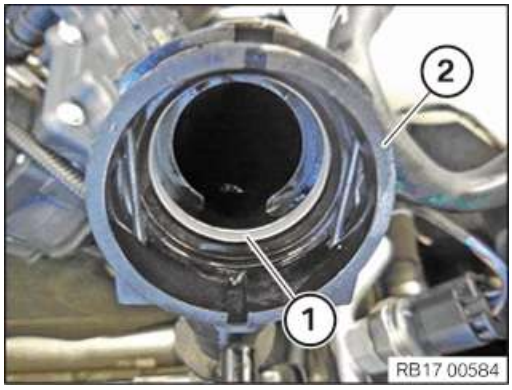


- Unlock and disconnect the coolant line (1).
- Catch and dispose of escaping coolant.

13 – Connecting the coolant lines for the low-temperature coolant circuit

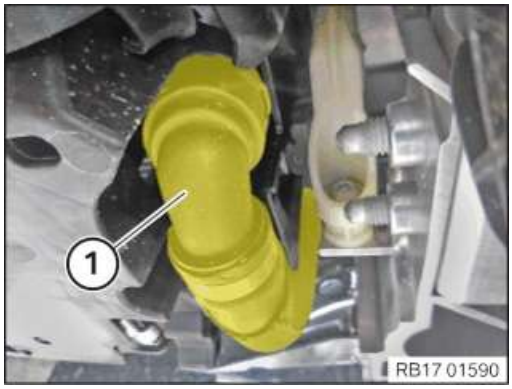
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



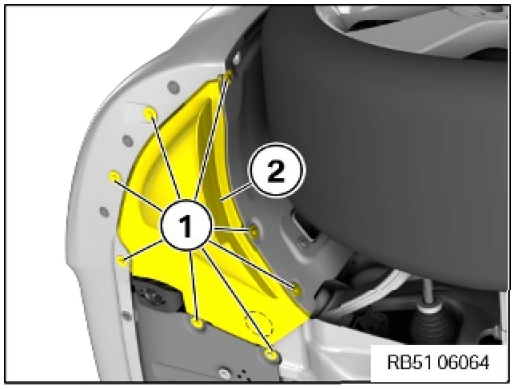
- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.

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- Connect and lock the coolant line (1).

  The coolant line (1) must audibly engage.



- Feed in and install cover (2) at the bottom front left.
- Tighten the screws (1).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

MAIN WORK

14 – Removing the intake plenum

RISK OF DAMAGE

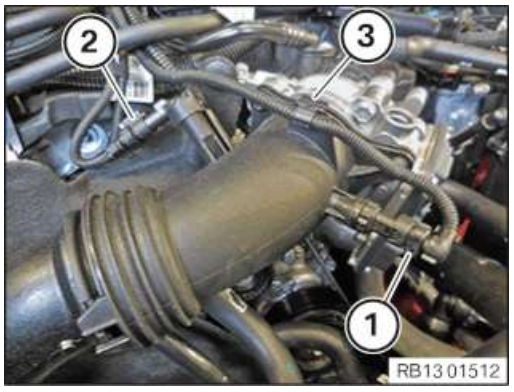
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

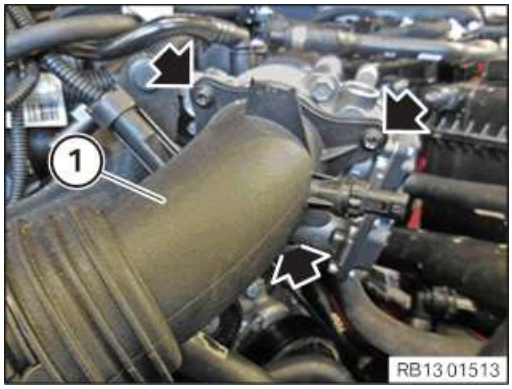
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

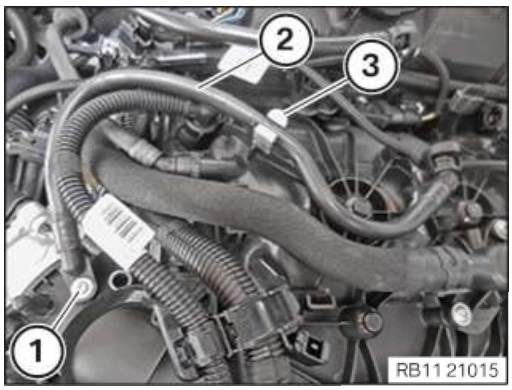


- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock and loosen clamp (3).

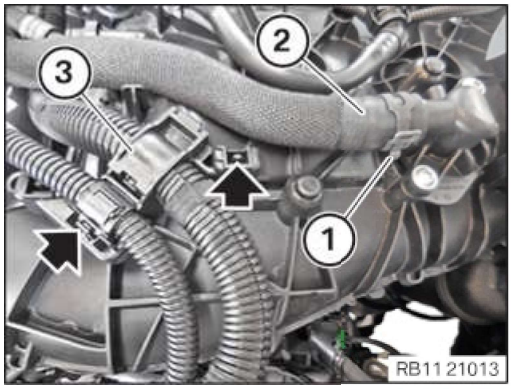
cardiagn.com



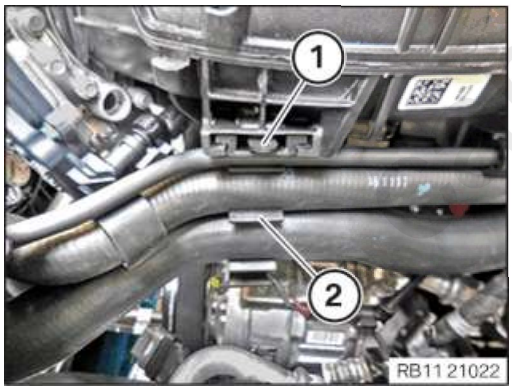
- Remove screws (arrows).
- Feed out charge air line (1) and place to one side.



- Loosen screw (1).
- Guide tank ventilation line (2) out of clamp (3) and remove it.



- Release the clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide the coolant hose (2) out and remove.
- Catch and dispose of escaping coolant.
- Unlock the locks (arrows).
- Guide out the wiring harness section (3) for sensor system 2 and place to one side.

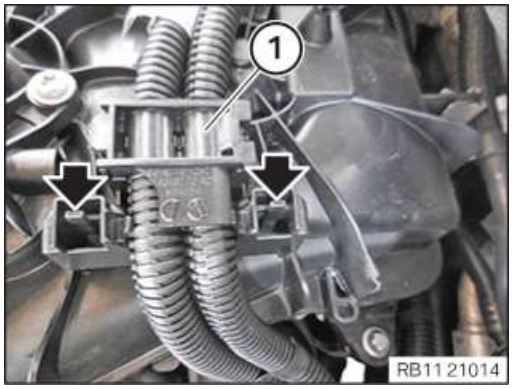


- Unlock the lock (1).
- Thread out holder (2) and set aside.

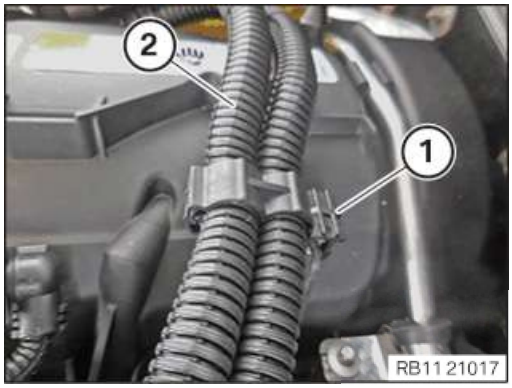


- Unlock plug connection (1) and disconnect.
- Loosen screw (2).

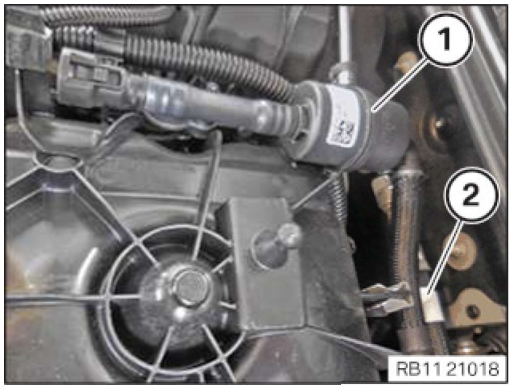
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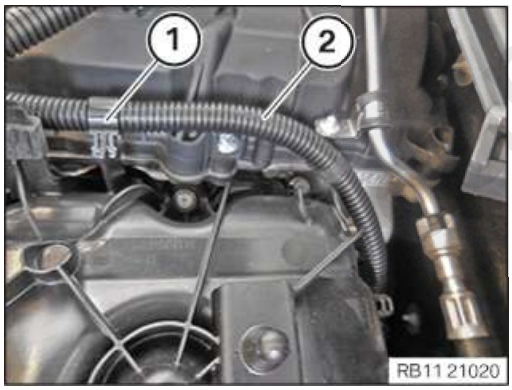
- Unlock the locks (arrows).
- Thread out the wiring harness section (1) for the injectors and ignition coils and set it aside.



- Loosen clamp (1).
- Thread out the wiring harness section (2) for the injectors and ignition coils and set it aside.



- Guide tank ventilation line (1) out of clamp (2) and place it aside.

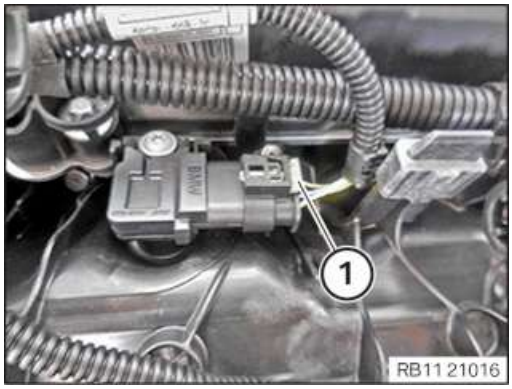


- Loosen clamp (1).
- Guide out the wiring harness section (2) for the sensor system 1 and place to one side.

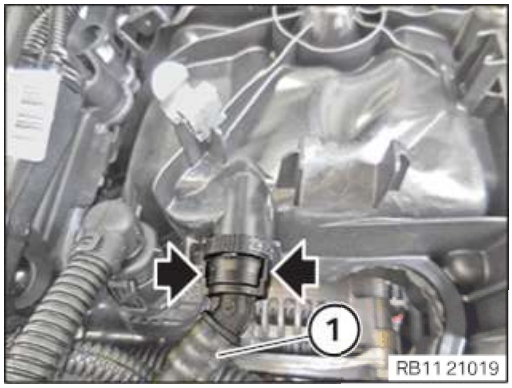


- Loosen screw (1).

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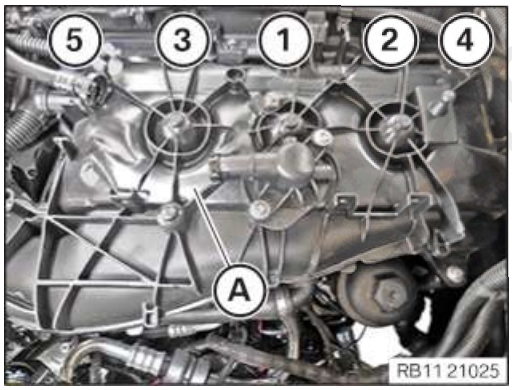
- Unlock plug connection (1) and disconnect.



- Unlock the locks (arrows).
- Feed the tank ventilation line (1) out and set it aside.



- Unlock and release coolant feed line (1).
- Catch and dispose of escaping coolant.

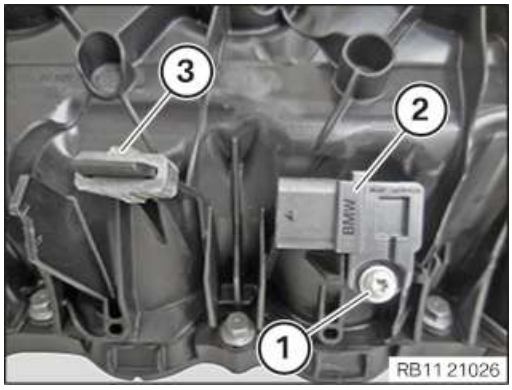


TECHNICAL INFORMATION

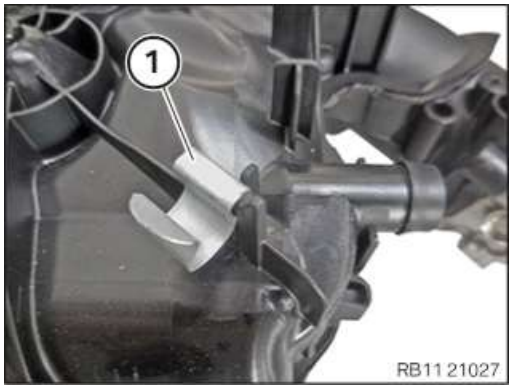
Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Loosen screws in the order (5) to (1).
- Thread out intake plenum (A) and remove.

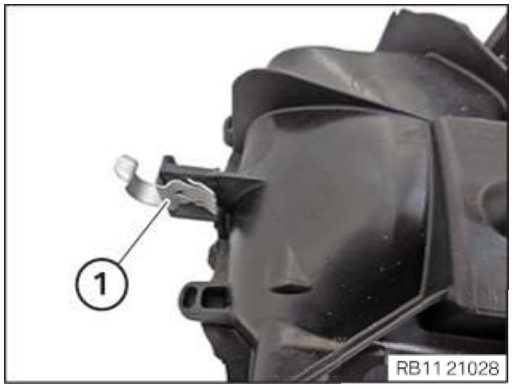
15 – Renew intake plenum



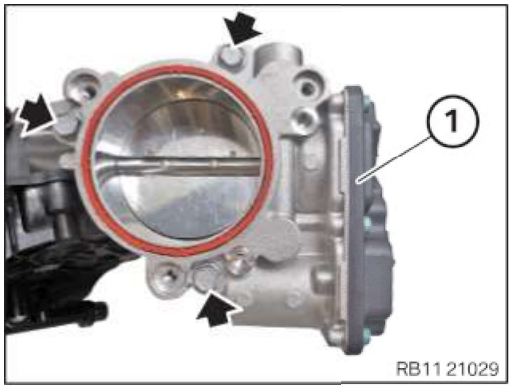
- Loosen screw (1).
- Remove the charging pressure sensor (2).
- Guide out and remove holder (3).



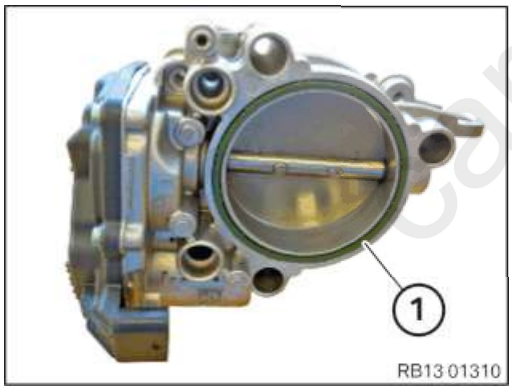
- Loosen clamp (1).



- Loosen clamp (1).

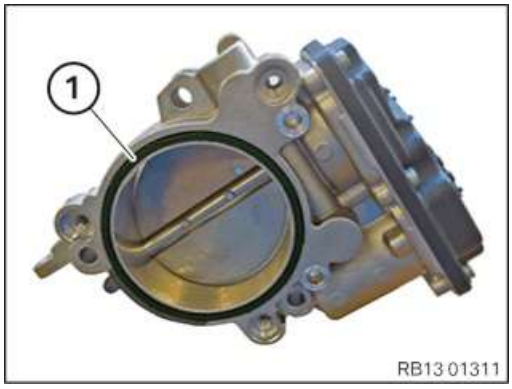


- Remove screws (arrows).
- Remove the throttle bodies (1).



- Renew sealing ring (1).

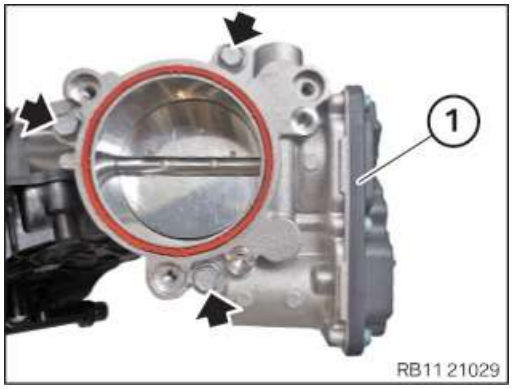
  Parts: Sealing ring



- Renew sealing ring (1).

  Parts: Sealing ring

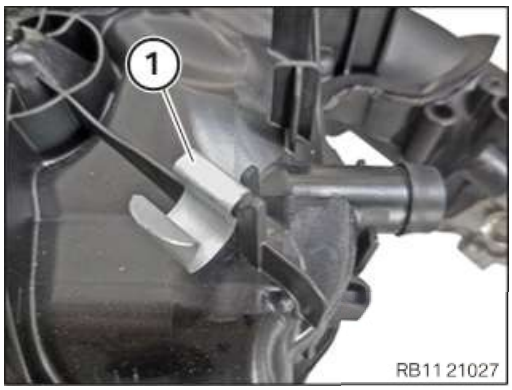
cardiagn.com



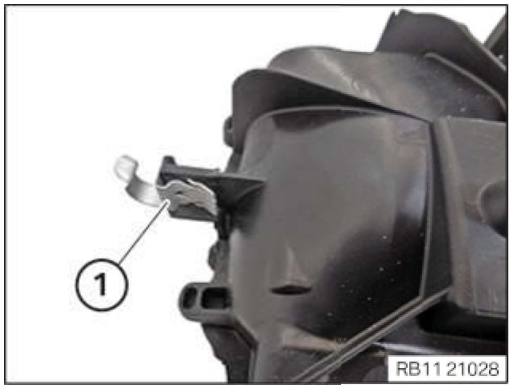
- Feed in and install the throttle body (1).
- Tighten screws (arrows).

Throttle body to intake plenum

M6X50		Tightening torque	7 Nm



- Secure clamps (1).

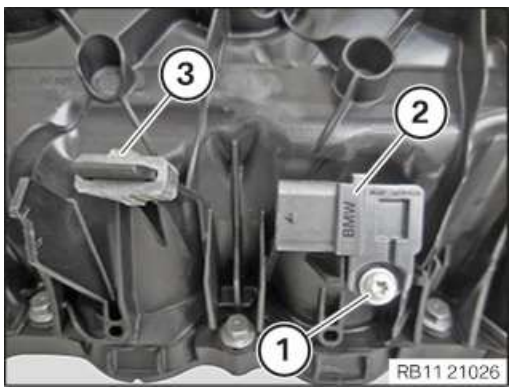


- Secure clamps (1).



- Check sealing ring (1) for damage, renew if necessary.

  Parts: Sealing ring
- Apply a thin coat of lubricant to the sealing ring (1) of the charging pressure sensor.



- Insert and install the holder (3).
- Insert and install the charging pressure sensor (2).
- Tighten down screw (1).

Charging pressure sensor to intake plenum

TS6X20		Tightening torque	4 Nm

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RISK OF DAMAGE

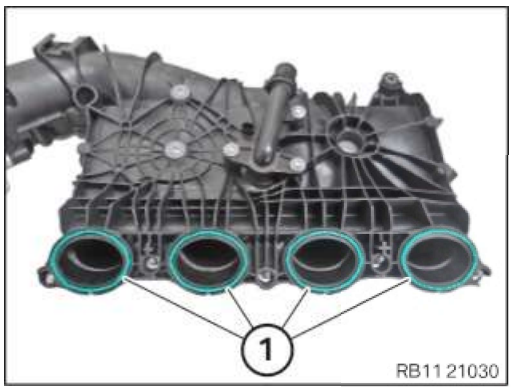
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

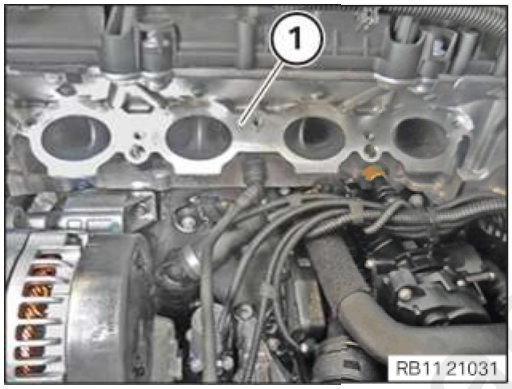
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.

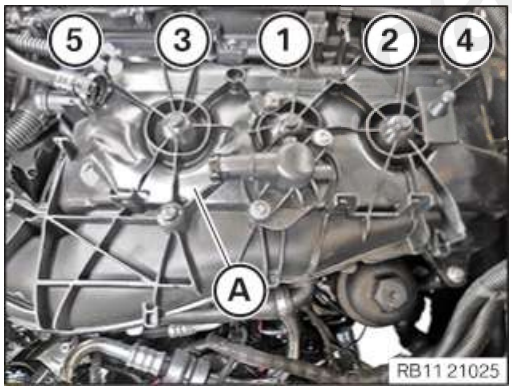


- Renew gaskets (1).

  Parts: Seals



- Clean contact surface (1).



TECHNICAL INFORMATION

Additional coolant can escape. Make sure that no coolant enters the intake port of the cylinder head.

- Guide in and position intake plenum (A) on the cylinder head.
- Tighten screws in the order (1) to (5).

Note: Tighten the bolts in 360 degree steps.

Intake plenum to cylinder head

M6		Tightening torque	10 Nm

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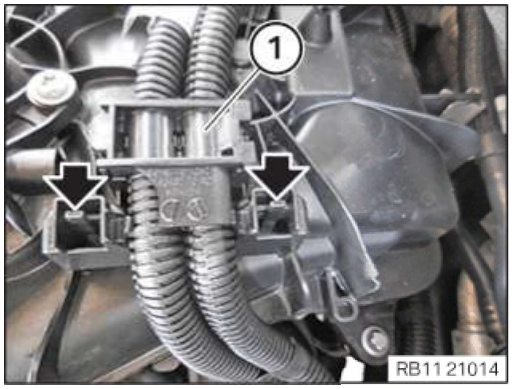
- Connect and lock coolant feed line (1).
- Make sure that coolant feed line (1) engages audibly.



- Tighten down screw (1).

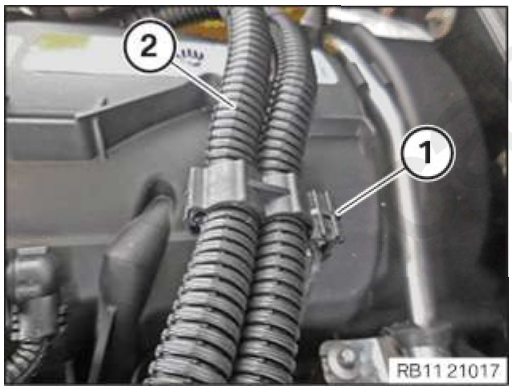
Intake plenum to support

M6X25		Tightening torque	8 Nm

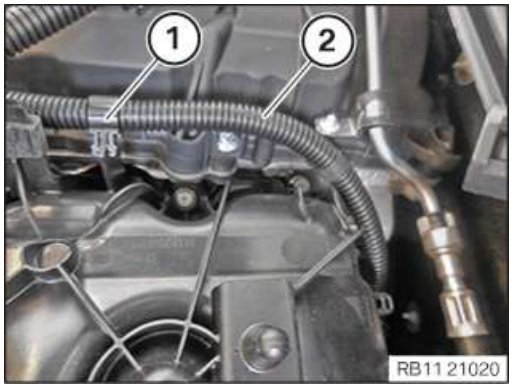


- Insert and install the wiring harness section (1) for the injectors and ignition coils.

  The locks (arrows) must engage audibly.



- Insert and install the wiring harness section (2) for the injectors and ignition coils.
- Secure clamps (1).



- Guide in and install wiring harness section (2) for sensor system 1.
- Secure clamps (1).

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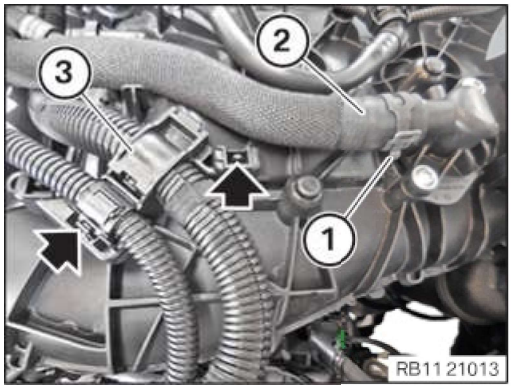
- Insert and install the tank ventilation line (1).
- Secure the tank ventilation line (1) to the clamp (2).



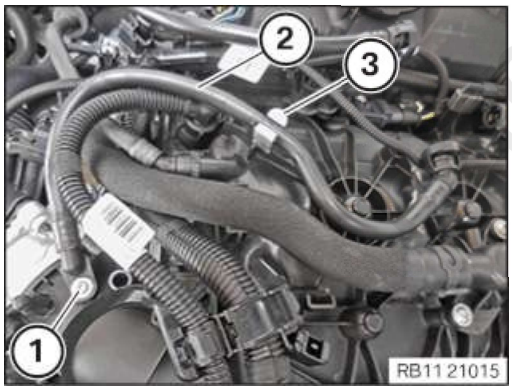
- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.
- Tighten down screw (2).

Throttle body to holder

M6X25		Tightening torque	8 Nm



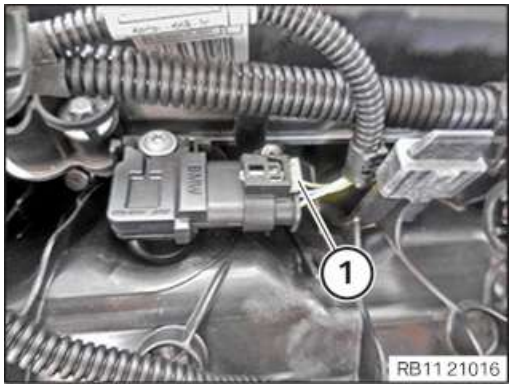
- Insert and install the coolant hose (2).
- Secure clamping collar (1) with the special tool 0 495 794 (17 2 050).
- Guide in and install wiring harness section (3) for sensor system 2.
- Make sure that you can hear the locks (arrows) engage.



- Insert and install the tank ventilation line (2).
- Secure the tank ventilation line (2) to the clamp (3).
- Tighten down screw (1).

Tank ventilation line to intake plenum

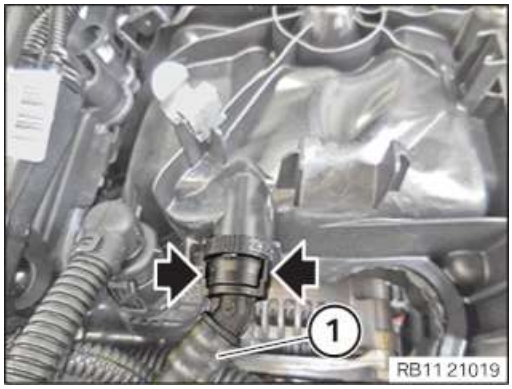
Oval-head screw		Tightening torque	3 Nm



- Connect connectors (1) and lock.

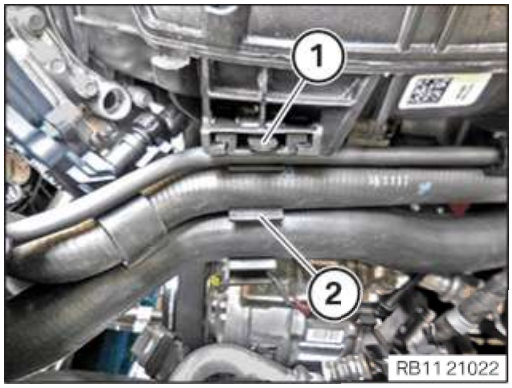
  The connector (1) must engage audibly.

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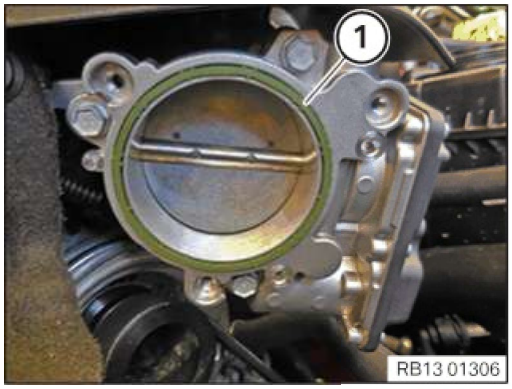


- Insert and install the tank ventilation line (1).

  The locks (arrows) must engage audibly.

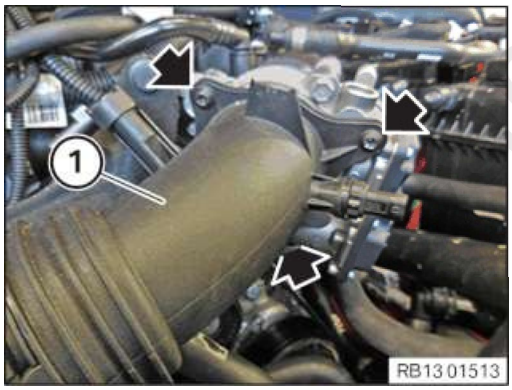


- Insert and install the holder (2).
- Ensure that the lock (1)engages audibly.



- Renew the gasket (1).

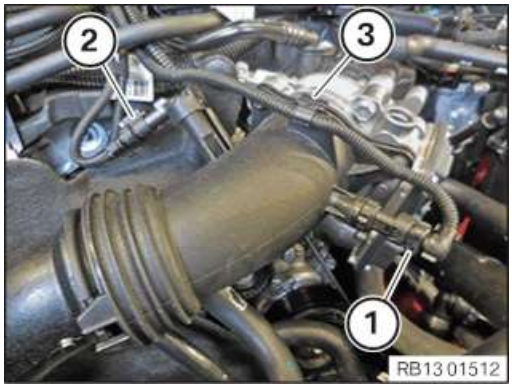
  Parts: Gasket



- Insert and install charge air line (1).
- Tighten screws (arrows).

Charge air line to throttle body

M6		Tightening torque	8 Nm

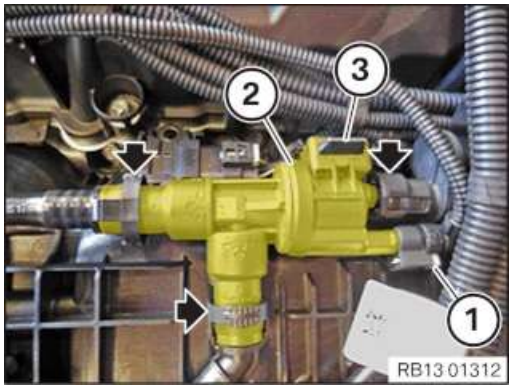


- Connect connectors (1) and lock.
- Connect connectors (2) and lock.
- Make sure you can hear the connectors (1) and (2) engage.
- Secure clamps (3).

POSTPROCESSES

17 – Installing the tank vent valve

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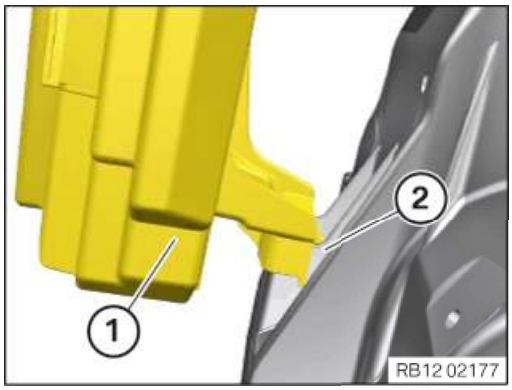


- Secure the tank vent valve (2) to the holder (3).
- Connect and lock the tank ventilation lines (arrows).

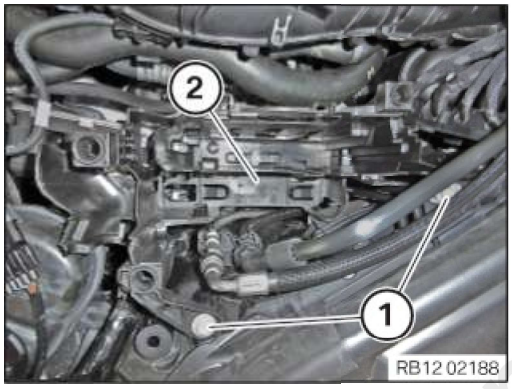
  The tank ventilation lines (arrows) must audibly engage.
- Connect and lock the connector (1).

  The connector (1) must engage audibly.

18 – Installing the control unit holder



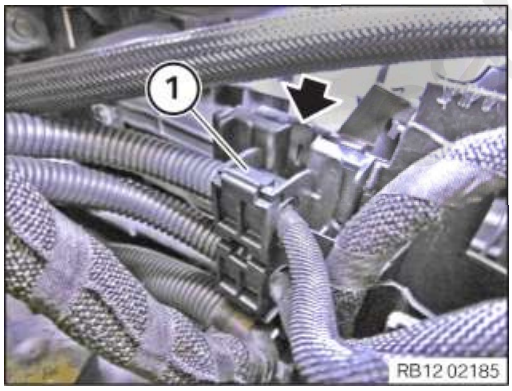
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

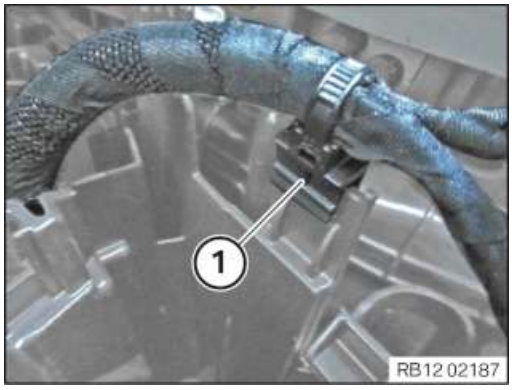
Control unit holder on spring strut dome

Hexagon screw	Tightening torque	8 Nm



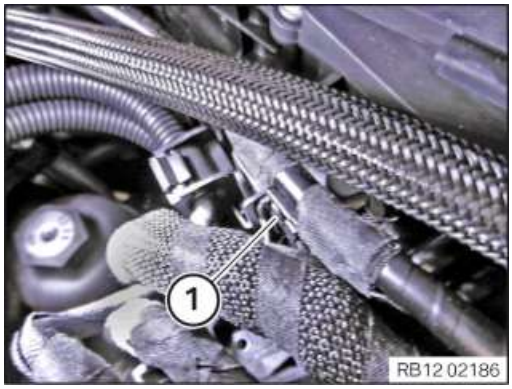
- Feed in and install the cable clip (1).

  Lock (arrow) must audibly engage.

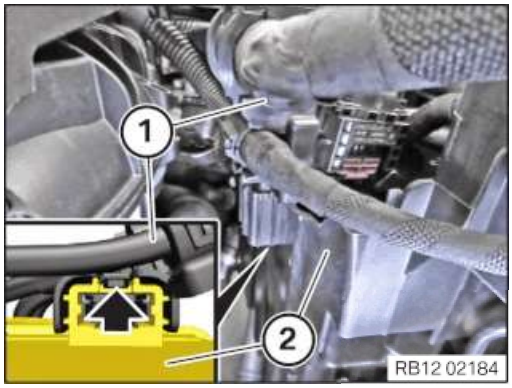


- Secure clamps (1).

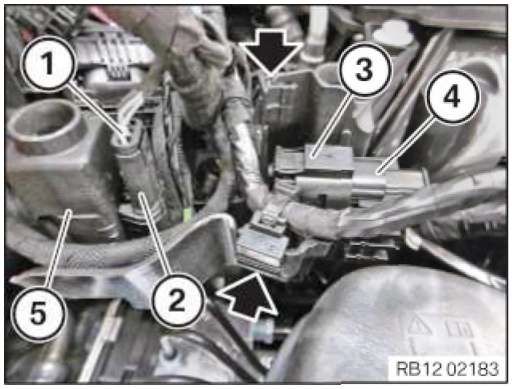
carsdiagn.com



- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

19 – Installing the integrated supply module (PDM)

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

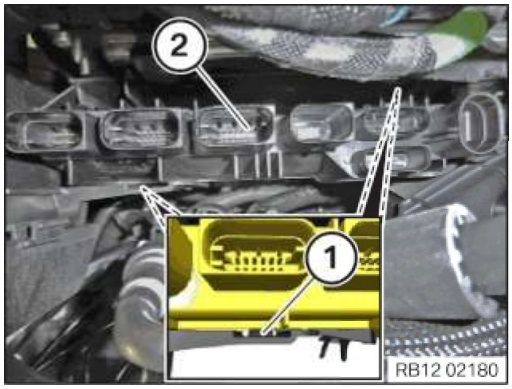
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RISK OF DAMAGE

Electrostatic discharge.

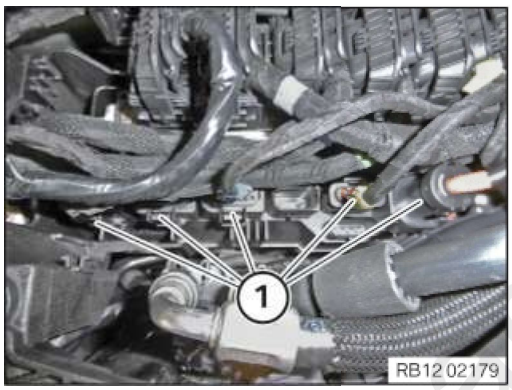
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.



- Insert and install the integrated supply module (PDM) (2).

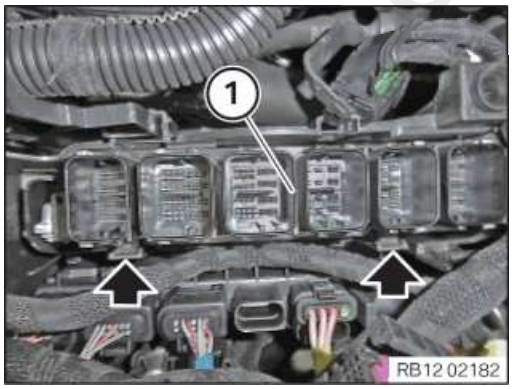
  The latch mechanisms (1) must engage audibly.
- Unlock the latch mechanisms (1).



- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.

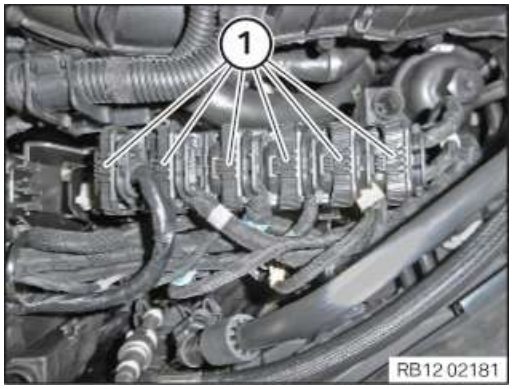
20 – Installing the DME control unit



- Feed in and install DME control unit (1).

  The locks (arrows) must engage audibly.

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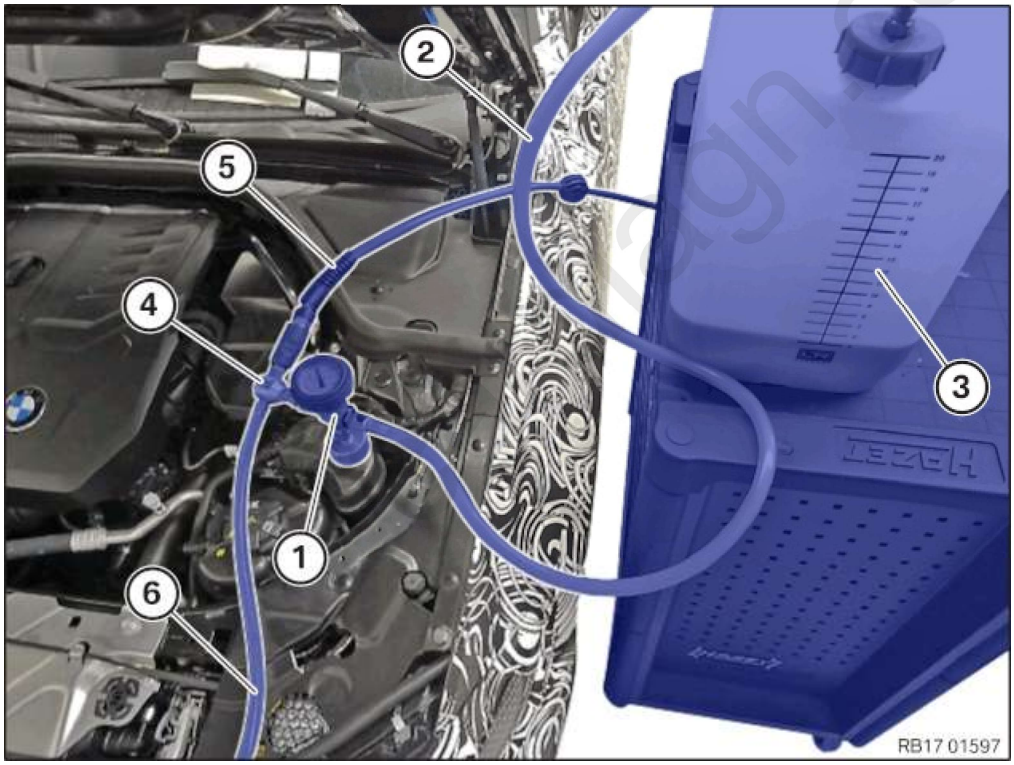
- Connect connectors (1) and lock.
  All connectors (1) must engage audibly.



- Insert and install cover (1) into guides.

21 – Filling the low-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

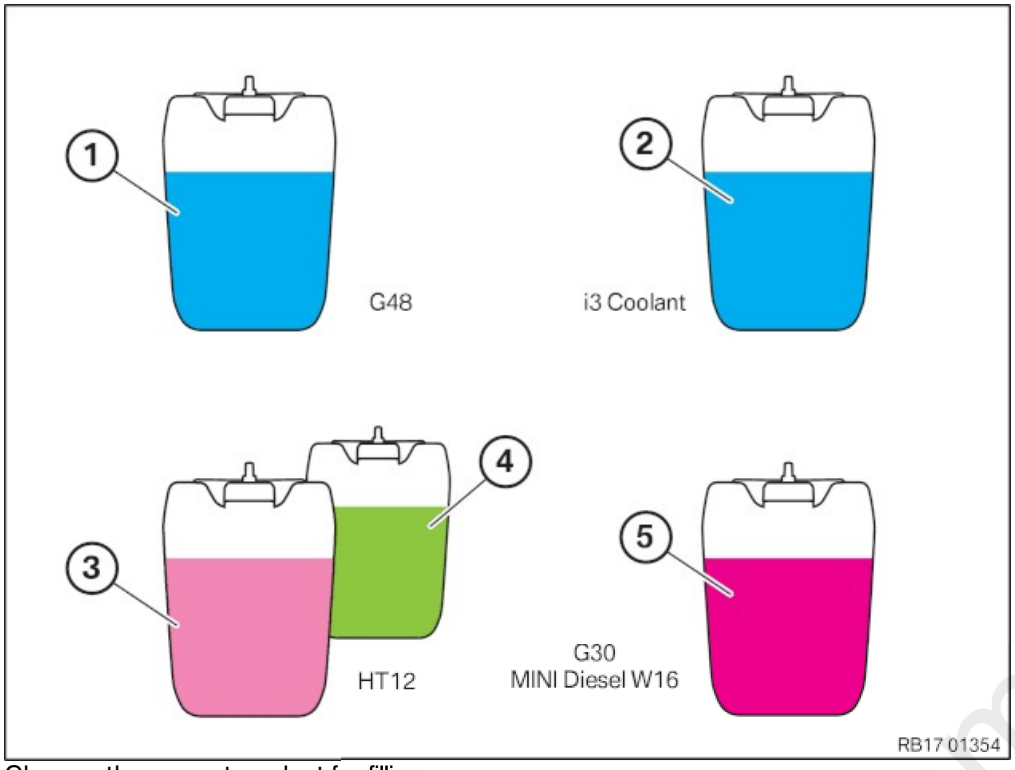
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

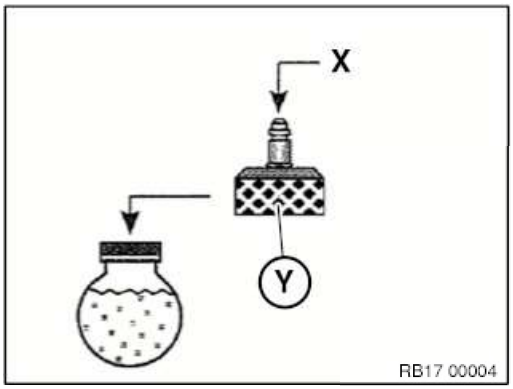
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 109

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

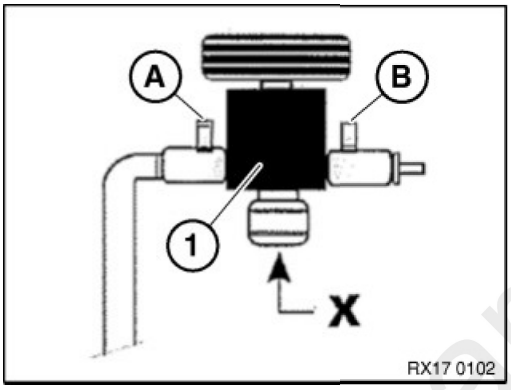
Capacity of low-temperature coolant circuit G20

B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

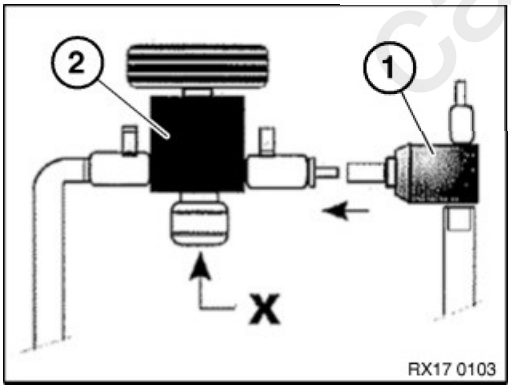
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

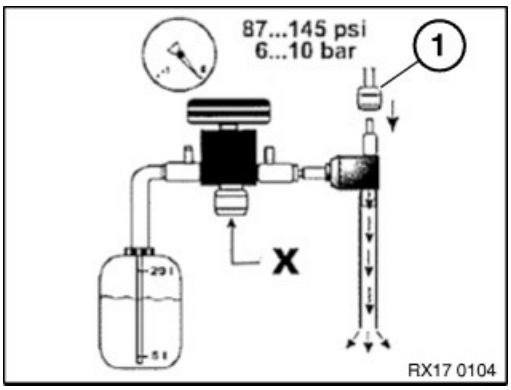


- Check that shutoff valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

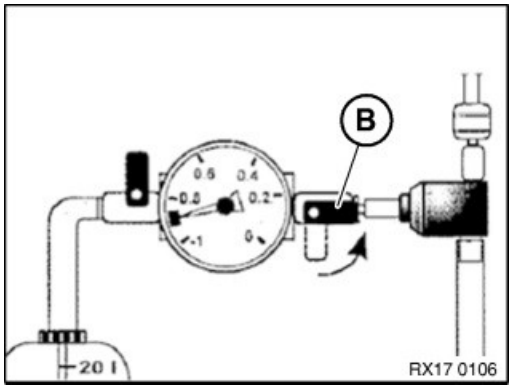
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

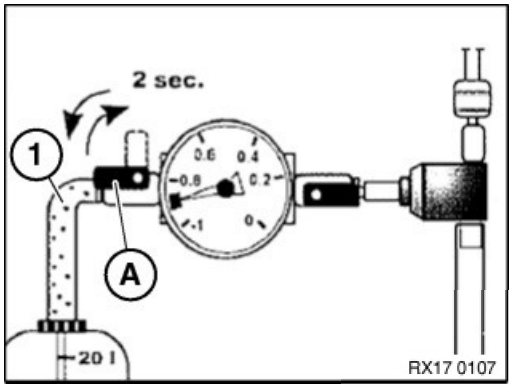
  (X)is the connection on the coolant expansion tank.

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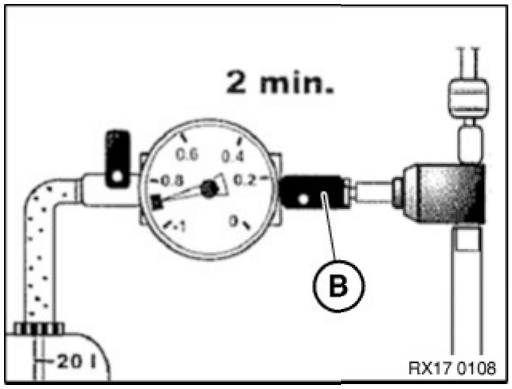
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

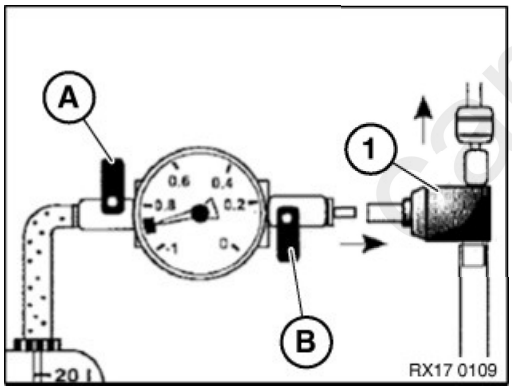


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

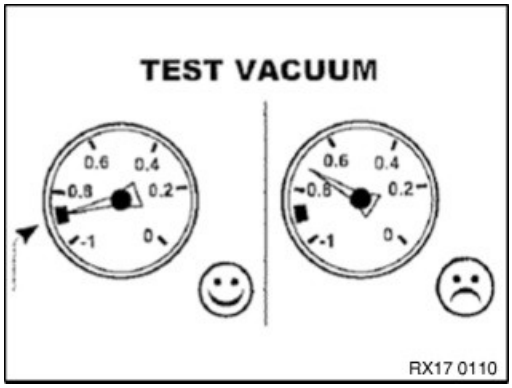
The coolant hoses contract during vacuum build-up.

- After a vacuum of -0.7 to -0.95 bar has been created in the coolant circuit (duration approx. 2 min), shut the shutoff valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

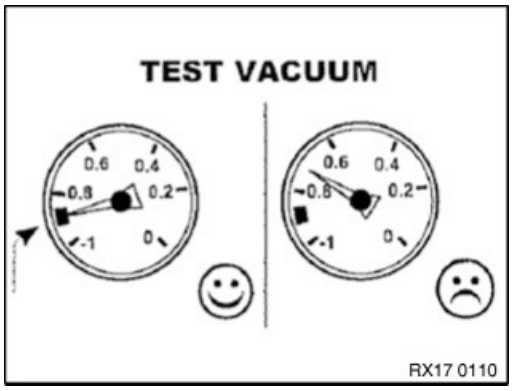
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



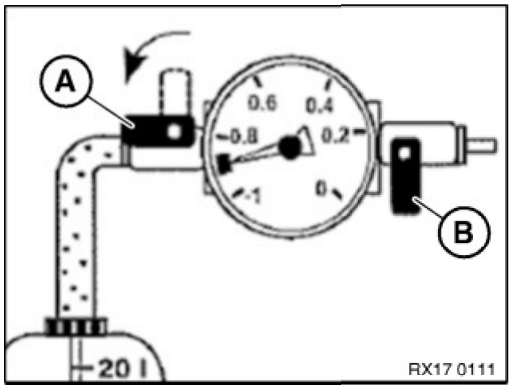
- The vacuum in the coolant circuit must be maintained for at least 30 seconds.

Result

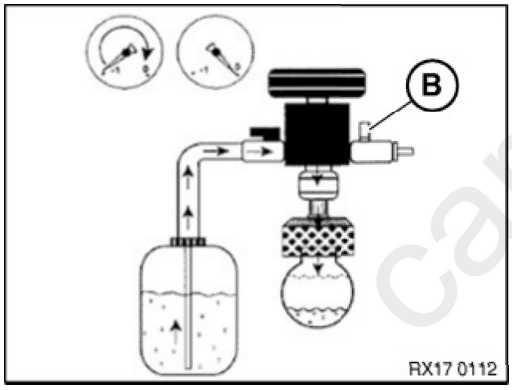
» Vacuum remains constant.

Measure

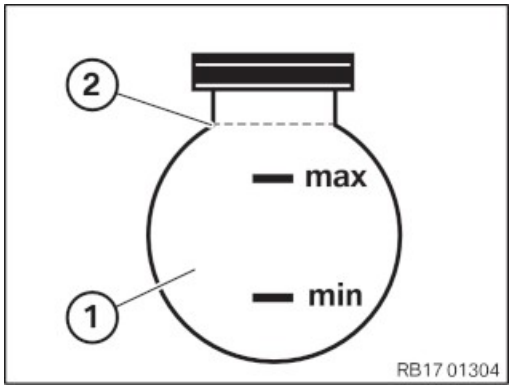
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the low-temperature coolant expansion tank (1).
- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to the lower edge of the coolant filler neck (2) of the low-temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

22 – Disconnecting all battery earth leads

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- See additional information.

23 – Bleeding the low-temperature cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

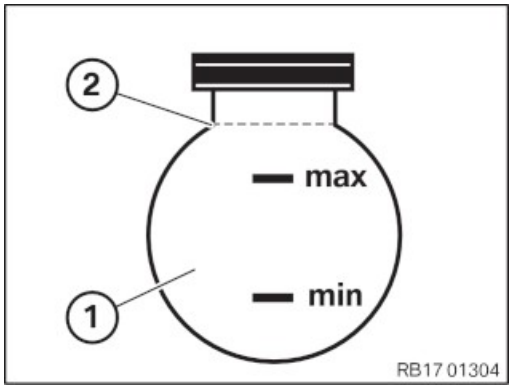
Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Adjust the coolant level in the low-temperature coolant expansion tank (1) up to lower edge (2) of the coolant filler neck of low-temperature coolant expansion tank (1).
- Close the sealing cap on the coolant expansion tank of the low-temperature coolant circuit.
- Ensure that the bonnet is **open**.
- Connect battery charger.
- Switch on the ignition and ensure that it remains **switched on** (for example, activate the low-beam headlight and the hazard warning lights **at the same time**).
- If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Ensure that the Driving Experience Control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **not** press on the brake pedal.
- Do **not** start engine.

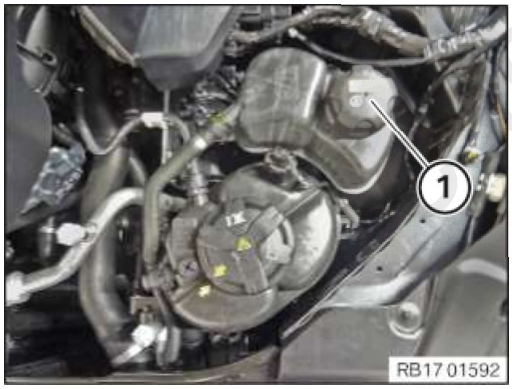
  The cooling system bleeding routine will start.

  The electric coolant pump in the low-temperature coolant circuit is activated for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends after 11 minutes.

  The electric coolant pump is **no** longer activated.
- Note the display in the instrument cluster (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).



TECHNICAL INFORMATION

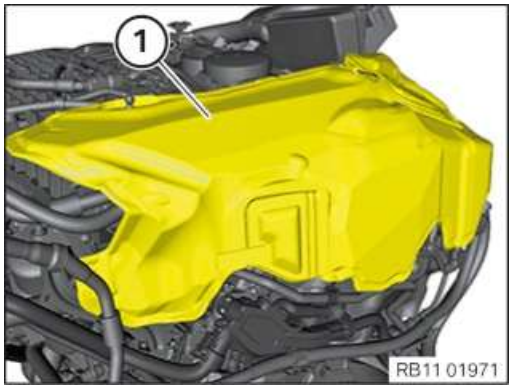
After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in coolant expansion tank (2) of the low-temperature coolant circuit to **100 ml** above the **maximum mark** (1) .
- Close sealing cap (1).

24 – Installing acoustic cover at rear



- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

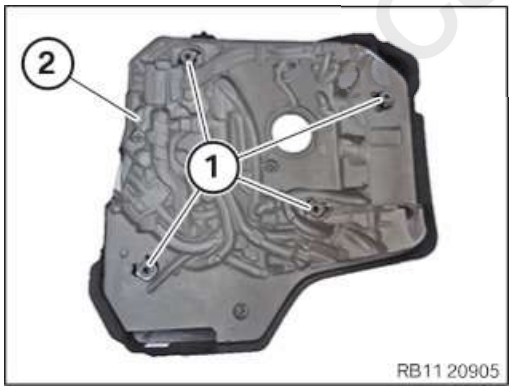
25 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

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- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

26 – Install the seal for the bonnet

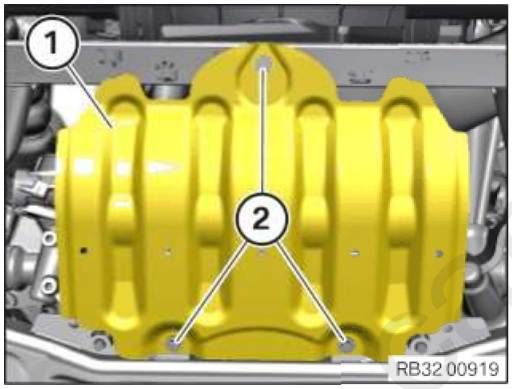


- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

27 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

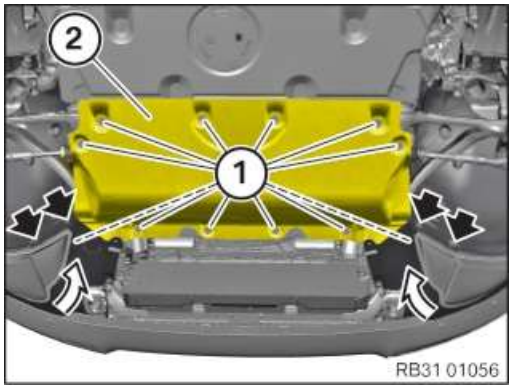


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

28 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

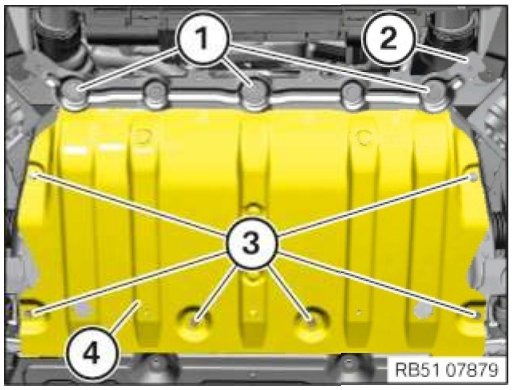
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

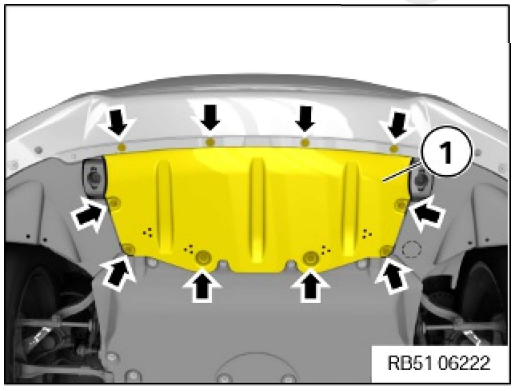
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

29 – Installing the front underbody protection



- **Version 1:**

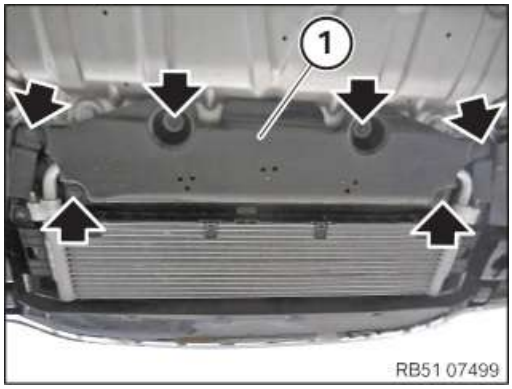
  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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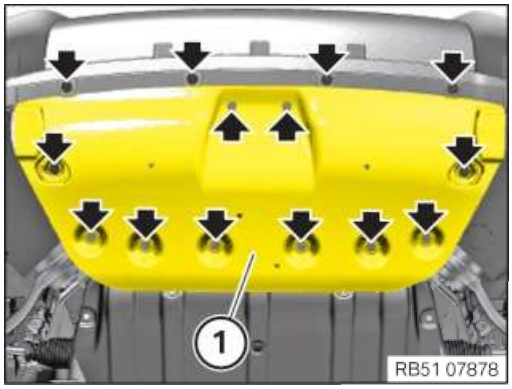
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Cover, front bottom on side — Used in step 13

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Throttle body to intake plenum — Used in step 15

M6X50		Tightening torque	7 Nm

Charging pressure sensor to intake plenum — Used in step 15

TS6X20		Tightening torque	4 Nm

Intake plenum to cylinder head — Used in step 16

M6		Tightening torque	10 Nm

Intake plenum to support — Used in step 16

M6X25		Tightening torque	8 Nm

Throttle body to holder — Used in step 16

M6X25		Tightening torque	8 Nm

Tank ventilation line to intake plenum — Used in step 16

Oval-head screw		Tightening torque	3 Nm

Charge air line to throttle body — Used in step 16

M6		Tightening torque	8 Nm

Control unit holder on spring strut dome — Used in step 18

Hexagon screw		Tightening torque	8 Nm

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Bumper buffer device steering on front axle support Used in step 27

M10		Tightening torque	56 Nm

Underbody protection of the steering gear Used in step 28

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) Used in step 28

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support Used in step 28

M10		Tightening torque	56 Nm

Underbody protection front Used in step 29

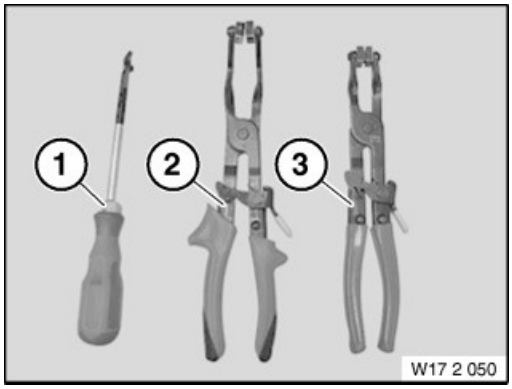
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

0 495 794 (17 2 050) Pliers

Used in step 1416

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Common

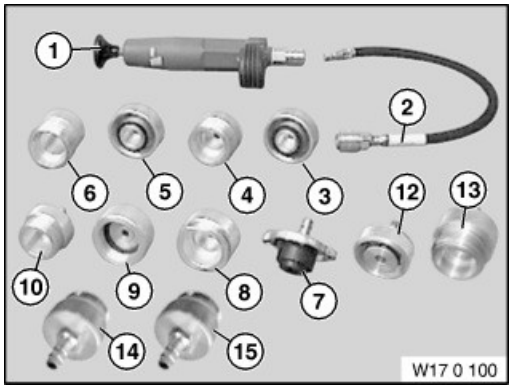
Usage	(Set of pliers) For assembling and disassembling the spring band clamps (Coolant hoses)
Included in the tool or work	
Storage location	B85
Replaced by	
In connection with	
SI-Number	01 26 06 (321)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 795 (17 2 051)		**Release tool** Remaining inventories will be sold off and then no longer available individually, but as part of complete tool set 17 2 050 = 0495794 only.	
2	0 495 796 (17 2 052)		**Pliers** (Pliers (curved version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	
3	0 495 797 (17 2 053)		**Pliers** (Pliers (straight version) Remaining inventories will be sold off and then no longer available as individual parts, but as part of complete tool set 17 2 050 = 0495794 only.	

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0 494 417 (17 0 100) Tester



Common Used in step 21

Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	
Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with

5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

Overview Technical Data

Capacity of low-temperature coolant circuit G20 Used in step 21

B48B20O1/B46B20O1 (Low-temperature coolant circuit)	4.2 l

Expendable materials: Technically suitable antifreeze and corrosion inhibitor

Links

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11 65 020 Removing and installing/replacing exhaust turbocharger

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE



Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

TECHNICAL INFORMATION

Prior to replacing the exhaust turbocharger: Observe the notes on troubleshooting on the exhaust turbocharger.

For additional information see: FUB-FUB-FB-130003-A10 Troubleshooting on the exhaust turbocharger

TECHNICAL INFORMATION

For exhaust turbocharger damage: Check the pressure pipes, charge air cooler and intake plenum for foreign matter, damage and correct functionality.

If the oil return line is exchanged, then the connecting pipe to the oil sump must ALWAYS be cleaned, as the connecting pipe can coke.

PRELIMINARY WORK

1 – Bring front compartment lid in the service position

Prerequisite

Engine compartment lid is open.

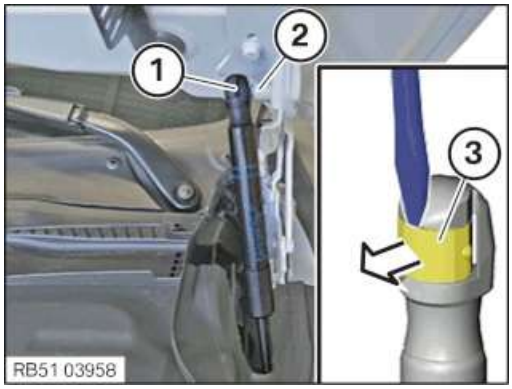
CAUTION

Shutting bonnet or tailgate.

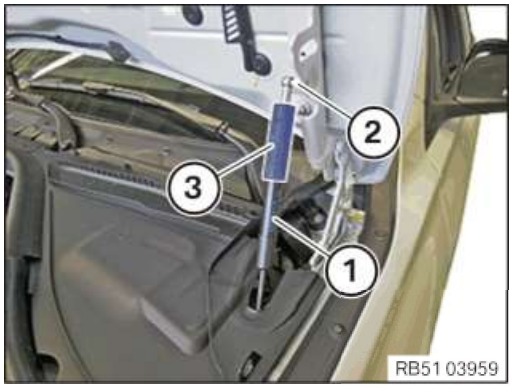
Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

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- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

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3 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

4 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

5 – Removing the clean air pipe with the resonator

WARNING

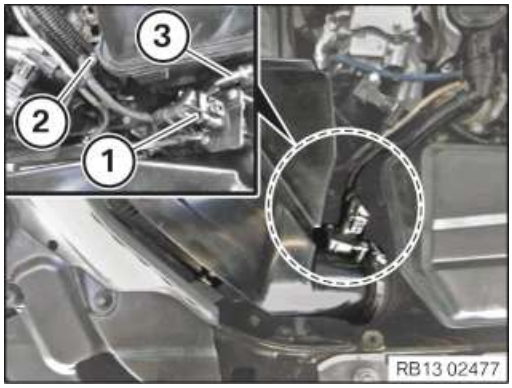
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

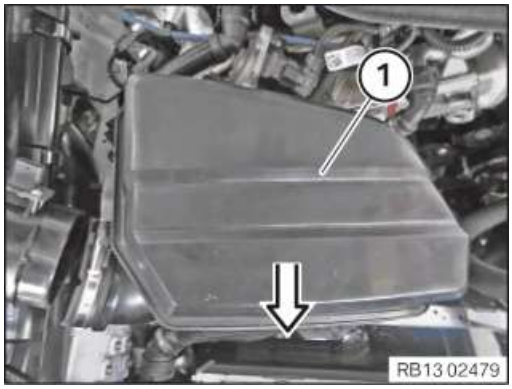


- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

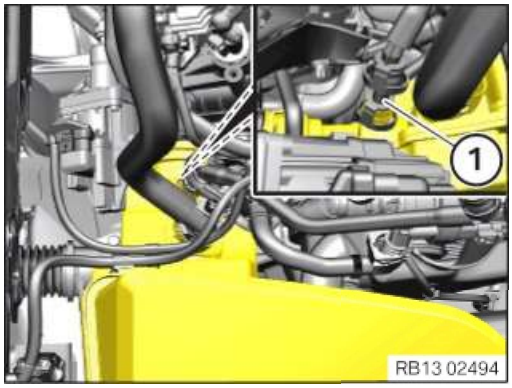


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

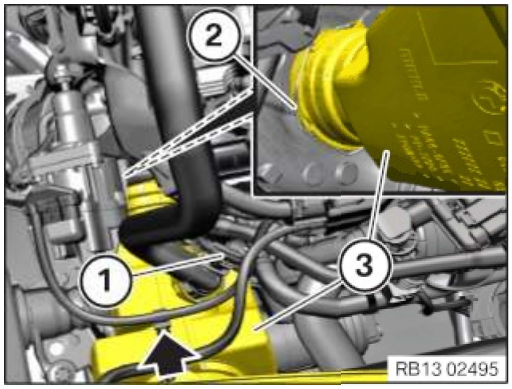
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- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

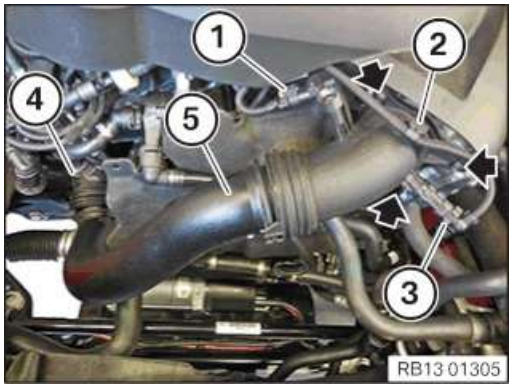
6 – Remove charge air line

WARNING

Hot surfaces.

Risk of burning!

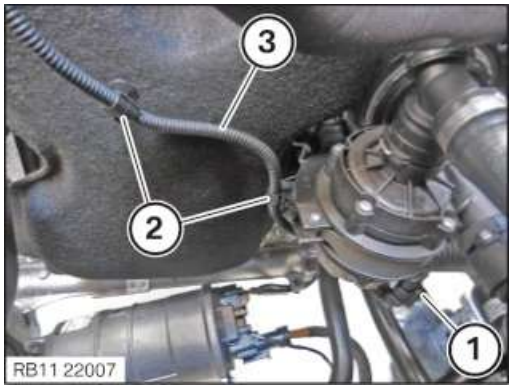
- Perform all work only on components that have cooled down.



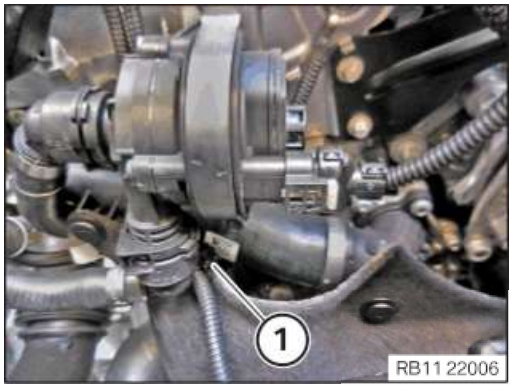
- Unlock and loosen the connector (1) on the charging pressure sensor.
- Unlock and loosen clamp (2).
- Unlock and disconnect the connector (3) from the charge-air temperature sensor.
- Remove screws (arrows).
- Unlock and loosen the clamp (4) on the exhaust turbocharger.
- Guide out and remove charge air line (5).

7 – Removing the acoustic cover for the engine at the front

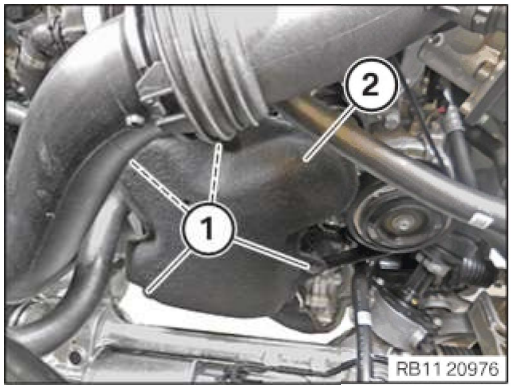
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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Remove the wiring harness section (3) and put to one side.



- Loosen clamp (1).



- Detach all expanding rivets (1).
- Guide the acoustic cover (2) out and remove.

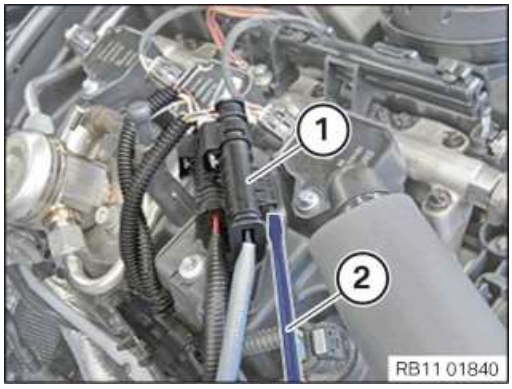
8 – Remove the control sensor

WARNING

Hot surfaces.

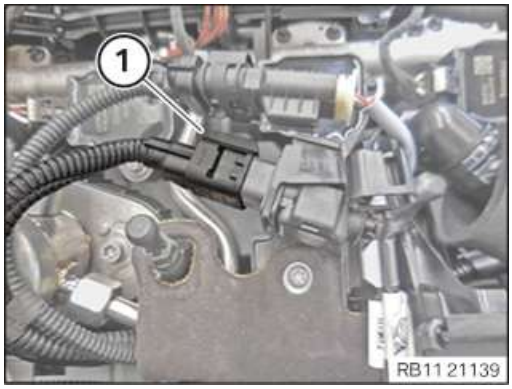
Risk of burning!

- Perform all work only on components that have cooled down.

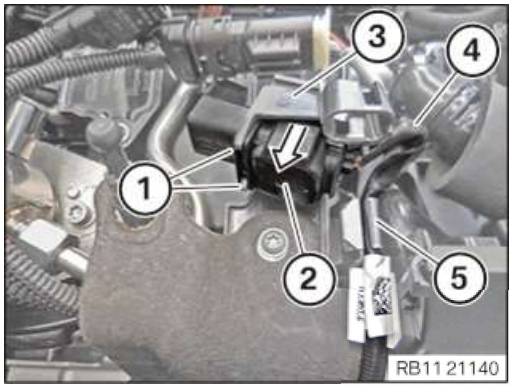


- Unlock connector (1) with screwdriver (2) and remove from the carrier plate.
- Unlock and loosen connector (1).

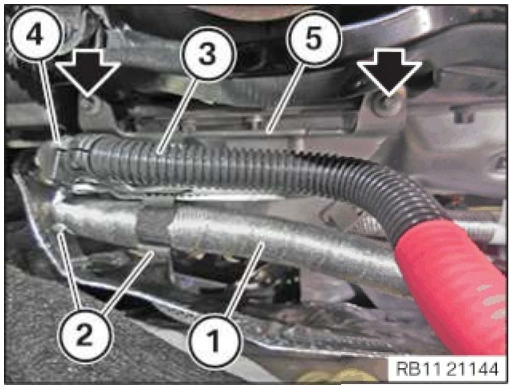
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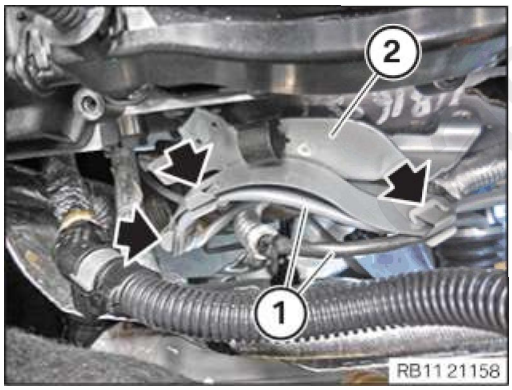
- Unlock and loosen connector (1).



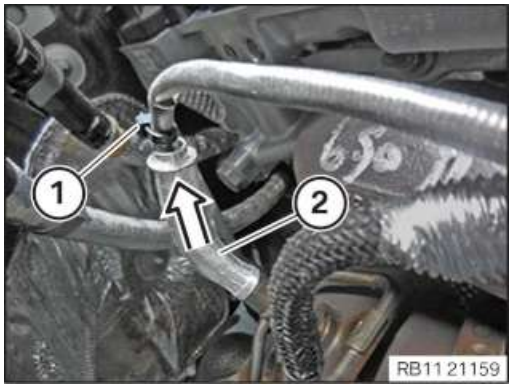
- Unlock the locks (1).
- Guide the connector (2) out of the bracket (3)in the **direction of the arrow** and set it aside.
- Release the cable (4) from the clamp (5).



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.



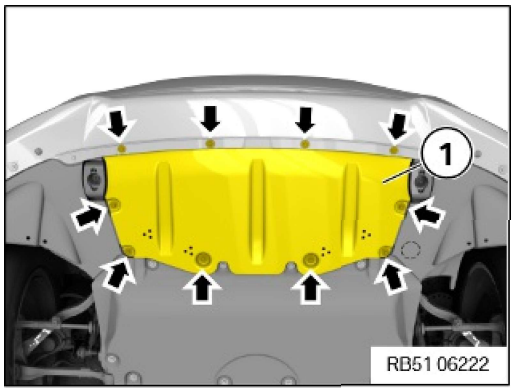
- Unfasten cable strap (1).
- Feed out the heat shield (2) **in direction of arrow** and set it aside.

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- Release and remove the control sensor (1) with the special tool 0 491 074 (11 7 020).

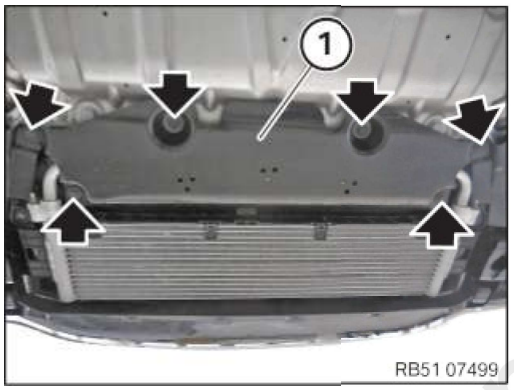
9 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

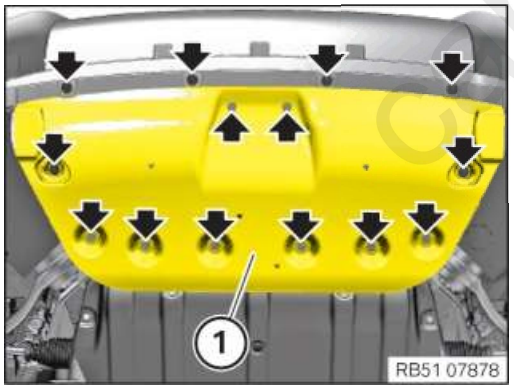
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

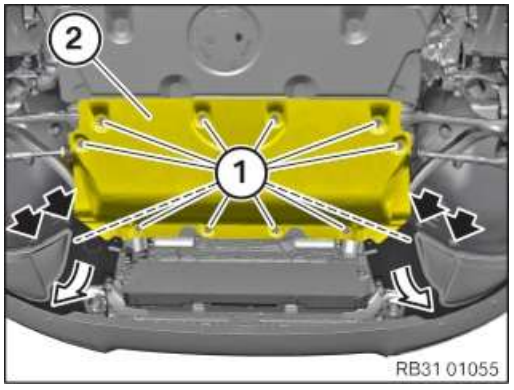


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

10 – Remove the underbody protection of the steering gear



- **Version 1:**

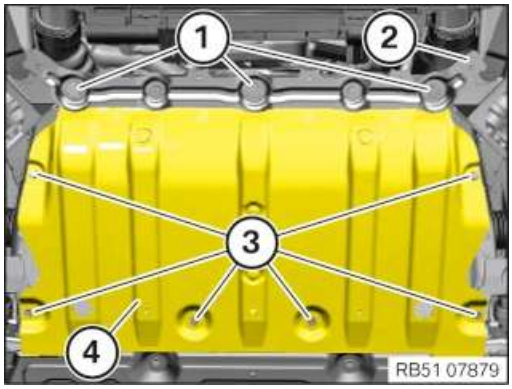
  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).

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- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

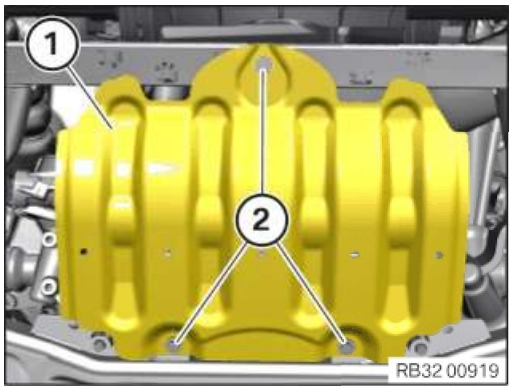
  Loosen screws (3).

  Slide the steering gear underbody protection (4) out and remove.

11 – If installed: Removing the steering start protection

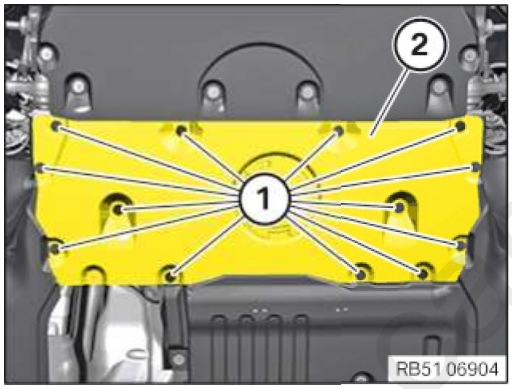
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

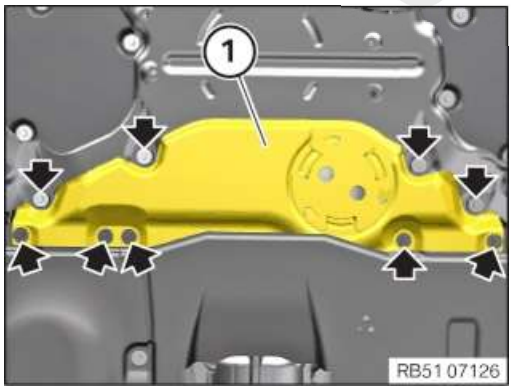
12 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



- **Version with all-wheel drive:**

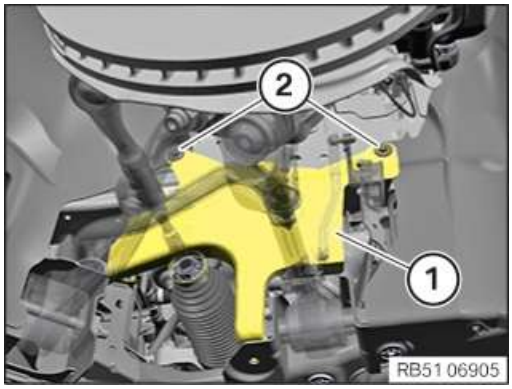
  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

13 – Remove the cover of the steering assembly

Prerequisite

Underbody protection of the steering gear is removed.



- Loosen screws (2).
- Remove the cover (1).

14 – Draining the coolant from the high-temperature cooling system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

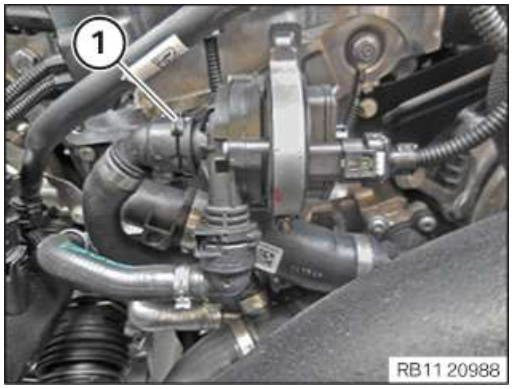
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

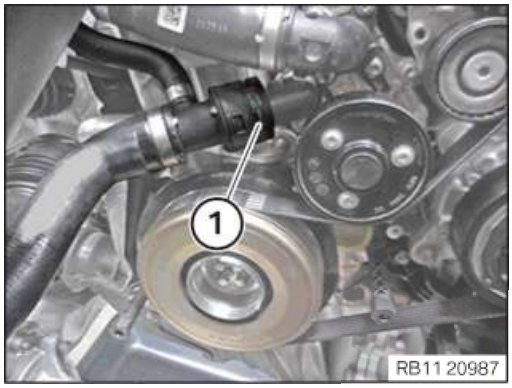


- Loosen sealing cap (1).

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- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

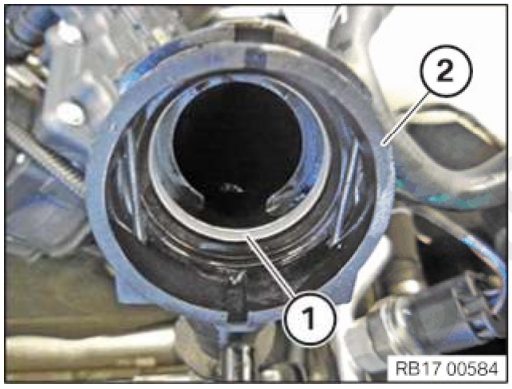


- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

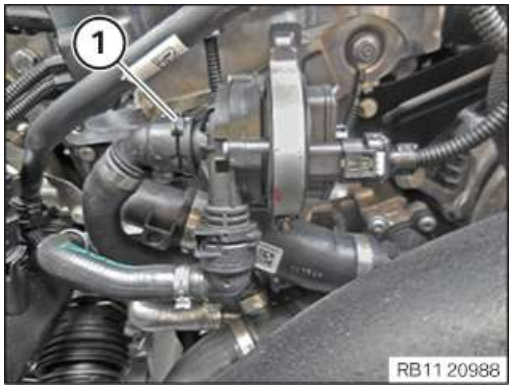
15 – Connecting the coolant lines for the high-temperature coolant circuit

TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing rings (1) of the coolant lines (2) for damage and renew if necessary.



- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

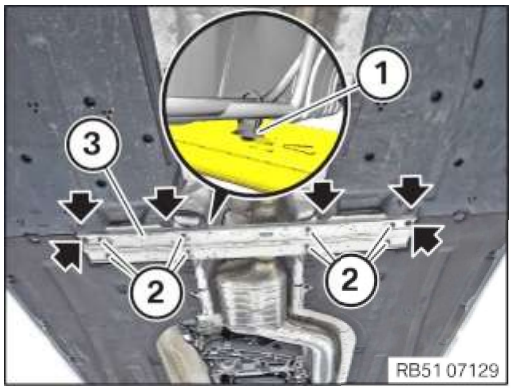
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- Connect and lock coolant line (1).

  Coolant line (1) must audibly engage.

16 – Remove the connecting support from the tunnel



- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

17 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

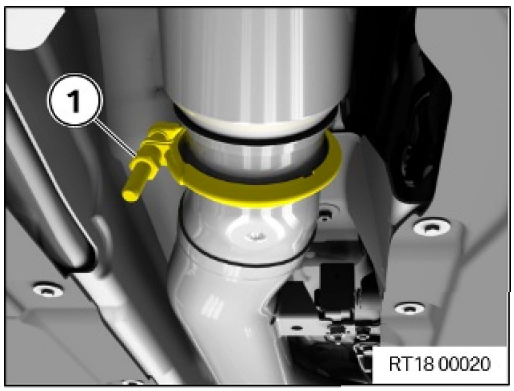
- Remove and install heavy components with the aid of another person/other persons.

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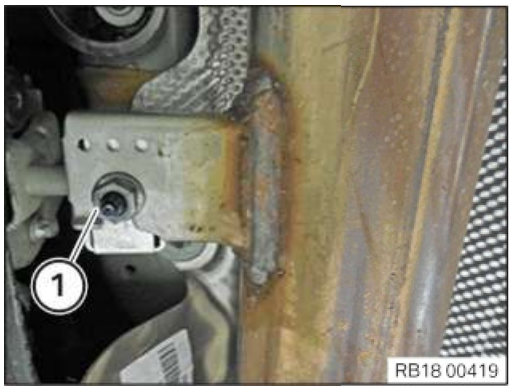
- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).

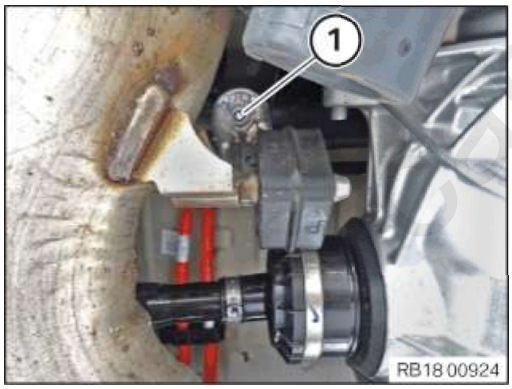


- **Equipment specification 2 (V-clips)**

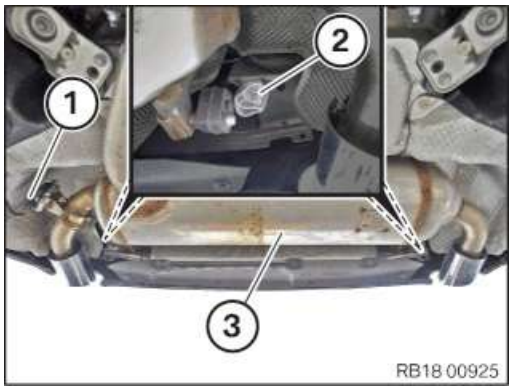
  Unfasten clamp (1).



- Loosen nut (1).



- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

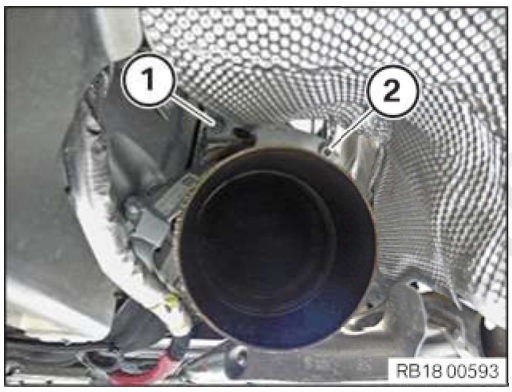
- Remove and install heavy components with the aid of another person/other persons.

CAUTION

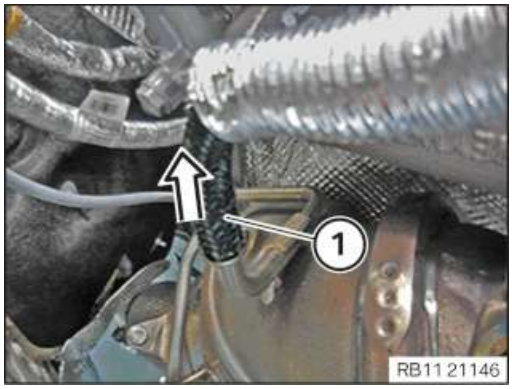
Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

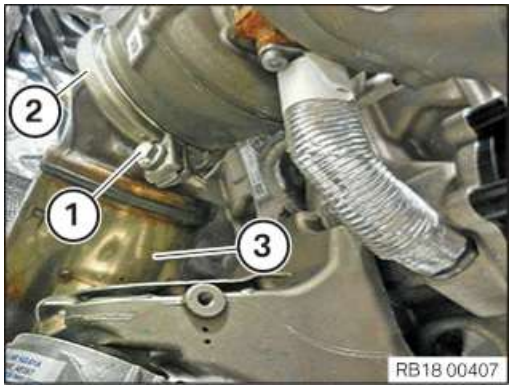


- Loosen screw (1).
- Loosen nut (2).

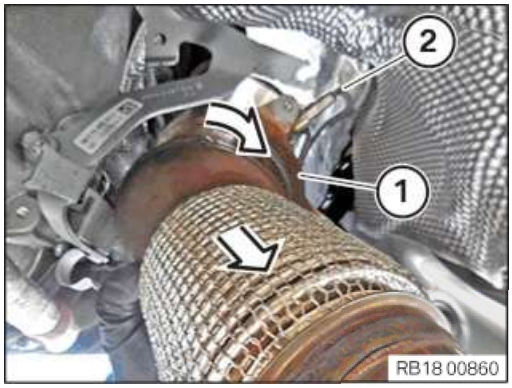


- Pull off pressure hose (1) in direction of arrow and set it aside.

carmanualsdiagn.com



- Loosen screw (1).
- Feed out V-clip (2) on catalytic converter (3) and remove.

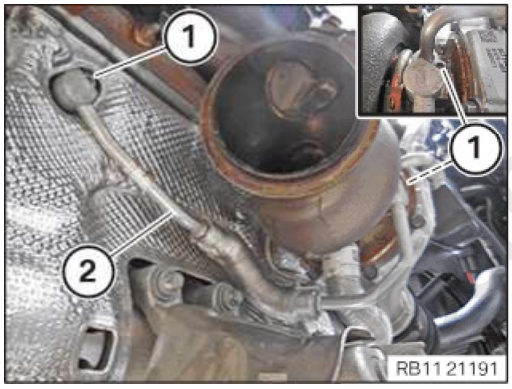


- Guide out catalytic converter (1) in direction of arrow and remove.
- Ensure that monitoring oxygen sensor (2) is **not** damaged.

19 – Remove the coolant feed line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen screws (1).
- Guide out and remove the coolant feed line (2) from the crankcase.
- Guide out and remove the coolant feed line (2) from the exhaust turbocharger.

20 – Remove the coolant return line for the exhaust turbocharger

WARNING

Hot fluids.

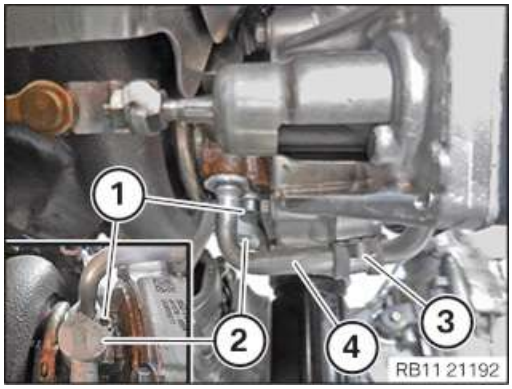
Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

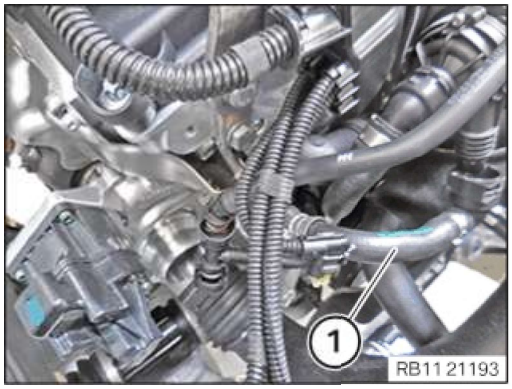
tdiagn.com



- Loosen screw (1).
- Guide out the coolant feed line (2) for the exhaust turbocharger and place it aside.
- Loosen screw (3).
- Guide out coolant return line (4) for the exhaust turbocharger and place it aside.



- Unlock and release the coolant return line for the exhaust turbocharger (1).

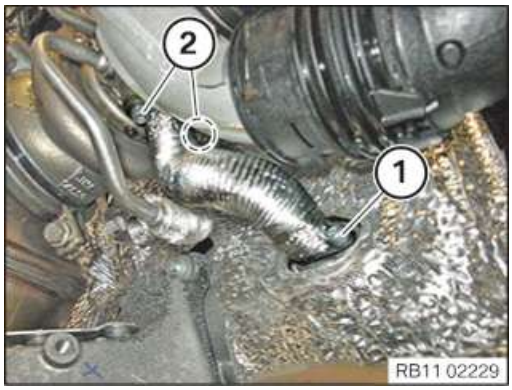


- Feed out and remove the coolant return line (1) for the exhaust turbocharger.

21 – Removing the oil return line for the exhaust turbocharger

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



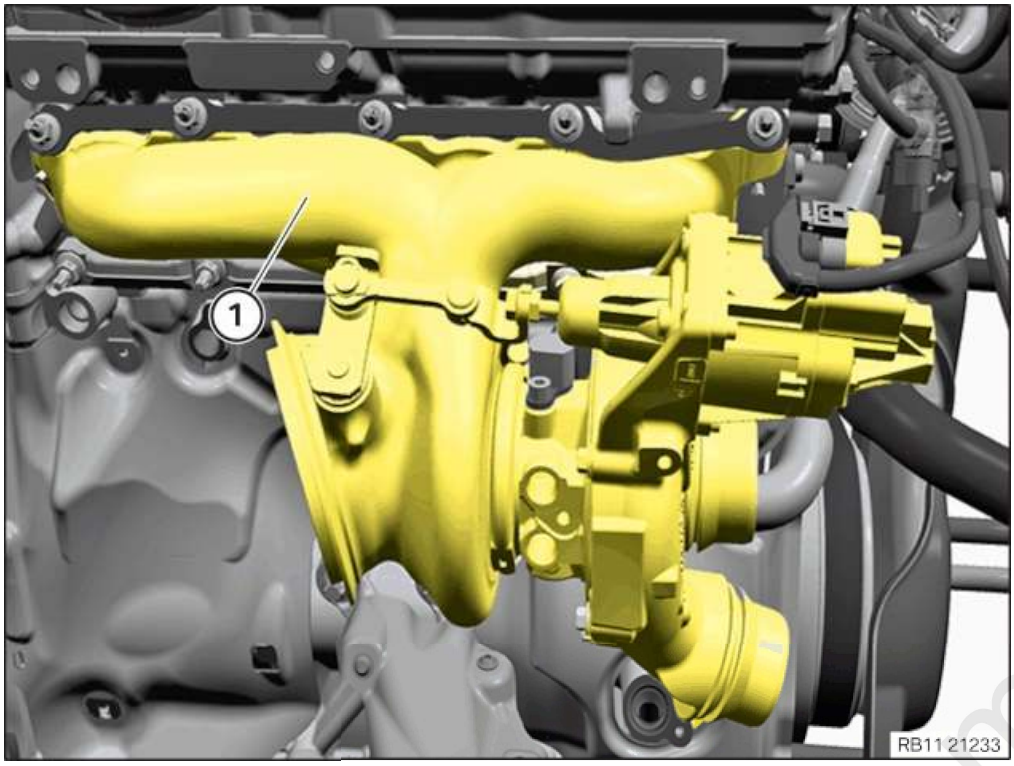
- Have a rag ready and catch any engine oil that may emerge.
- Loosen the screws (1) and (2).
- Guide out and remove the oil return line .

MAIN WORK

22 – Remove exhaust turbocharger

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Exhaust turbocharger



1 Exhaust turbocharger

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

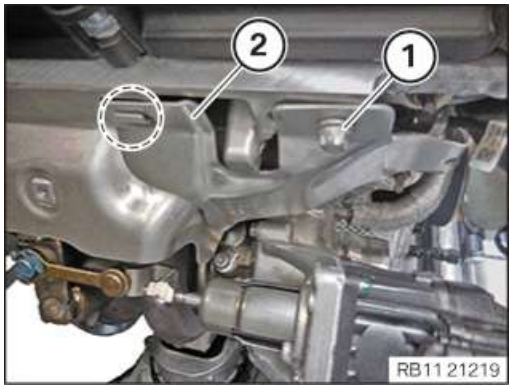
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

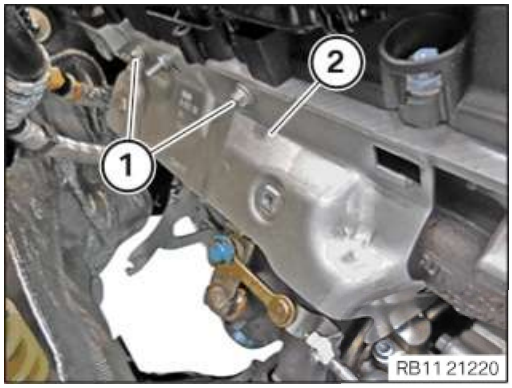


- Loosen screw (1).

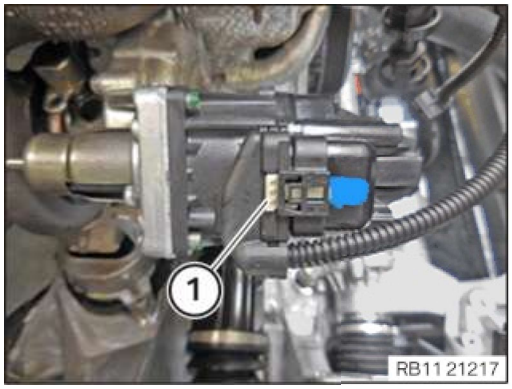
cardiagn.com



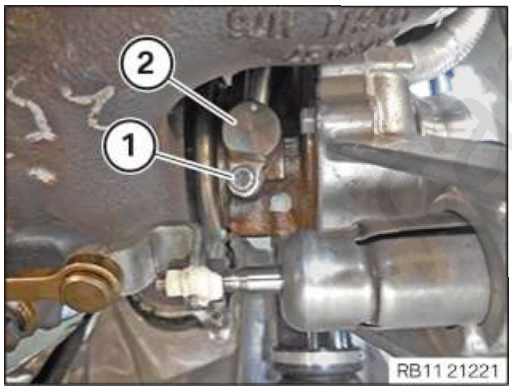
- Loosen screw (1).
- Remove the heat shield (2) from the **marked** area and remove.



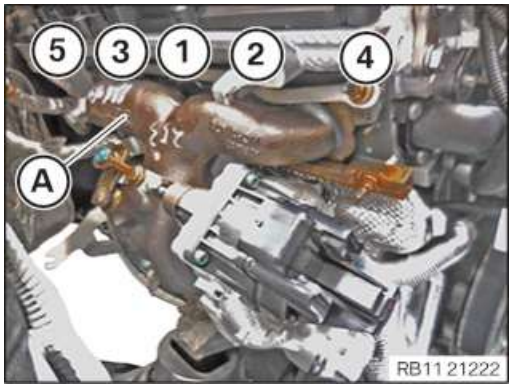
- Loosen screws (1).
- Feed out and remove the heat shield (2).



- Unlock and loosen connector (1).



- Loosen screw (1).
- Guide out oil feed line (2) for the exhaust turbocharger and place it aside.



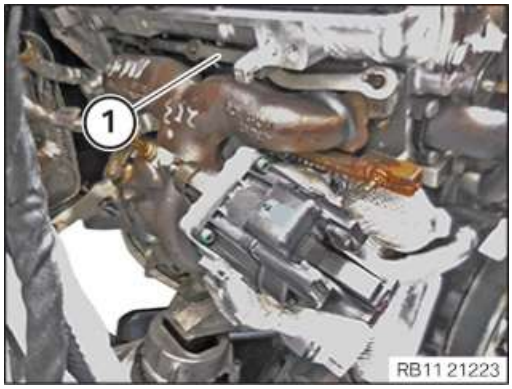
- Protect the exhaust turbocharger (A) from falling.

TECHNICAL INFORMATION

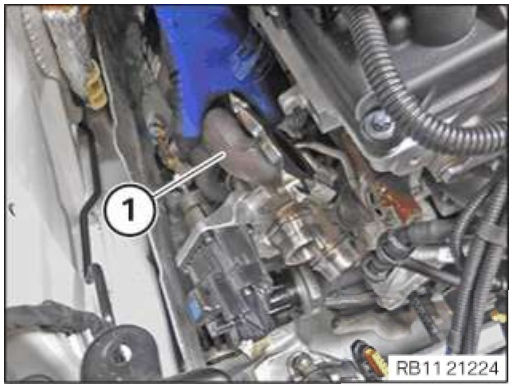
Exhaust manifold/exhaust turbocharger is not bolted to the underside, but clamped instead. When removing/replacing the exhaust manifold/exhaust turbocharger, the clamping strip remains screwed on.

- Unscrew the nuts in sequence (5) to (1).

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- Remove reinforcement plate (1).



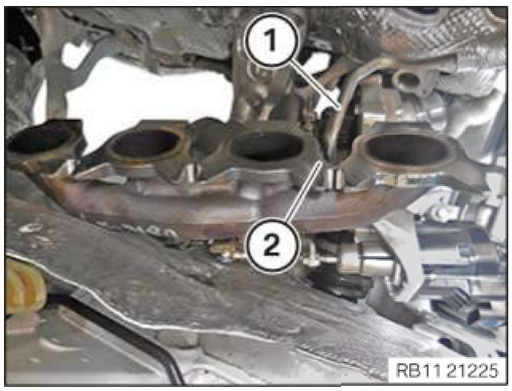
CAUTION

Heavy component.

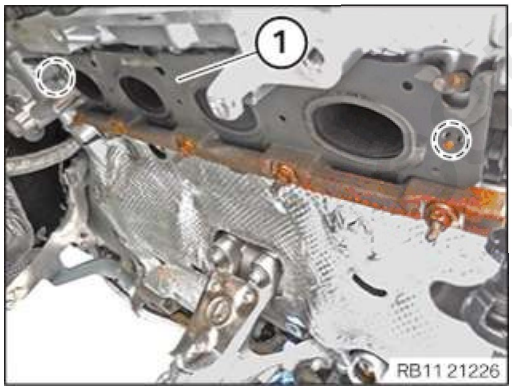
Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Guide out exhaust turbocharger (1) and set it aside.



- Guide out oil feed line (1) for the exhaust turbocharger and place it aside.
- Thread out and remove exhaust turbocharger (2).



- Guide seal (1) out of the **marked** area and remove it.

23 – Prepare for the installation of the exhaust turbocharger

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- Check the oil feed lines and the oil return lines for contamination or obstruction, clean or renew if necessary.
- If the oil feed lines and/or oil return lines are heavily contaminated, we recommend changing the engine oil and the oil filter.
- If installed: Check the coolant feed lines and the coolant return lines for the exhaust turbocharger for contamination or obstruction, clean or renew if necessary.
- Check that the screw connections and the plug connections of all the lines are correct.
- Check air cleaner for contamination and clean or renew as needed.
- Check correct functioning of crankcase ventilation.
- Replace all gaskets.

  Parts: Seals

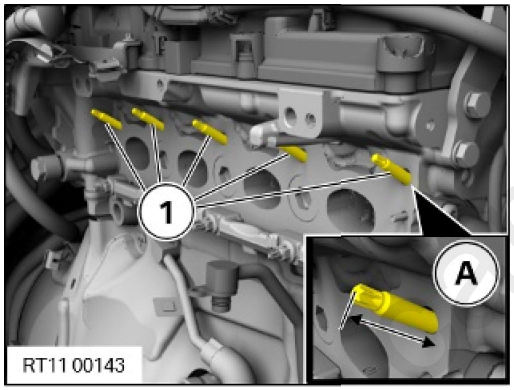
24 – Installing exhaust turbocharger

RISK OF DAMAGE

Damage to the electrical wastegate valve controller.

The electrical wastegate valve controller may be damaged as a result of the excessive forces required when removing and installing a jammed exhaust turbocharger.

- Do not pull on the electrical wastegate valve controller.
- Apply force to the turbine housing and exhaust manifold only.
  - Do not pull on the compressor housing.

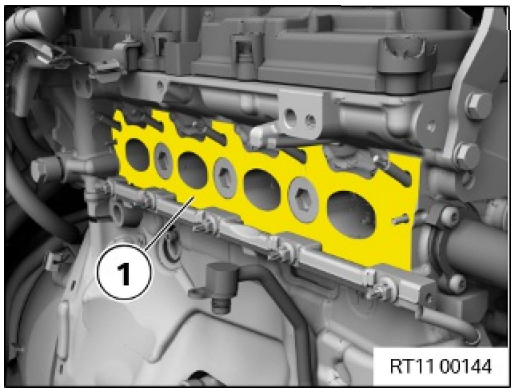


- Check stud bolt (1) for damage, renew stud bolt (1) if necessary.

  Parts: Stud bolt
- Check screw-in depth (A) of the upper stud bolt (1); if necessary screw in stud bolt further.

Screw-in depth of upper stud bolt on cylinder head

Dimension A	30 mm



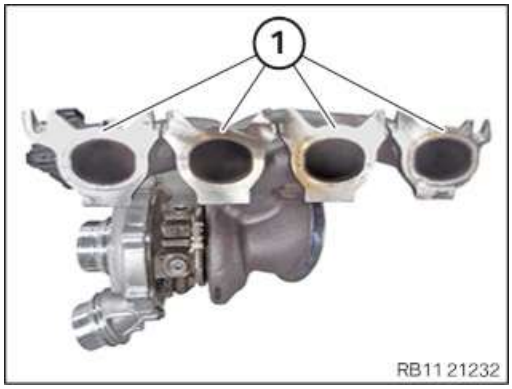
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the cylinder head (1) using the special tool 0 495 102 (11 4 470).



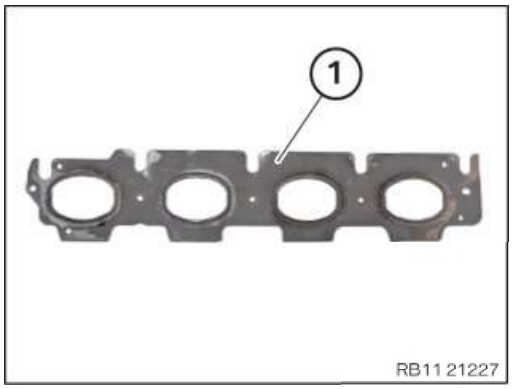
RISK OF DAMAGE

Damage to the surface.

The use of metal-cutting tools (e.g. emery cloth) to clean the surfaces can damage them and lead to leaks or engine damage.

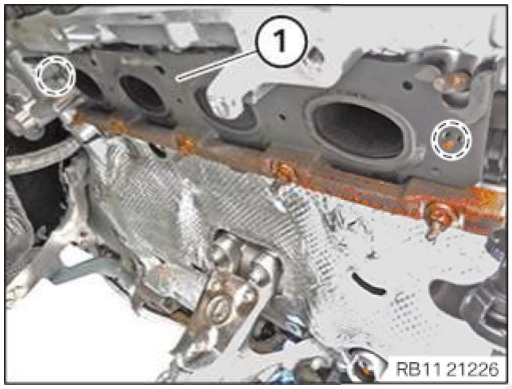
- Do not use any metal-cutting tools.

- Clean the sealing surfaces on the exhaust turbocharger (1) using the special tool 0 495 102 (11 4 470).

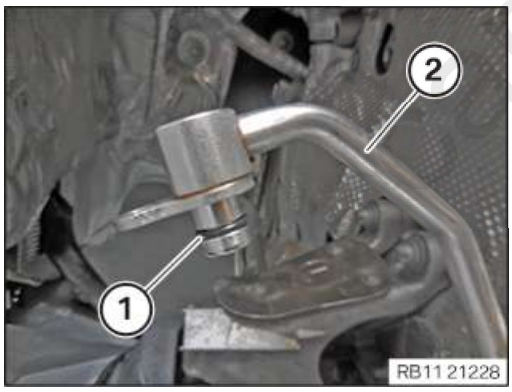


- Renew gasket (1).

  Parts: Seals



- Insert and install the gasket (1).
- Make sure the seal (1) has been **correctly** installed in the guide pins in the **marked** area.



- Renew O-rings (1) on the oil feed line (2) for the exhaust turbocharger with the special tool 0 496 714 (00 9 030).

  Parts: O-ring

TECHNICAL INFORMATION

- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

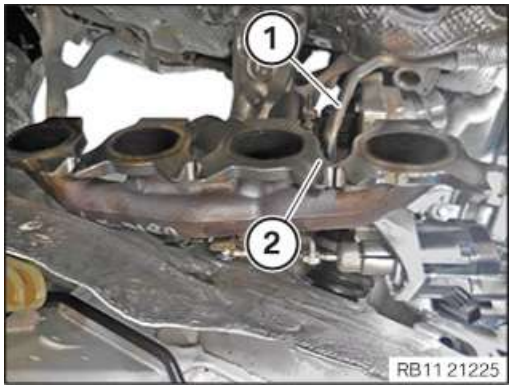
- Fill oil feed line (2) for the exhaust turbocharger with engine oil till the rim.

Engine oil

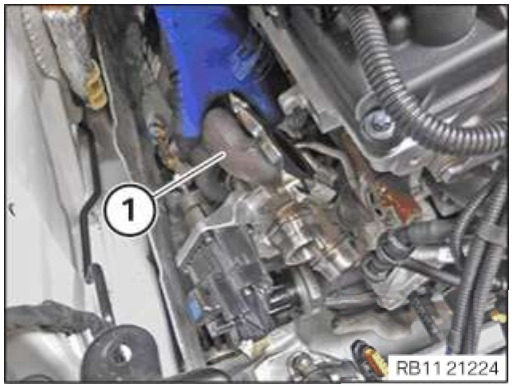
Technically suitable engine oils for BMW Group engines	

3.0 Technically appropriate engine oils for BMW Group engines

diagn.com



- Feed in and position the exhaust turbocharger (2).
- Feed in and position the oil feed line (1) for the exhaust turbocharger on the exhaust turbocharger (2).



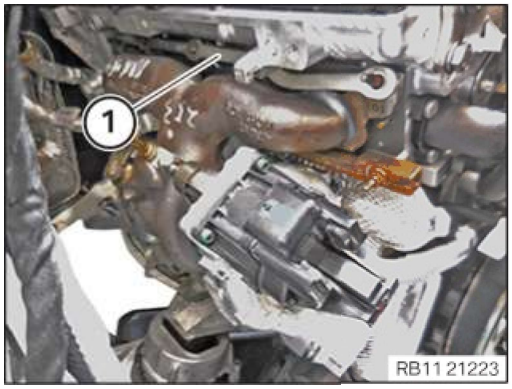
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

- Insert and install the exhaust turbocharger (1).

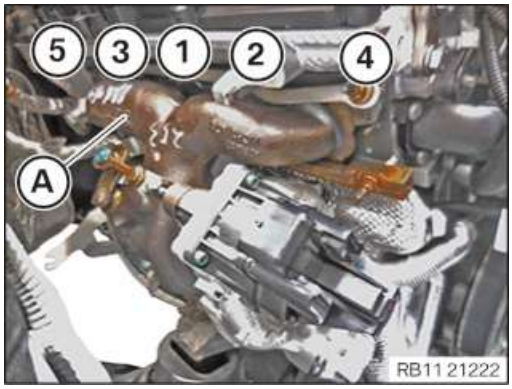


TECHNICAL INFORMATION

- Note the installation position of the component. The component may be installed in various installation positions.

- Mount sliding rail (1).
- The original BMW part number of the sliding rail (1) must be **legible** from the rear.

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TECHNICAL INFORMATION

When assembling, it is essential to observe screwing sequences and tightening torques.

Non-observance of these requirements may result in leaks and damage.

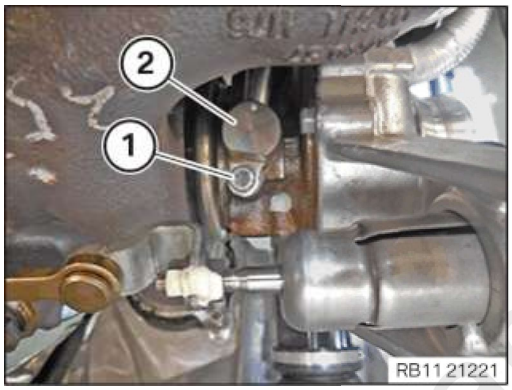
- Renew nuts (1) to (5).

  Parts: Nuts

- Tighten the nuts in sequence (1) to (5).

Exhaust turbocharger to cylinder head

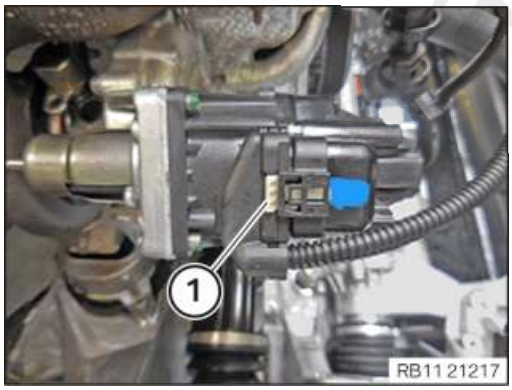
M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm



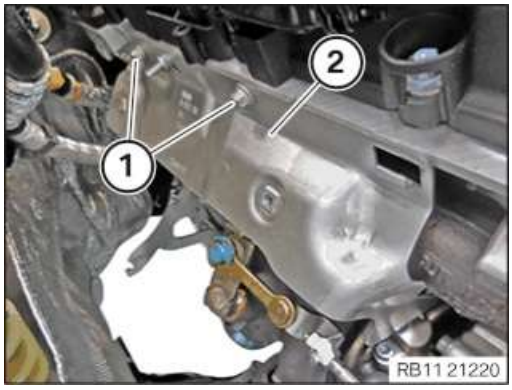
- Feed in and install the oil feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Oil feed line to exhaust turbocharger/crankcase

M6x12		Tightening torque	8 Nm



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

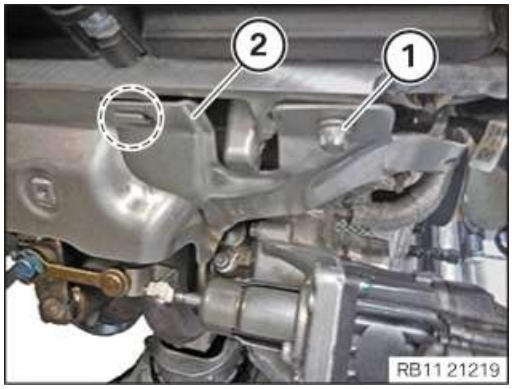


- Feed in and install the heat shield (2).
- Tighten the screws (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm

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- Feed the heat shield (2) into the **marked** area and install it.
- Tighten down screw (1).

Heat shield to cylinder head

M8 x 12		Tightening torque	19 Nm



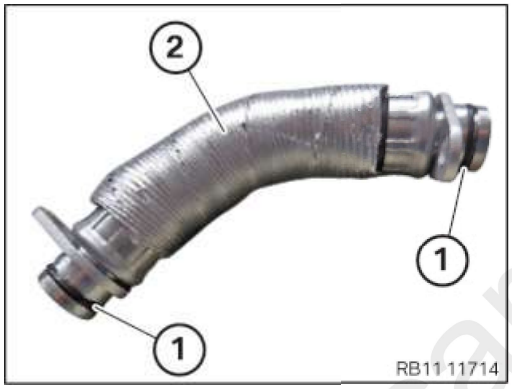
- Tighten down screw (1).

Heat shield to clamping strip

M6 x 12		Tightening torque	8 Nm

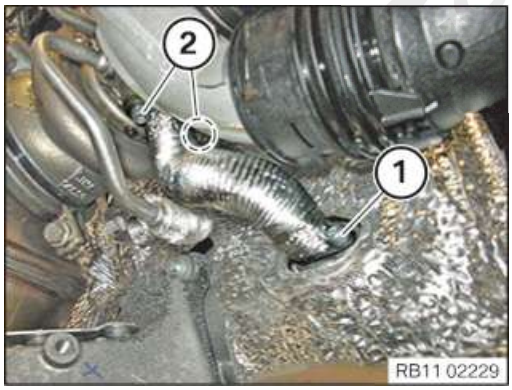
POSTPROCESSES

25 – Installing the oil return line for the exhaust turbocharger



- Renew the sealing rings (1) at the oil return line (2).

  Parts: Sealing ring



- Feed in and install the oil return line .
- Tighten the screws (1) and (2).

Oil return line to exhaust turbocharger/crankcase

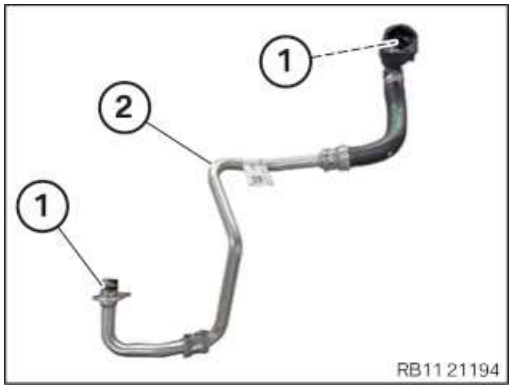
M6x14		Tightening torque	8 Nm

26 – Install the coolant return line for the exhaust turbocharger

TECHNICAL INFORMATION

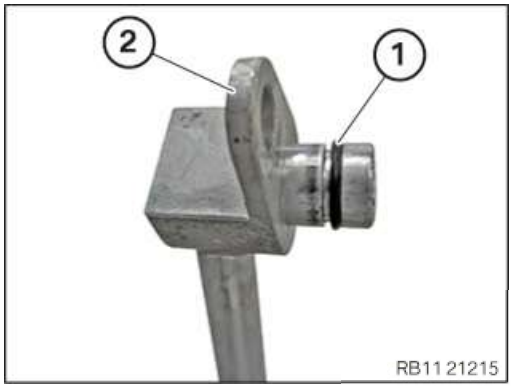
Make sure that the connections are locked correctly. The locks must engage audibly.

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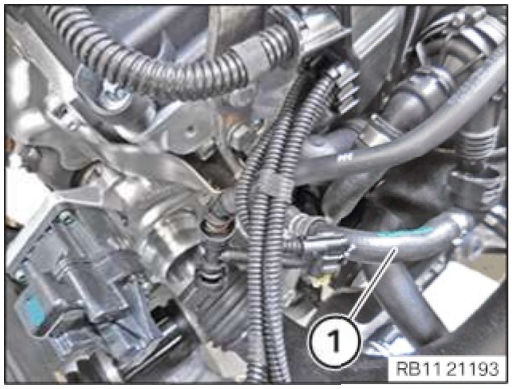
- Renew O-rings (1) on the coolant return line (2) with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Renew O-rings (1) on the coolant feed line (2) with special tool 0 496 714 (00 9 030).

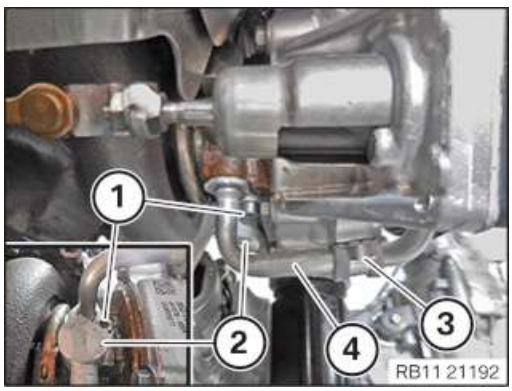
  Parts: O-ring



- Insert and position the coolant return line (1) for the exhaust turbocharger.



- Connect coolant return line (1) for the exhaust turbocharger and lock.
- Make sure that the coolant return line (1) for the exhaust turbocharger engages audibly.



- Insert and install the coolant return line (4) for the exhaust turbocharger.
- Feed in and install coolant feed line (2) for the exhaust turbocharger.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

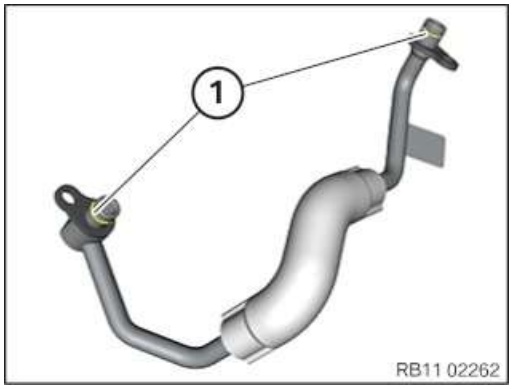
- Tighten down screw (3).

Coolant return line holder to exhaust turbocharger

M6		Tightening torque	8 Nm

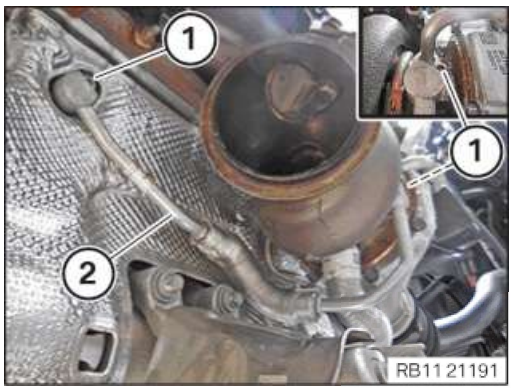
27 – Install the coolant feed line for the exhaust turbocharger

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- Renew O-rings (1) on the coolant feed line with special tool 0 496 714 (00 9 030).

  Parts: O-rings



- Insert the coolant feed line (2) onto the crankcase and install.
- Tighten down screw (1).

Coolant feed line to crankcase

M6 x 12		Tightening torque	8 Nm

- Insert the coolant feed line (2) onto the exhaust turbocharger and install.
- Tighten down screw (1).

Coolant feed line/coolant return line to exhaust turbocharger

M6 x 12		Tightening torque	8 Nm

28 – Install catalytic converter



- Renew the V-clip (1).

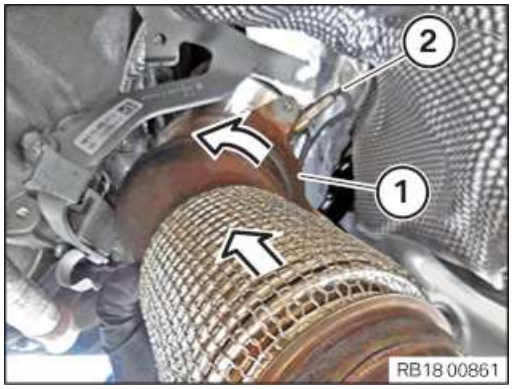
  Parts: V-band clamp



- Renew the gasket (1).

  Parts: Gasket

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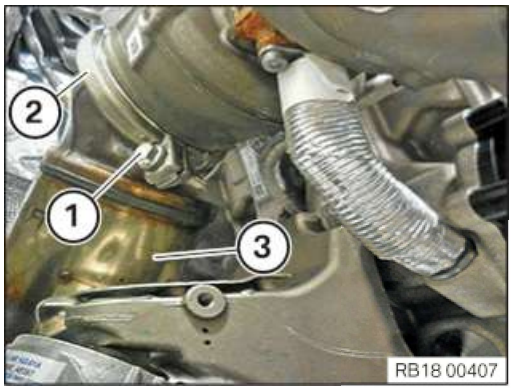
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

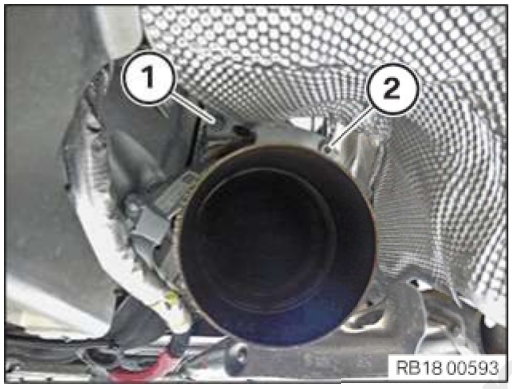
- Remove and install heavy components with the aid of another person/other persons.

- Guide in and install the catalytic converter (1) in the direction of arrow.
- Make sure that the monitoring oxygen sensor (2) **is not damaged.**



- Renew the V-clip (2).

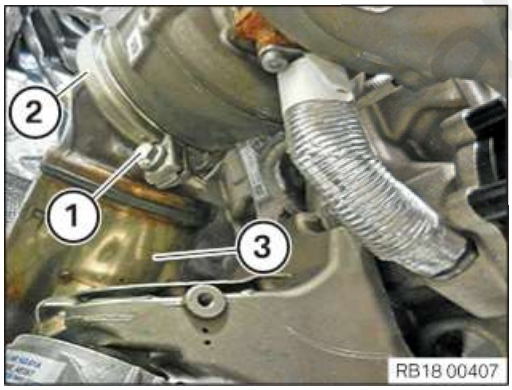
  Parts: V-band clamp
- Feed in and install V-clip (2) on the catalytic converter (3).
- Position the bolt (1).



- Renew the screw (1).

  Parts: Screw
- Position the bolt (1).
- Renew nut (2).

  Parts: Nut
- Position the nut (2).



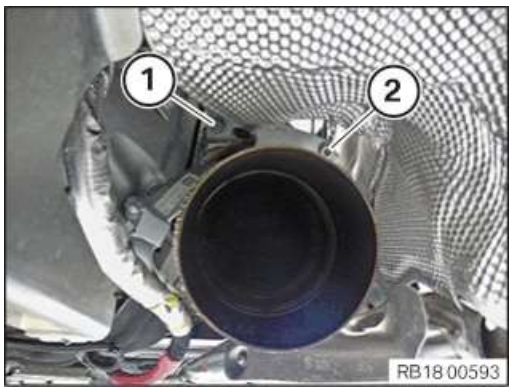
- Position the catalytic converter (3).
- Position V-clip (2).

Note: Ensure correct mounting orientation of the V-clip.

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm



- Tighten down screw (1).

Catalytic converter to holder

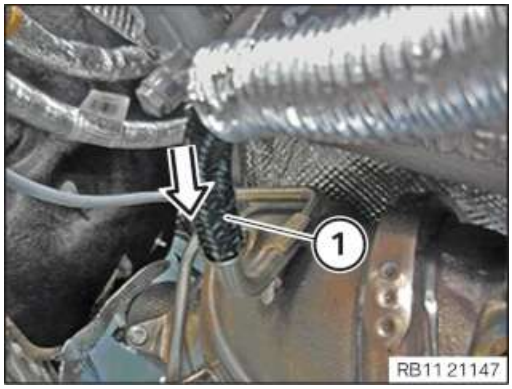
M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm

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- Check the pressure hose (1) for damage and renew hardened pressure hose (1) if necessary.
- Connect the pressure hose (1) in direction of arrow to the limit position.

29 – Installing the complete exhaust system

CAUTION

Component with heavy weight.

Danger of injury!

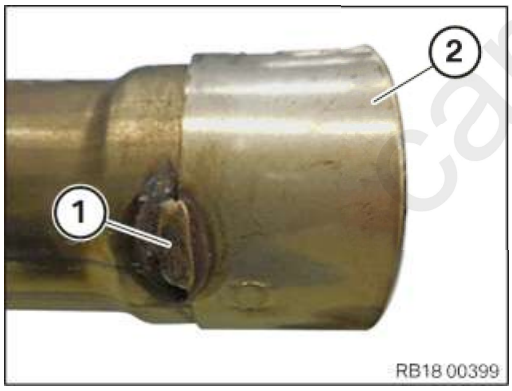
- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.



CAUTION

Swarf resulting from sawing or grinding components.

Danger of injury!

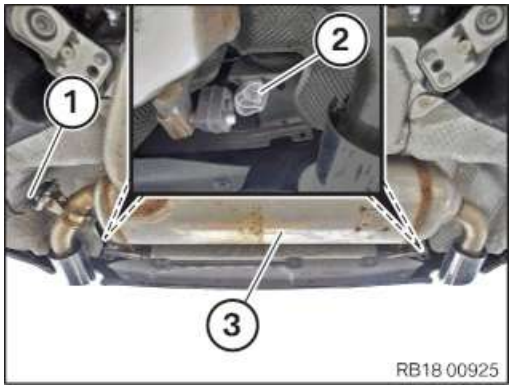
- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp

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- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

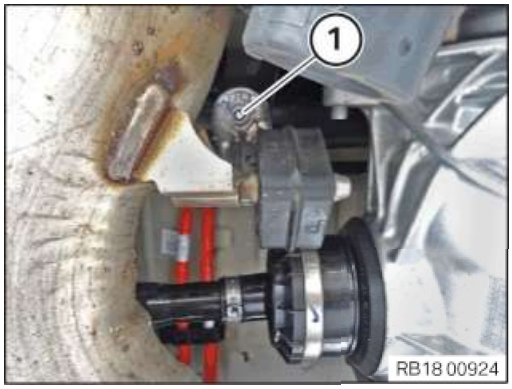
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

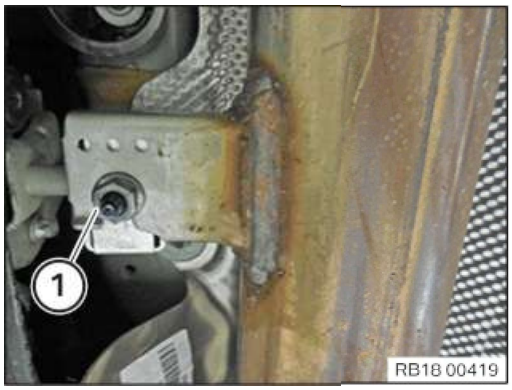


- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm

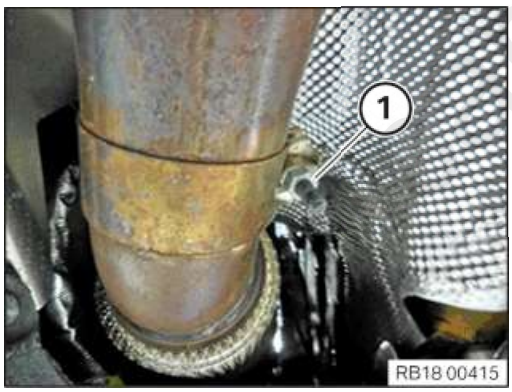


- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

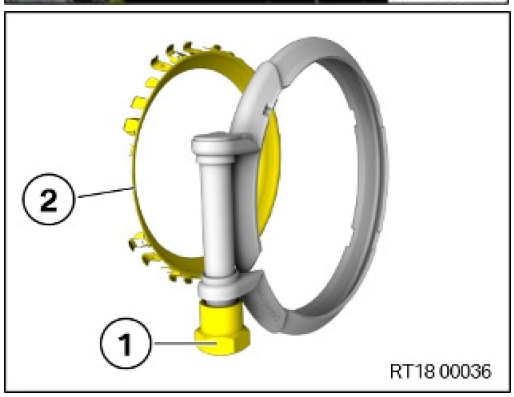
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm



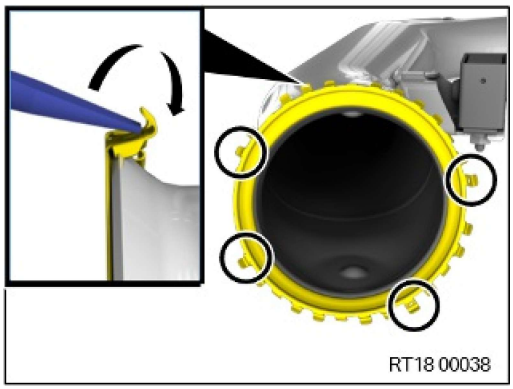
- **Equipment specification 2 (V-clips)**

  Renew V-band clamp.

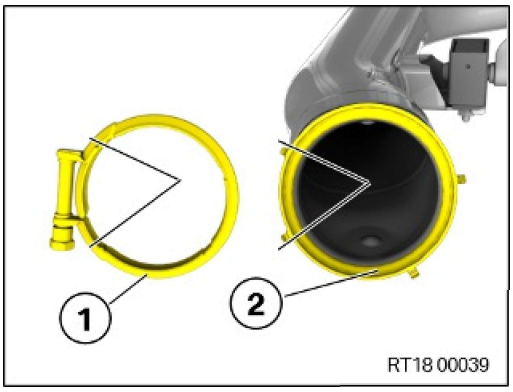
  Parts: V-band clamp

  Unscrew the nut (1) and remove the sealing ring (2).

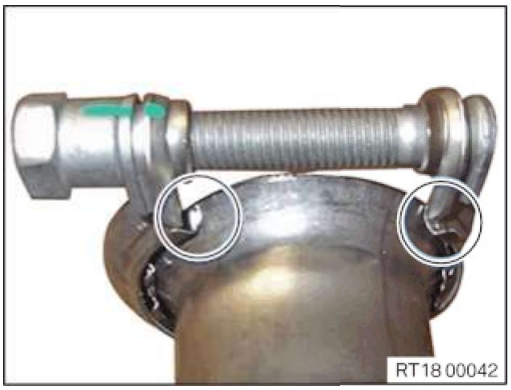
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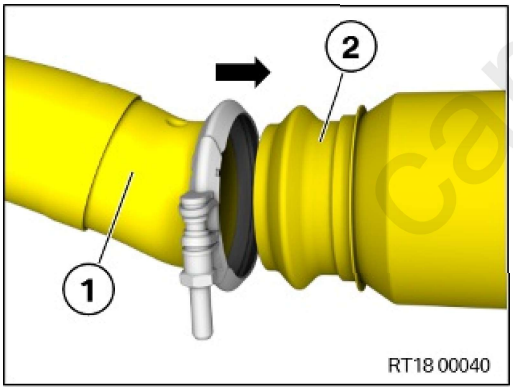
- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.



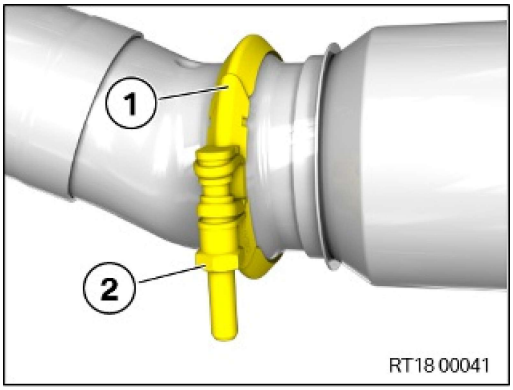
- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).



- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.



- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).



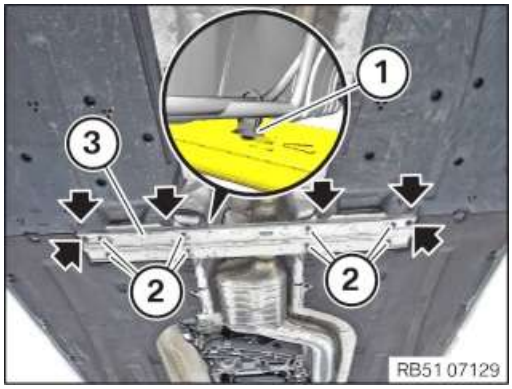
- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

30 – Install the connecting supports on the tunnel

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- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- Tighten screws (arrows).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

31 – Install the control sensor

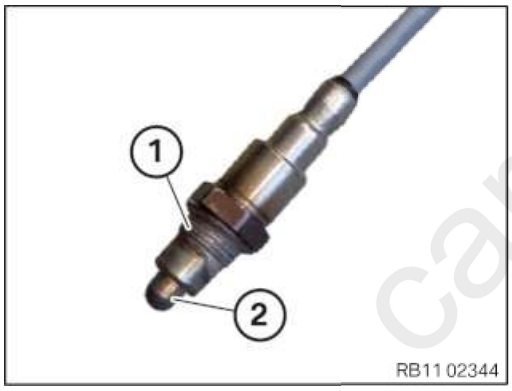
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

  (2) = Sensor ceramics

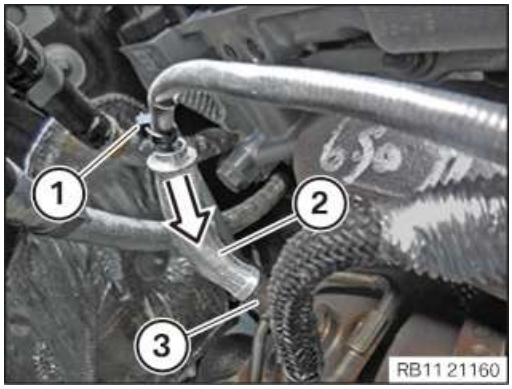


- Screw the control sensor (1) in and tighten it with the special tool 0 491 074 (11 7 020).

Control sensor

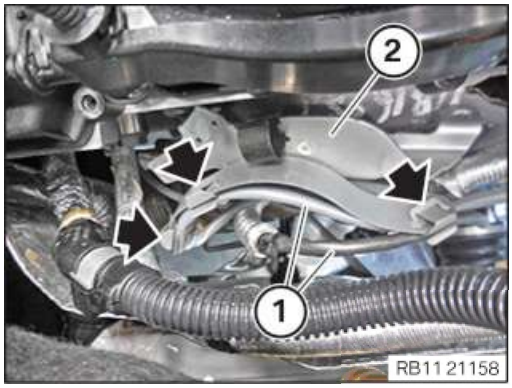
M18x1.5		Tightening torque	50 Nm

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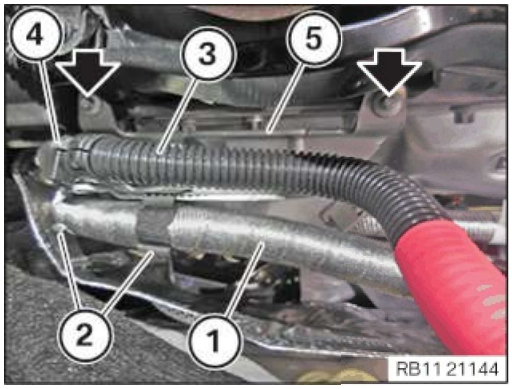


- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

  Parts: Cable strap
- Guide in and install the cable strap (1).



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

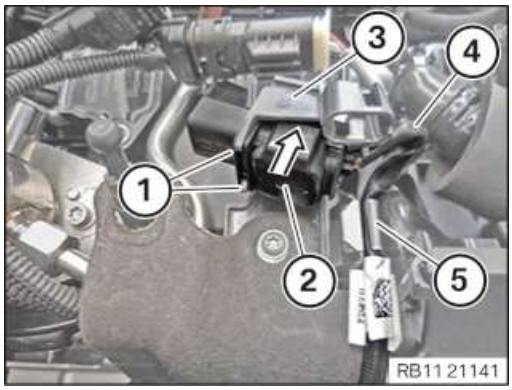
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

Holder, positive battery cable to cylinder head cover

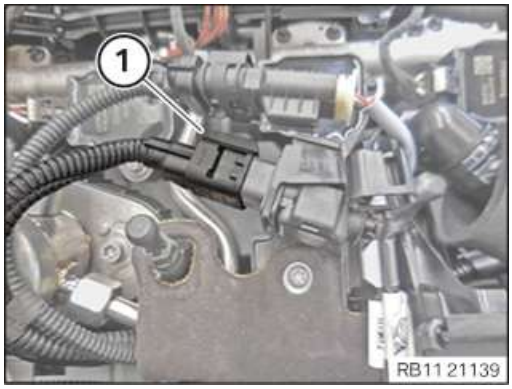
6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).

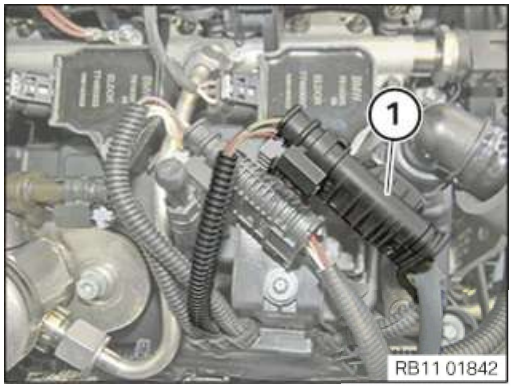


- Guide in the connector (2) in the direction of arrow at the carrier plate (3) and install.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).

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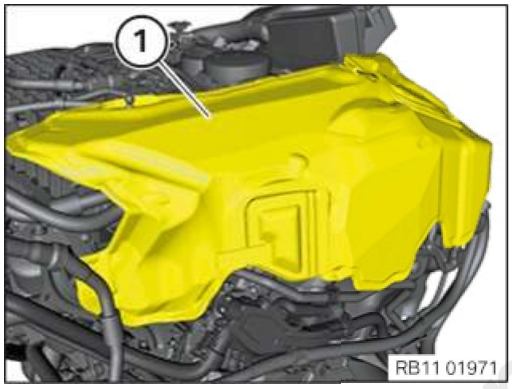


- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



- Connect and lock the connector (1).
- Guide the connector (1) into the carrier plate in the direction of arrow.
- Ensure the connector (1) audibly engages with the carrier plate.

32 – Installing acoustic cover at rear



- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



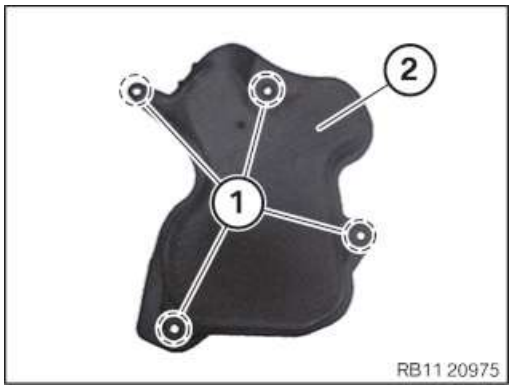
- Install the acoustic cover (1) from the top and clip it in into the marked areas.

33 – Install the seal for the bonnet



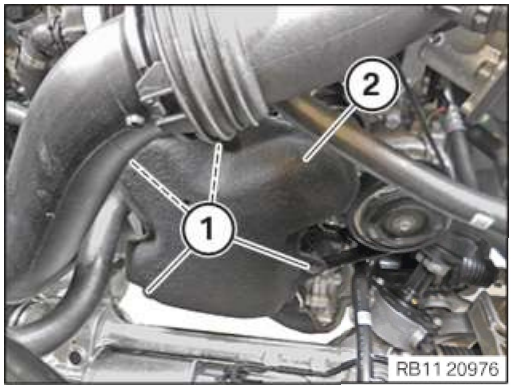
- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

34 – Install the acoustic cover for the engine at the front

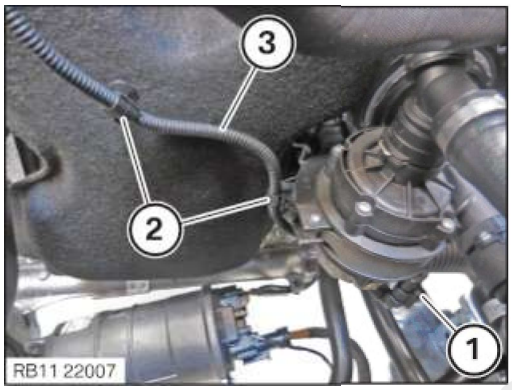


- Check if acoustic cover (2) in marked area (1) is damaged and replace acoustic cover (2) if necessary.

  Parts: Acoustic cover

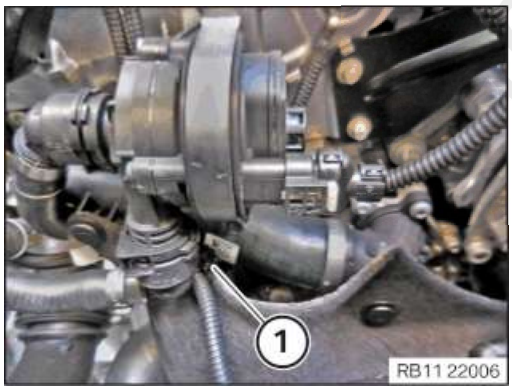


- Thread in and position the acoustic cover (2).
- Mount all expanding rivets (1).



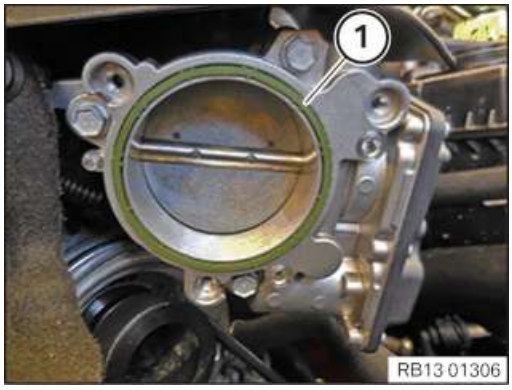
- Feed in and position wiring harness section (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (1).

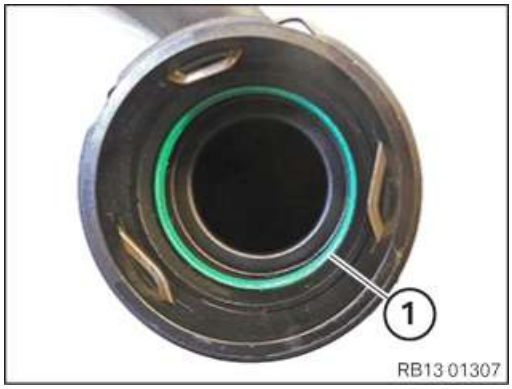
35 – Install charge air line



- Renew the sealing ring (1) on the throttle valve.

  Parts: Sealing ring

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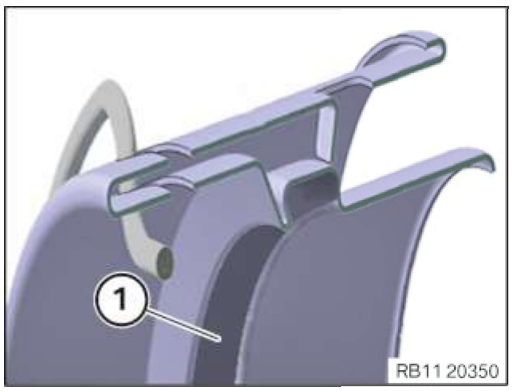


- Check the sealing ring (1) on the charge air line for damage and renew, if necessary.

▶ **Replace damaged gasket**

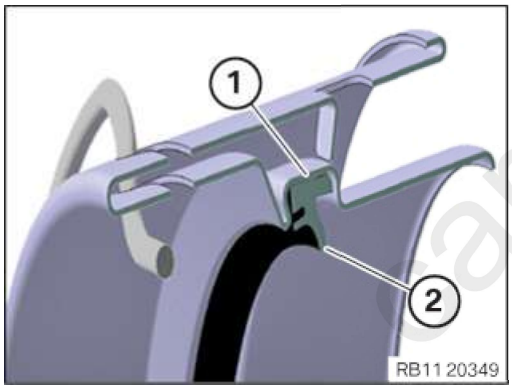
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



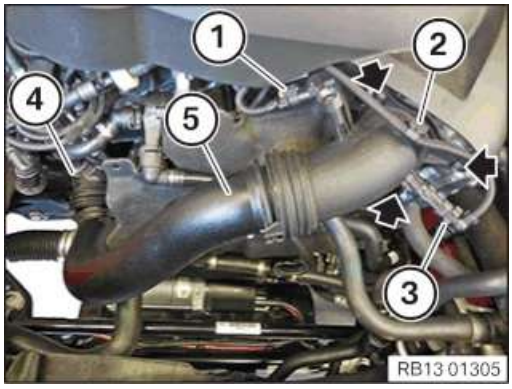
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



- Insert and install charge air line (5).
- Lock the clamp (4) on the exhaust turbocharger.

  The clamp (4) must engage audibly.
- Tighten screws (arrows).

Charge air line to throttle body

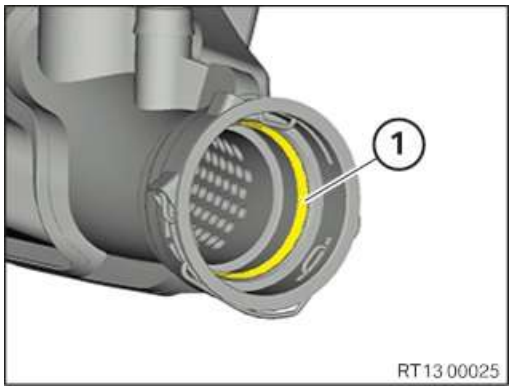
M6		Tightening torque	8 Nm

- Connect and lock the connector (3) on the charge-air pressure sensor.
- Connect and lock the connector (1) on the charging pressure sensor.

  All connectors must audibly engage.
- Secure clamps (2).

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36 – Installing the clean air pipe with resonator

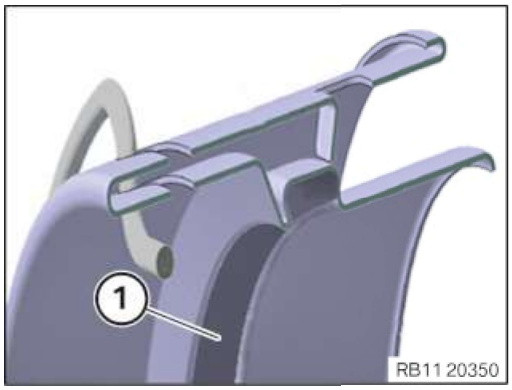


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

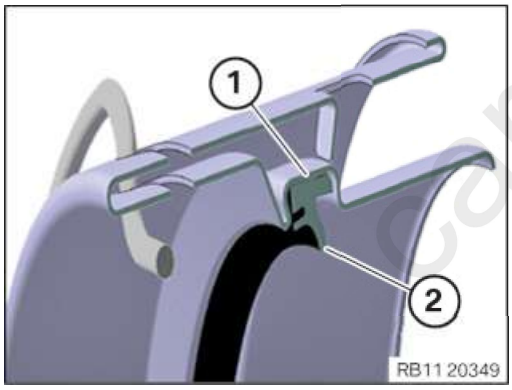
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



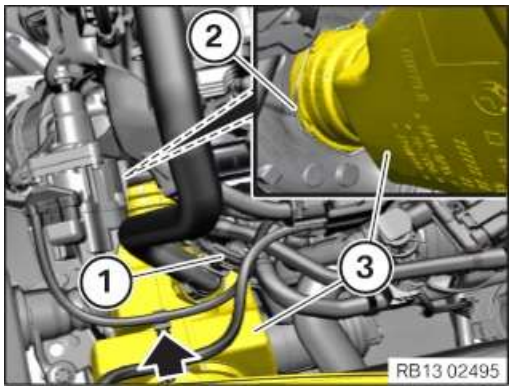
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).

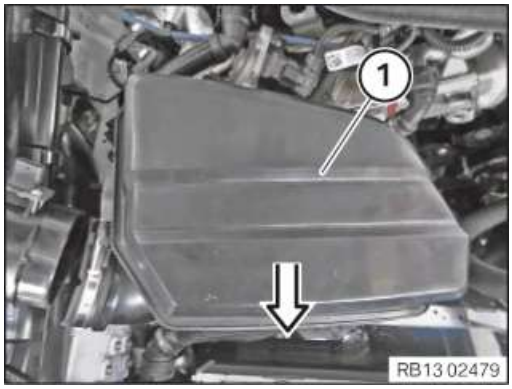


- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

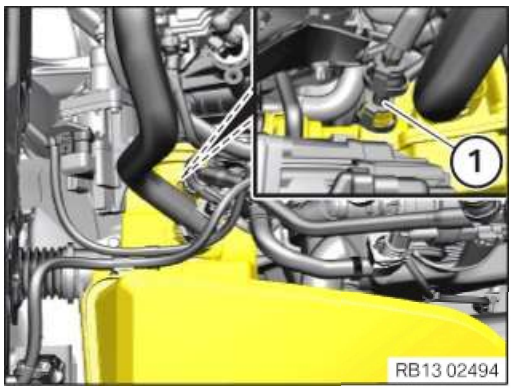
  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Secure clamp (arrow).

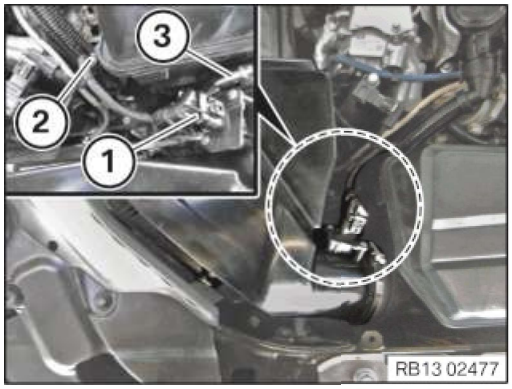
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- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

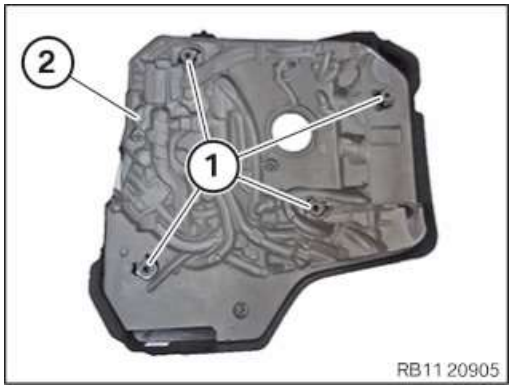
37 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



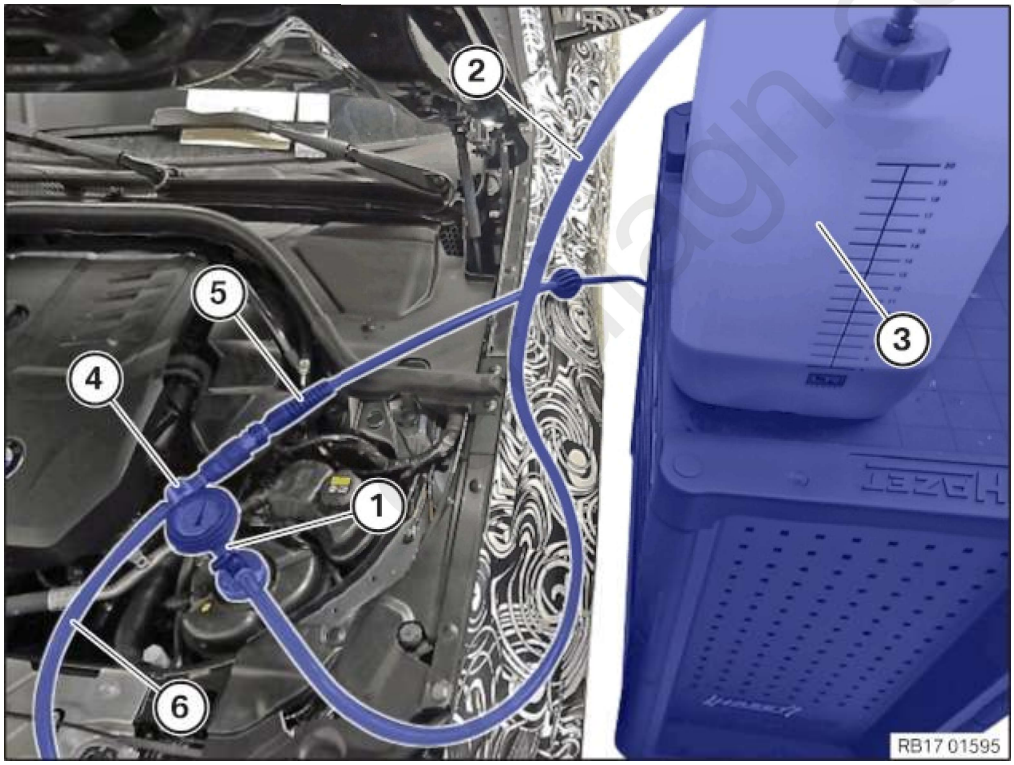
- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.
  The acoustic cover (1) must audibly engage into place.

38 – Fill the high-temperature cooling system with the vacuum filler device

Vacuum filler device



Vacuum filler device - connected to the coolant expansion tank

1 Vacuum filler device with pressure gauge and shutoff valves

2 Filling hose

3 Fluid tank with coolant

4 Venturi nozzle

5 Compressed air connection (maximum of 6 bar)

6 Out-going hose (lead out-going hose into a collecting vessel)

Prerequisite

The coolant expansion tank for the cooling system must be empty. The fluid tank of the vacuum filler device must have a sufficient quantity of premixed coolant, 1 l to 2 l more than the specified capacity for the vehicle. The fluid tank of the vacuum filler device must be positioned at the same height as the coolant expansion tank. The compressed air connection must have a pressure of 6 bar. Ignition is switched off.

TECHNICAL INFORMATION

Follow notes for repair work on the cooling system.

For additional information see:

Main group 17

17 00 ... Notes for working on the cooling system

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Mixing different coolants is not permitted.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

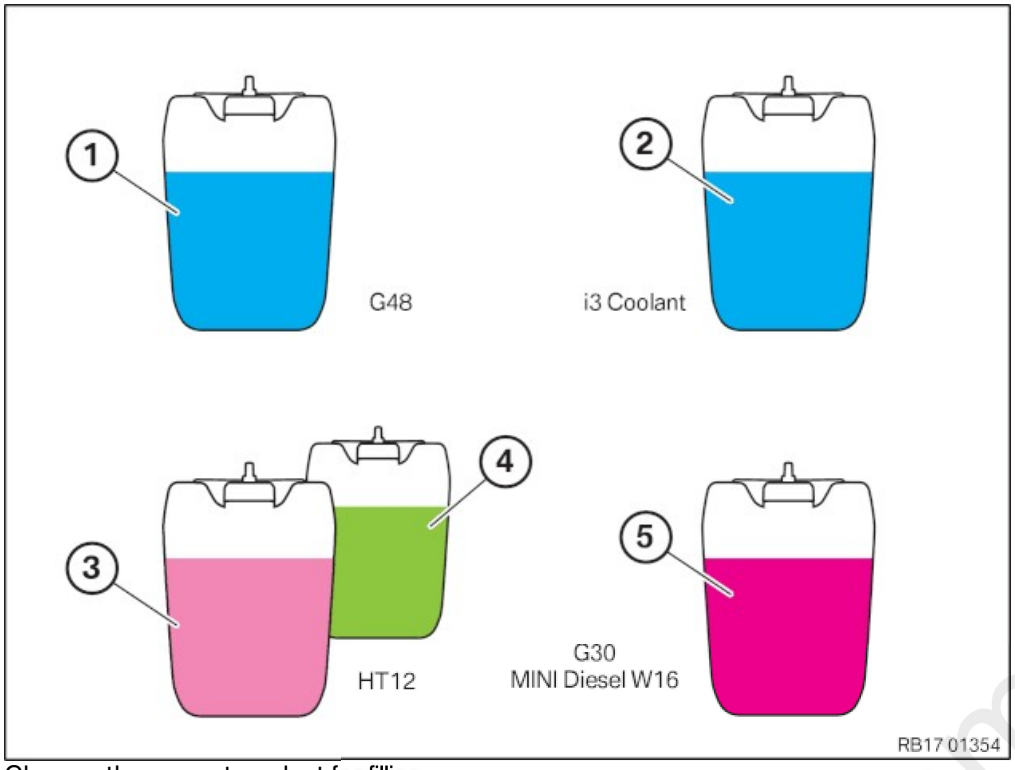
TECHNICAL INFORMATION

Make sure that the ignition (terminal 15) is switched off prior to creating the vacuum with the vacuum filler device.

▸ **Observe the coolant type**

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Coolant in the vacuum filler device container



Choose the correct coolant for filling

A vehicle must be filled with the coolant with which it is delivered ex works

1. G48 (Blue) G48 must not be mixed with the i3Coolant or the G30 MINI diesel fuelW16.

2. i3 coolant (blue) is used only for the i3 heater circuit. i3 coolant must not be filled in the other coolant circuits or mixed with the other coolants.

3. HT12 (Pink) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

4. HT12 (Green) HT12 must not be mixed with the i3 coolant or the G30 MINI diesel fuel W16.

5. G30 (Pink) must be used only for the **MINI diesel fuel W16**. G30 must not be filled in the other coolant circuits or mixed with the other coolants.

RISK OF DAMAGE

Damage to the engine.

The use of an incorrect coolant may lead to corrosion or gelling in the engine.

- Use only approved coolants for the specific vehicle.
- Fill the vehicle only with the coolant with which it was delivered ex works.
- Mix only compatible coolants. The colour does not allow any assessment about the compatibility of coolants.
- Selection of the correct coolant only by means of the part number.

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- Select a suitable adapter (Y) from the set of special tools 0 494 417 (17 0 100):

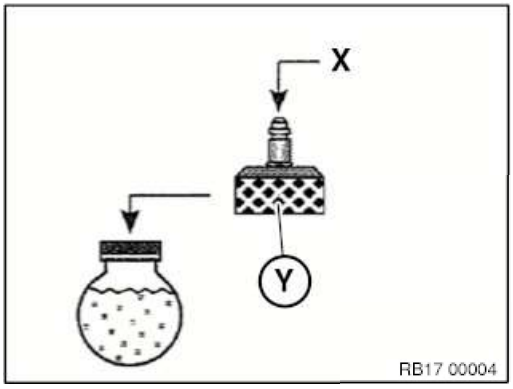
Type	Engine	Adapter (Y) from 17 0 100
G20/G29	B46 / B48 /B58	17 0 113

- The fluid tank of the vacuum filler device must be filled with 1 l to 2 l more than the specified capacity of coolant for the vehicle.

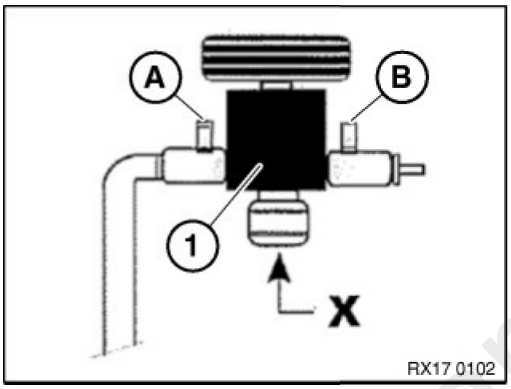
Capacity of high-temperature coolant circuit G20

B48B20O1/B46B20O1	9.8 l

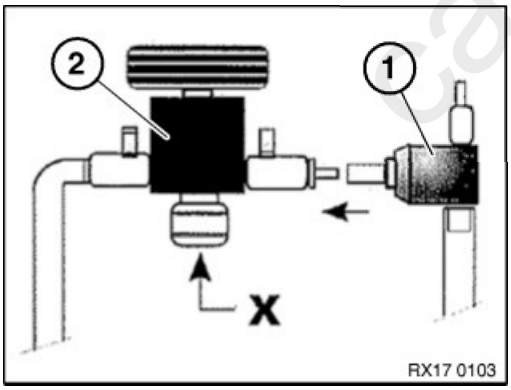
Expendable materials: Technically suitable antifreeze and corrosion inhibitor



- Connect the selected adapter (Y) to the coolant expansion tank.
- Connect vacuum filler device to connection (X) of the adapter.

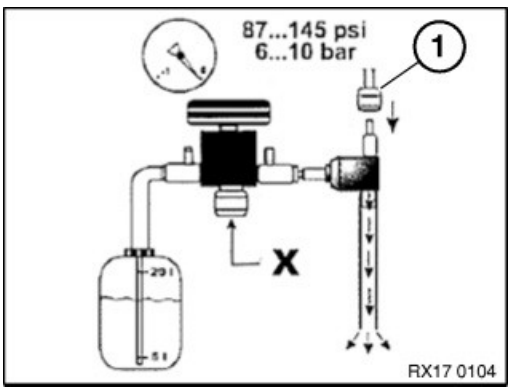


- Check whether shut-off valves (A) and (B) of the vacuum filler device (1) are closed.
- Connect and lock connection (X) to the coolant expansion tank.



- Connect Venturi nozzle (1) to the vacuum filler device (2).

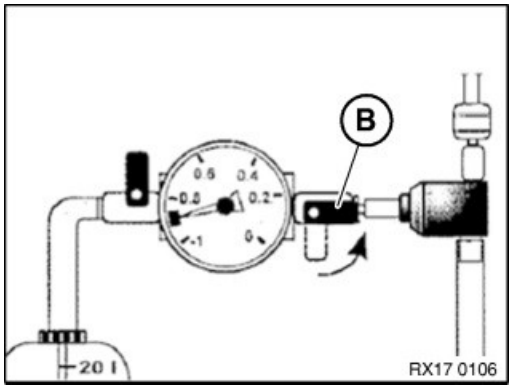
  (X)is the connection on the coolant expansion tank.



- Connect compressed air (1).

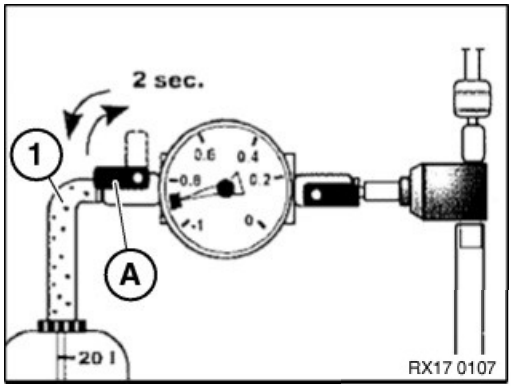
  (X)is the connection on the coolant expansion tank.

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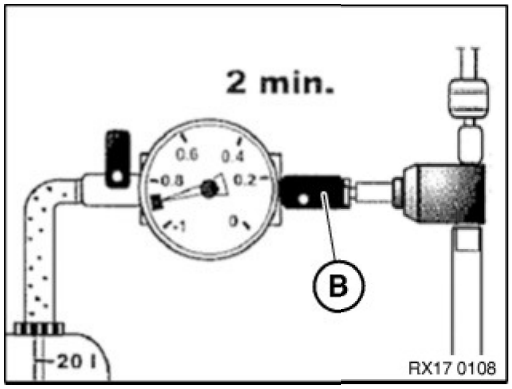
- Open shut-off valve (B).

  The venturi nozzle produces a flow noise.



- Open shutoff valve (A) until the fuel filling hose (1) is full without bubbles.
- Close shutoff valve (A) again.

» The filling hose (1) has now been bled.

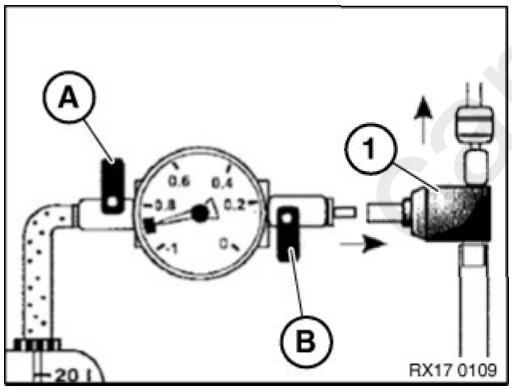


- Check the coolant hoses for porosity and renew porous coolant hoses as required.

TECHNICAL INFORMATION

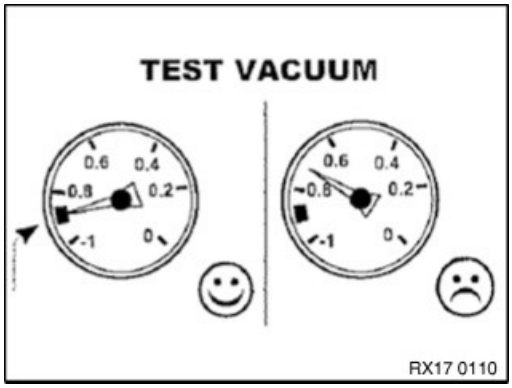
The coolant hoses contract during vacuum build-up.

- After having established a vacuum in the coolant circuit of between -0.7 to -0.95 bar (duration approximately 2 min), close the shut-off valve (B).



- Check whether the shutoff valves (A) and (B) are closed.
- Disconnect the Venturi nozzle (1).

Check



- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

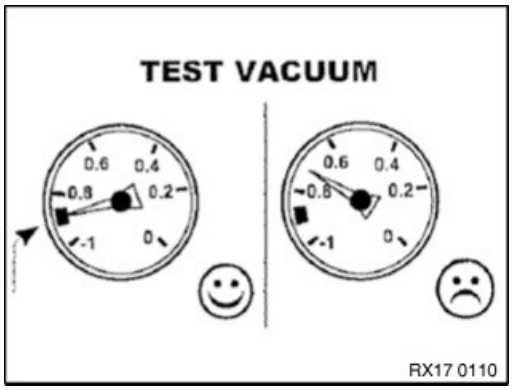
» Vacuum drops.

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Measure

- Look for the leak, repair it and start the filling procedure from the beginning.

Check



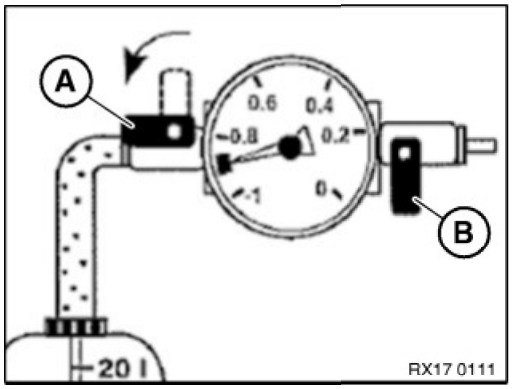
- Make sure the vacuum in the coolant circuit is maintained for at least 30 seconds.

Result

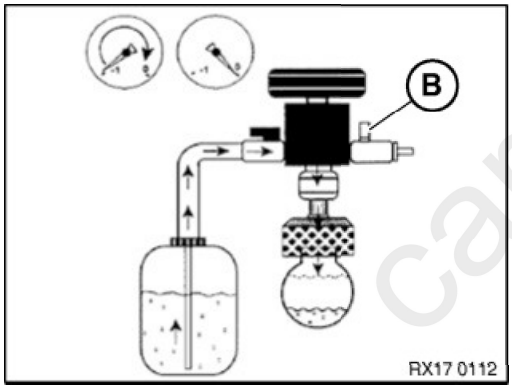
» Vacuum remains constant.

Measure

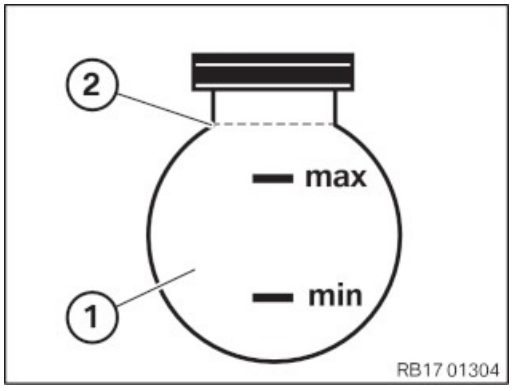
- Continue with filling.



- Keep shutoff valve (B) closed during the filling process.
- To fill the cooling system, open the shutoff valve (A) to the fluid tank of the vacuum filler device.



- Stop the filling procedure when the needle in the pressure measuring device is on 0 bar or it no longer drops.
- If necessary, reduce remaining vacuum. In order to do so, open shutoff valve (B).



- Remove the vacuum filler device with the adapter from the high temperature coolant expansion tank (1).
- Top up the coolant level in the high temperature coolant expansion tank (1) to the lower edge of the coolant filler neck (2) in the high temperature coolant expansion tank (1).
- After filling the cooling system with the vacuum filler device, **also** run the cooling system bleeding routine.

39 – Bleed the high-temperature coolant circuit

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TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Filling **without** the vacuum filler device (watering can filling) is **not permitted**.

Non-compliance will result in danger of component damage and/or engine damage.

Filling specification **absolutely must** be adhered to.

The operation of the vehicle is not permitted unless the filling procedure has been completed. Otherwise, functional limitations (degradation) and/or overheating may occur.

A bleeding procedure is required after a part has been exchanged in the cooling system and/or after refilling the cooling system.

TECHNICAL INFORMATION

Before starting the automatic cooling system bleeding routine, make sure that **all coolant circuits** are **filled**. If the cooling system bleeding routine is started while one of the coolant circuits is empty, there is a risk of damage to the electric coolant pump when running it dry.

Make sure that terminal 15 is not disconnected for the bleeding procedure. Switch on low-beam headlights and hazard warning lights. If the low-beam headlights and hazard warning lights are not switched on, the ignition (terminal 15) will switch off automatically after a certain period of time and interrupt the bleeding procedure.

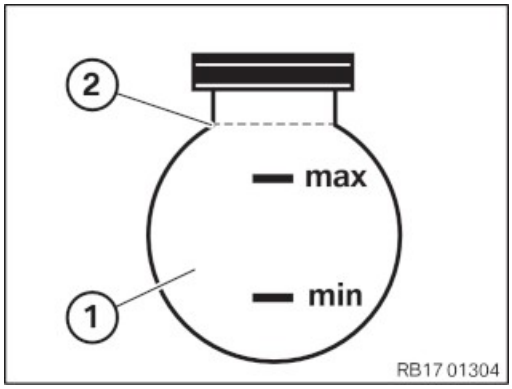
TECHNICAL INFORMATION

The electrical fan is activated during the entire cooling system bleeding routine.

TECHNICAL INFORMATION

The driving experience switch must not be set to the ECO PRO switch position.

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- Open the bleeder screw on the coolant expansion tank for the high-temperature coolant circuit and close it again after approx. **10 s**.

  You can close the bleeder screw prior to expiry of the 10 s once coolant escapes.
- Adjust the coolant level in the high temperature coolant expansion tank (1) to the lower edge (2) of the coolant filler neck of the the high temperature coolant expansion tank (1) .
- Close the sealing cap on the coolant expansion tank of the high--temperature cooling circuit.
- Make sure the bonnet is **closed**.
- Make sure that the wheels touch the ground.
- Engage the parking brake.
- Do not engage any gear in manual-shift gearbox, and engage the gear to "P" or "N" automatic transmission.
- Connect battery charger.
- Switch on the ignition and make sure that it remains **switched on** (for example, activate the low-beam headlight and the **hazard warning light at the same time**).

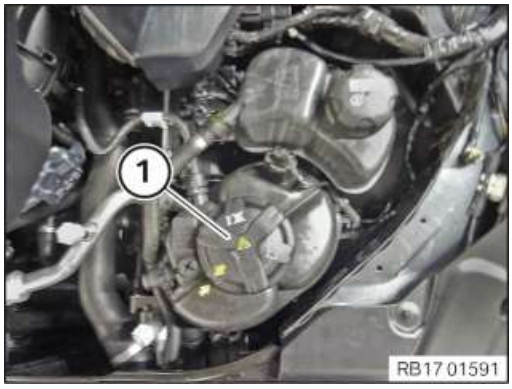
  If the low-beam headlight and the hazard warning light are **not** switched on, the ignition (**terminal 15**) will switch off automatically after some time and interrupts the bleeding procedure.
- Check that the driving experience control is **not** in the **"ECO-PRO"** switch position.
- Adjust the heating to **maximum** temperature and adjust the blower to the **lowest** stage.
- Hold the accelerator pedal down to the limit position for at least **10 s** and do **no** kick the brake pedal.
- Start engine.
- Start the cooling system bleeding routine, pay attention to the display on the instrument cluster (KOMBI). ("Service function started")

  The engine speed (up to 3500 rpm) and the actuators in the cooling system are activated **automatically** for 11 minutes according to a cooling system bleeding routine.

  The cooling system bleeding routine ends approx. 11 min **after** the engine starts.

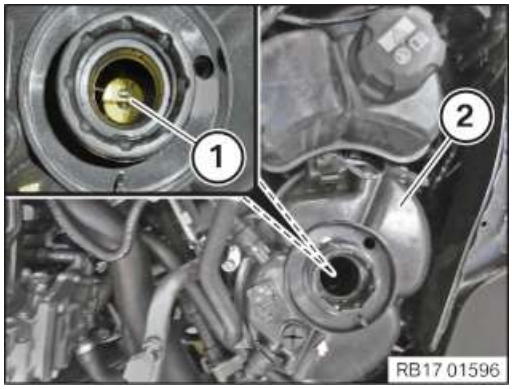
  The engine speed **drops** to the idle speed.
- Observe the display *in the instrument cluster* (KOMBI).

  If the service function is interrupted, the cooling system bleeding routine **must** be repeated.
- Switch off engine.
- Allow the coolant temperature to cool down to **< 50°C**.



- Loosen sealing cap (1).

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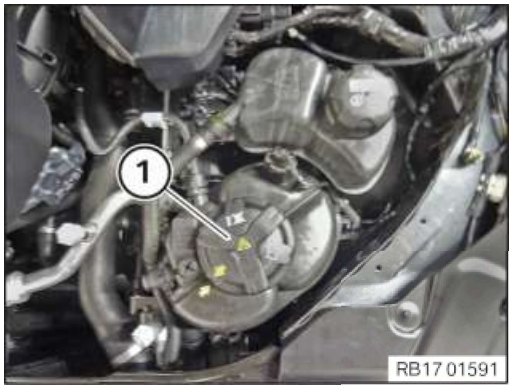
TECHNICAL INFORMATION

After the cooling system bleeding routine, the cooling system is topped up above the maximum mark.

Overfilling the cooling system serves to balance the remaining air in the cooling system.

The normal filling level of the coolant is reached while driving.

- Adjust the filling level in the coolant expansion tank (2) of the high-temperature coolant circuit to **200 ml** over the **maximum mark**(1) .

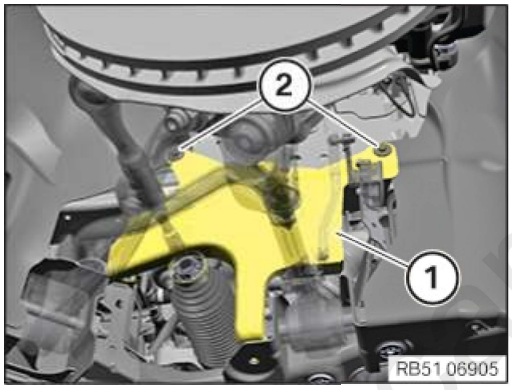


- Close sealing cap (1).
- Close the sealing cap (1) until the **arrows** are flush.

40 – Install the cover of the steering assembly

Prerequisite

The underbody protection of the steering gear is removed.



- Position the cover (1).
- Tighten the screws (2).

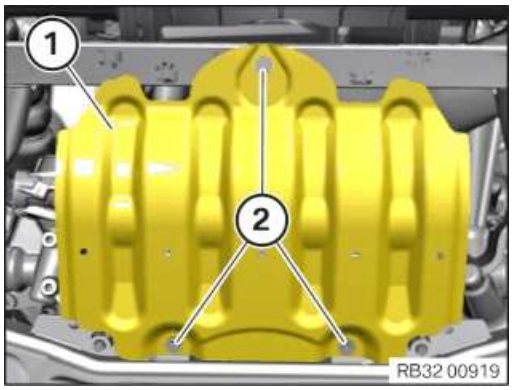
Cover, steering unit

Screw		Tightening torque	3 Nm

41 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.



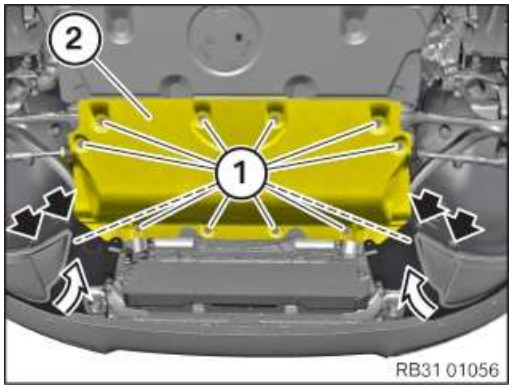
- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

42 – Install the underbody protection of the steering gear

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- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

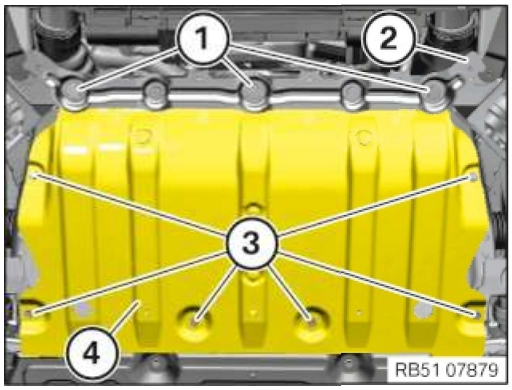
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

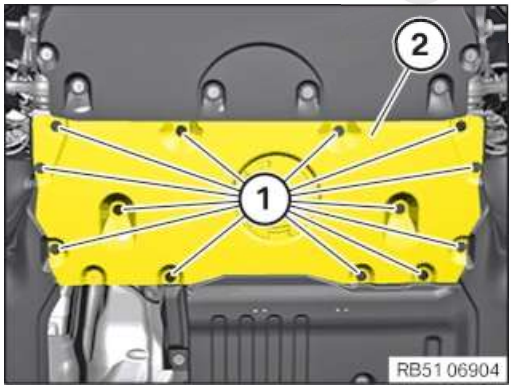
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

43 – Installing the centre underbody protection



- **Version with rear-wheel drive:**

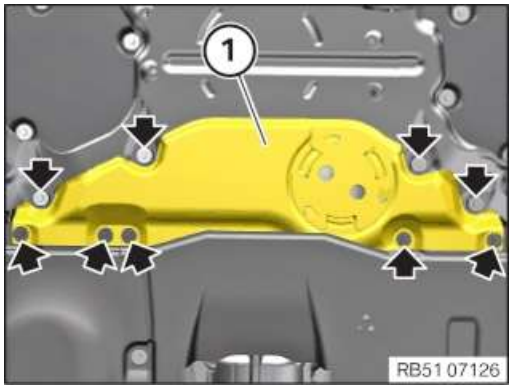
  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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- **Version with all-wheel drive:**

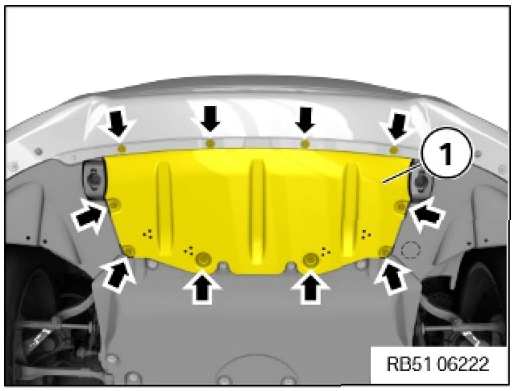
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

44 – Installing the front underbody protection



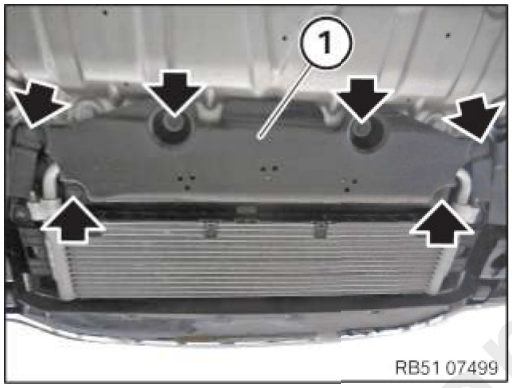
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



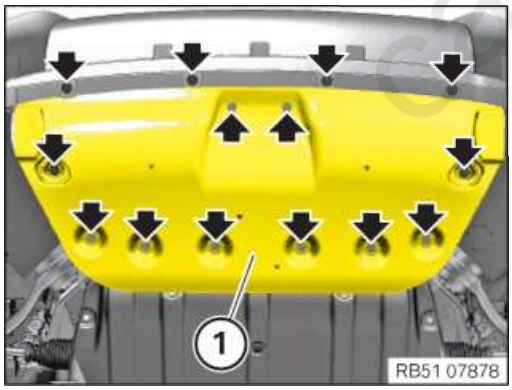
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

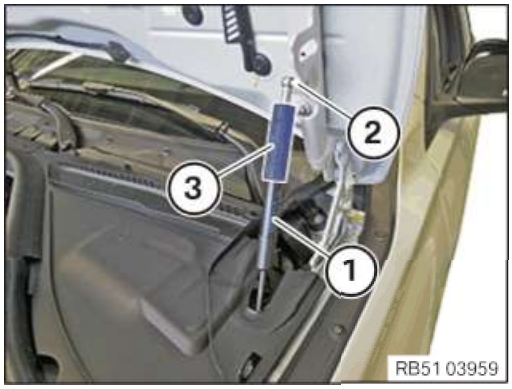
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

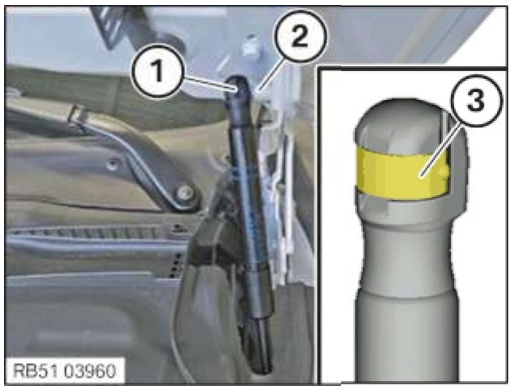
45 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

46 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.



CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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Additional Information

Overview of Tightening Torques

Exhaust turbocharger to cylinder head — Used in step 24

M7	Observe tightening sequence. *Replace nuts.*	1. Jointing torque	10 Nm
		2. tightening torque	10 Nm
		3. Jointing torque	16 Nm
		4. tightening torque	16 Nm
		5. Tightening torque	16 Nm

Oil feed line to exhaust turbocharger/crankcase — Used in step 24

M6x12		Tightening torque	8 Nm

Heat shield to cylinder head — Used in step 24

M8 x 12		Tightening torque	19 Nm

Heat shield to clamping strip			Used in step 24
M6 x 12		Tightening torque	8 Nm

Oil return line to exhaust turbocharger/crankcase			Used in step 25
M6x14		Tightening torque	8 Nm

Coolant feed line/coolant return line to exhaust turbocharger			Used in step 2627
M6 x 12		Tightening torque	8 Nm

Coolant return line holder to exhaust turbocharger			Used in step 26
M6		Tightening torque	8 Nm

Coolant feed line to crankcase			Used in step 27
M6 x 12		Tightening torque	8 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger			Used in step 28
V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Catalytic converter to holder			Used in step 28
M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder			Used in step 28
M8	Renew nut.	Tightening torque	19 Nm

Rear silencer to body / bumper support			Used in step 29
M8	Replace nuts.	Tightening torque	19 Nm

Exhaust system to rear axle carrier			Used in step 29
Nut M8	Renew nut.	Tightening torque	19 Nm

Front silencer / petrol particulate filter on transmission bracket			Used in step 29
M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter			Used in step 29
Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter			Used in step 29
V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

Connecting support to tunnel			Used in step 30
M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

Control sensor			Used in step 31
M18x1.5		Tightening torque	50 Nm

Holder, positive battery cable to cylinder head cover			Used in step 31
6X18		Tightening torque	6 Nm

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Charge air line to throttle body — Used in step 35

M6		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing — Used in step 36

Clamp		Tightening torque	3 Nm

Cover, steering unit — Used in step 40

Screw		Tightening torque	3 Nm

Bumper buffer device steering on front axle support — Used in step 41

M10		Tightening torque	56 Nm

Underbody protection of the steering gear — Used in step 42

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws) — Used in step 42

Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support — Used in step 42

M10		Tightening torque	56 Nm

Underbody protection — Used in step 43

Hexagon screw		Tightening torque	3 Nm

Underbody protection front — Used in step 44

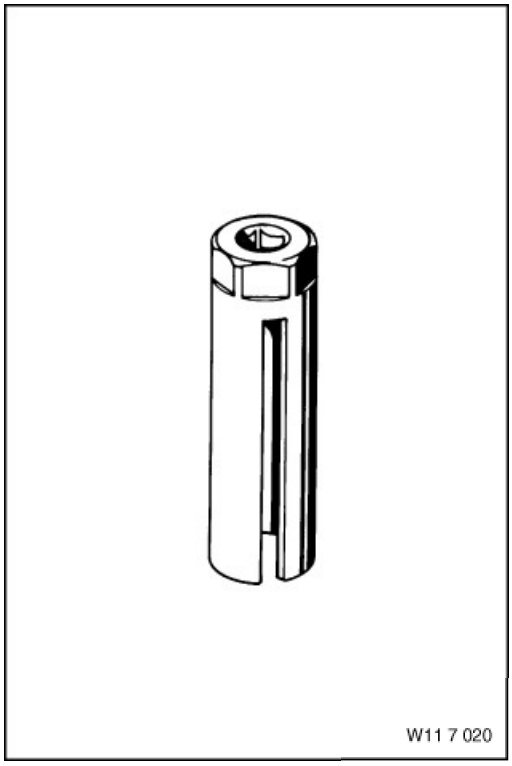
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

0 491 074 (11 7 020) Socket wrench insert

Used in step 831

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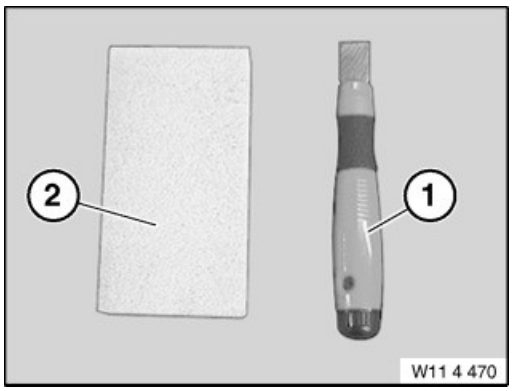


Common

Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

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0 495 102 (11 4 470) Tool

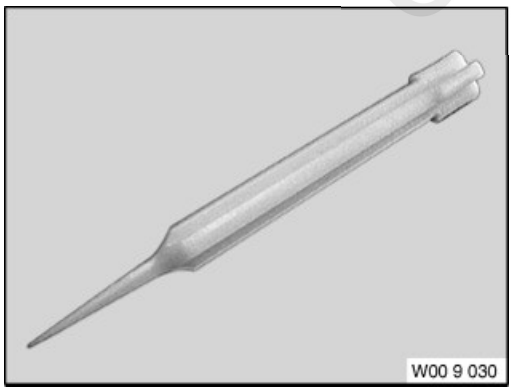


Common	Used in step 24
Usage	(cleaning kit) For cleaning sealing surfaces on magnesium crankcase/cylinder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

0 496 714 (00 9 030) Wedge

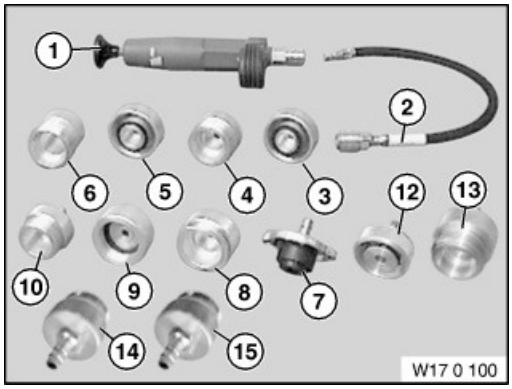


Common	Used in step 242627
Usage	For dismantling O-rings, gaskets and trim panels. This special tool replaces special tool 00 9 316.
Included in the tool or work	
Storage location	A50
Replaced by	
In connection with	
SI-Number	01 20 09 (581)

0 494 417 (17 0 100) Tester

Common	Used in step 38
Usage	For checking engine cooling system on watertightness. For checking radiator cap.
Included in the tool or work	

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Storage location	Individual
Replaced by	
In connection with	
SI-Number	01 07 02 (884)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
5	0 494 422 (17 0 105)		**Adapter** For radiator cap (sawtooth thread)	
10	0 494 427 (17 0 111)		**Adapter** For radiator cap R53/W11, R50/W17 adapter replaced 17 0 052.	
1	0 494 418 (17 0 101)		**Pump**	
2	0 494 419 (17 0 102)		**Hose** (hose with quick-release coupling)	
3	0 494 420 (17 0 103)		**Adapter** For radiator cap (normal thread)	
4	0 494 421 (17 0 104)		**Adapter** For radiator cap (normal thread)	
6	0 494 423 (17 0 106)		**Adapter** For radiator cap (sawtooth thread)	
7	0 494 424 (17 0 107)		**Adapter** For radiator cap R50 / W10	
8	0 494 425 (17 0 108)		**Adapter** For radiator cap R50 / W10	
9	0 494 426 (17 0 109)		**Adapter** For radiator connection R53/W11, R50/W17 adapter corresponds to 17 0 051	
11	0 494 428 (17 0 112)		**Case**	
12	0 494 642 (17 0 113)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
13	0 494 643 (17 0 114)		**Adapter** For radiator cap Model series: E60, E61, E63, E64 SI no.: 1 08 03 (988)	
14	0 495 889 (17 0 115)		**Adapter** For radiator cap Model series: N12, N14	

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Overview Technical Data

Capacity of high-temperature coolant circuit G20	Used in step 38
B48B20O1/B46B20O1	9.8 l
Expendable materials: Technically suitable antifreeze and corrosion inhibitor	

Screw-in depth of upper stud bolt on cylinder head	Used in step 24
Dimension A	30 mm

Links

Functional descriptions	**Used in step**
Troubleshooting on the exhaust turbocharger	

General repair instructions	**Used in step**
11 00 ... Overview of consumables (Electronic Parts Catalogue)	31

Repair instructions	**Used in step**
17 00 ... Notes for working on cooling system.	38
61 35 ... Notes on ESD protection (Electro Static Discharge)	

Operating materials	**Used in step**
3.0 Technically appropriate engine oils for BMW Group engines	24

Operating materials	**Used in step**
Main group 17	38

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This documentation refers to special tools that were not yet available when going to press.

11 65 803 Replace electrical controller drive for wastegate

PRELIMINARY WORK

1 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

2 – Removing the clean air pipe with the resonator

WARNING

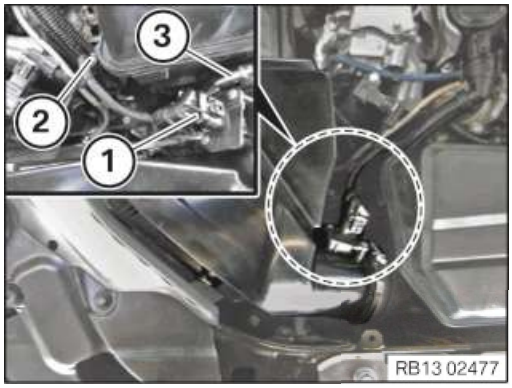
Hot surfaces.

Risk of burning!

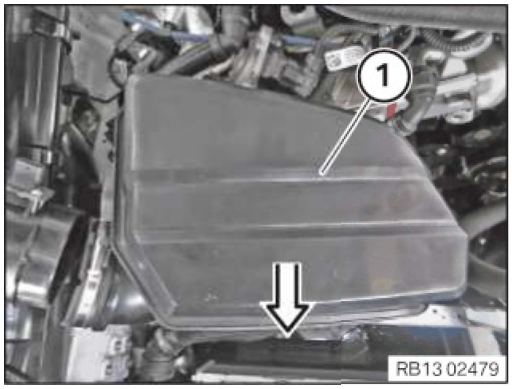
- Perform all work only on components that have cooled down.



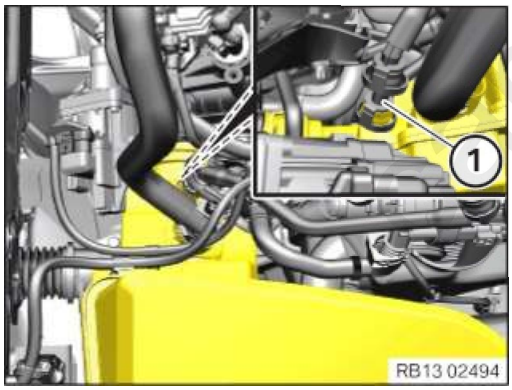
- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.



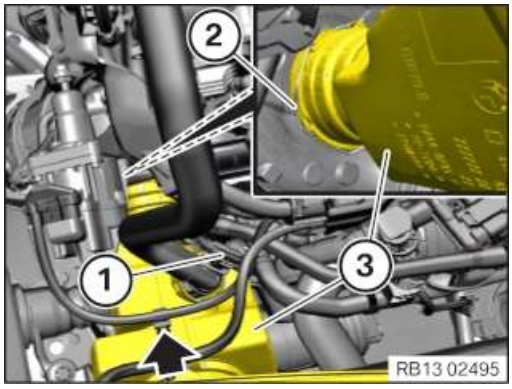
- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and disconnect the tank ventilation line (1).



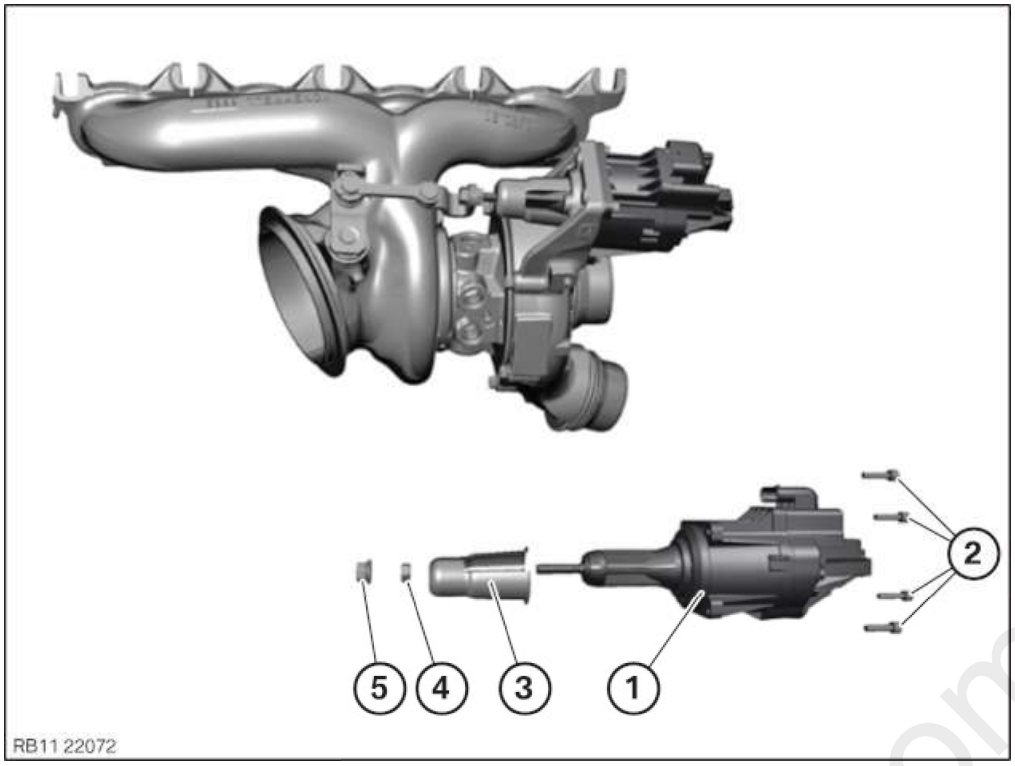
- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

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MAIN WORK

3 – Removing electrical wastegate valve controller

Electrical wastegate valve actuator



1. **Electrical wastegate valve actuator**
2. **Screws for the electrical wastegate valve controller**
3. **Heat shield for the electrical wastegate valve controller**
4. **Adjusting nuts for the electrical wastegate valve controller**
5. **Lock nuts for the electrical wastegate valve controller**

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

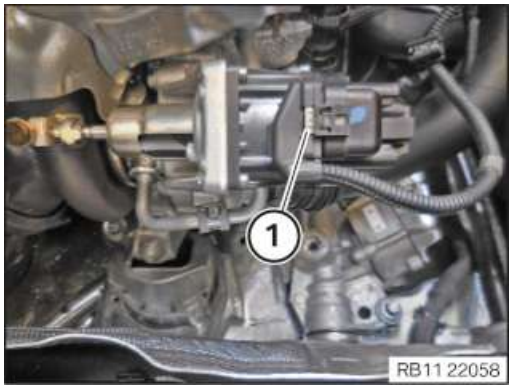
RISK OF DAMAGE

Electrostatic discharge.

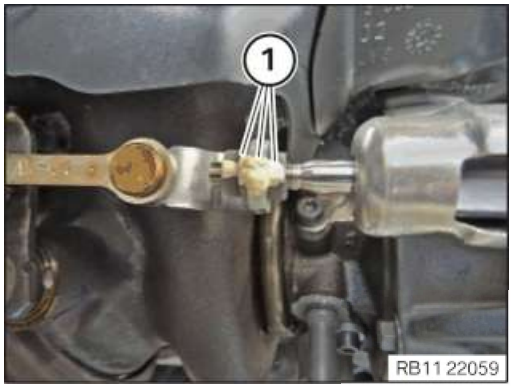
Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

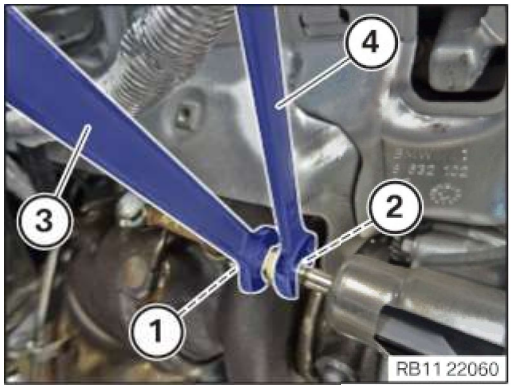
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- Unlock plug connection (1) and disconnect.



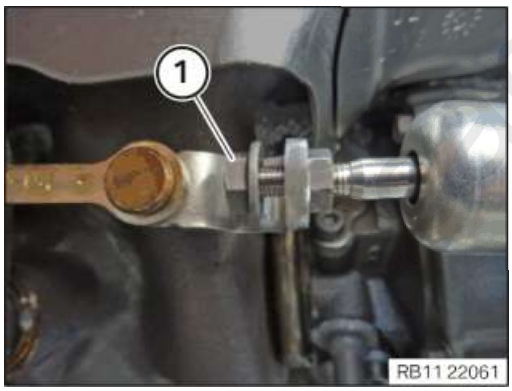
- Remove the paint (1) with conventional tools.



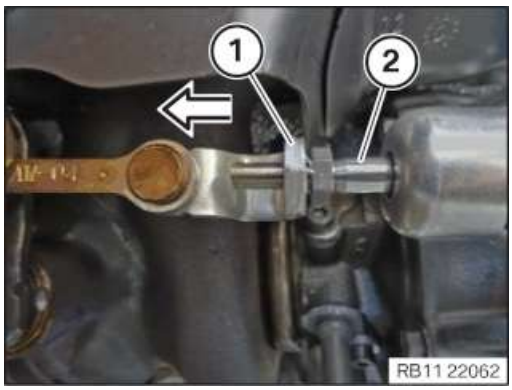
TECHNICAL INFORMATION

The adjusting nuts must be locked using two open-end spanners. If only one open-end spanner is used, there is a risk of the electrical controller drive being damaged.

- Counter-support the nut (2) using an open-end spanner (4) commercially available.
- Loosen the nut (1) using an open-end spanner (3) commercially available.

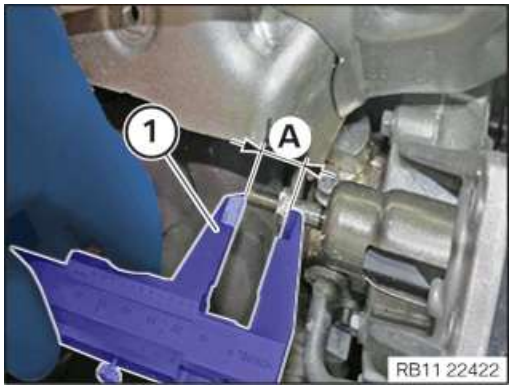


- Thread out and remove the nut (1).



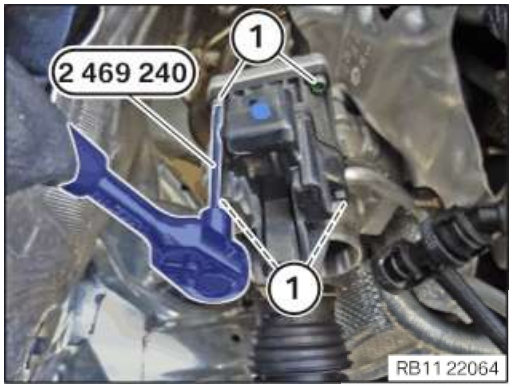
- Thread out lever (1) of wastegate valve **carefully** in direction of arrow away from control rod (2) of electrical wastegate valve controller and place to one side.

  Any application of lateral force to the control rod (2) of the electrical wastegate valve controller must be avoided.

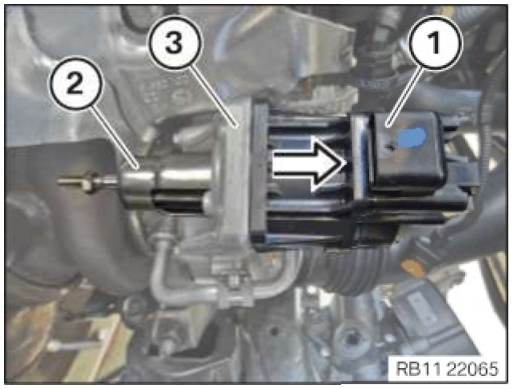


- Determine dimension (A) using standard tool (1).
- Enter determined dimension (A) in table.

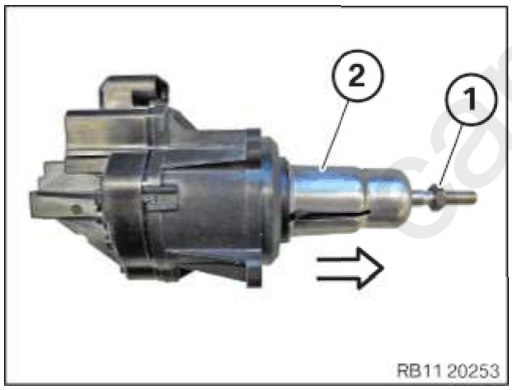
Determined value	Dimension (A) in mm
1.	mm



- Release the screws (1) with the special tool .



- Thread out the electrical wastegate valve controller (1) with the heat shield (2) **carefully** in the direction of the arrow from the bore hole of the compressor housing (3) and remove it.

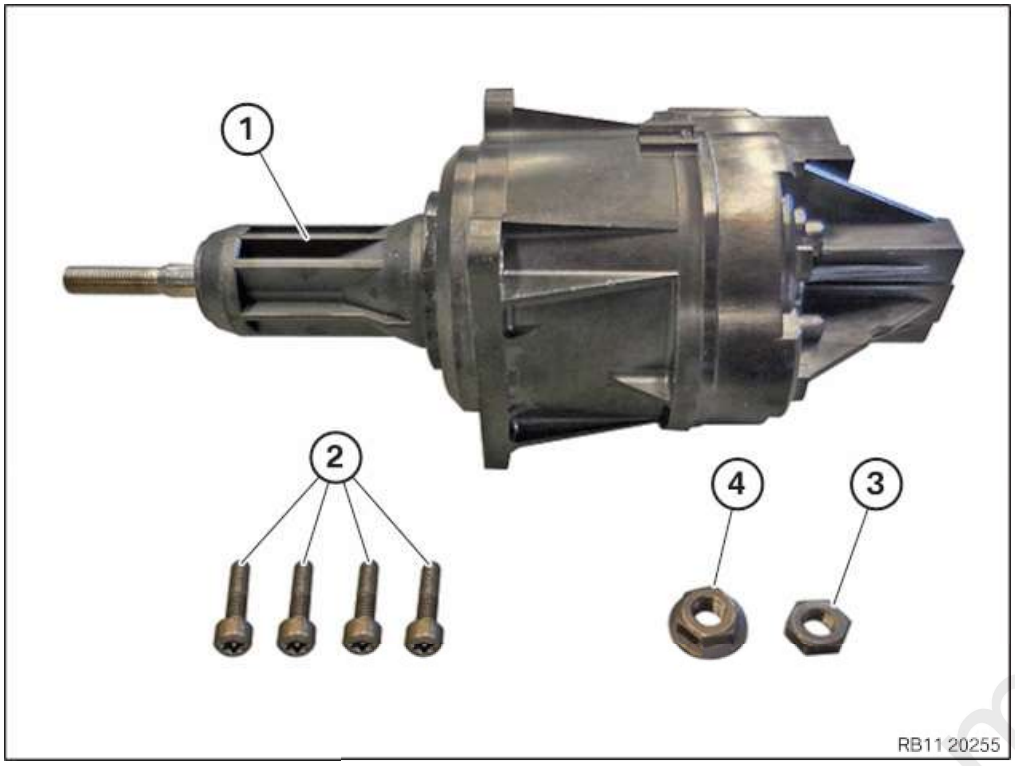


- Loosen nut (1).
- Thread out the heat shield (2) in the direction of the arrow and remove.

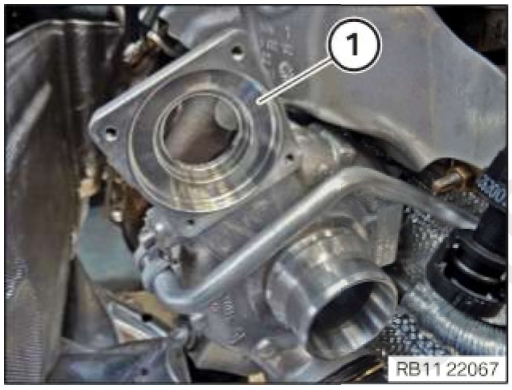
4 – Install electrical wastegate valve controller

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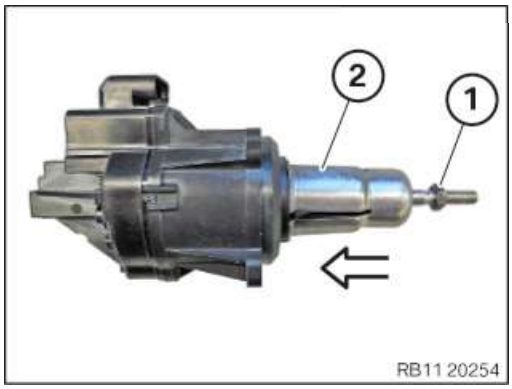
Repair kit for the electrical wastegate valve controller



1. **Electrical wastegate valve actuator**
2. **Screws for the electrical wastegate valve controller**
3. **Adjusting nut for the electrical wastegate valve controller**
4. **Mounting nut for the wastegate linkage**



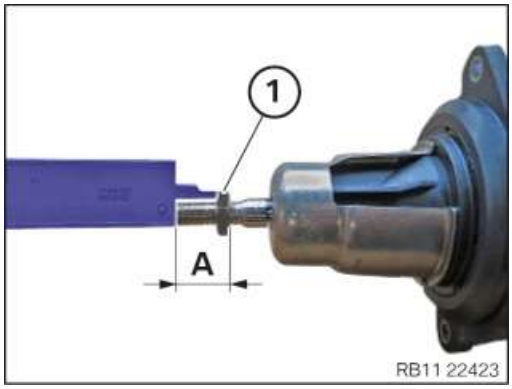
- Check contact surface (1) on exhaust turbocharger for contamination and clean if necessary.



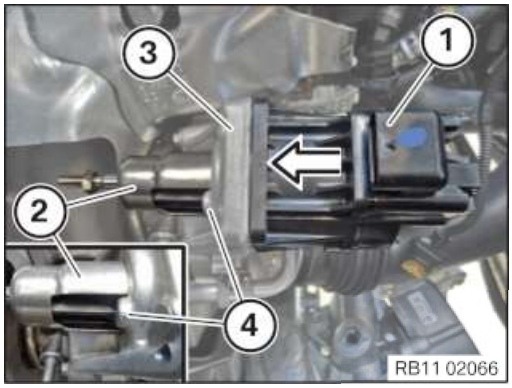
- Insert and install the heat shield (2) in the direction of the arrow.
- Renew nut (1).

  Parts: Nut

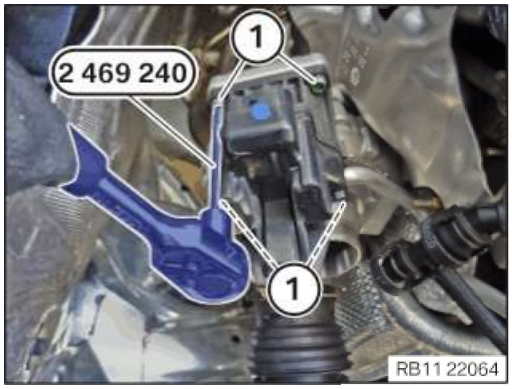
  The nut (1) is included in the repair kit.
- Insert and install the nut (1).
- Screw on the nut (1) up to the limit position so that it is touching.



- Adjust adjusting nut (1) to the determined dimension (A).



- Feed electrical wastegate valve controller (1) with heat shield (2) into bore hole of compressor housing (3) in direction of arrow and position.
- Make sure that the heat shield (2) is positioned correctly in relation to the groove (4) of the compressor housing (3).



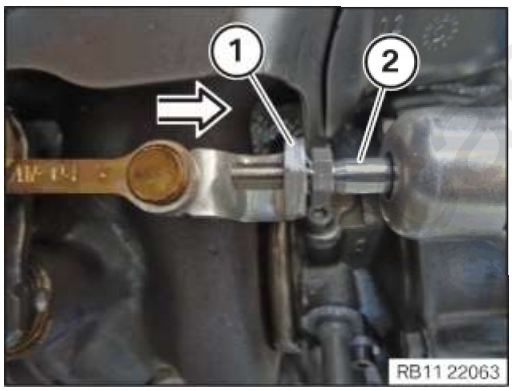
- Renew screws (1).

  Parts: Bolts

  The bolts (1) are included in the repair kit.
- Hand-tighten the bolts (1).
- Tighten the screws (1) cross-wise with the special tool .

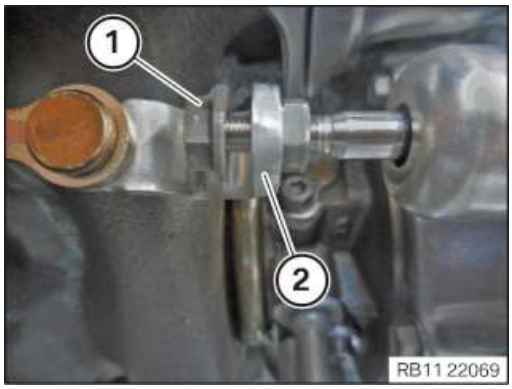
Electrical controller drive to exhaust turbocharger

	Renew screws. *Tighten screws crosswise.*	Tightening torque	3 ±0,5 Nm



- Push the lever (1) of the wastegate valve **carefully** in direction of arrow onto the control rod (2) up to the limit position so that it is touching.

  Any effect of lateral force on the control rod (1) must be avoided.

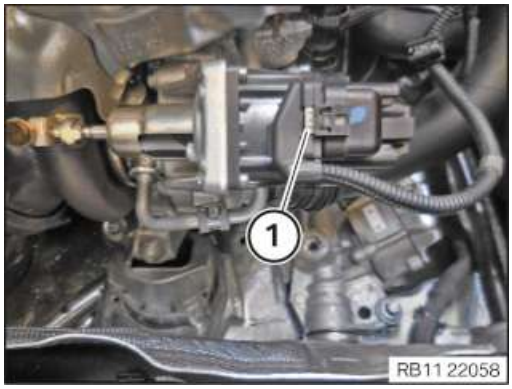


- Renew nut (1).

  Parts: Nut

  The nut (1) is included in the repair kit.
- Position the nut (1) on the wastegate valve lever (2).

mydiagn.com



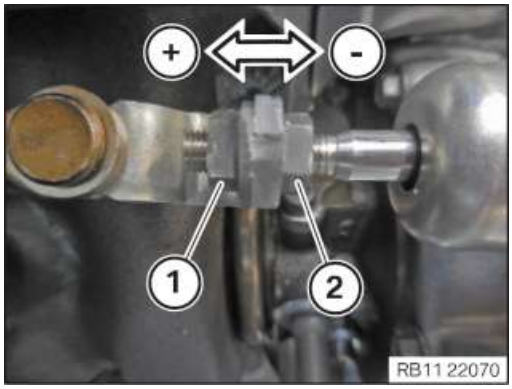
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

5 – Adjust electrical wastegate valve controller (after vehicle diagnosis)



- Perform the following operations only, when the setting for the electric wastegate valve controller is specified by the vehicle diagnosis.
- Connect diagnosis system:
  - Service functions
  - Power train
  - Engine electrical system
  - Adjustment functions
  - Adjusting wastegate linkage

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TECHNICAL INFORMATION

The adjusting nuts must be locked using two open-end spanners. If only one open-end spanner is used, there is a risk of the electrical controller drive being damaged.

- Mark lock nut (1) and adjusting nut (2) with a coloured mark.
- Loosen lock nut (1).
- According to the diagnostic function: Shorten the adjustment travel (-) or lengthen the adjustment travel (+).

  One rotation of the adjusting nut = 0.75 mm adjustment travel.
- **Example 1:**
  - Measured actual value (via diagnostic function) = 0.75 mm
  - Required correction: +0.75 mm divided by 0.75 mm = +1.0 revolutions

  For the correction of the setting of the control rod: Adjust the lock nut (1) by 1.0 revolutions in the direction (+) then reposition adjustment nut (2).

Control rod of electrical wastegate valve controller

M6	Always use a second open-end spanner (for counter support) to tighten the lock nut!	Tightening torque	6 ± 0,3 Nm

- **Example 2:**
  - Measured actual value (via diagnostic function) = -1.5 mm
  - Required correction: -1.5 mm divided by 0.75 mm = 2.0 revolutions

  For the correction of the setting of the control rod: Adjust the lock nut (2) by 2.0 revolutions in the direction (-) then reposition the adjustment nut (1).

Control rod of electrical wastegate valve controller

M6	Always use a second open-end spanner (for counter support) to tighten the lock nut!	Tightening torque	6 ± 0,3 Nm

- After Installation note: Recheck the basic setting with the diagnostic function.

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POSTPROCESSES

6 – Installing the clean air pipe with resonator

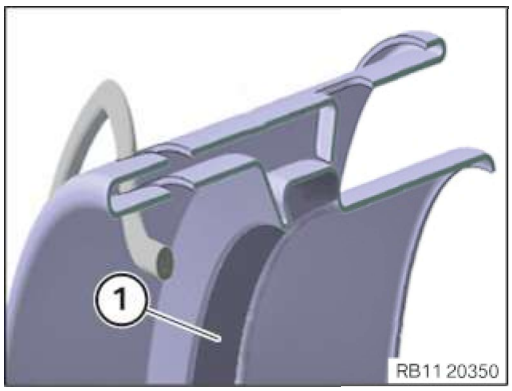


- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

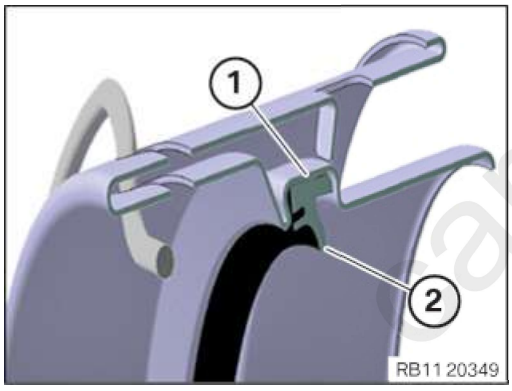
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



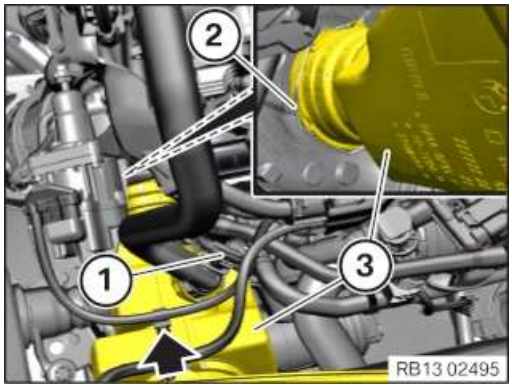
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).

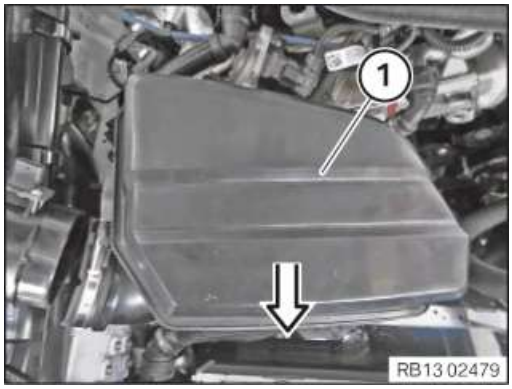


- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

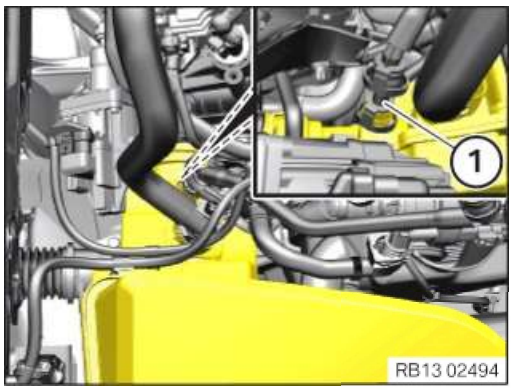
  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Secure clamp (arrow).

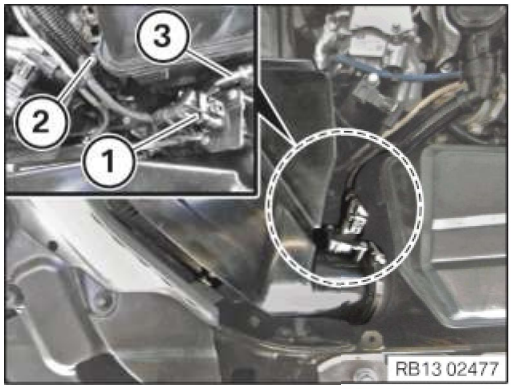
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- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

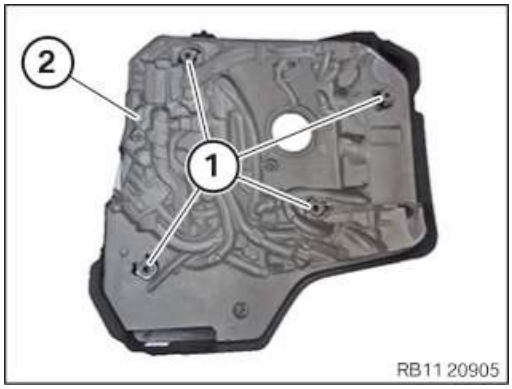
7 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

Additional Information

Overview of Tightening Torques

Electrical controller drive to exhaust turbocharger			Used in step 4
	Renew screws. *Tighten screws crosswise.*	Tightening torque	3 ± 0,5 Nm

Control rod of electrical wastegate valve controller			Used in step 5
M6	Always use a second open-end spanner (for counter support) to tighten the lock nut!	Tightening torque	6 ± 0,3 Nm

Clean air pipe to upper section of intake filter housing			Used in step 6
Clamp		Tightening torque	3 Nm

Overview of Special Tools

Links

Repair instructions	**Used in step**
61 35 ... Notes on ESD protection (Electro Static Discharge)	3

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This documentation refers to special tools that were not yet available when going to press.

11 66 000 Removing and installing/replacing vacuum pump

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WARNING

Motor vehicle may slip off the vehicle hoist where components are supported.

Danger! Life-threatening injuries!

- Secure the vehicle hoist against lowering and lifting.

WARNING

Vehicle may slip off the vehicle hoist if the vehicle hoist is handled incorrectly.

Danger! Life-threatening injuries!

- Observe safety information on raising the vehicle using a vehicle hoist.
- For additional information see: 00 ... Raising the vehicle using a vehicle hoist.

WARNING

Motor vehicle may slip off the vehicle hoist if the weight is distributed unevenly.

Danger! Life-threatening injuries!

- Ensure there is a specific weight compensation on the motor vehicle.

WARNING

Falling or tipping of a heavy component.

Danger! Life-threatening injuries!

- Before lowering or removing the front axle: Secure the engine in mounting orientation.
- For additional information see: 11 00 670 Securing engine in installation position.

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Detach battery earth lead from battery.
- For additional batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

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1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

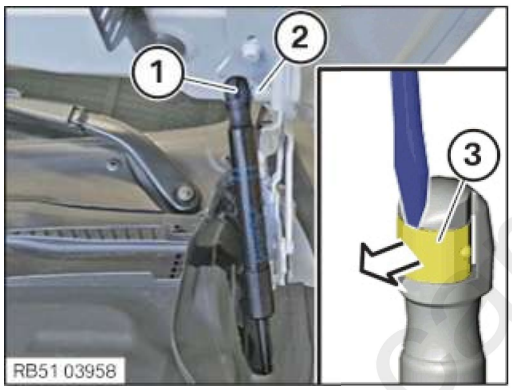
Engine compartment lid is open.

CAUTION

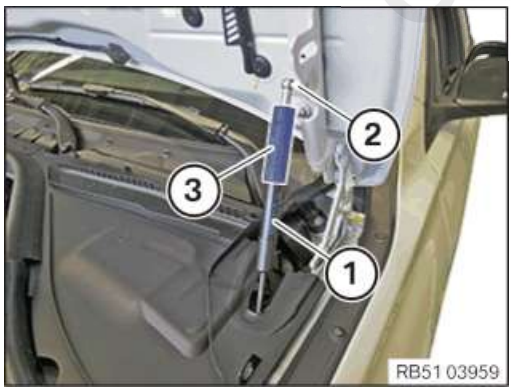
Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.



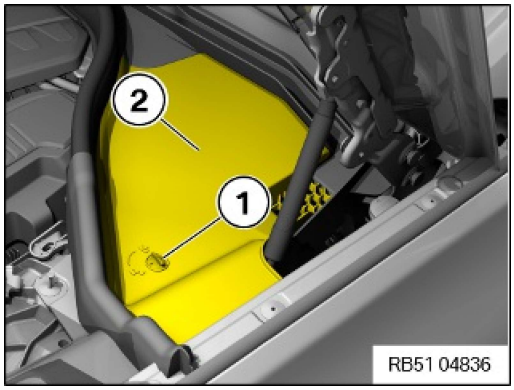
TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the bonnet support and open the bonnet further.
- Push special tool or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

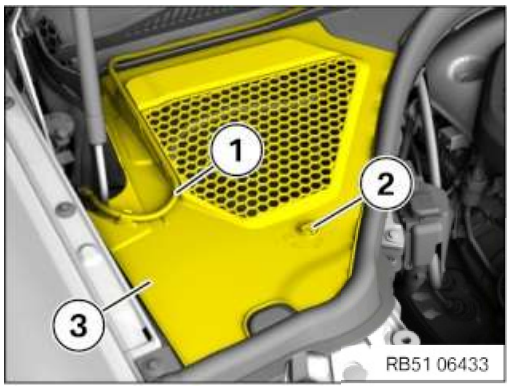
3 – Remove the cover of the engine compartment at the rear left

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- Loosen the lock (1).
- Remove rear left cover of engine compartment (2).

4 – Remove the cover of the rear right engine compartment

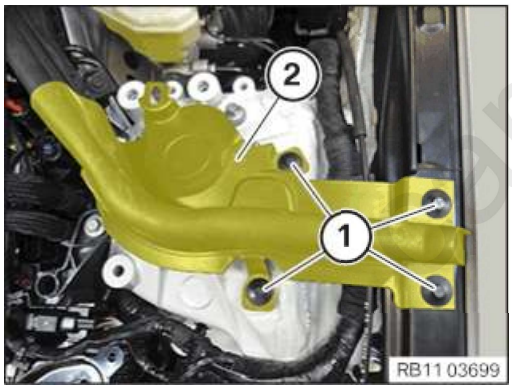


- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover of rear right engine compartment (3).

5 – Removing side bonnet gaskets

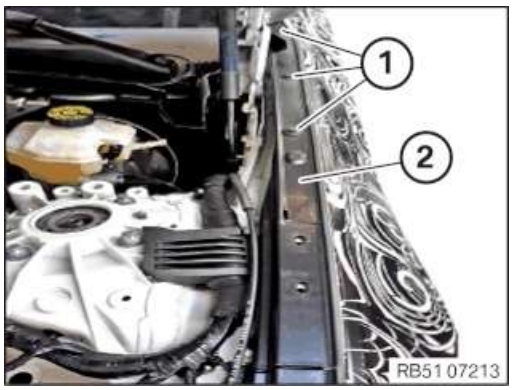
NOTICE

Perform the operations on the left and right side.



- Loosen the rivet (1).
- Remove side bonnet seal (2) from spring strut dome.

6 – Remove sealing of the side panel



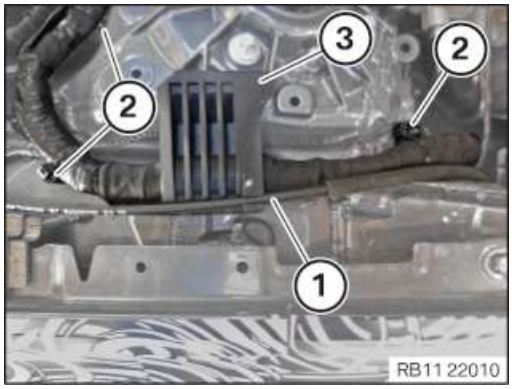
NOTICE

Description is for left component only. Procedure on the right side is identical.

- Loosen the expanding rivet (1).
- Guide out seal (2) and remove.

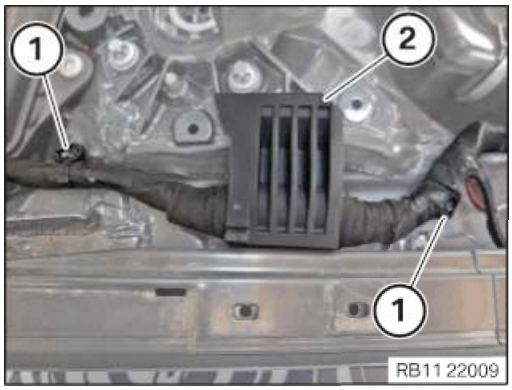
7 – Partially loosen the wiring harness section on the spring strut dome

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- Feed out the cable (1) of the front flap and set it aside.
- Loosen clamps (2).
- Feed out wiring harness section (3) on the spring strut dome on left and set it aside.

8 – Releasing the wiring harness section on the right spring strut dome



- Loosen clamps (1).
- Guide out wiring harness section (2) on the right spring strut dome and set it aside.

9 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

10 – Removing the clean air pipe with the resonator

WARNING

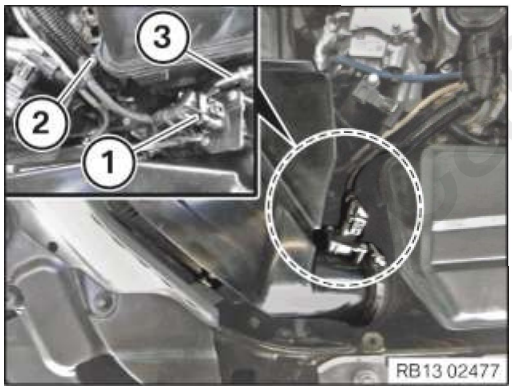
Hot surfaces.

Risk of burning!

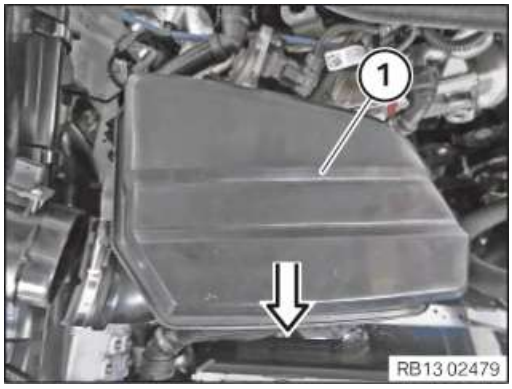
- Perform all work only on components that have cooled down.



- Unlock the locks (1).
- Feed the engine ventilation line (2) out and set it aside.

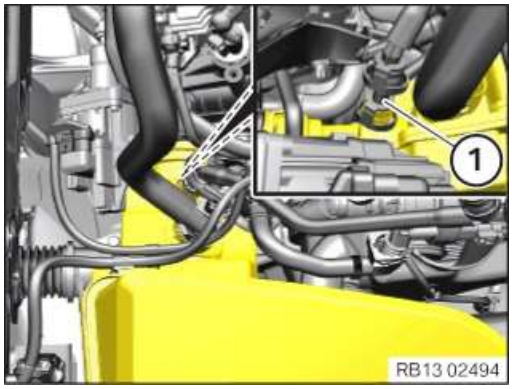


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

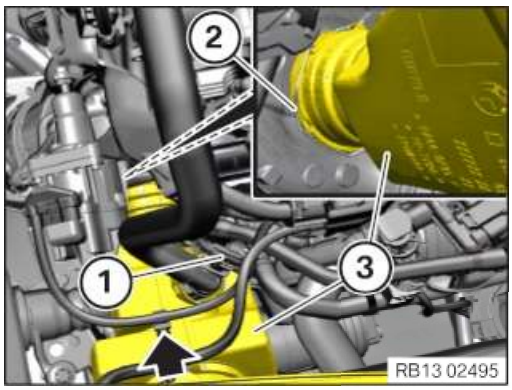


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.

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- Unlock and disconnect the tank ventilation line (1).



- Loosen the clamp (arrow).
- Unlock plug connection (1) and disconnect.
- Unlock the clamp (2).
- Feed out clean air pipe with resonator (3) and remove.

11 – Removing both front wheels

▸ **Removing the wheel**



- In vehicles with M Carbon ceramic brake: The wheel assembly jack must be used to remove the wheel (see workshop equipment).

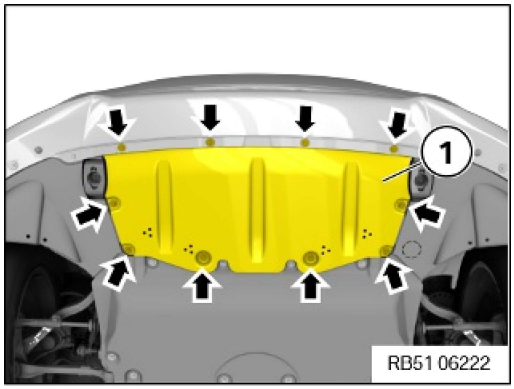
  This process is intended to prevent damage to the brake disc.



- If several wheels are removed simultaneously: Use a piece of chalk to mark on each tyre the axle and side on which the corresponding wheel is fitted.
- Release the wheel bolts (arrows) crosswise and remove the wheel.
- To release and tighten wheel bolts with a security code: Use a suitable adapter from the tool set .

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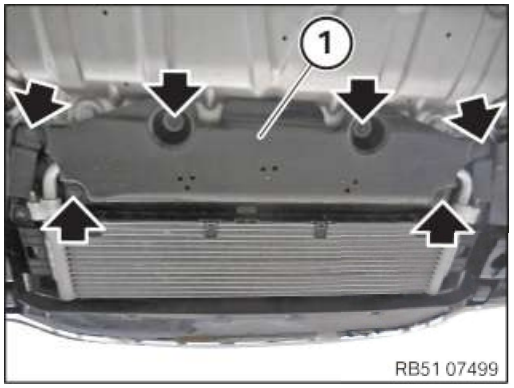
12 – Removing the front underbody protection



- **Version 1:**

  Remove screws (arrows).

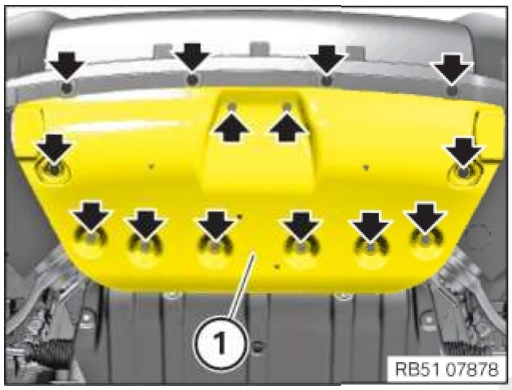
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version 2:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

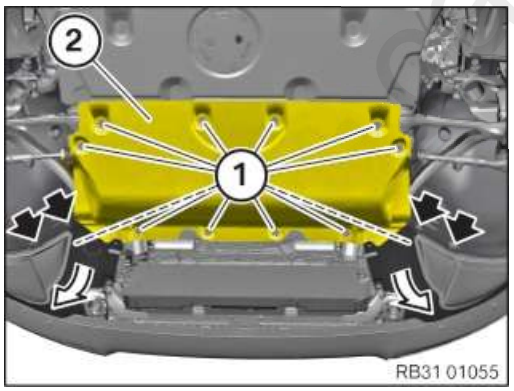


- **Version 3:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

13 – Remove the underbody protection of the steering gear



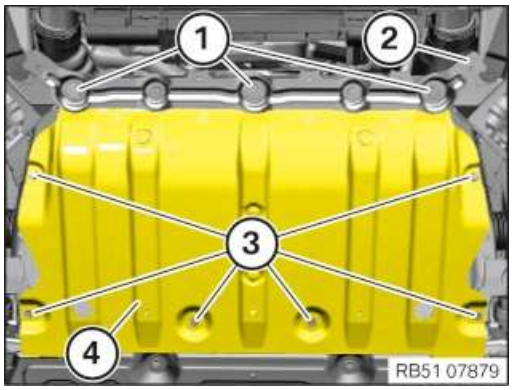
- **Version 1:**

  Unscrew the screws (arrows) of the wheel arch cover on wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove underbody protection of the steering gear (2).



- **Version 2:**

  Loosen screws (1).

  Remove the holder of the underride protection (2).

  Loosen screws (3).

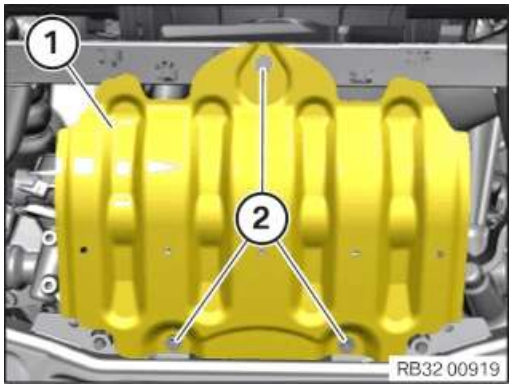
  Slide the steering gear underbody protection (4) out and remove.

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14 – If installed: Removing the steering start protection

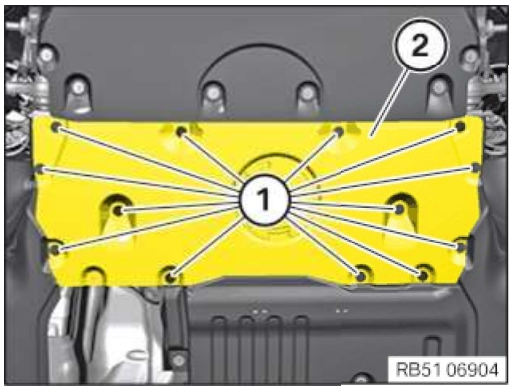
Prerequisite

The front underbody protection is removed.



- Loosen screws (2).
- Remove guard (1).

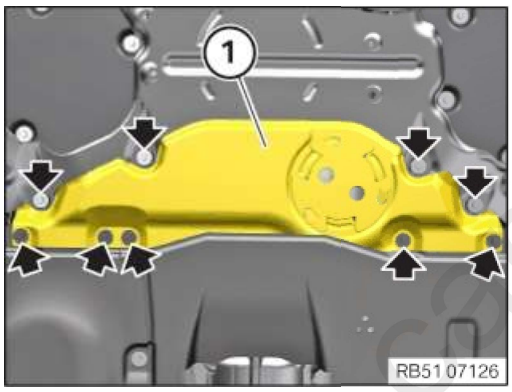
15 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

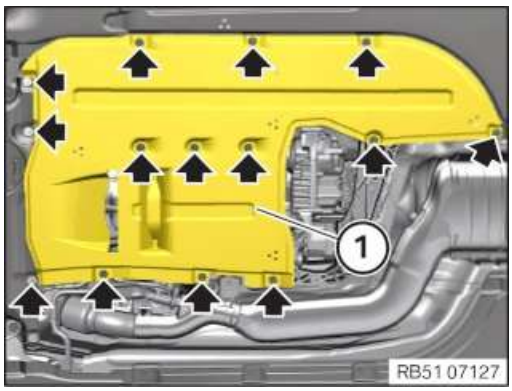


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

16 – Remove rear underbody protection

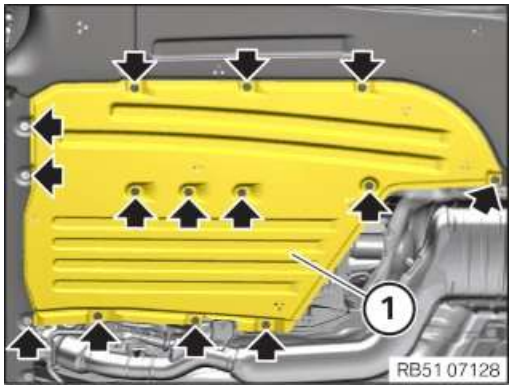


- **Version 1:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version 2:**

  Remove screws (arrows).

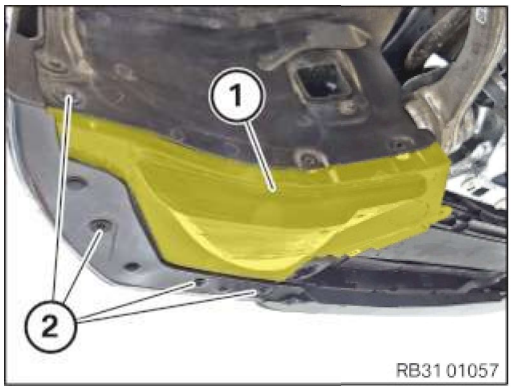
  Guide out rear underbody protection (1) and remove it.

17 – Removing the bottom left and right wheel arch cover

NOTICE

Description is for left component only. Procedure on the right side is identical.

▶ **Remove bottom wheel arch cover**

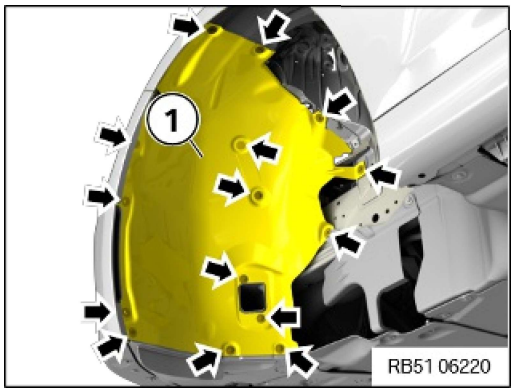


- Loosen screws (2).
- Remove bottom wheel arch cover (1)

18 – Removing the front section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.



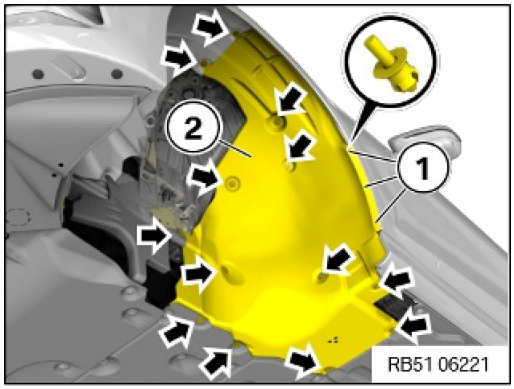
- Remove screws (arrows).
- Remove front section of the front wheel arch cover (1).

19 – Removing the rear section of the front wheel arch cover front

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.

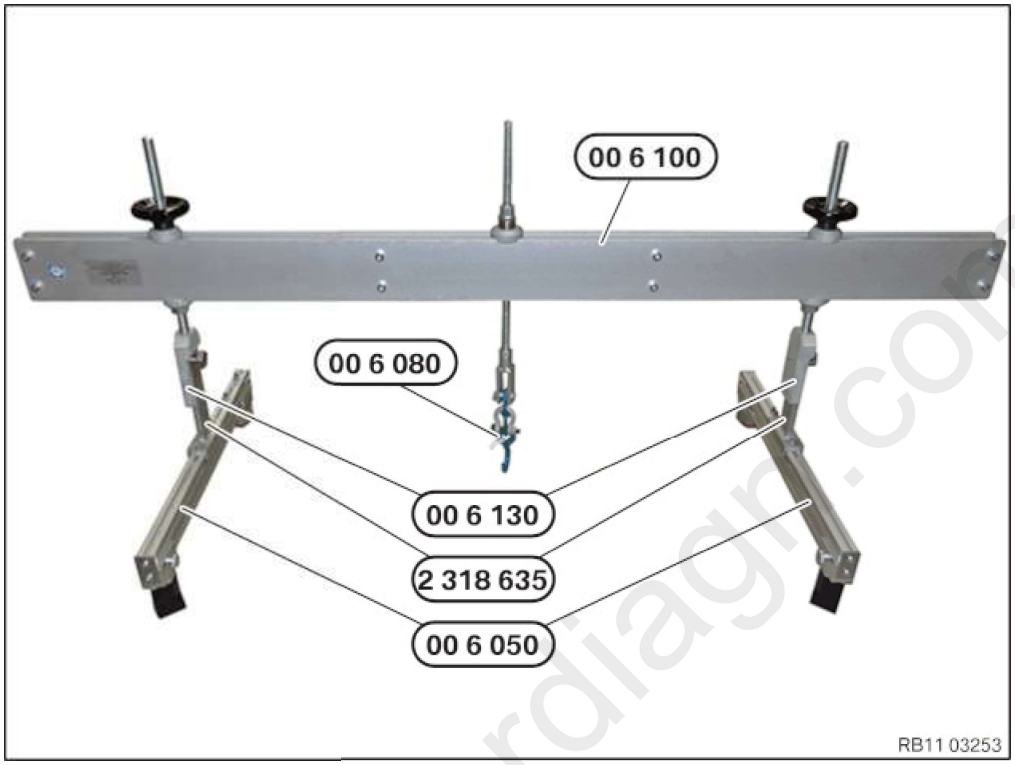
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- Loosen the expanding rivet (1).
- Remove screws (arrows).
- Remove the rear section of the front wheel arch cover (2).

20 – Securing engine in installation position

Overview: Prepared engine bridge



CAUTION

Components connected to the engine joint or cross member.

Danger of injury!

- Check lifting eyes and engine mounting brackets for damage, e.g. cracks.
- Attach the component to correctly mounted engine joints or cross members only.
- Exclusively lift the component, do not move it forwards, backwards or in transverse direction.



- Guide in and position special tool 2 459 012 on cylinder head.
- Tighten the screws (1) of special tool 2 459 012.

Special tool to cylinder head

M8		Tightening torque	21,5 Nm

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- **Carefully** position engine bridge (1) with help from an auxiliary person.



- Make sure that special tool on the left is correctly positioned on the lock support.
- Make sure that special tool from the set of special tools , left, rests correctly on the spring strut dome.



- Make sure that special tool on the right is correctly positioned on the lock support.
- Make sure that special tool from the set of special tools , right, rests correctly on the spring strut dome.



- Align the engine bridge by moving it on the profile strips of the special tool above the engine mounting bracket (1) and screw it down.
- Align the hook above the engine mounting bracket (1).
- Connect the hook to the engine mounting bracket (1).



- Check whether the special tool on the right is correctly positioned on the lock support.

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- Check whether the special tool from the special tool kit , right, rests correctly on the spring strut dome.



- Check whether the special tool on the left is correctly positioned on the lock support.



- Check whether the special tool from the special tool kit , left, rests correctly on the spring strut dome.



- Release screw (1) on the left engine mount from the top with a commercially available tool.



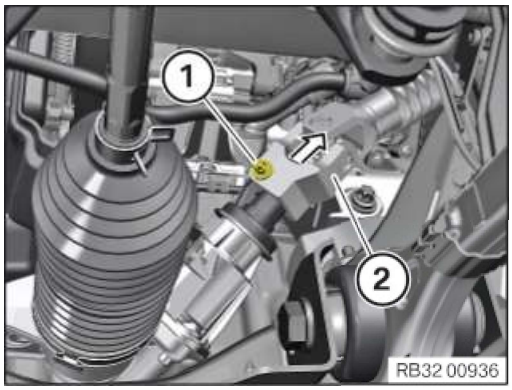
- Release screw (1) on the right engine mount from the top with a commercially available tool.

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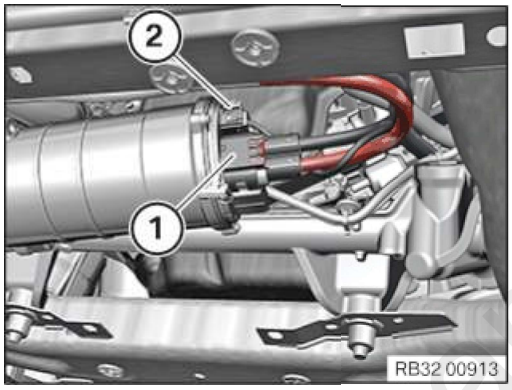
- Raise the engine by turning the special tool 2 361 506 (00 6 103) (spindle) by 10 mm.

21 – Releasing lower steering shaft from steering gear

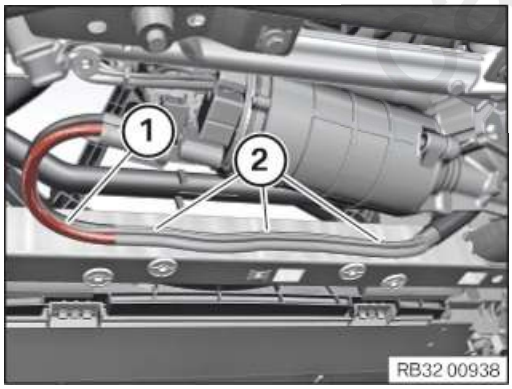


- Loosen screw (1).
- Pull off lower steering shaft (2) from steering gear in direction of arrow.

22 – Detach the wiring harness of the EPS from the front axle support

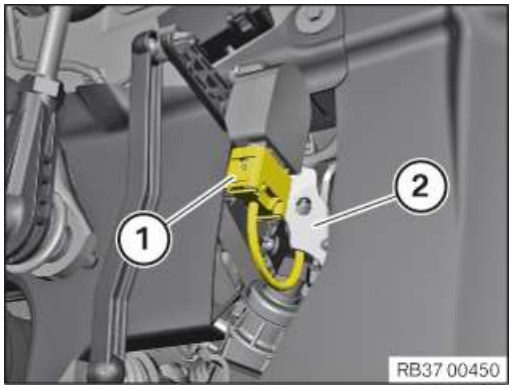


- Unlock and disconnect the plug connections (1) and (2).



- Loosen the holder (2).
- Place wiring harness (1) to one side.

23 – Detach the line connection of the ride height sensor



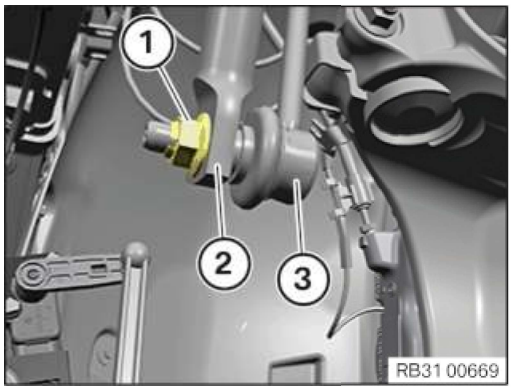
- Unlock plug connection (1) and disconnect.
- Unclip the line from holder (2).

24 – Release the left and right anti-roll bar link from the anti-roll bar

NOTICE

Perform the operations on the left and right side.

▸ **Loosening the anti-roll bar link from the anti-roll bar**



- Loosen nut (1).

Note: Use the Torx socket for counter support.

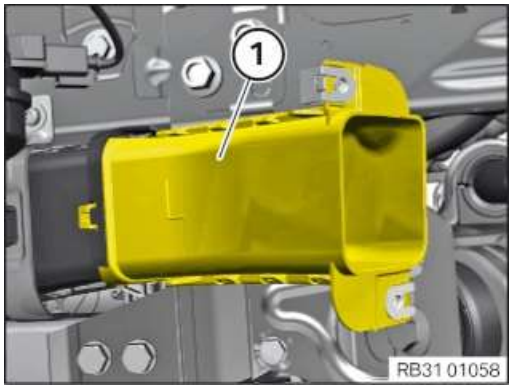
- Loosen the anti-roll bar link (3) from the anti-roll bar (2).

25 – Removing the left and right brake air duct partially

NOTICE

Perform the operations on the left and right side.

▸ **Removing brake air duct partially**



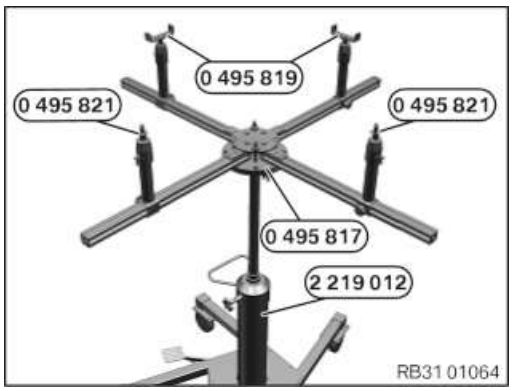
- Unclip and remove air duct (1).

26 – Preparing the special tool

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TECHNICAL INFORMATION

In a profile rail pair, two profile rails are connected to one another by gearing.



- Fit the special tool completely on the universal jack 2 219 012 with the help of an auxiliary person.
- Insert special tools in telescopic supports of a profile rail pair.
- Insert special tools in telescopic supports of other profile rail pair.

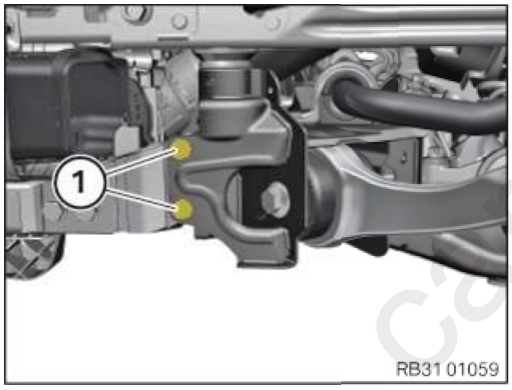
27 – Lower front axle support

WARNING

Falling or tipping of a heavy component.

Danger! Life-threatening injuries!

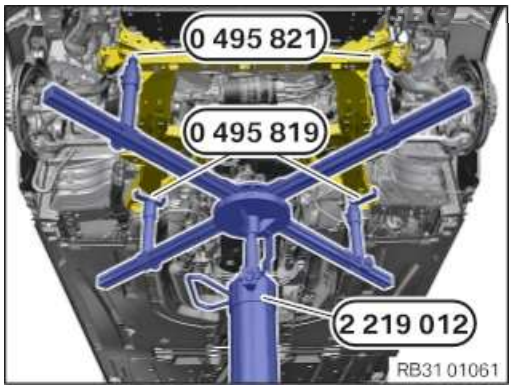
- Before lowering or removing the front axle: Secure the engine in mounting orientation.
- For additional information see: 11 00 670 Securing engine in installation position.



NOTICE

Perform the operations on the left and right side.

- Loosen screws (1).

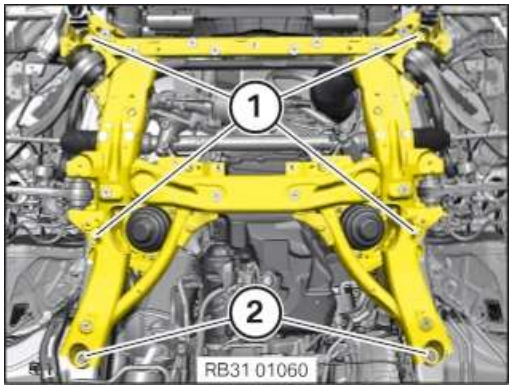


- Position the universal jack 2 219 012 with the special tools and on the front axle support.

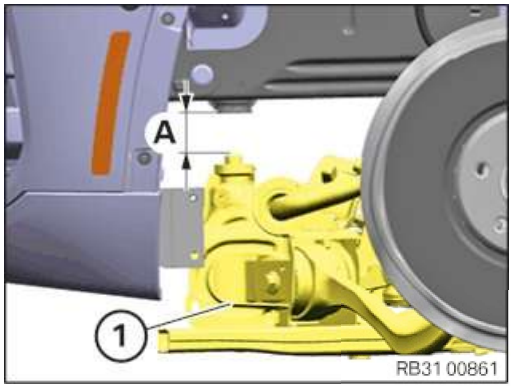
  The centre of gravity of the front axle must be centred over the universal jack 2 219 012 !

- Support the front axle support with the universal jack 2 219 012.

carflash.com



- Loosen screws (1) and (2).



- Lower the front axle support (1) with the universal jack by dimension (A).

  Dimensions (A) = maximum 15 cm

28 – Releasing the oil drain plug

WARNING

Hot fluids.

Risk of scalding!

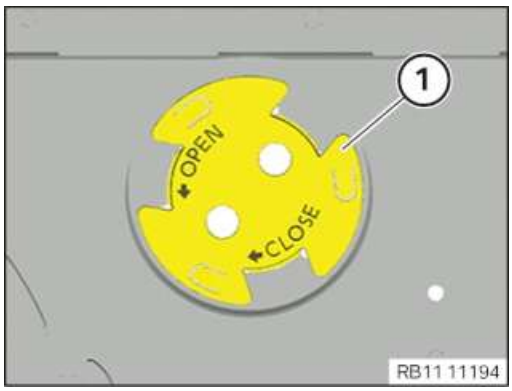
- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

WARNING

Hot surfaces.

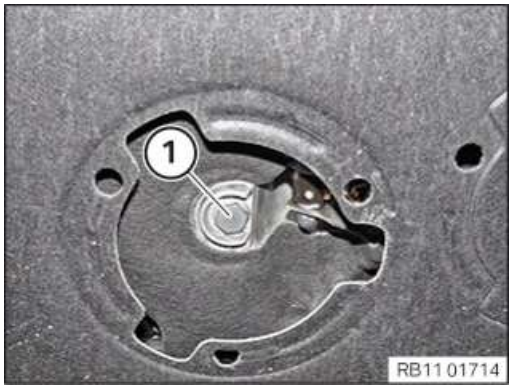
Risk of burning!

- Perform all work only on components that have cooled down.



- Turn and remove service cap (1).

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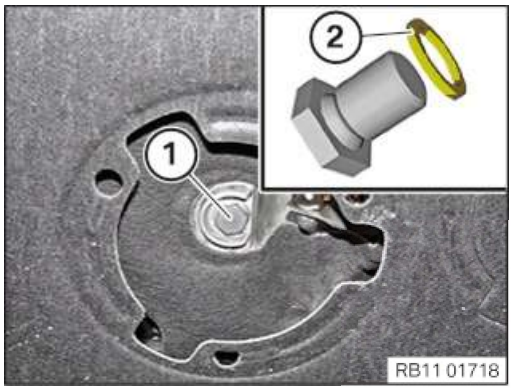
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

29 – Tightening the oil drain plug



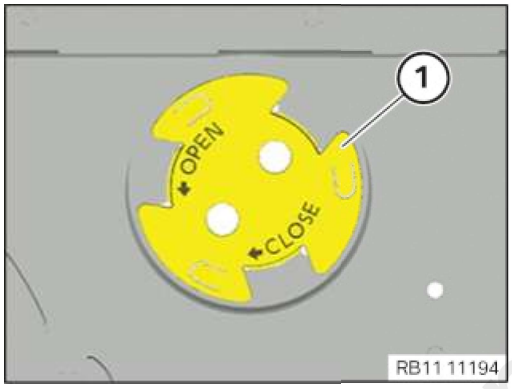
- Renew sealing ring (2).

  Parts: Sealing ring

- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

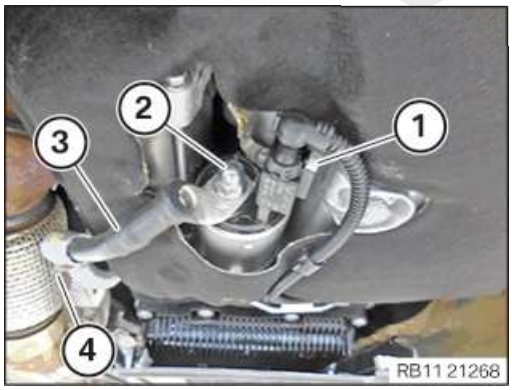


- Install service cap (1).

30 – Removing the acoustic cover of the oil sump

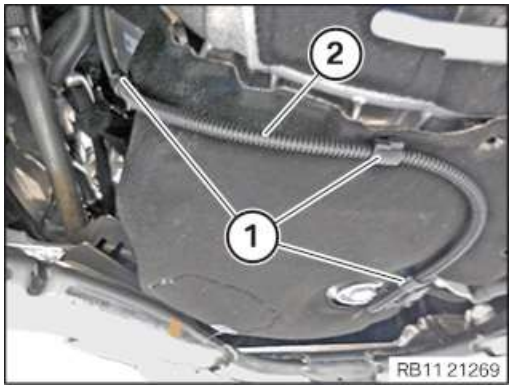
Prerequisite

Disconnect all negative battery cables.

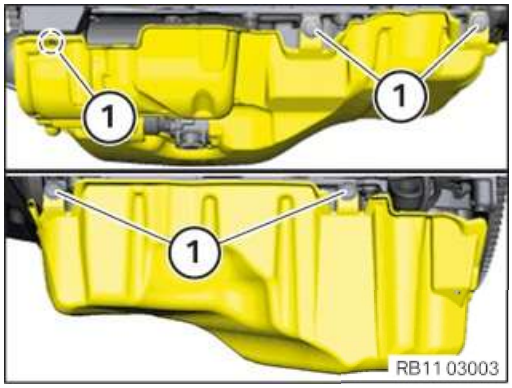


- Unlock and loosen connector (1).
- Loosen nut (2).
- Guide the positive battery cable (3) out of the clamp (4) and lay to one side.

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- Unlock and loosen the clamps (1).
- Guide out the wiring harness section of automatic transmission (2) and set it aside.



- Detach all expanding rivets (1).



- Guide out acoustic cover (1) downwards to the rear and remove it.

31 – Removing starter motor

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

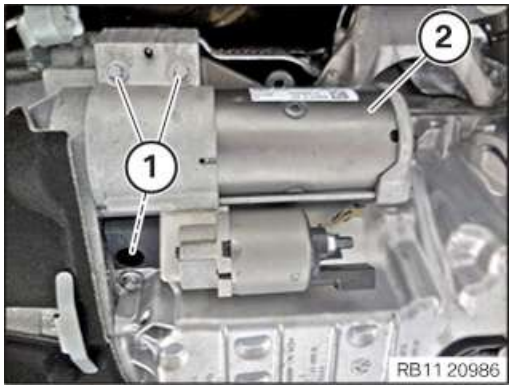
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 Information on electrostatic discharge (ESD) protection.

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- Loosen screws (1).
- Guide out and remove starter (2).

32 – Remove oil sump

RISK OF DAMAGE

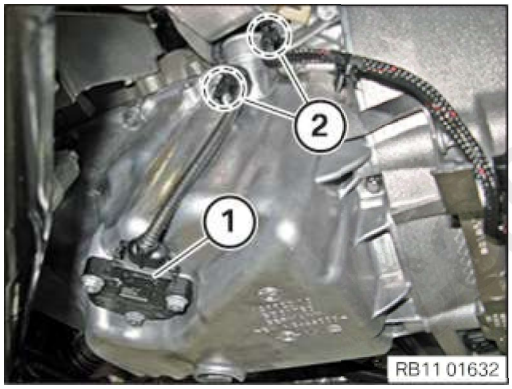
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

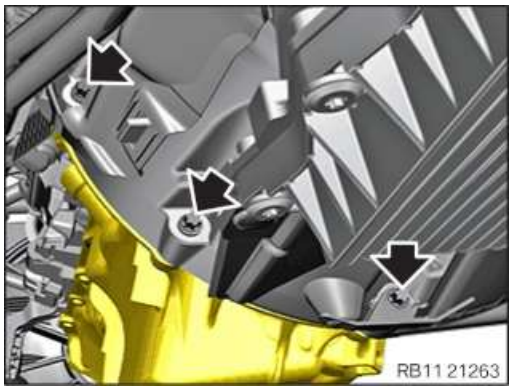
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

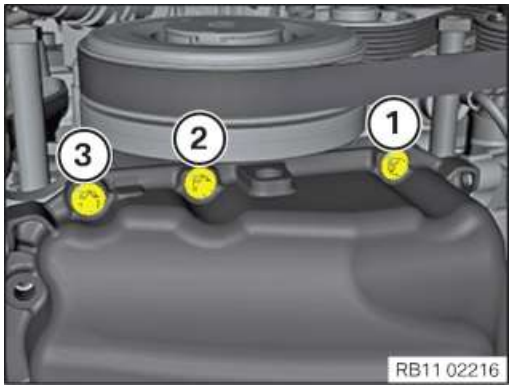
Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



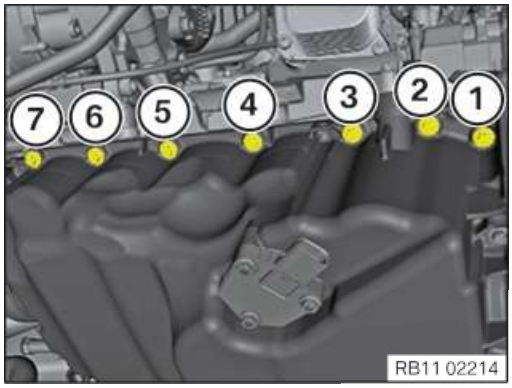
- Unlock and loosen connector (1).
- Release the cable from the clips (2) of the oil sump.



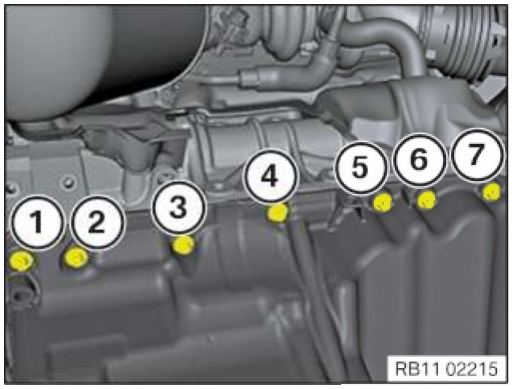
- Unscrew the transmission bolts (arrows).



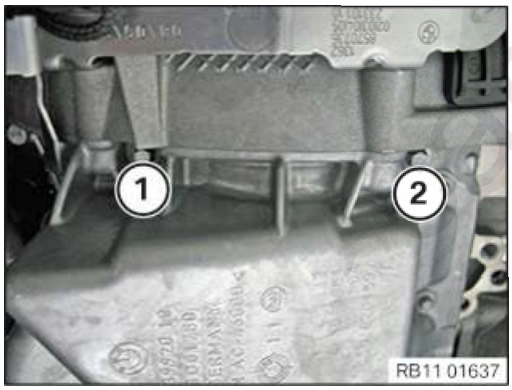
- Loosen screws (1), (2) and (3).



- Loosen screws (1) to (7).



- Loosen screws (1) to (7).



- Loosen screws (1) and (2).



TECHNICAL INFORMATION

Increased force may be necessary during disassembly because the component is bonded with liquid sealing compound.

- Release the oil sump in the **marked** areas using suitable tools (1).

rdiagn.com



- Guide out the oil sump (1) downwards to the rear and remove.

MAIN WORK

33 – Remove the oil vacuum pump

RISK OF DAMAGE

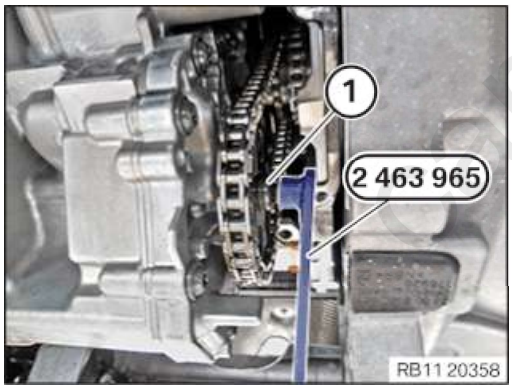
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

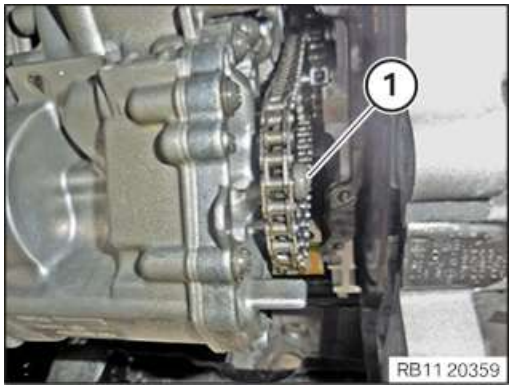
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

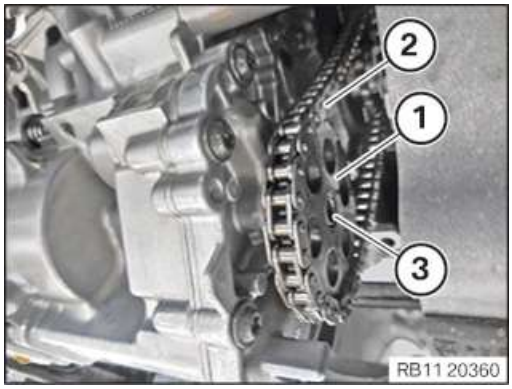
The thread is a left-hand thread.



- Release bolt (1) with the special tool 2 463 965.



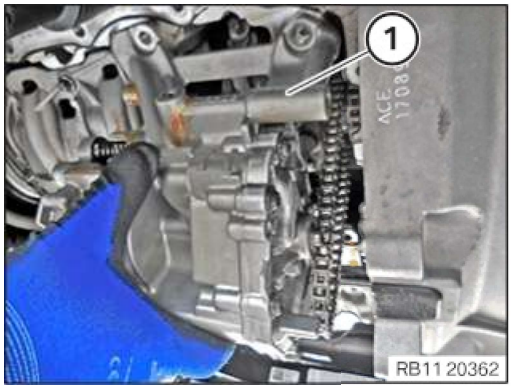
- Thread out the bolt (1) and remove it.



- Detach the camshaft sprocket (1) from the oil vacuum pump (3).
- Feed the camshaft sprocket (1) out of the drive chain (2) and remove it.



- Loosen screws (1).



- Feed out the oil vacuum pump (1) and remove it.

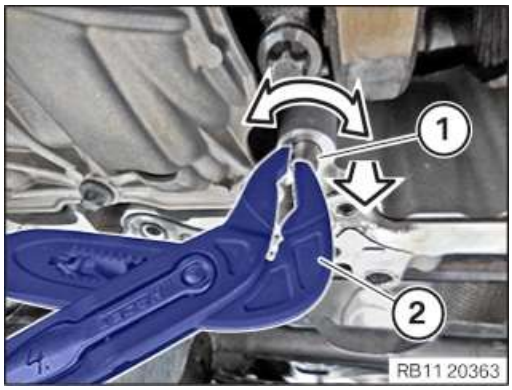
34 – Oil vacuum pump preparation

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



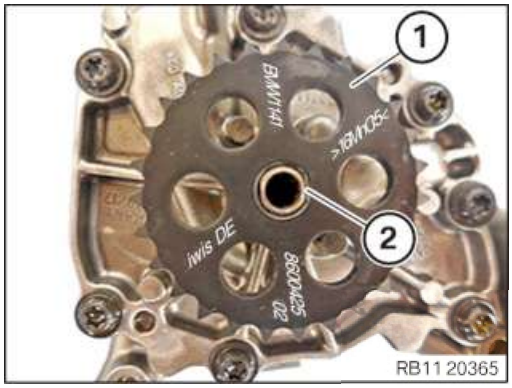
- Remove the centring sleeves (1) in direction of arrow using conventional tools (2).
- Renew the centring sleeves (1).

  Parts: Centring sleeves

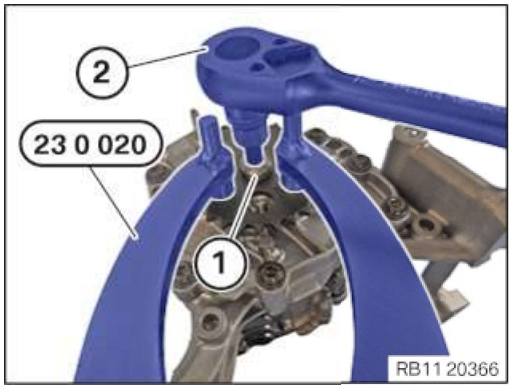
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- Insert and install new centring sleeves (1) on the oil vacuum pump (2).



- Insert and install the camshaft sprocket (1) on the oil vacuum pump (2).
- Make sure the **labelling** on the camshaft sprocket points to the **front**.



TECHNICAL INFORMATION

The thread is a left-hand thread.

- Insert and install the new screw (1).
- Hold camshaft sprocket with special tool 0 491 440 (23 0 020) and tighten screw (1) with conventional tools (2).

Note: Carry out work with a second person assisting.

Camshaft sprocket to oil vacuum pump

M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °

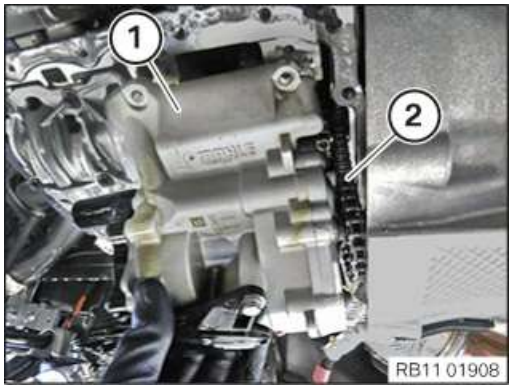


- Make sure the sealing ring (1) is installed correctly.

  The sealing ring (1) must not be damaged or missing.

35 – Install the oil vacuum pump

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- Feed the oil vacuum pump (1) into the drive chain (2) and position it.



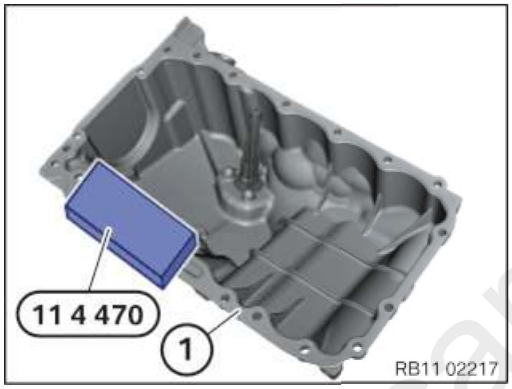
- Tighten the new bolts (1).

Oil vacuum pump to crankcase

M8	Renew screw.	1. Tightening torque 2. Angle of rotation	15 Nm 45 °

POSTPROCESSES

36 – Refitting sump



TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the fine seal remains on the sealing surface (1) of the oil sump with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215

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TECHNICAL INFORMATION

The sealing surfaces must be free from oils, grease and cleaning agents.

- Remove the rough seal remains on the sealing surface (1) of the crankcase with the special tool 0 495 102 (11 4 470).
- Clean sealing surface (1) with brake cleaner.

Expendable materials

Brake cleaner2.0	500 ml, Spray can	83192365214
	20 , Canister	83192365215



- Have the special tool ready.



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

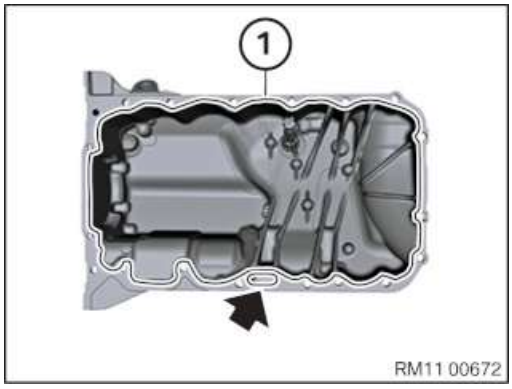
- Position the sealing compound (1) on special tool as shown.

  Parts: Sealing compound

Sealing compound

Loctite 5970 liquid sealing compound	50 ml, Cartridge	83190404517

Overview of consumables (Electronic Parts Catalogue)



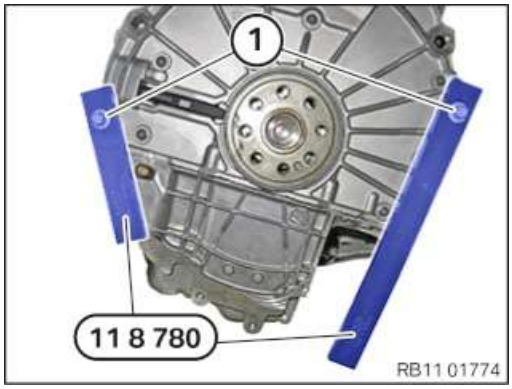
TECHNICAL INFORMATION

The maximum application time of the liquid sealing compound is 12 minutes.

- Apply the sealing compound along the line (1) with a thickness of 2 mm to 2.5 mm.

  Apply the sealing compound along the inner edge.
- Completely encircle the oil return orifice (arrow) with the sealing compound.

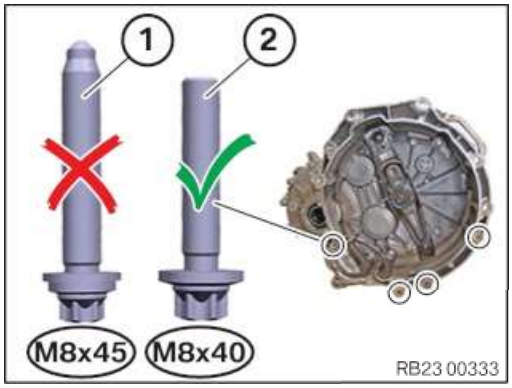
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TECHNICAL INFORMATION

The special tool 11 8 780 is only required when the transmission is removed.

- Position the special tool 0 496 120 (11 8 780) with the transmission bolts (1) so that the oil sump is exactly flush with engine block.
- If necessary, renew fitting sleeves.



RISK OF DAMAGE

Component damage caused by incorrect screw length.

The use of screws with the incorrect screw length can damage the component.

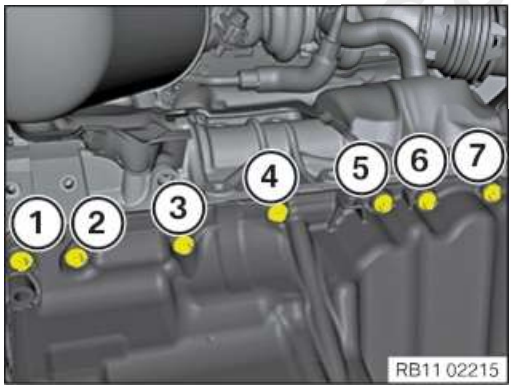
- Check for correct screw length.
- Re-install screws that correspond to the original screw length.

- Ensure that the **correct** screw (2) (M8x40) is used for mounting the oil sump on the transmission.

  The screw (1) (mounting bolt of the starter motor) may **never** be used for mounting the oil sump.



- Install oil sump (1) to top front.
- **Hand-tighten** all oil sump screws but do not tighten completely.

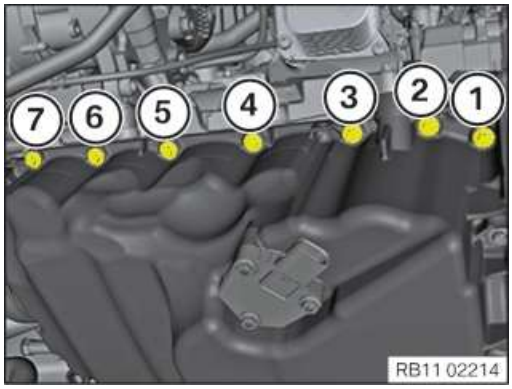


- Tighten the screws (1) to (7).

Oil sump to crankcase

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

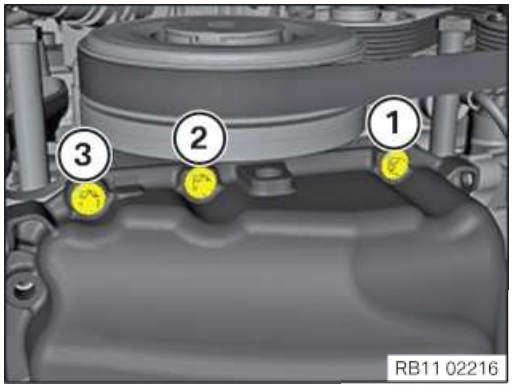
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- Tighten the screws (1) to (7).

Oil sump to crankcase

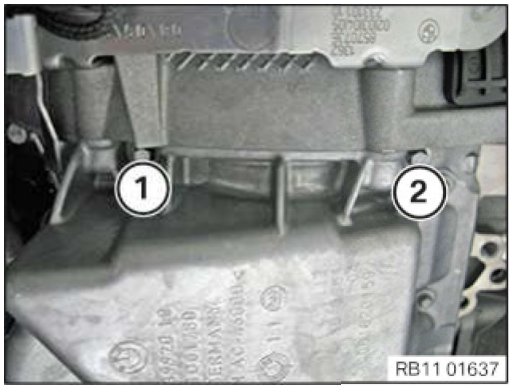
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten the screws (1), (2) and (3).

Oil sump to crankcase

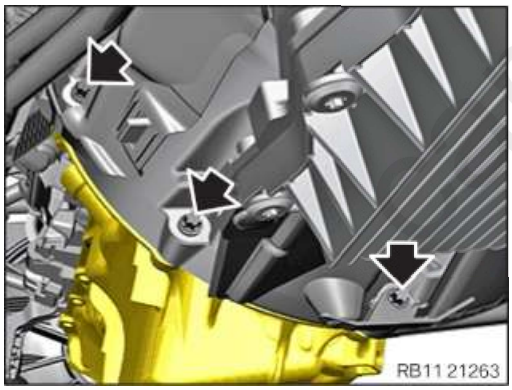
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten down screws (1) and (2).

Oil sump to crankcase

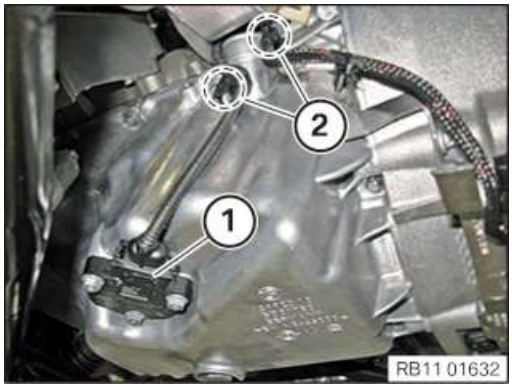
M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm



- Tighten transmission screws (1).

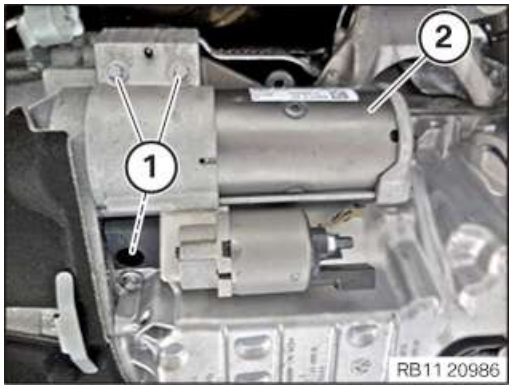
Transmission to oil sump (manual gearbox and automatic transmission)

M8 x 50		Tightening torque	19 Nm



- Fasten cable on the clips (2) from the oil sump.
- Connect and lock the connector (1).
- Make sure the connector 1 engages audibly.

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- Insert and install the starter motor (2).
- Tighten the screws (1).

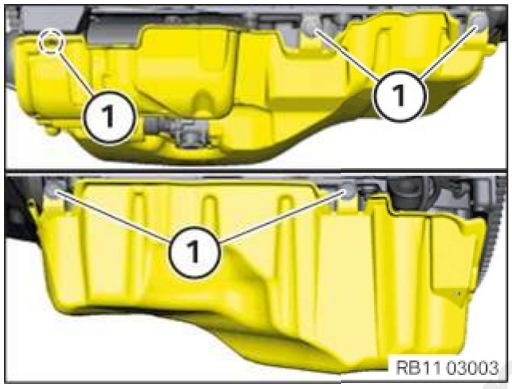
Starter motor to engine

M8X60		Tightening torque	19 Nm

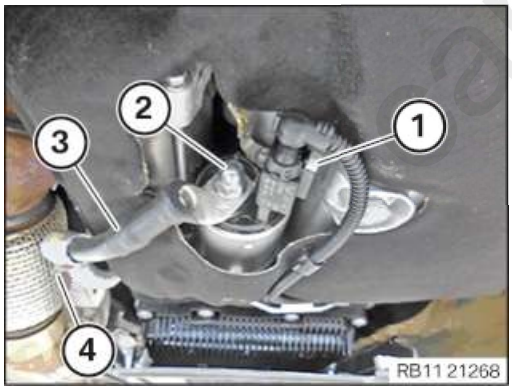
38 – Installing the acoustic cover for the oil sump



- Install acoustic cover (1) to the top front.

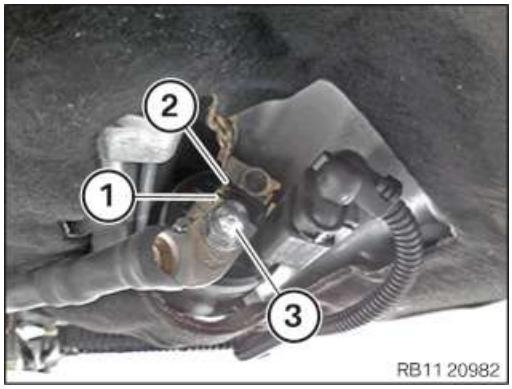


- Secure all expanding rivets (1).



- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.
- Insert and install the positive battery cable (3).
- Secure positive battery cable (3) at the clamp (4).
- Tighten the nut (2) hand-tight.

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CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

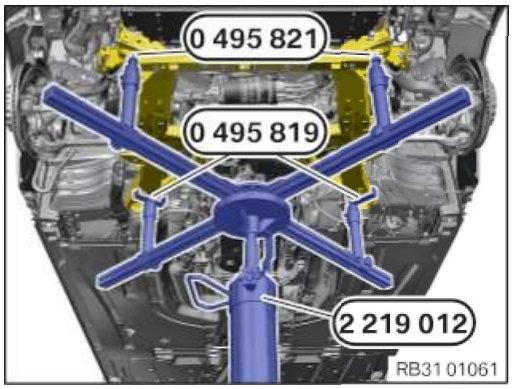
- Route the positive battery cable without abrasions and do not trap.

- Attach positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

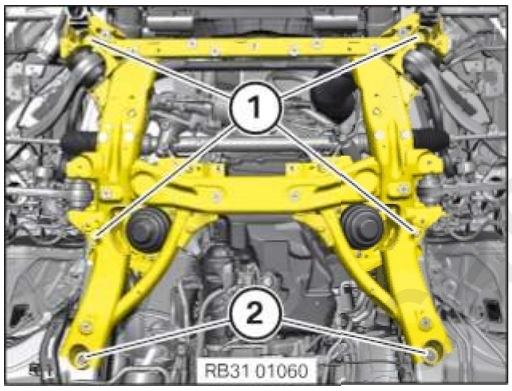
Battery positive lead to starter

M8		Tightening torque	13,5 Nm

39 – Lift front axle support and fasten.



- Carefully lift the front axle support with the universal jack 2 219 012 and position on the body.



- Replace the screws (1).

  Parts: Bolts
- Tighten the screws (1).

Front axle support to front/centre of body

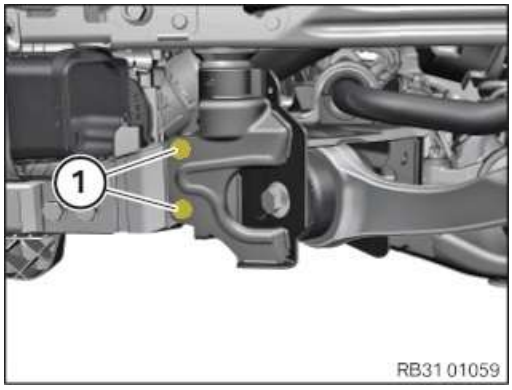
M12	Renew screws.	Jointing torque	108 Nm

- Replace the screws (2).

  Parts: Bolts
- Tighten the screws (2).

Front axle carrier to body, rear

M14	Renew screws.	Tightening torque	175 Nm

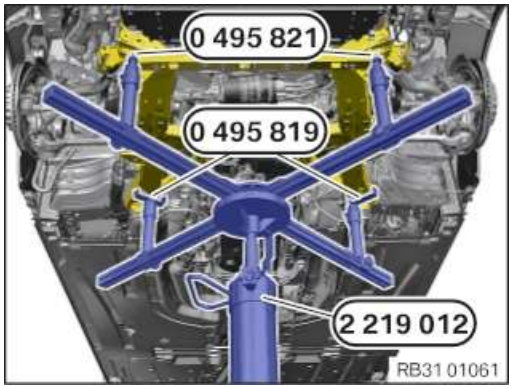


- Position the adapter for the front axle support on the front axle support .
- Tighten the screws (1).

Adapter, front axle support to front axle support

M8x70		Tightening torque	19 Nm

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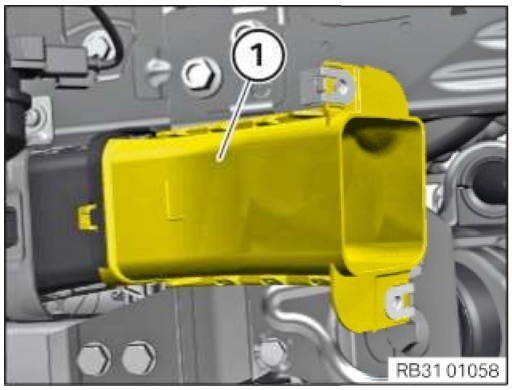
- Lower the universal jack 2 219 012 and place to one side.

40 – Partially installing the left and right brake air duct

NOTICE

Perform the operations on the left and right side.

▸ **Installing the brake air duct partially**



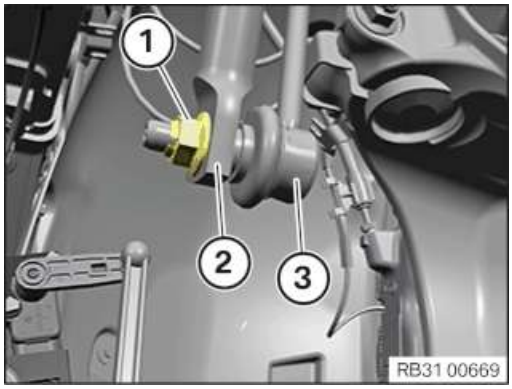
- Position and clip in air duct (1).

41 – Securing the anti-roll bar link to the left and right anti-roll bar

NOTICE

Perform the operations on the left and right side.

▸ **Securing the anti-roll bar link to the anti-roll bar**



- Position the anti-roll bar link (3) on the anti-roll bar (2).
- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

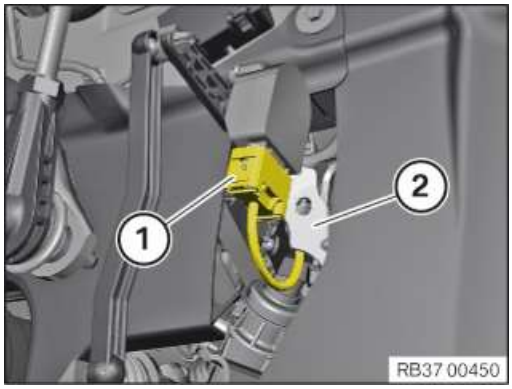
Note: Use the Torx socket for counter support.

Front anti-roll bar link to anti-roll bar/spring strut

M10	Renew nut.	Tightening torque	56 Nm

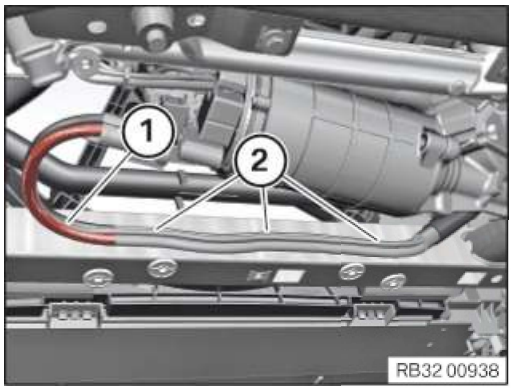
42 – Attach the line connection of the ride height sensor

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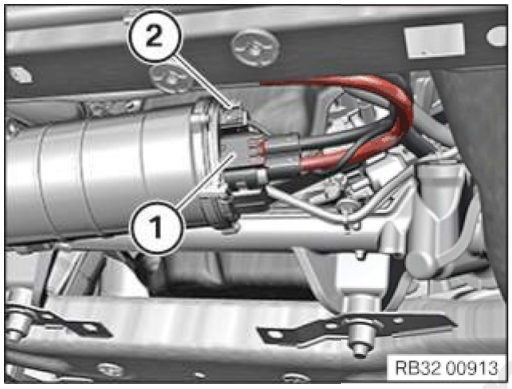


- Position the line .
- Clip in line on holder (2) .
- Connect connectors (1) and lock.

43 – Secure the wiring harness for the EPS on the front axle support



- Position the EPS wiring harness (1) from the front axle support.
- Secure the holder (2).

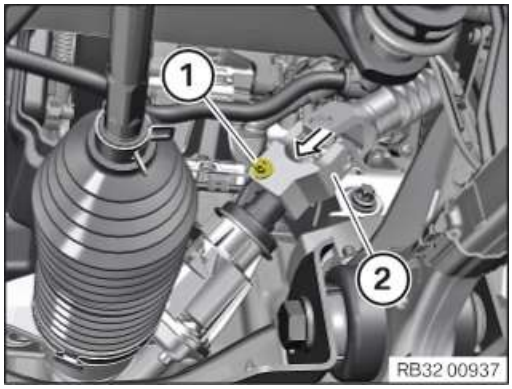


- Connect connectors (1) and (2) lock.

44 – Securing the steering shaft at the bottom on the steering gear

TECHNICAL INFORMATION

The universal joint can only be installed in one position.
The universal joint and the bottom steering gear and/or steering shaft are encoded with each other.
The clamping bolt must e positioned in the groove of the steering gear groove or the steering shaft.



- Clean the screw threads to remove all remnants of screw locking adhesive.
- Slide the lower steering shaft (2) onto the steering gear in the direction of the arrow.
- Renew the clamping bolt (1).

  Parts: Clamping bolt
- Tighten the clamping bolt (1).

Universal joint to steering box

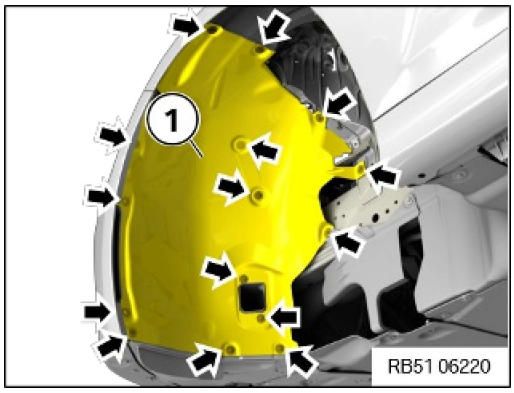
M8	Recut screw thread. Renew clamping bolt. No retorquing permitted!	Tightening torque	28 Nm

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45 – Install the front section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.



- Install the front section of the front wheel arch cover (1).
- Tighten screws (arrows).

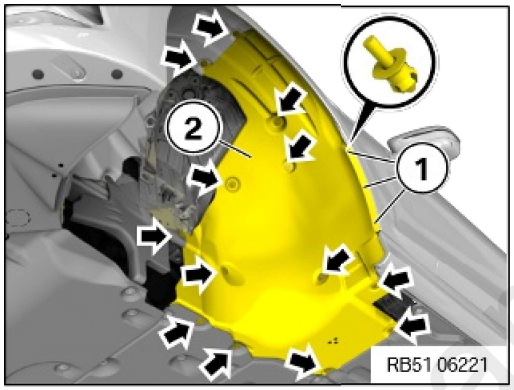
Wheel arch trim panel, front

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

46 – Install the rear section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.



- Install the rear section of the front wheel arch cover(2) .
- Tighten screws (arrows).

Wheel arch trim panel, front

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

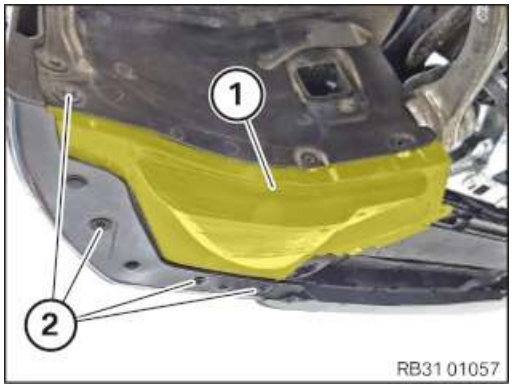
- Secure expanding rivet (1).

47 – Installing the bottom left and right wheel arch cover

NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Installing the bottom wheel arch cover**



- Position the bottom wheel arch cover (1).
- Tighten the screws (2).

Cover, front bottom on side

Hexagon screw for thermoplastic		Tightening torque	3 Nm

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▶ **Mounting the wheel**



TECHNICAL INFORMATION

The contact surface between the brake disc and the wheel rim must be clean and free from oil and grease. There is otherwise a risk of the wheel becoming loose at a later time.

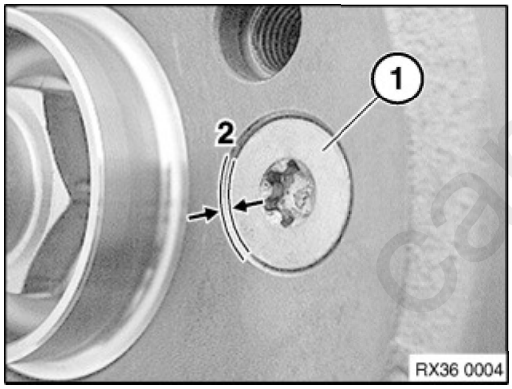
- Remove dirt, grease residues and corrosion from the contact surface with a drill and the special tool 2 344 011.

  Do not operate special tool 2 344 011 with an impact screwdriver.
- Degrease the contact surfaces with the universal cleaner (see BMW Group Parts).
- In the event of grease residue in the area of the wheel bolt holes, remove and clean the brake disc.



- Remove dirt, grease residues and corrosion from the contact surface with a drill and the special tool 2 344 011.

  Do not operate special tool 2 344 011 with an impact screwdriver.
- Degrease the contact surfaces with the universal cleaner (see BMW Group Parts).



- Check that the mounting bolt (1) for the brake disc is securely seated.

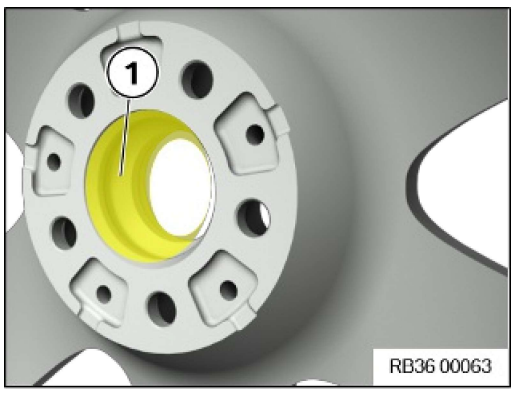
  The mounting bolt (1) for the brake disc may not protrude under any circumstances on the contact surface (2) between the brake disc and the wheel rim.

Brake disc to front wheel hub

M8	Renew screw.	Tightening torque	16 Nm

Brake disc to rear wheel hub

M8	Renew screw.	Tightening torque	16 Nm



- Thinly grease the wheel centring (1) in the wheel rim.

Expendable materials

Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233

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- Lightly grease the front and rear wheel hubs in this area (1) to protect from corrosion.

Expendable materials

Brake block paste * TU = Trade Unit. TU numbers cannot be ordered! For invoicing purposes only.	3 g, Bag	83192158851
	100 g, Tube	83192158852
	5 g, TU*	83230140233



- In vehicles with M Carbon ceramic brake: The wheel assembly jack must be used to install the wheel (see workshop equipment).

  This process is intended to prevent damage to the brake disc.

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TECHNICAL INFORMATION

Never use impact screwdrivers or electric screwdrivers to screw in and tighten the wheel bolts.

The wheel rim must rest uniformly against the brake disc.

In the case of non-original BMW wheel bolts/wheel rims, it may be necessary to retighten the wheel bolts on account of setting properties (refer to the documentation from the manufacturer).

Do not apply oil to new wheel bolts.

- Renew corroded wheel bolts.

  Parts: Wheel bolts
- Clean the wheel bolts.
- Check wheel bolts and threads for damage, renew the wheel bolts if necessary.
- Join and tighten the wheel bolts (arrows).

Wheel bolts

M14 / SW17	Screw in wheel bolts and evenly tighten crosswise by hand in order to centre the wheel rim. Tighten wheel bolts to the prescribed tightening torque with a calibrated torque wrench in a crosswise sequence. Check all the wheel bolts in the same order or retighten to the prescribed tightening torque again.	Tightening torque Check	140 Nm 140 Nm

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49 – Loosen the attachment of the engine in installation position



- Lower engine by turning the spindle 2 361 506 (00 6 103) until the engine lies completely on the engine supports.



TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Remove the engine bridge (1) with an auxiliary person.



- Tighten bolt (1) of the left engine mount from the bottom using a standard tool.

Engine mount to engine mounting bracket

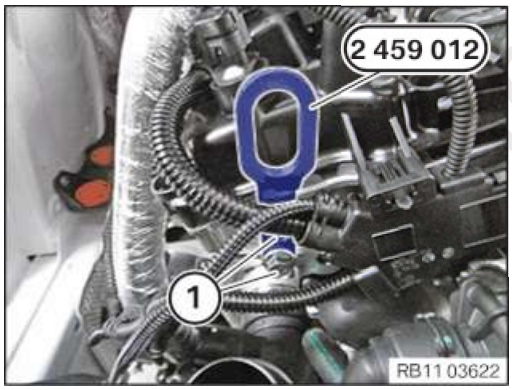
M12		Tightening torque	100 Nm



- Tighten bolt (1) of the right engine mount from the top using a standard tool.

Engine mount to engine mounting bracket

M12		Tightening torque	100 Nm



- Unscrew the bolts (1) of the special tool 2 459 012.
- Feed out the special tool 2 459 012 at the cylinder head and remove.

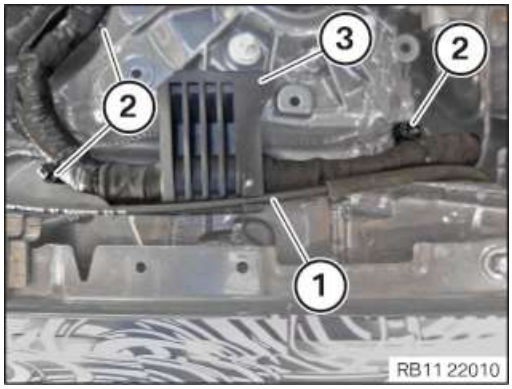
50 – Securing the wiring harness section to the left spring strut dome

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in and position wiring harness section (3) on the left spring strut dome.
- Secure clamps (2).
- Guide in and install cable (1) of the front flap.

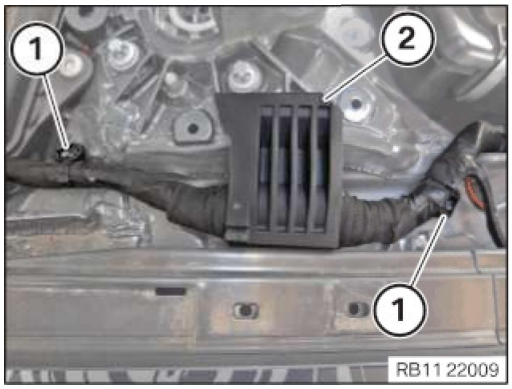
51 – Secure wiring harness section on right spring strut dome

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

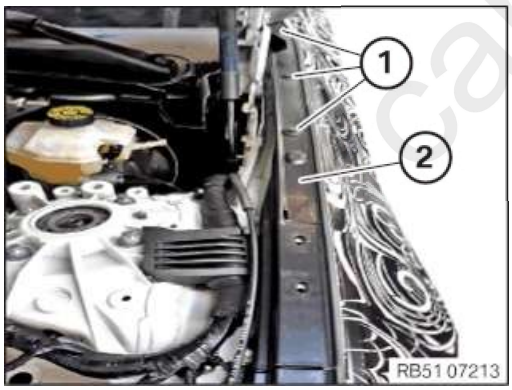
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in and position the wiring harness section (2) of right spring strut dome.
- Secure clamps (1).

52 – Installation of side panel sealing.



NOTICE

Description is for left component only. Procedure on the right side is identical.

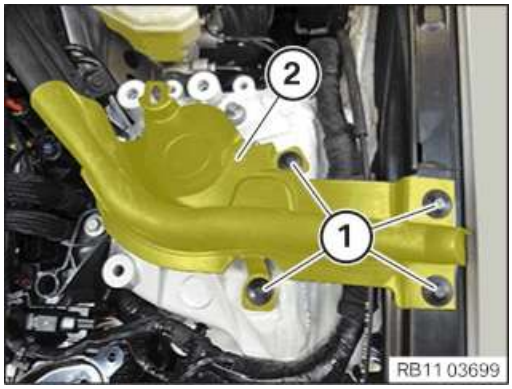
- Guide the sealing (2) in and install it.
- Mount the expanding rivets (1).

53 – Install side bonnet seals

NOTICE

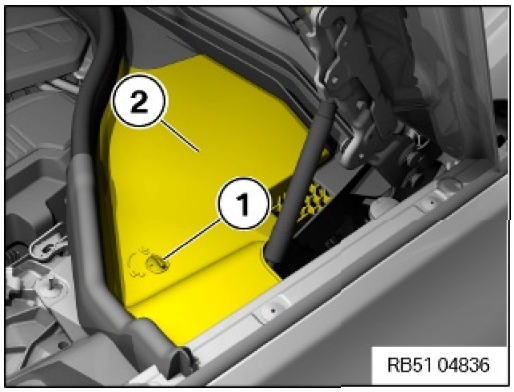
Perform the operations on the left and right side.

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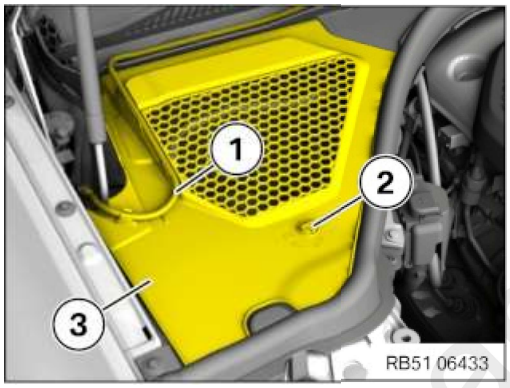
- Position the side bonnet seal (2) on the spring strut dome.
- Secure the rivet (1).

54 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

55 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

56 – Installing the clean air pipe with resonator



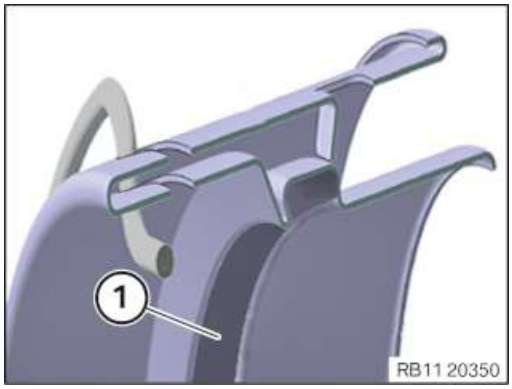
- Check the seal (1) for damages, replace if necessary.

▸ **Replace damaged gasket**

TECHNICAL INFORMATION

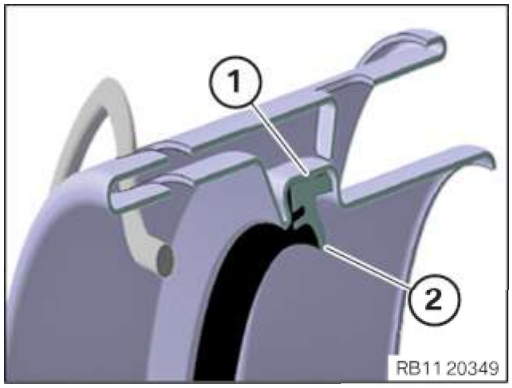
Do not use pointed or sharp-edged tools for the installation and/or removal.

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- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



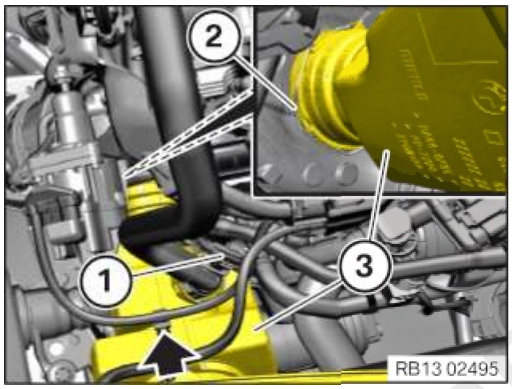
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

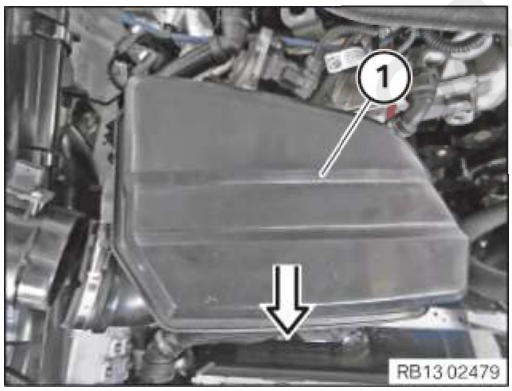
- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is pointing downwards (see figure).



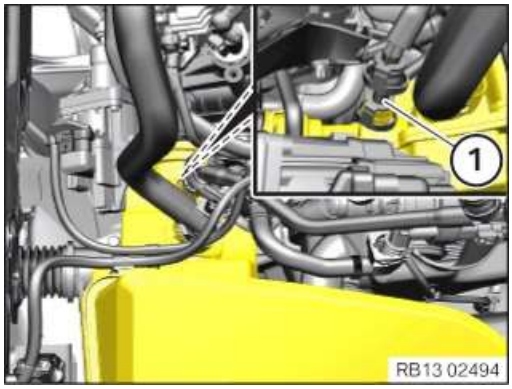
- Guide in and install the clean air pipe with resonator (3).
- Lock clamp (2).

  The clamp (2) must engage audibly.
- Connect connectors (1) and lock.

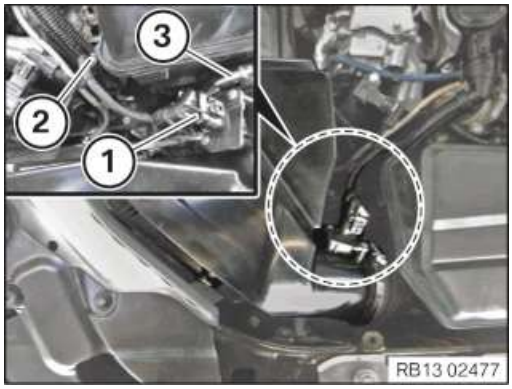
  The connector (1) must engage audibly.
- Secure clamp (arrow).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Connect and lock the tank ventilation line (1).



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure the clamp (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install the engine ventilation line (2).
- Ensure that the locks (1) engage audibly.

57 – Topping up the engine oil

RISK OF DAMAGE

Damage to the petrol particulate filter.

Vehicles equipped with a petrol particulate filter must be operated with low-ash engine oil only.

- Use BMW Longlife-04 , BMW Longlife-12 FE or BMW Longlife-17 FE+ engine oils or engine oils approved by BMW matching the same specifications only.
- For additional information see: Overview of approved engine oils for BMW Group engines.

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Drain the engine oil.

- Pour in engine oil.

Engine oil B48B20O1/B46B20O1

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Engine oil

Filling capacity, engine oil change with oil filter element	5,25 l
Engine oil: Technically suitable engine oils for BMW Group engines	

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58 – Disconnecting all battery earth leads



- See additional information.

59 – Check engine oil level

- Park vehicle on a horizontal surface.
- In the case of automatic transmission, shift to selector lever position N or P.
- Accelerator pedal is not pressed.
- Engine is running and is at operating temperature.
- Read off the engine oil level in the instrument cluster (KOMBI) or on the control display.
- Top up engine oil if necessary.

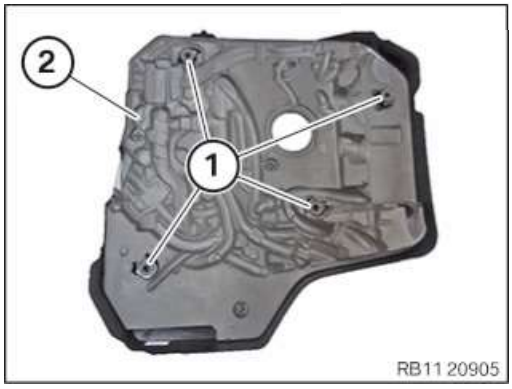
60 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check all rubber mounts (1) of acoustic cover (2) for correct seating.

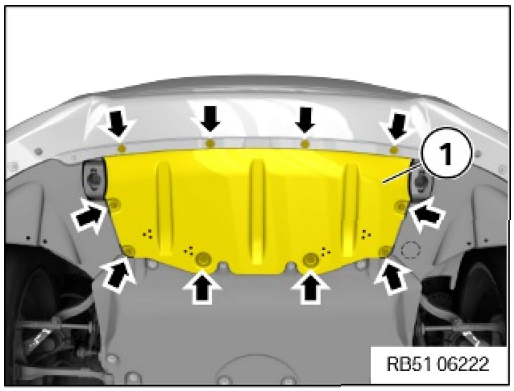
obdiagn.com



- Clip in the acoustic cover (1) into the holders in the **marked** areas.

  The acoustic cover (1) must audibly engage into place.

61 – Installing the front underbody protection



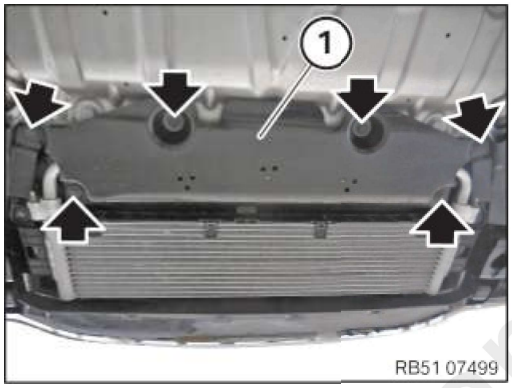
- **Version 1:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



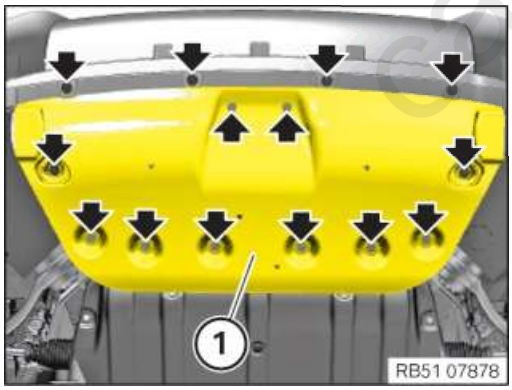
- **Version 2:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version 3:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

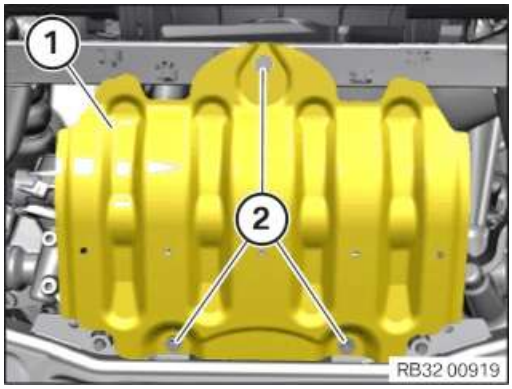
Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

62 – If installed: Installing the steering guard

Prerequisite

The front underbody protection is removed.

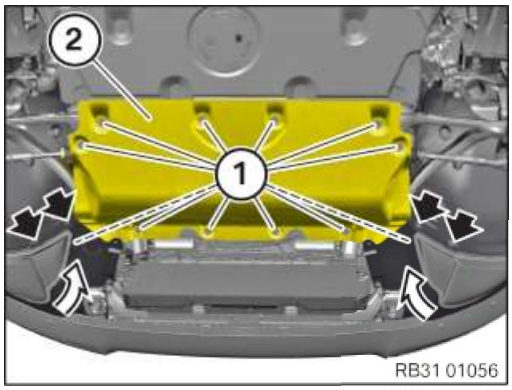


- Remove guard (1).
- Tighten the screws (2).

Bumper buffer device steering on front axle support

M10		Tightening torque	56 Nm

63 – Install the underbody protection of the steering gear



- **Version 1:**
- Position the underbody protection of the steering gear (2).
- Tighten the screws (1).

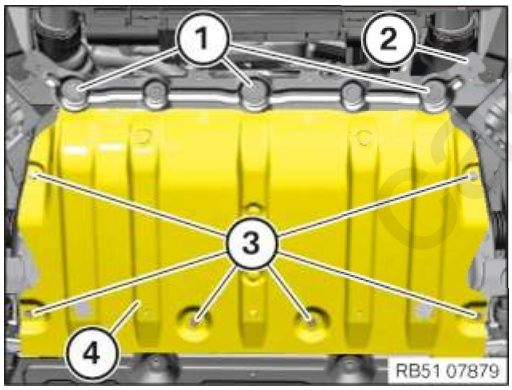
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.
- Tighten the screws (arrows) of the bottom wheel arch cover on the wheel arch cover.

Wheel arch cover (screws)

Thermoplastic hexagon screw		Tightening torque	3 Nm



- **Version 2:**
- Guide in the steering gear underbody protection (4) and install.
- Tighten the screws (3).

Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

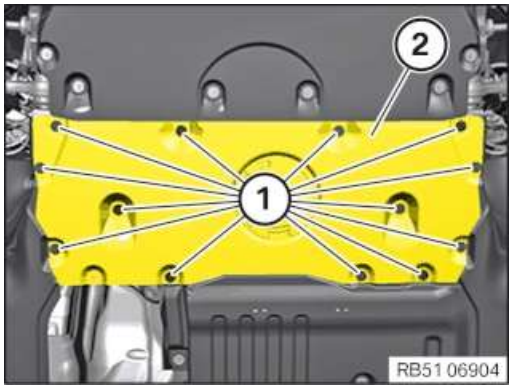
- Position holder of underride protection (2).
- Tighten the screws (1).

Holder underride guard to front axle support

M10		Tightening torque	56 Nm

64 – Installing the centre underbody protection

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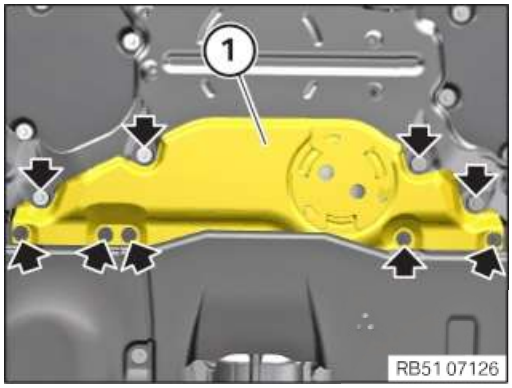
- **Version with rear-wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

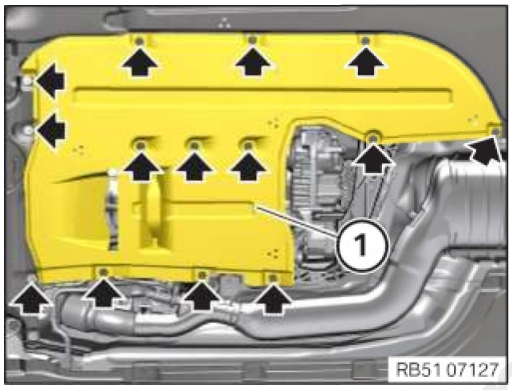
  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

65 – Installing underbody protection at rear



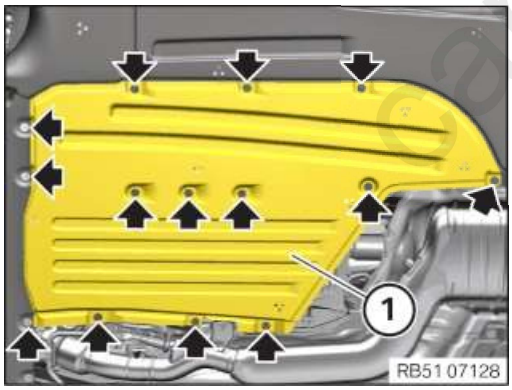
- **Version 1:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version 2:**

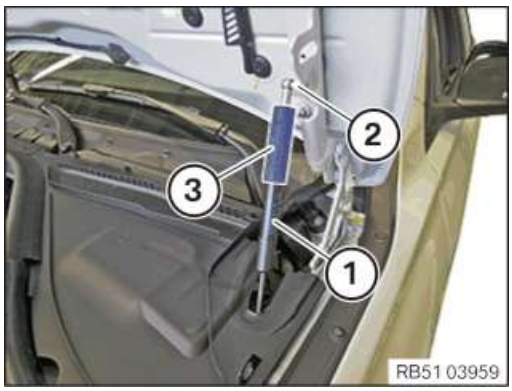
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

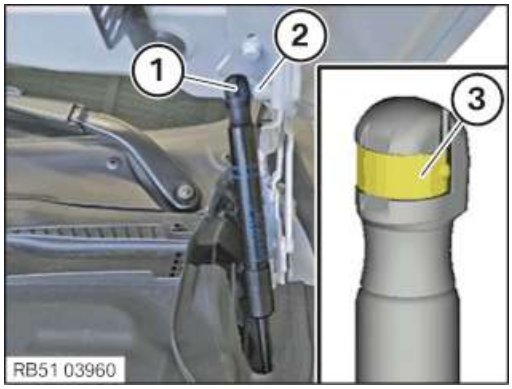
Hexagon screw		Tightening torque	3 Nm

66 – Take bonnet out of the service position



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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CAUTION

Shutting bonnet or tailgate.

Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.

- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

Additional Information

Overview of Tightening Torques

Special tool to cylinder head — Used in step 20

M8		Tightening torque	21,5 Nm

Oil drain plug — Used in step 29

M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Camshaft sprocket to oil vacuum pump — Used in step 34

M8	Important - left-hand thread Renew screw.	1. Jointing torque 2. Angle of rotation	5 Nm 90 °

Oil vacuum pump to crankcase — Used in step 35

M8	Renew screw.	1. Tightening torque 2. Angle of rotation	15 Nm 45 °

Oil sump to crankcase — Used in step 36

M8x30		Tightening torque	24 Nm
M8x110		Tightening torque	24 Nm

Transmission to oil sump (manual gearbox and automatic transmission) — Used in step 36

M8 x 50		Tightening torque	19 Nm

Starter motor to engine — Used in step 37

M8X60		Tightening torque	19 Nm

Battery positive lead to starter — Used in step 38

M8		Tightening torque	13,5 Nm

Front axle support to front/centre of body — Used in step 39

M12	Renew screws.	Jointing torque	108 Nm

Front axle carrier to body, rear — Used in step 39

M14	Renew screws.	Tightening torque	175 Nm

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Adapter, front axle support to front axle support — Used in step 39

M8x70		Tightening torque	19 Nm

Front anti-roll bar link to anti-roll bar/spring strut — Used in step 41

M10	Renew nut.	Tightening torque	56 Nm

Universal joint to steering box — Used in step 44

M8	Recut screw thread. Renew clamping bolt. No retorquing permitted!	Tightening torque	28 Nm

Wheel arch trim panel, front — Used in step 4546

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

Cover, front bottom on side — Used in step 47

Hexagon screw for thermoplastic		Tightening torque	3 Nm

Brake disc to front wheel hub — Used in step 48

M8	Renew screw.	Tightening torque	16 Nm

Brake disc to rear wheel hub — Used in step 48

M8	Renew screw.	Tightening torque	16 Nm

Wheel bolts — Used in step 48

M14 / SW17	Screw in wheel bolts and evenly tighten crosswise by hand in order to centre the wheel rim. Tighten wheel bolts to the prescribed tightening torque with a calibrated torque wrench in a crosswise sequence. Check all the wheel bolts in the same order or retighten to the prescribed tightening torque again.	Tightening torque Check	140 Nm 140 Nm

Engine mount to engine mounting bracket — Used in step 49

M12		Tightening torque	100 Nm

Clean air pipe to upper section of intake filter housing — Used in step 56

Clamp		Tightening torque	3 Nm

Underbody protection front — Used in step 61

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Bumper buffer device steering on front axle support — Used in step 62

M10		Tightening torque	56 Nm

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Underbody protection of the steering gear			Used in step 63
Hexagon screw for thermoplastic		Tightening torque	3 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Wheel arch cover (screws)			Used in step 63
Thermoplastic hexagon screw		Tightening torque	3 Nm

Holder underride guard to front axle support			Used in step 63
M10		Tightening torque	56 Nm

Underbody protection			Used in step 6465
Hexagon screw		Tightening torque	3 Nm

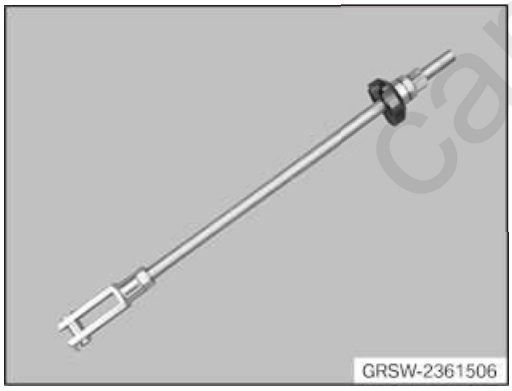
Overview of Special Tools

2 459 012 Holder



Common	Used in step 2049
Usage	For removing and installing the cylinder head. Contour-graphic silhouette foil is included in the delivery specification.
Included in the tool or work	
Storage location	A58
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

2 361 506 (00 6 103) Spindle



Common	Used in step 2049
Usage	Spindle (central spindle) for Traverse 00 6 100.
Included in the tool or work	0 496 852
Storage location	
Replaced by	
In connection with	
SI-Number	01 17 10 (659)

2 219 012 Hydraulic lifter



Common	Used in step 262739
Usage	For raising and lowering various vehicle components.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	01 05 90 (207)

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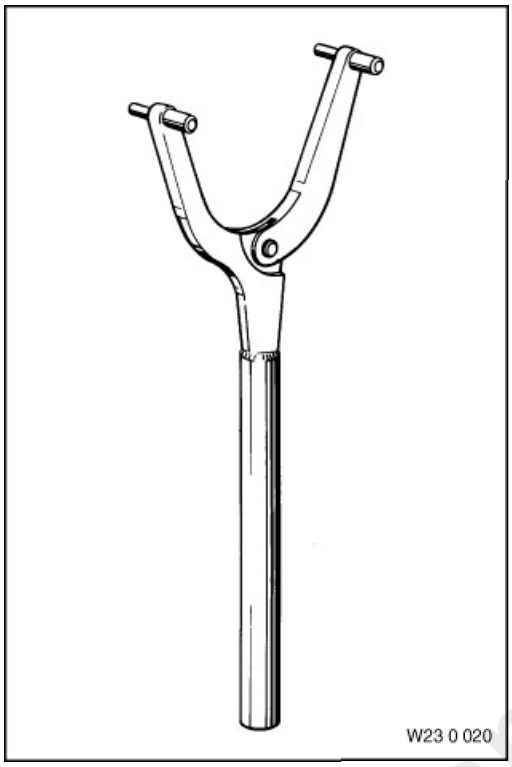
2 463 965 Socket wrench



Common Used in step 33

Usage	with T30, T40 and torx 45
Included in the tool or work	
Storage location	B6
Replaced by	
In connection with	
SI-Number	01 07 17 (487)

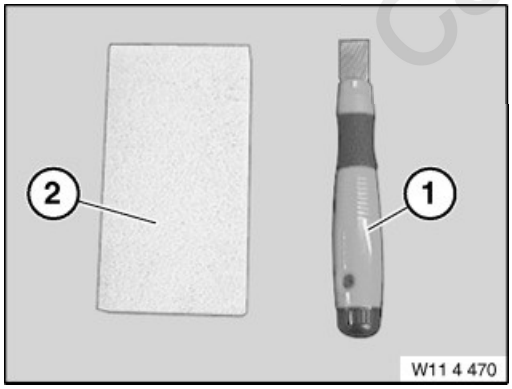
0 491 440 (23 0 020) Holder



Common Used in step 34

Usage	(counter support) For all three- and four-hole flanges when releasing and tightening down
Included in the tool or work	
Storage location	B4
Replaced by	
In connection with	
SI-Number	

0 495 102 (11 4 470) Tool



Common Used in step 36

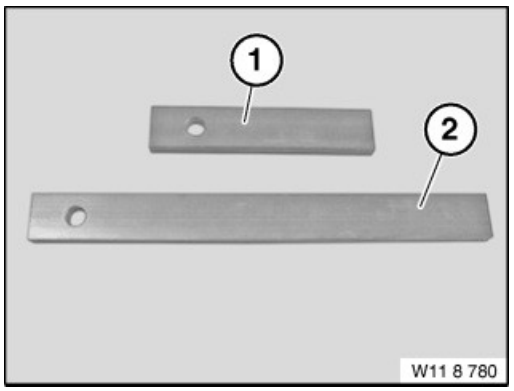
Usage	(cleaning kit) For cleaning sealing surfaces on *magnesium crankcase/cy*linder head.
Included in the tool or work	
Storage location	C52
Replaced by	
In connection with	
SI-Number	01 17 04 (130)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 495 103 (11 4 471)		**Scraper**	
2	0 495 104 (11 4 472)		**Extractor** (grindstone)	

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0 496 120 (11 8 780) Plate



Common Used in step 36

Usage	(Mounting plates) For securing transmission oil sump when gearbox is removed.
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 05 07 (353)

Consisting of

Pos	BMW Order number	Replaced by	Designation	In Connection with
1	0 496 121 (11 8 781)		**Plate** (Mounting plate, short)Discontinued; only available via set 11 8 780 = 0496120.	
2	0 496 122 (11 8 782)		**Plate** (Mounting plate, long) Discontinued; only available via set 11 8 780 = 0496120.	

2 344 011 Tool

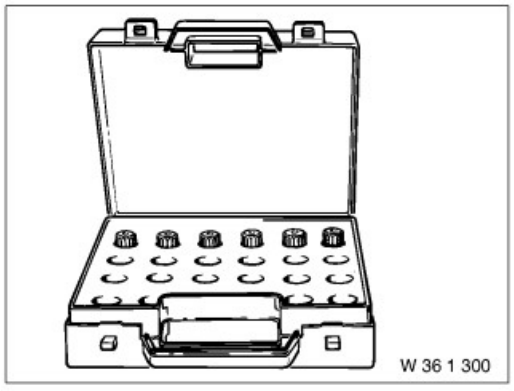


Common Used in step 48

Usage	Tool (wheel hub grinder) for cleaning the connection of the wheel rim (wheel contact face) to the wheel hub.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	08 08 12 (872)

Replacement tools:

0 495 221 (36 1 323) Wheel stud



Common Used in step 11

Usage	(Code 30) Code 39 available separately, (see EPC) under 36 13 1 181 259
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

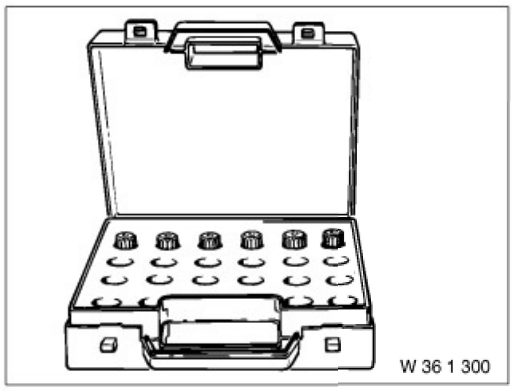
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0 495 224 (36 1 326) Wheel stud



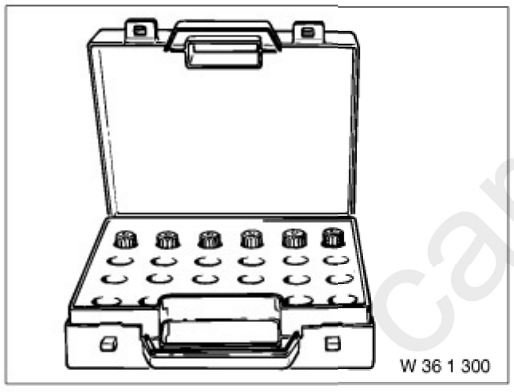
Common	Used in step 11
Usage	(Code 33) With centring bore available separately, (see EPC) under 36 13 6 765 546
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 225 (36 1 327) Wheel stud



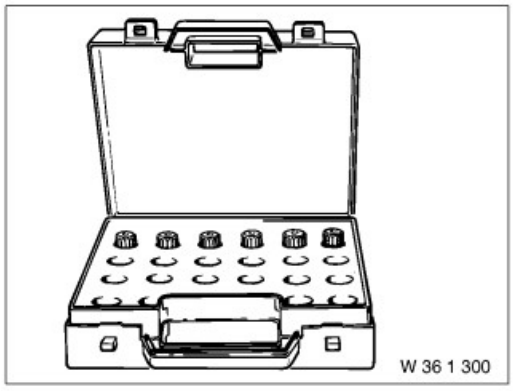
Common	Used in step 11
Usage	(Code 34) With centring bore available separately (see EPC) under 36 13 6 765 547
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 226 (36 1 328) Wheel stud



Common	Used in step 11
Usage	(Code 35) With centring bore available separately, (see EPC) under 36 13 6 762 340
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 227 (36 1 329) Wheel stud



Common	Used in step 11
Usage	(Code 36) With centring bore available separately (see EPC) under 36 13 6 762 341
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

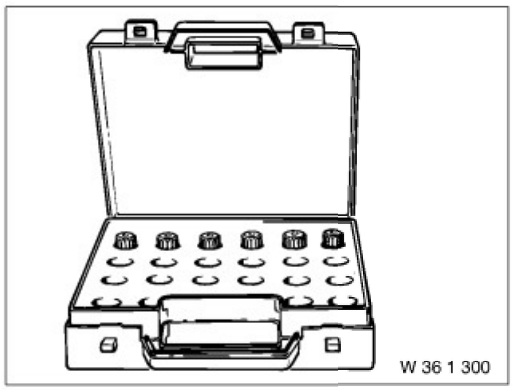
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0 495 228 (36 1 331) Wheel stud



Common	Used in step 11
Usage	(Code 37) With centring bore available separately (see EPC) under 36 13 6 762 342
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 229 (36 1 332) Wheel stud



Common	Used in step 11
Usage	(Code 38) With centring bore available separately (see EPC) under 36 13 6 762 343
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

0 495 230 (36 1 333) Wheel stud



Common	Used in step 11
Usage	(Code 40) With centring bore available separately (see EPC) under 36 13 6 762 344
Included in the tool or work	0 492 518
Storage location	
Replaced by	
In connection with	
SI-Number	

Overview Technical Data

Engine oil B48B20O1/B46B20O1	Used in step 57
Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Engine oil	Used in step 57
Filling capacity, engine oil change with oil filter element	5,25 l

Engine oil: Technically suitable engine oils for BMW Group engines

Links

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General repair instructions	Used in step
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Repair instructions	Used in step
61 20 900 Disconnecting and connecting battery earth lead	158
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61 20 900 Disconnecting and connecting battery earth lead	158
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11 78 610 Replace the lambda oxygen monitoring sensor

WARNING

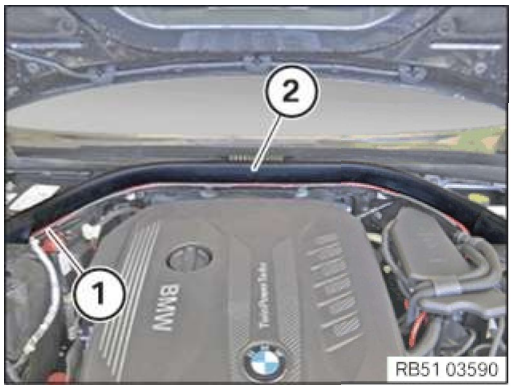
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

PRELIMINARY WORK

1 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

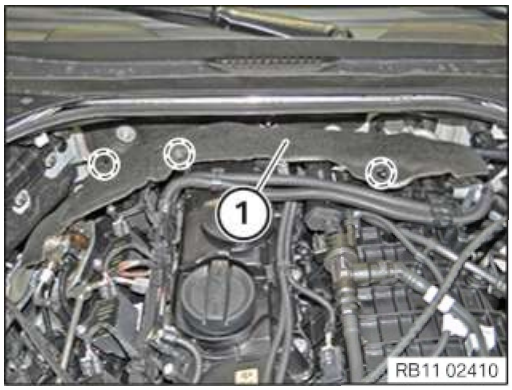
- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

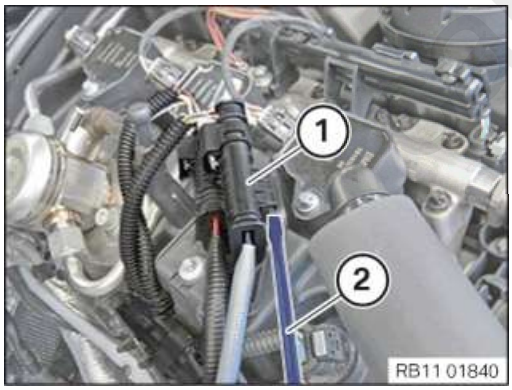
4 – Remove the control sensor

WARNING

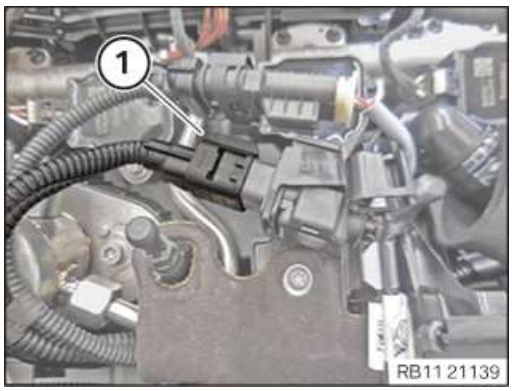
Hot surfaces.

Risk of burning!

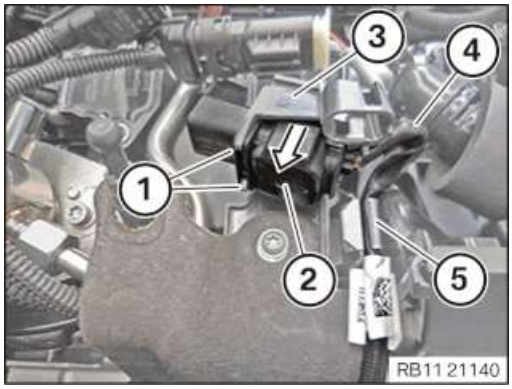
- Perform all work only on components that have cooled down.



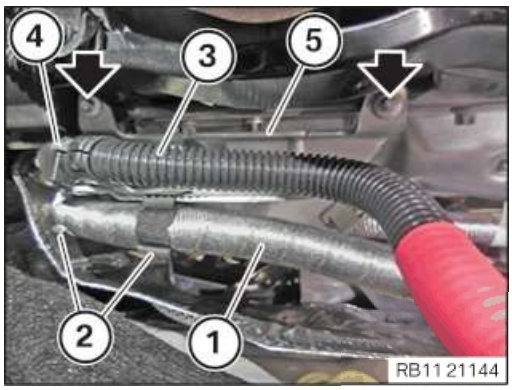
- Unlock connector (1) with screwdriver (2) and remove from the carrier plate.
- Unlock and loosen connector (1).



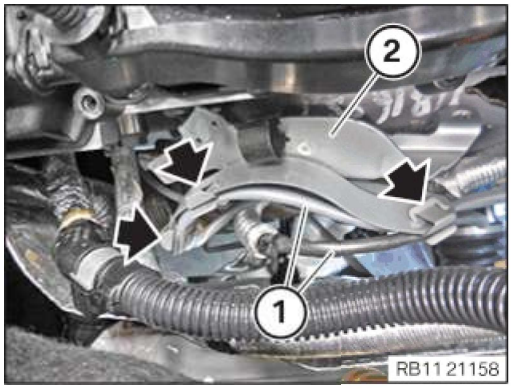
- Unlock and loosen connector (1).



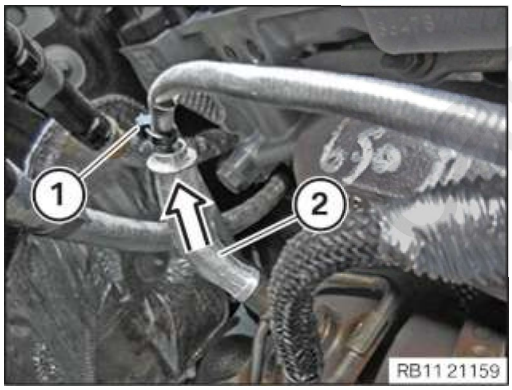
- Unlock the locks (1).
- Guide the connector (2) out of the bracket (3)in the **direction of the arrow** and set it aside.
- Release the cable (4) from the clamp (5).



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.

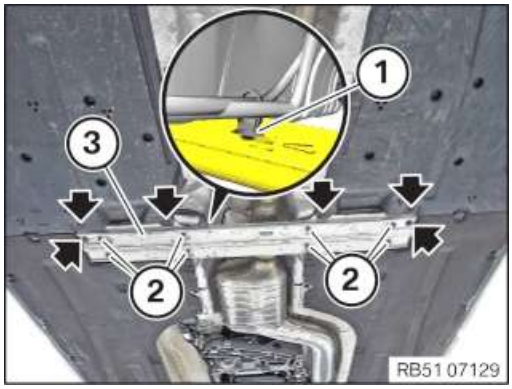


- Unfasten cable strap (1).
- Feed out the heat shield (2) **in direction of arrow** and set it aside.



- Release and remove the control sensor (1) with the special tool 0 491 074 (11 7 020).

5 – Remove the connecting support from the tunnel



- Remove screws (arrows).
- **If installed:** Loosen clamp (1).
- Loosen screws (2).
- Guide out and remove connecting support (3) on the tunnel.

6 – Remove complete exhaust system

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

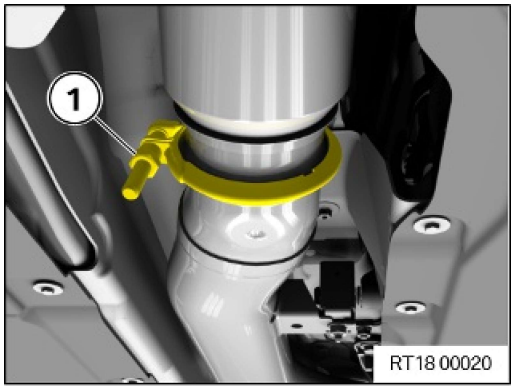
- Remove and install heavy components with the aid of another person/other persons.



- **Equipment specification 1 (ribbon clamp)**

  Detach the ribbon clamp (1).

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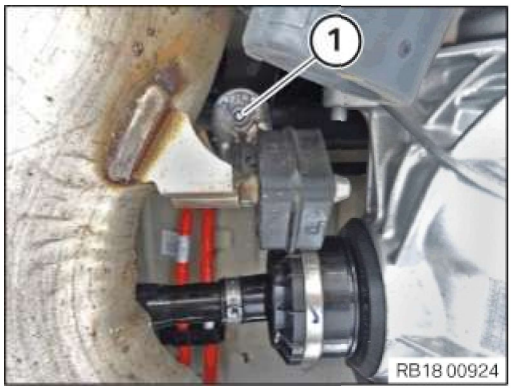


- **Equipment specification 2 (V-clips)**

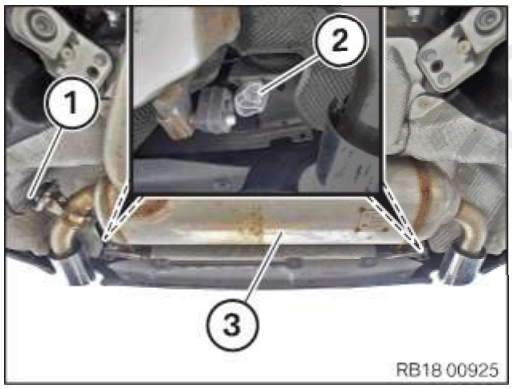
  Unfasten clamp (1).



- Loosen nut (1).

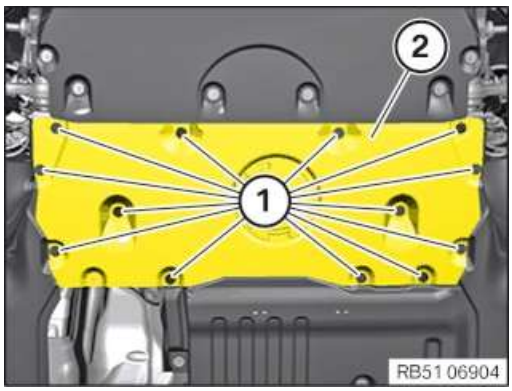


- Release nut (1) on the rear axle support.



- Unlock plug connection (1) and disconnect.
- Loosen nuts (2).
- Lower and remove the exhaust system (3) with the assistance of a second person.

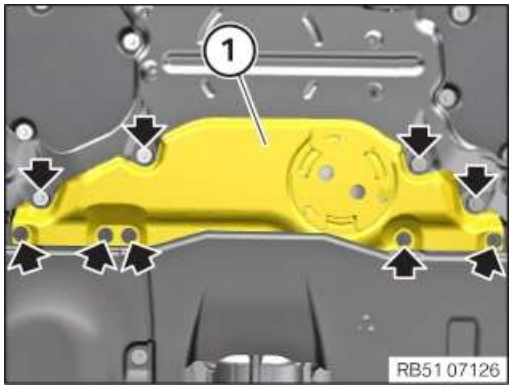
7 – Removing the centre underbody protection



- **Version with rear-wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

8 – Remove catalytic converter

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

CAUTION

Heavy component.

Heavy components can lead to injury or damage.

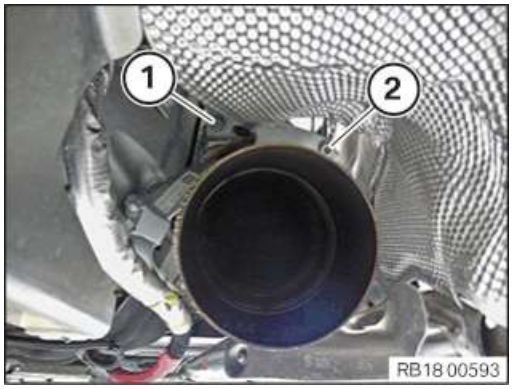
- Remove and install heavy components with the aid of another person/other persons.

CAUTION

Component with heavy weight.

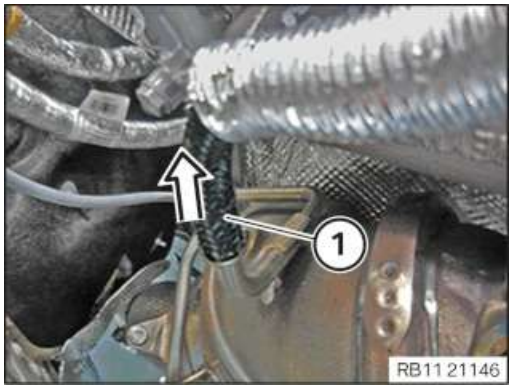
Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

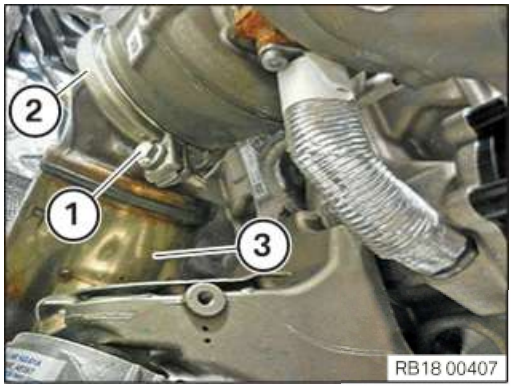


- Loosen screw (1).
- Loosen nut (2).

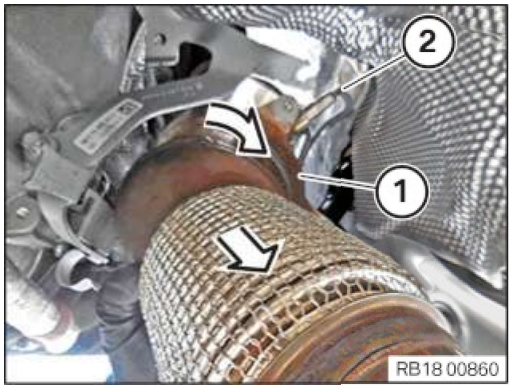
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- Pull off pressure hose (1) in direction of arrow and set it aside.



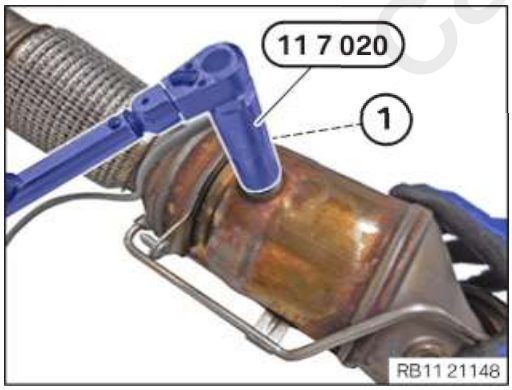
- Loosen screw (1).
- Feed out V-clip (2) on catalytic converter (3) and remove.



- Guide out catalytic converter (1) in direction of arrow and remove.
- Ensure that monitoring oxygen sensor (2) is **not** damaged.

MAIN WORK

9 – Remove the monitoring sensor



- Release the monitoring oxygen sensor (1) using special tool 0 491 074 (11 7 020).

Note: Remove the monitoring oxygen sensor with an auxiliary person.

- Remove the monitoring oxygen sensor (1).

10 – Install the monitoring sensor

▸ **Preparing oxygen sensor**

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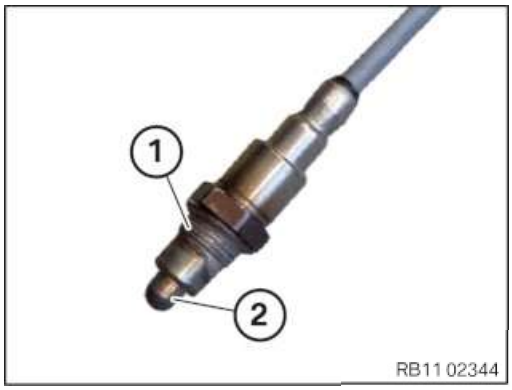
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



TECHNICAL INFORMATION

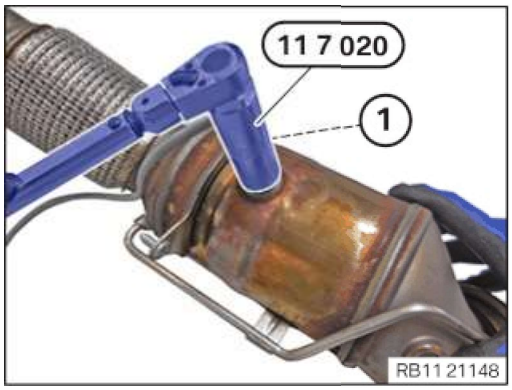
For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

  (2) = Sensor ceramics



- Feed in the monitoring oxygen sensor (1) and install.
- Tighten the monitoring oxygen sensor (1) with special tool 0 491 074 (11 7 020).

Monitoring sensor

M18x1.5			50 Nm

POSTPROCESSES

11 – Install catalytic converter



- Renew the V-clip (1).

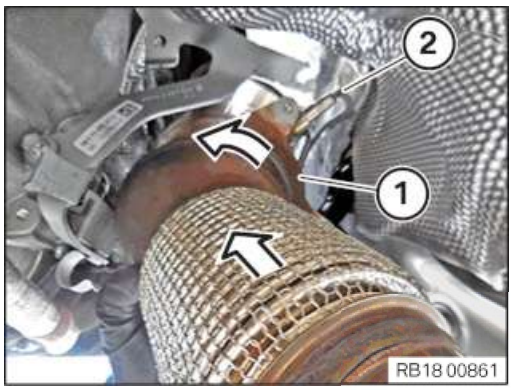
  Parts: V-band clamp

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- Renew the gasket (1).

  Parts: Gasket



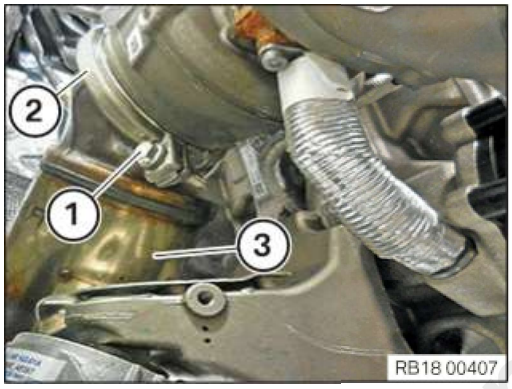
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

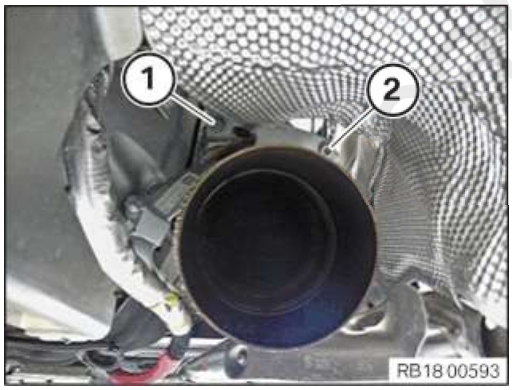
- Remove and install heavy components with the aid of another person/other persons.

- Guide in and install the catalytic converter (1) in the direction of arrow.
- Make sure that the monitoring oxygen sensor (2) **is not damaged.**



- Renew the V-clip (2).

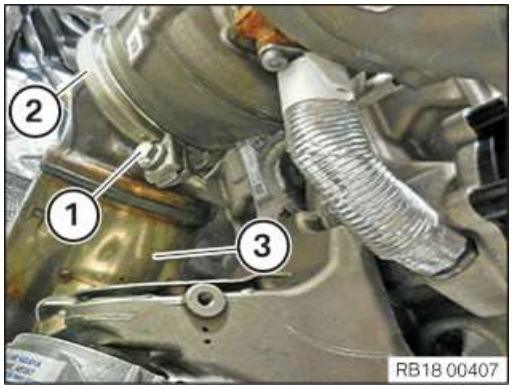
  Parts: V-band clamp
- Feed in and install V-clip (2) on the catalytic converter (3).
- Position the bolt (1).



- Renew the screw (1).

  Parts: Screw
- Position the bolt (1).
- Renew nut (2).

  Parts: Nut
- Position the nut (2).



- Position the catalytic converter (3).
- Position V-clip (2).

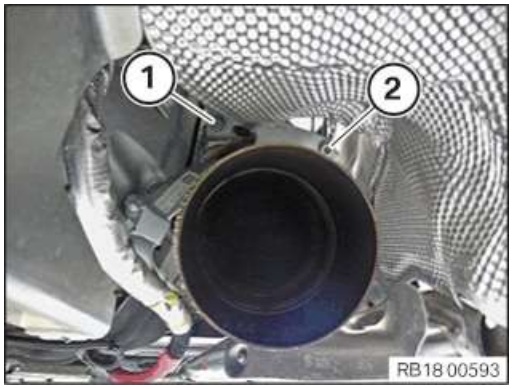
Note: Ensure correct mounting orientation of the V-clip.

- Tighten down screw (1).

Catalytic converter / petrol particulate filter to exhaust turbocharger

V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

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- Tighten down screw (1).

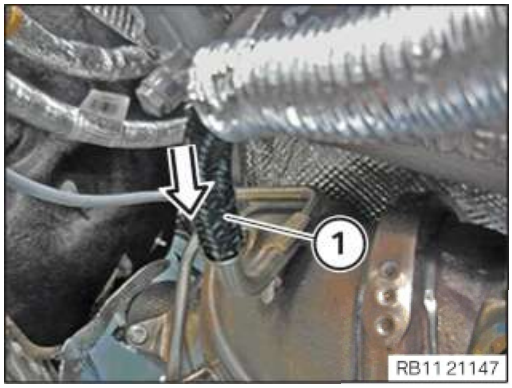
Catalytic converter to holder

M8	Renew screw.	Tightening torque	19 Nm

- Tighten nut (2).

Catalytic converter to holder

M8	Renew nut.	Tightening torque	19 Nm



- Check the pressure hose (1) for damage and renew hardened pressure hose (1) if necessary.
- Connect the pressure hose (1) in direction of arrow to the limit position.

12 – Installing the complete exhaust system

CAUTION

Component with heavy weight.

Danger of injury!

- Note component's centre of gravity.
- Support component using a jack.
- Secure component against falling off the jack.

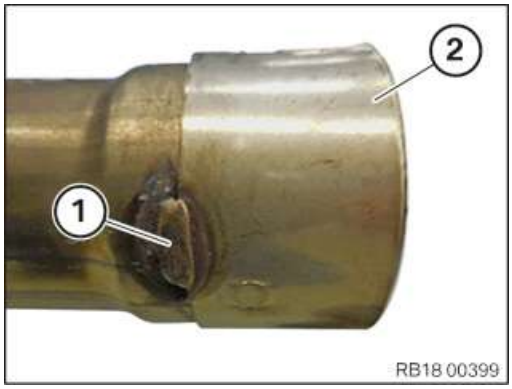
CAUTION

Heavy component.

Heavy components can lead to injury or damage.

- Remove and install heavy components with the aid of another person/other persons.

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CAUTION

Swarf resulting from sawing or grinding components.

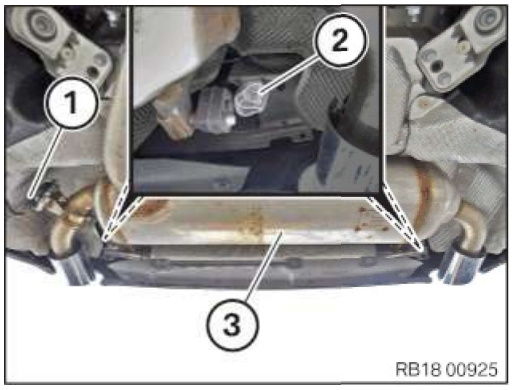
Danger of injury!

- Conduct all work in appropriate personal protective equipment only.
- Wear safety goggles and protective gloves.

- **Equipment specification 1 (ribbon clamp)**

  Open the weld seam (1) with a conventional tool.
- Remove ribbon clamp (2).
- Renew the (2) ribbon clamp.

  Parts: Ribbon cable clamp



- Feed in and install the exhaust system (3) with a second person.
- Renew nuts (2).

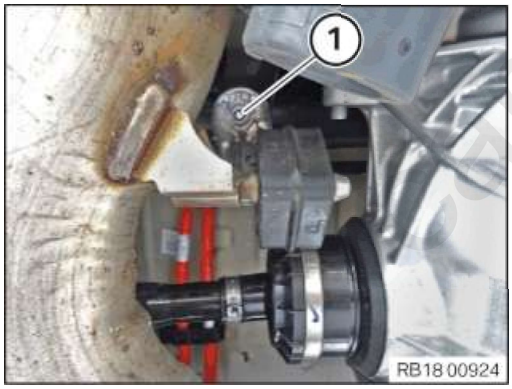
  Parts: Nuts
- Tighten nuts (2).

Rear silencer to body / bumper support

M8	Replace nuts.	Tightening torque	19 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Renew nut (1).

  Parts: Nut
- Tighten the bolt (1) on the rear axle support.

Exhaust system to rear axle carrier

Nut M8	Renew nut.	Tightening torque	19 Nm



- Renew nut (1).

  Parts: Nut
- Tighten nut (1).

Front silencer / petrol particulate filter on transmission bracket

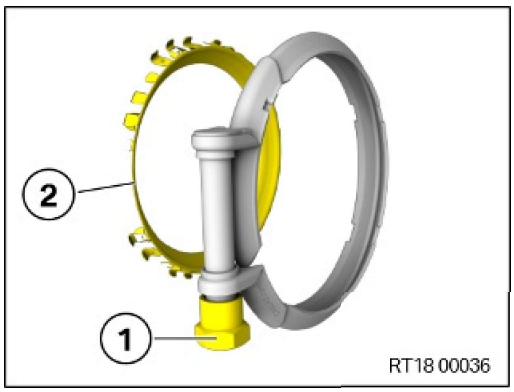
M8	Renew nut.	Tightening torque	19 Nm



- Tighten the ribbon clamp (1).

Exhaust system to catalytic converter

Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

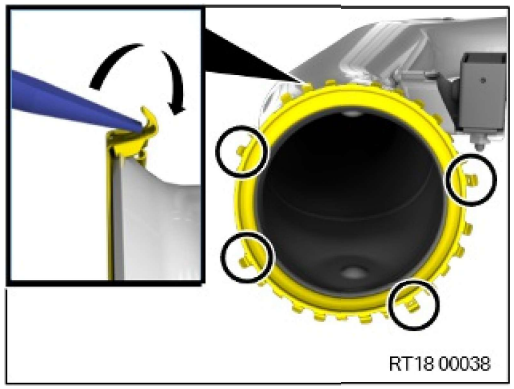


- **Equipment specification 2 (V-clips)**

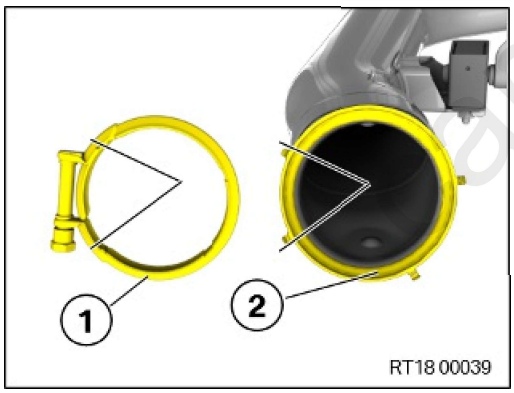
  Renew V-band clamp.

  Parts: V-band clamp

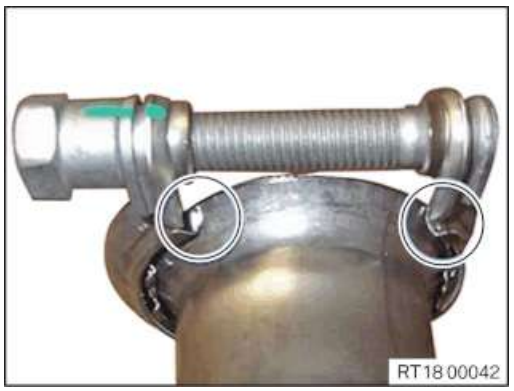
  Unscrew the nut (1) and remove the sealing ring (2).



- Bend all sheet metal tabs over with a suitable tool, except those in the marked areas.

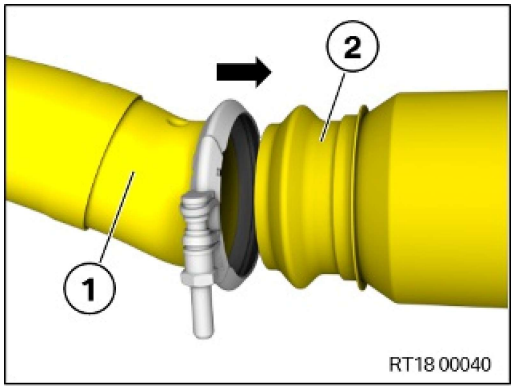


- Mount the V-clip (1) on the sealing ring (2).
- Make sure that the V-clip (1) is positioned correctly on the sealing ring (2).

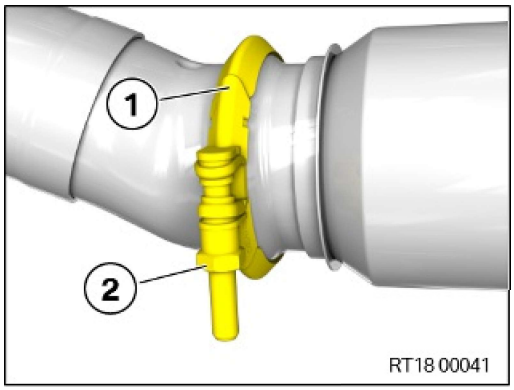


- Ensure that the V-clip rests against the sheet metal tabs in the marked areas after mounting.

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- Connect the exhaust system (1) with the catalytic converter (2) and position it correctly (arrow).

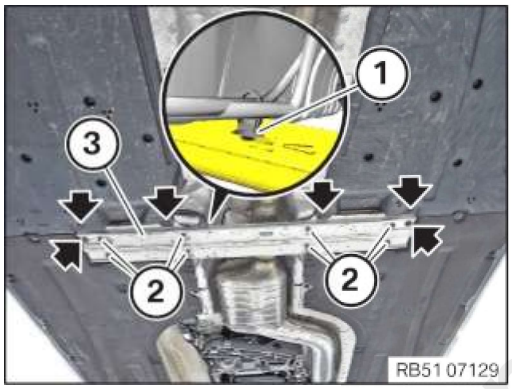


- Make sure that V-clip (1) is fitted correctly.
- Tighten down screw (2).

V-clip to catalytic converter

V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

13 – Install the connecting supports on the tunnel



- Guide in and install connecting support (3) on the tunnel.
- Tighten the screws (2).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

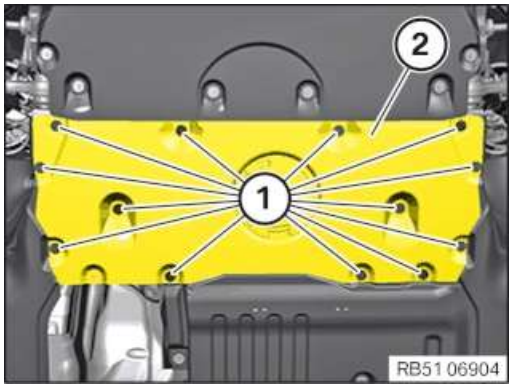
- Tighten screws (arrows).

Connecting support to tunnel

M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

- **If installed:** Secure clamps (1).

14 – Installing the centre underbody protection



- **Version with rear-wheel drive:**

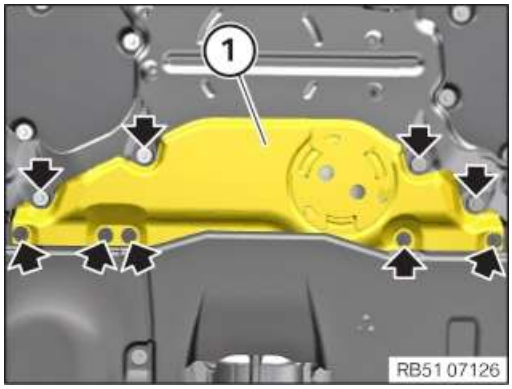
  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

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- **Version with all-wheel drive:**

  Guide in and install the centre of underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

15 – Install the control sensor

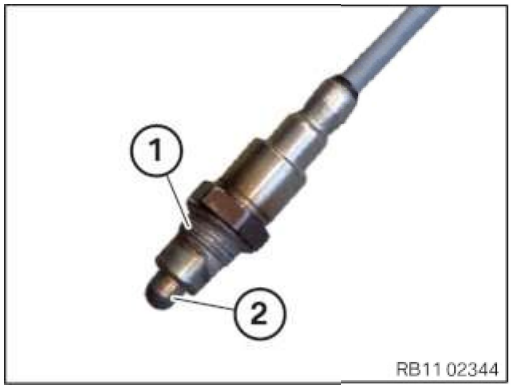
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

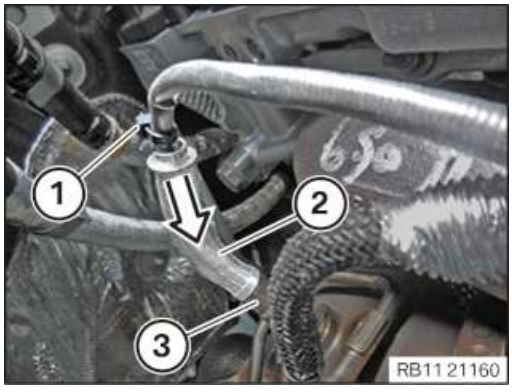
  (2) = Sensor ceramics



- Screw the control sensor (1) in and tighten it with the special tool 0 491 074 (11 7 020).

Control sensor

M18x1.5		Tightening torque	50 Nm

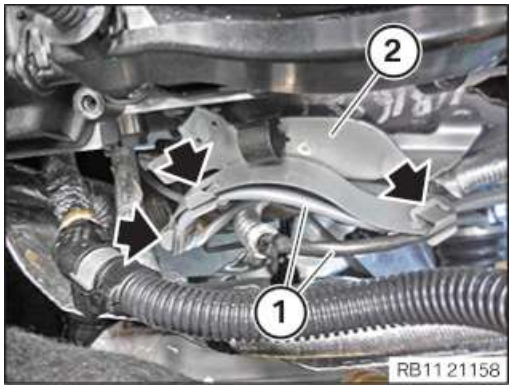


- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

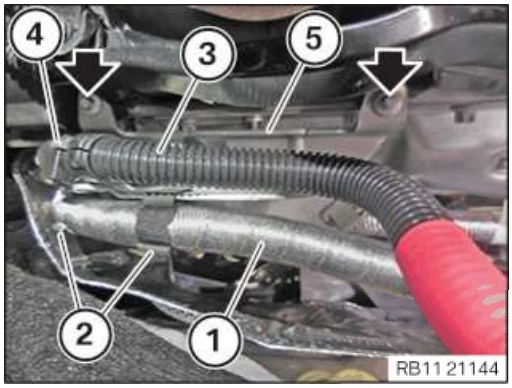
  Parts: Cable strap

- Guide in and install the cable strap (1).

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- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

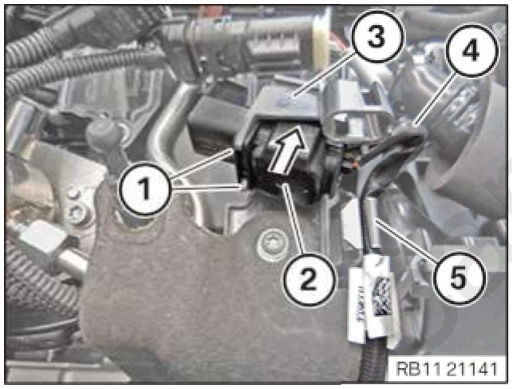
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

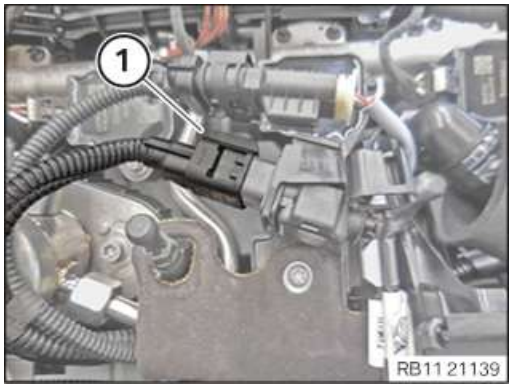
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).



- Guide in the connector (2) in the direction of arrow at the carrier plate (3) and install.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).

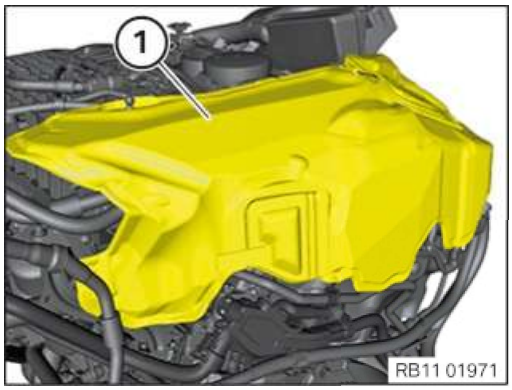


- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.

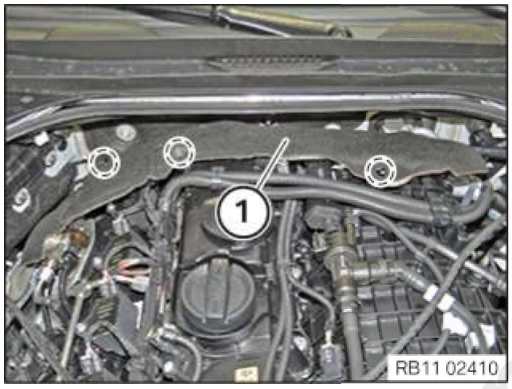


- Connect and lock the connector (1).
- Guide the connector (1) into the carrier plate in the direction of arrow.
- Ensure the connector (1) audibly engages with the carrier plate.

16 – Installing acoustic cover at rear



- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

17 – Install acoustic cover

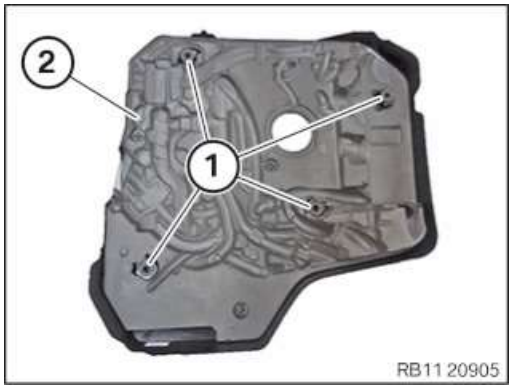
RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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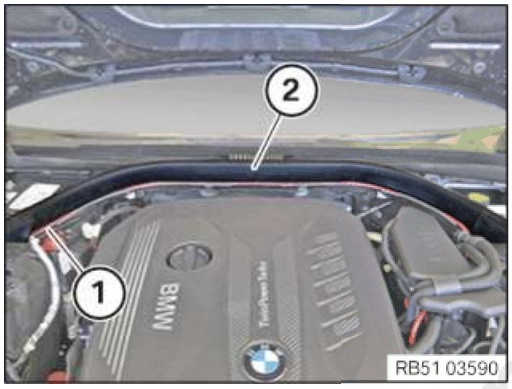


- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.
  The acoustic cover (1) must audibly engage into place.

18 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

Additional Information

Overview of Tightening Torques

Monitoring sensor			Used in step 10
M18x1.5			50 Nm

Catalytic converter / petrol particulate filter to exhaust turbocharger			Used in step 11
V-band clamp	Renew V-band clamp.	Tightening torque	13 Nm

Catalytic converter to holder			Used in step 11
M8	Renew screw.	Tightening torque	19 Nm

Catalytic converter to holder			Used in step 11
M8	Renew nut.	Tightening torque	19 Nm

Rear silencer to body / bumper support			Used in step 12
M8	Replace nuts.	Tightening torque	19 Nm

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Exhaust system to rear axle carrier			Used in step 12
Nut M8	Renew nut.	Tightening torque	19 Nm

Front silencer / petrol particulate filter on transmission bracket			Used in step 12
M8	Renew nut.	Tightening torque	19 Nm

Exhaust system to catalytic converter			Used in step 12
Ribbon cable clamp	Renew flat band clip.	Tightening torque	26 Nm

V-clip to catalytic converter			Used in step 12
V-band clamp	Renew V-band clamp.	Tightening torque	22 Nm

Connecting support to tunnel			Used in step 13
M8x25 screw		Tightening torque	20 Nm
Screw		Tightening torque	3 Nm

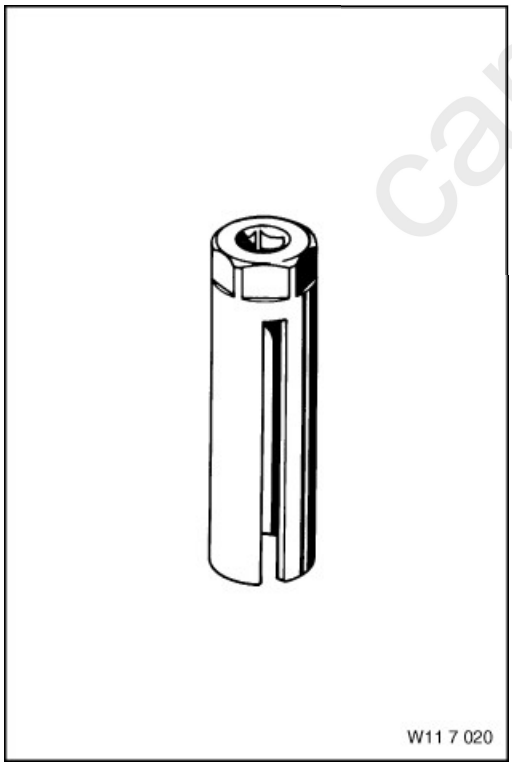
Underbody protection			Used in step 14
Hexagon screw		Tightening torque	3 Nm

Control sensor			Used in step 15
M18x1.5		Tightening torque	50 Nm

Holder, positive battery cable to cylinder head cover			Used in step 15
6X18		Tightening torque	6 Nm

Overview of Special Tools

0 491 074 (11 7 020) Socket wrench insert



Common	Used in step 491015
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

Links

General repair instructions	Used in step

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11 78 510 Replacing oxygen sensor

WARNING

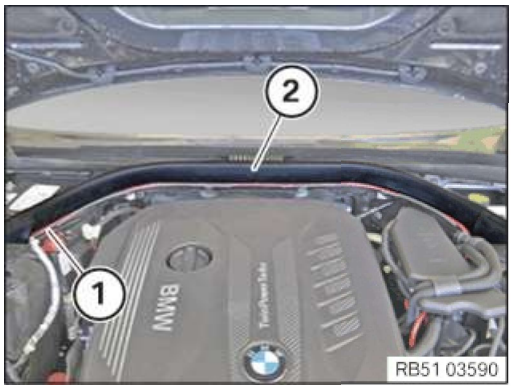
Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

PRELIMINARY WORK

1 – Remove the seal for the rear bonnet



- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

2 – Removing the acoustic cover

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

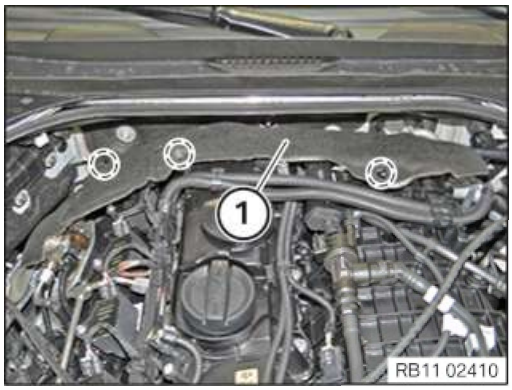
- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Unclip the acoustic cover (1) from the holders in the **marked** areas towards the top.

3 – Removing acoustic cover at rear



- Unclip the acoustic cover (1) in the marked areas and remove it to the top.

MAIN WORK

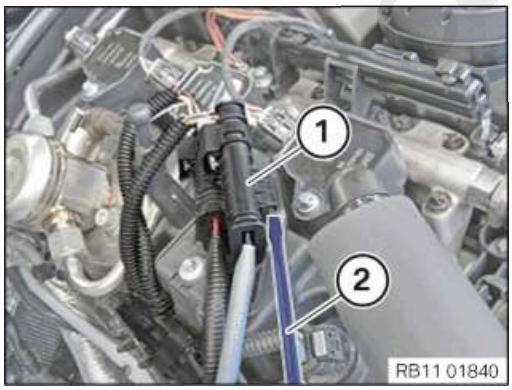
4 – Remove the control sensor

WARNING

Hot surfaces.

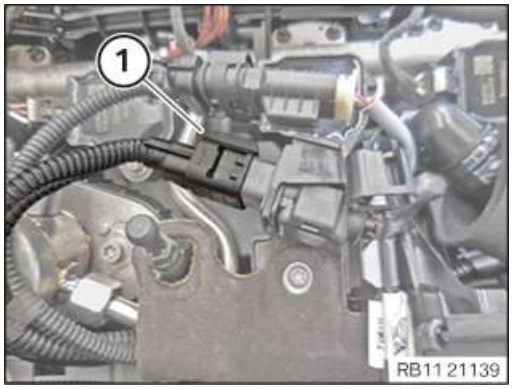
Risk of burning!

- Perform all work only on components that have cooled down.

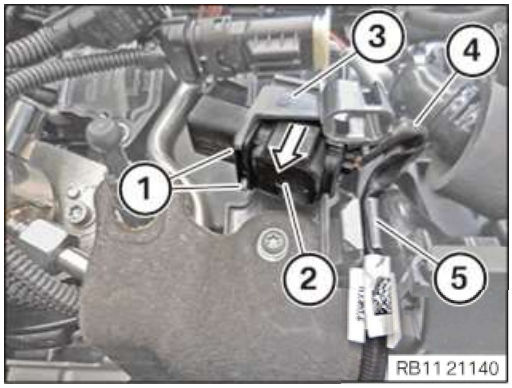


- Unlock connector (1) with screwdriver (2) and remove from the carrier plate.
- Unlock and loosen connector (1).

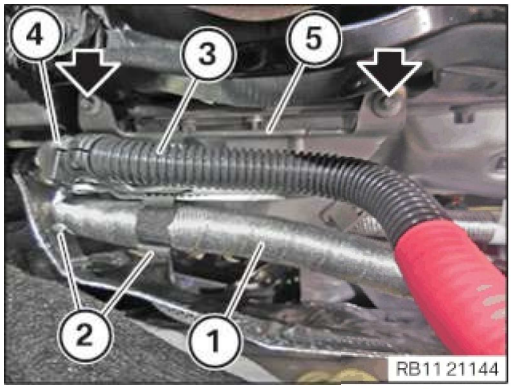
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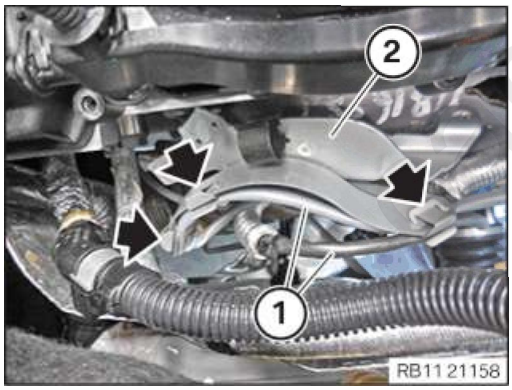
- Unlock and loosen connector (1).



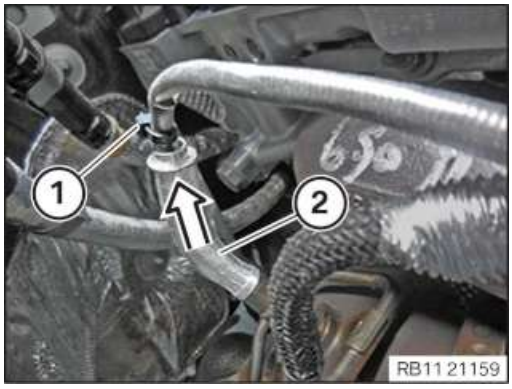
- Unlock the locks (1).
- Guide the connector (2) out of the bracket (3)in the **direction of the arrow** and set it aside.
- Release the cable (4) from the clamp (5).



- Remove positive battery cable (1) from clamps (2).
- Detach the positive battery cable (3) from the bracket (4).
- Remove screws (arrows).
- Feed out the bracket (5) of the positive battery cable and set it aside.



- Release the cable (1) from the clamps (arrows).
- Feed out and remove the bracket (2) of the positive battery cable.



- Unfasten cable strap (1).
- Feed out the heat shield (2) **in direction of arrow** and set it aside.

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- Release and remove the control sensor (1) with the special tool 0 491 074 (11 7 020).

5 – Install the control sensor

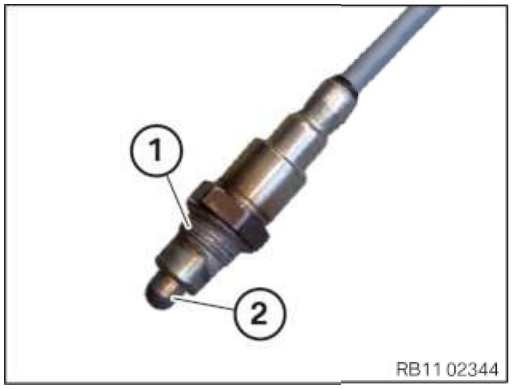
TECHNICAL INFORMATION

New oxygen sensors are to be greased lightly and evenly on the thread.

For oxygen sensors that are reused, the following should be observed:

Lightly and evenly grease the oxygen sensor only on the thread. Do not clean and grease that part of the oxygen sensor which protrudes in the exhaust branch (sensor ceramics).

For additional information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue



TECHNICAL INFORMATION

For more information see: 11 00 ... Overview of consumables in Electronic Parts Catalogue

- Prepare the oxygen sensor.

  Do not damage the sensor ceramics.

  (1) = Thread

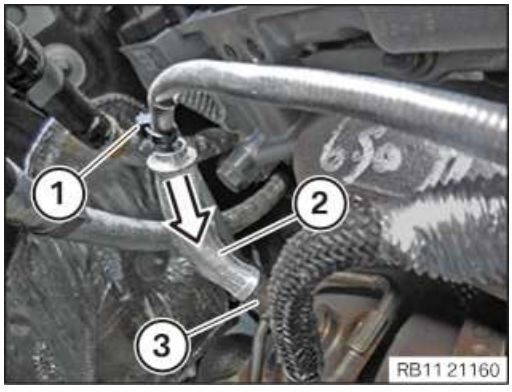
  (2) = Sensor ceramics



- Screw the control sensor (1) in and tighten it with the special tool 0 491 074 (11 7 020).

Control sensor

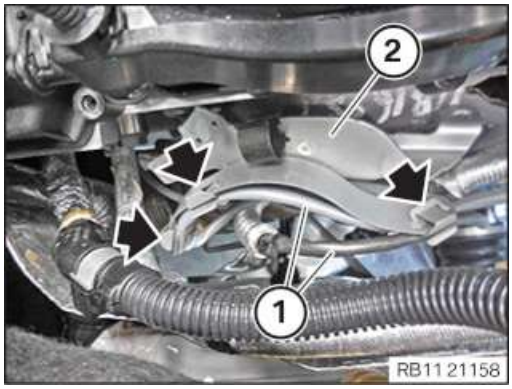
M18x1.5		Tightening torque	50 Nm



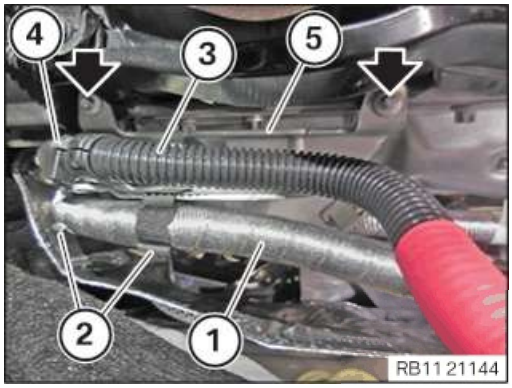
- Guide in the heat protection (2) in the direction of arrow and install.
- Ensure that the heat protection (2) is touching the limit position (3).
- Renew the cable straps (1).

  Parts: Cable strap

- Guide in and install the cable strap (1).



- Insert and position the bracket (2) of the positive battery cable.
- Secure the cable (1) in the clamps (arrows).



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

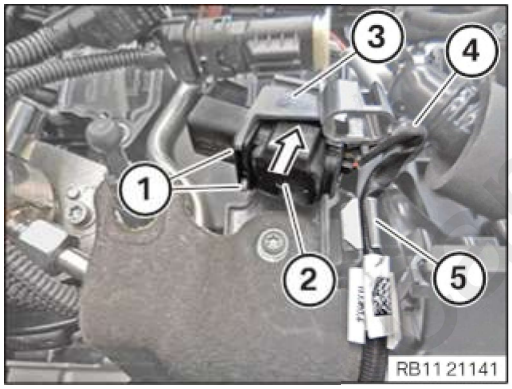
- Route the positive battery cable without abrasions and do not trap.

- Insert and position the bracket (5) of the positive battery cable.
- Tighten screws (arrows).

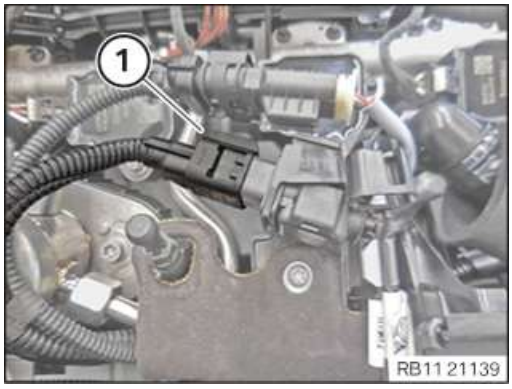
Holder, positive battery cable to cylinder head cover

6X18		Tightening torque	6 Nm

- Secure the positive battery cable (1) at the clamps (2).
- Secure the positive battery cable (3) at the clamps (4).



- Guide in the connector (2) in the direction of arrow at the carrier plate (3) and install.
- Locks (1) must engage audibly.
- Secure cable (4) to the clamp (5).



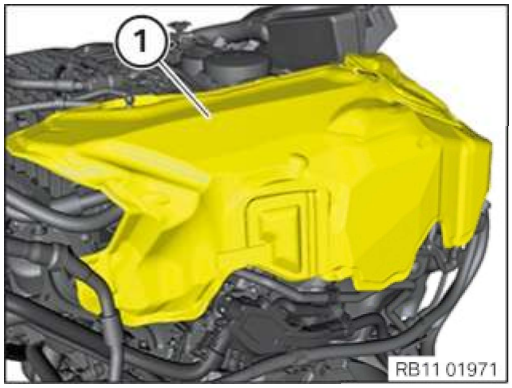
- Connect and lock the connector (1).
- Make sure the connector (1) engages audibly.



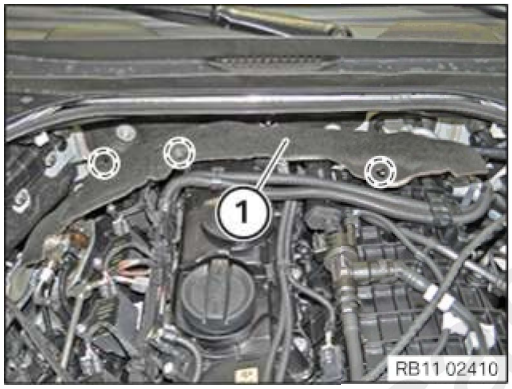
- Connect and lock the connector (1).
- Guide the connector (1) into the carrier plate in the direction of arrow.
- Ensure the connector (1) audibly engages with the carrier plate.

POSTPROCESSES

6 – Installing acoustic cover at rear



- Make sure the acoustic cover (1) is correctly positioned on the rear side of the engine.



- Install the acoustic cover (1) from the top and clip it in into the marked areas.

7 – Install acoustic cover

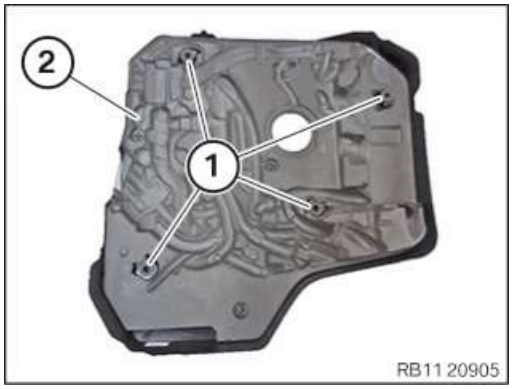
RISK OF DAMAGE

Damage to the acoustic cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover.

- Disassemble or mount the acoustic cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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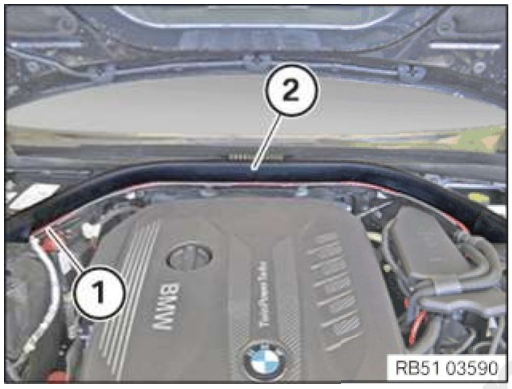


- Check all rubber mounts (1) of acoustic cover (2) for correct seating.



- Clip in the acoustic cover (1) into the holders in the **marked** areas.
  The acoustic cover (1) must audibly engage into place.

8 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

Additional Information

Overview of Tightening Torques

Control sensor — Used in step 5

M18x1.5		Tightening torque	50 Nm

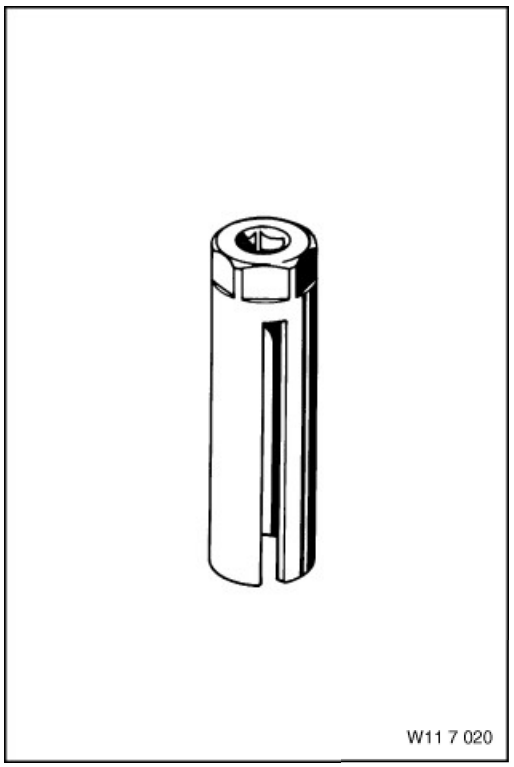
Holder, positive battery cable to cylinder head cover — Used in step 5

6X18		Tightening torque	6 Nm

Overview of Special Tools

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0 491 074 (11 7 020) Socket wrench insert



Common	Used in step 45
Usage	(Socket wrench insert 22 mm) For loosening and tightening the oxygen sensor
Included in the tool or work	
Storage location	A9
Replaced by	
In connection with	
SI-Number	

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Links

General repair instructions	Used in step
11 00 ... Overview of consumables (Electronic Parts Catalogue)	5

11 . . . . . Equipment recoding special tool number of the transverse member for fixing the engine in the installation location

Equipment recoding from 00 0 200 to 00 6 0 000

Designation	Special tool new	Special tool previous
Cross-member, previous	---	00 0 200
Cross-member, new	00 6 000	---
Mounting bridge	00 6 001	00 0 201
Spindle with hook	00 6 002	00 0 202
Extension	00 6 003	00 0 203
Adapter support	00 6 004	00 0 204
Extension	00 6 005	00 0 205
Chain with hook	00 6 006	00 0 209
Set of supports	00 6 010	00 0 206
Set of supports	00 6 020	00 0 207
Set of supports	00 6 030	00 0 208
Connector	00 6 031	---
Profile strip (2 x)	00 6 032	---
Supports (4 x)	00 6 033	---
Set of supports	00 6 040	---
Profile strip	00 6 041	00 0 451
Supports (2 x)	00 6 042	00 0 452
Supports, short (2 x)	00 6 043	---
Set of supports	00 6 050	---
Profile strip (2 x)	00 6 051	---
Supports, short (2 x)	00 6 052	---
Supports, long (2 x)	00 6 053	---
Support, long	00 6 060	---
Supports (2 x)	00 6 070	---

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61 00 ... Parking-residing-driving

Vehicles of the G series feature a new type of terminal control:

Functional description of the parking-residing-driving terminal control

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